DOCTOR OF PHILOSOPHY

Opportunities and potential for organic farming in the arid lands of Jordan

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Award date:
2007

Awarding institution:
Coventry University

OPPORTUNITIES AND POTENTIAL FOR ORGANIC FARMING IN THE ARID LANDS OF JORDAN

BY:

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A thesis submitted in partial fulfilment of the University's requirements for the Degree of Doctor of Philosophy

April 2007

Coventry University
in collaboration with the Jordan Badia Research and Development Centre (JBRDC) and Henry Doubleday Research Association (HDRA)

Abstract

Certified organic farming is developing rapidly world-wide and has become of interest to many farmers, politicians, environmentalists and governments and is practised now in nearly all countries of the world. However, adoption of certified organic farming is not an easy option for farmers and it carries with it several technical, economic, social, cultural and legal barriers. The Jordanian Government is interested in proposing organic farming to farmers, but has not yet investigated whether or not organic farming will be a suitable system. Therefore, this research was based on the need to investigate the main barriers and to evaluate opportunities and potential for organic farming in Jordan's arid lands and to propose an action plan for the adoption of organic farming based on local farmer participation, using farmers' local knowledge and their initiative, as well as institutional participation. To do so, a two-stage research methodology was employed in this research to gain the necessary data during two periods of fieldwork, April to September 2004 and July to September 2005. During this fieldwork, interviews with 46 farmers using an open questionnaire and interviews with discussion groups and government officials were conducted to investigate barriers and potential for organic farming in Jordan. For the second stage, a national workshop was conducted attended by the Minister of Agriculture and stakeholders to generate suggestions, priorities and recommendations for an action plan to adopt organic farming in Jordan.

Respondents reported that the main barriers to adopting organic farming were perception, technical, nutrient availability, cultural/social, marketing, economic, institutional, lack of national regulation and lack of information and advice, but that labour was not a barrier. Findings also showed that despite barriers the area has potential for organic production owing to its extensive area, good water quality, potential farmers and international agreements. The action plan was developed based on the empirical results of stage one (questionnaire, interviews and the discussion groups) and stage two (the workshop outcomes), and utilising the five perceived attributes of innovations: relative advantage, complexity, trialability, compatibility and observability. The plan is divided into four levels: government, field, academic, and regional and international, and the role of each level and its relationship with other levels is explained.

The research shows that the success of this plan with delivery of its objectives does not rely on the work of only the Ministry of Agriculture (MoA) or any other single body, but on everyone involved in the organic farming movement in Jordan. In addition, the methodology developed in this research is considered to be of value for future researchers wanting to conduct research on organic farming or research related to sustainable agricultural development in the developing world context.

Dedication

Yes it was only a dream in June 1997 when I graduated from the University of Jordan. The dream was to join the Jordan Badia Research and Development Centre (JBRDC), after graduation, for few years and then to do my PhD in England. The dream has become a fact and the fact has become a simple work. I dedicate this simple work to my loving parents who suffered for many years to make me who I am and to be proud of who I am. Yes they do not read and write but they taught me that education and knowledge are the keys to happiness. Without their knowledge, wisdom, guidance, and patience, I would not have the goals to strive and do the best to reach my dreams. I also dedicate this work to my sisters, brothers, nieces and nephews who I did not see for two years. I also cannot forget to dedicate this work to my brother Sulaiman who supported me at a very early stage of my PhD. And I say to my brother Dr. Ali I hope this simple work will convince you to believe that organic farming is the best farming system for Jordan.

Acknowledgment

When I was given the opportunity to do my PhD at Coventry University I was both excited and apprehensive at the same time. I am glad I took the offer up as this has been one of the most exciting endeavors I have undertaken. I would like to dedicate this achievement to almighty Allah for seeing me through what was sometimes a difficult path to follow, especially in my field.

I would also like to thank my director of studies Professor Phil Harris. He taught me the essence of perseverance and became more than a supervisor and more like a friend. Thank you for keeping me going. Without your patience, support and guidance I'm not sure I could have achieved this. Thank you again.

There are three of my supervisors who helped me through my time here and I believe they deserve a special mention.

Dr Angela Browne, how could I forget you, you dedicated time, understanding and guidance. Your insight is invaluable to the completion of this work. Words cannot express how grateful I am. I thank you.

There was a time during my thesis that I found myself stuck and Professor Hazel Barrett, you showed me the way to organize myself and interact with people in order to collect data, which as any PhD student knows is the backbone of our research. For this time allocation you gave me, I thank you.

Dr Julia Wright, thank you for making me comfortable and showing me the way around my initial hesitations, without which, I would have been in a dilemma. This gave me the inspiration to push forward. And I could not forget my trip with you to Australia to present some of this research results. Thanks should also go to Melissa Harvey from HDRA for her support. Dr. Timothy Olabiyi, you desire special thanks and what ever I say will not be enough to thank you.

I am extremely grateful to the farmers, MoA staff, the private agricultural engineers, and Sekem-Egypt who without their participation in this research, it would not have happened. I am also very much indebted to Mr. Mohammad Shahbaz and Dr Raed Al-Tabini for their support, assistance, encouragement and guidance to do this work. The JBRDC' falcons Mohsen, Ismael, Ahmad, Khaled, Suleman, Mustafa, Abu Bashar, Abu Abdullah, Abu Fankhor, thanks for getting me through, you know who you are. Dr Saad Al Ayyash, Dr Atef Al Kharabsheh and Dr Odeh Al-Meshan, you desire special thanks, thank you for the great help and support you provided.

I would like to thank Ann Furr for your continuous support and the work you have done not only for me but also for the Badia. I wish also to express my deep thanks to Dr Darius Campbell from DEFFRA for teaching me how to work with farmers and local communities; I really thank you for all the assistance you offered me. I wish also to extend my special thanks to my friend Dr Mohammad Al-Sa'd without you this wouldn't have happened, and also special thanks to your father Dr. Saleh Al-Sa'd for keep encouraging me to do this work. Thanks also to my friend Khalaf (Abu Hamzah) who kept calling me from Qatar and encouraging me to complete this work.

Special thanks must go to my friends at Coventry University Dr Liz, Dr. Navdeep, Michelle, Ruth, Asha, Gracy, Chris, and Zaineb. And special thanks for Dr Salim Al Marri (Abu Mohammad), Fayez Al Fayez, Ibraheem Al Sukkar, Mohammad Awamleh, Ammar Allawneh, Ahmed Hamid and Sultan Al Fayez for sharing my ups and downs during my stay at Coventry.

Finally I would like to thank the staff of Coventry University especially the research section, who gave me the ORS studentship and made it all possible. The Jordan Badia Research and Development Centre and its staff deserve special thanks for their logistic and financial support, without your help, this work would not be possible. Thank you.

Thanks it was great.

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Abbreviations

£	Sterling Pound
ACC	The Jordan Agricultural Credit Corporation
AI	Aridity Index
BPM	Black Plastic Mulch
JBRDC	Jordan Badia Research And Development Centre
CA	Codex Alimentarius
CAC	Codex Alimentarius Commission
CAP	Common Agricultural Policy
CBJ	Central Bank Of Jordan
COAE	The Centre Of Organic Agriculture In Egypt
COFCP	Common Organic Farming Credit Policy
DD	Decimal Degrees
DDT	Dichloro-Diphenyl-Trichloroethane
DEFRA	Department For Environment, Food And Rural Affairs
DFID	British Department For International Development
DMS	Degree, Minutes, Seconds
DoLI	Department Of Land And Irrigation
DoS	Department Of Statistics
DRCOF	Danish Research Centre For Organic Farming
ECOA	Egyptian Centre For Organic Agriculture
EEC	European Economic Community.
EU	European Union
FAO	Food And Agriculture Organisation
GATT	The General Agreement on Tariffs and Trade
GDP	Gross Domestic Product
GMO	Genetically Modified Organism
GPS	Geographical Position System
GTZ	The German Technical Cooperation Agency
ha	Hectare
HCST	Higher Council For Science And Technology
HDRA	Henry Doubleday Research Association
IBS	IFOAM Basic Standards
ICARDA	International Center For Agricultural Research In The Dry Areas
IFAD	International Fund For Agricultural Development
IFOAM	International Federation Of Organic Farming Movements
INPS	Integrated Plant Nutrition Systems
IPM	Integrated Pest Management
ITC	International Trade Centre
IUCN	The World Conservation Union
JAP	Jordan Agricultural Policy
JISM	Jordan Institution For Standards And Metrology
JOD	The Jordanian Dinar
kg	Kilogram
l	Litre

Aabbreviations continued

LAC	Latin American Countries
LD	Lethal Dose
MCM	Million Cubic Meter
MoA	Jordan Ministry Of Agriculture
MoP	Ministry of Planning
MoWI	Jordan Ministry Of Water And Irrigation
N	Number
NSAD	The National Strategy For Agricultural Development
NBAD	The North East Badia Agricultural Directorate
NCARRT	Jordan National Centre For Agricultural Research And Technology Transfer
NEB	Northeast Badia
NGOs	Non-Governmental Organisations
NOP	National Organic Program
NWMP	Jordan National Water Master Plan
ODA	British Overseas Development Administration
OFU	Organic Farming Unit
PAS	Private Agrichemical Suppliers
PET	Potential Evapotranspiration
PIC	Prior Informed Consent
PPD	Plant Production Department
R and D	Research And Development
Reg.	Regulations
RGS	Royal Geographical Society
SG	Secretary General
TYLCV	Tomato Yellow Leaf Curl Virus
UAA	Utilisable Agricultural Area
UK	United Kingdom
UKROFS	United Kingdom Register Of Organic Food Standards
UN	United Nations
US	United State
US$	United State Dollar
USAID	The United States Agency For International Development
USDA	United States Department Of Agriculture
WHO	The World Health Organization
WTO	The World Trade Organization
WWII	The Second World War

CHAPTER ONE: INTRODUCTION TO THE THESIS

CHAPTER ONE

Introduction to the Thesis

1.1. Introduction

Conventional farming systems have helped in the development of modern agriculture to increase food production and labour efficiency to meet ever rising demand (Dahama 1997, Kings 2005), but have also led to unexpected environmental changes that work against the prospects for sustainable increases in food production (Lampkin 1990, Glantz 1994, Dahama 1997, Kings 2005). The adoption of organic farming is one solution because it is considered as a holistic production management system that preserves the environment through minimisation of chemical use and maximisation of natural processes and techniques (Lampkin 1990, Scialabba and Hattam 2002, Soil Association 2003). Organic farming is described as a 'holistic' production system [this term will be used in the thesis] because it does not only consider the soil as a living organism, but also because it focuses on improvement of soil health, promoting and enhancing ecosystem health, including biological cycles and soil biological activity, using of local inputs and minimising the use of external inputs, avoiding the use of synthetic fertilisers and pesticides, relatively high-intensity use of labour (Sharma 2001, Scialabba and Hattam 2002, Sharma 2005); also it aims to optimise the health and productivity of interdependent communities of soil life, plants, animals and people (Scialabba and Hattam 2002). Therefore, understanding this holistic concept is essential to sustain a successful organic farming system (Lampkin 1990).

Organic farming is different from other farming systems not only because of its production methods or its holistic approach, but also because it is protected by law and regulations (Lampkin 1990, Scialabba and Hattam 2002) that protect not only consumers but also producers against fraudulent practices through inspection and certification (Scialabba and Hattam 2002). The rules ensure that only certified organic products are sold as organic (Lampkin 1990, Dabbert, Häring, and Zanoli

2004) but cannot ensure that organic products are completely free of residues, due to general environmental pollution (Scialabba and Hattam 2002). It is also important to note that organic farming is an old farming system widely used before the widespread introduction of agrichemicals, and that the ideas behind it have been around since the 1920s (Lampkin 1990, Dabbert, Häring, and Zanoli 2004). Moreover, it is noteworthy that with the increase in certified organic farming, several important publications have appeared in recent years concentrating on its potential, and on barriers, opportunities and environmental impacts (Lampkin 1990, Harris *et al.* 1998, Barrett *et al.* 2001, Barrett *et al.* 2002)

For the purpose of this research, it is important to understand the difference between certified and non-certified organic farming systems. According to Scialabba and Hattam (2002: 5), the differentiation between certified and non-certified organic faming is as follows:

> Agriculture that meets organic production standards, but is not subject to organic inspection, certification and labelling is referred to as "non-certified organic agriculture" as distinguished from "certified organic agriculture." While economic and institutional conditions differ, both rely on the same technology and principles. Although the results might be similar, non-certified organic agriculture may not always represent a deliberate choice between alternative production systems-lack of access to purchased inputs may constrain such choice. Whatever the motivation, an organic farm reflects an intentional management system in which a producer manages resources according to organic principles. Non-certified organic agriculture therefore includes traditional systems which do not use chemicals but which apply ecological approaches to enhance agricultural production.

Certified organic farming is practised now in nearly all countries of the world (Dabbert, Häring, and Zanoli 2004, Yussefi 2005), with a managed cultivation area of more than 31 million hectares, over 633891 farms worldwide and 62 million hectares of wild harvested plants (Yussefi and Willer 2007). Moreover, there is a rapid growth in its global market. The estimation of this market in 2006 was about US$ 40 billion, in which Europe was the largest market as a region with US$ 17 billion, and the USA was the largest single country market, with US$ 14.9 billion worth of sales (Sahota 2007).

Therefore, developing countries, including those with arid lands, have a great opportunity to benefit from the expansion of the global organic market, as demand is greater than supply (Barrett *et al.* 2001, Barrett *et al.* 2002, Hasbani 2004). These countries can benefit not only from the market, but also from environmental benefits, because organic farming has environmental benefits which could help maintain sustainable farming. Several authors (Lampkin 1990, Lampkin 1994a, Sharma 2001, Scialabba and Hattam 2002, Burton, Rigby, and Young 2003) have emphasised that the organic farming system benefits the environment through aiming to stop degradation and re-establishing natural balance. In this system, it is not permitted for farmers to use synthetic agrochemicals, and this safeguards biodiversity and ecological diversity, and limits the disruption to the environment caused by other food production systems (Lampkin 1990, Scialabba and Hattam 2002, Soil Association 2003).

However, adoption of organic farming is not an easy option for farmers and it carries with it several barriers (Lampkin 1990, Harris *et al.* 1998). These barriers could be technical, economic, social, cultural or legal (Dubgaard and Holst 1994, Padel and Lampkin 1994, Schneeberger, Darnhofer, and Eder 2002). Therefore, countries wishing to adopt organic farming should first investigate its potential and the possible barriers to it, and then set up a legal framework for its adoption. Adoption requires different procedures to overcome the barriers: for example, employing active government policy supporting organic farming, including certification and inspection, should be considered (Harris *et al.* 1998, Scialabba and Hattam 2002, Hasbani 2004). Other procedures might include financial support during and after conversion to an organic farming system (Dabbert, Häring, and Zanoli 2004, Willer 2005), adequate training and extension (Al-Bitar 2006), and stakeholders' involvement (IFAD 2001). Therefore, this research attempts to develop a methodology to adopt a sustainable organic faming system. This approach is explained in the following sections.

1.2. The scope of the research

It will be noted from the literature review in this research that many developed countries have developed national standards and regulations for organic farming, while many developing countries are still in the process of doing so. It is also been noted that there has been no practical overall methodology or strategy used by developing countries to adopt organic farming. As a result, this research uses Jordan as an example of a developing country, to establish a method that could be used by countries wishing to adopt organic farming. The results of this research and its methodology are generic, and could therefore be used by both developed and developing countries.

Jordan is proposing that organic farming be adopted by farmers (MoA 2003, OFU 2003), but without initially investigating whether or not organic farming will be a suitable system for farmers. Therefore, this research attempts to utilise a participatory approach whereby farmers themselves are involved in the development and diffusion of organic farming in Jordan. The research also aims to make a novel contribution to the knowledge of organic farming in arid lands by its research methodology, which involves farmers and stakeholders in developing a contemporary organic farming system. To do so, this research aims first to evaluate the opportunities and potential for organic farming in Jordan's arid lands, and then to propose a suitable action plan for the adoption of organic farming in Jordan based on local farmer participation, using farmers' local knowledge and their initiative, as well as institutional participation.

The development of the plan required both primary and secondary data, with analysis of the interrelationships of various factors, including cultural, biological and environmental ones, farmers' perceptions, and the available resources both technical and institutional combined with a theoretical approach (diffusion of innovation theory). To do so, the description of the research is divided into two stages: the first stage describes the barriers to and potential for, organic farming in Jordan and explains the methods used to undertake this investigation (questionnaire content and its construction, interview procedures used during the fieldwork, discussion groups and field observations). The second stages provides a description of the methods used for the development of the action plan, which included conducting a national workshop in Jordan attended by the Minister of Agriculture and stakeholders. The national workshop aimed at encouraging different stakeholders to come up with suggestions and recommendations to develop the plan, participating in its development to ensure a solid basis for the plan. Stage two shows that the development of the plan was based on empirical evidence from stage one, outcomes of the workshop and the application of the diffusion of innovation theory utilising the five perceived attributes of innovations: relative advantage, complexity, trialability, compatibility and observability.

The research proposes an action plan for Jordan to develop the organic farming sector, in which 1-5% of the cultivated area is to be converted to organic farming within ten years from its inception date. The plan is developed from research over three years and relies on a great deal of information collected from producers, officials, the private sector and Non-Governmental Organisations (NGOs), and is built on an integrated approach in which all stakeholders (farmers, government officials, academics, and national and international organisations) involve themselves closely in its development. The research shows that the plan implementation is to be under the guidance of the Ministry of Agriculture (MoA), a stakeholders' partnership, and supported by other relevant government organisations. However, the plan's success with delivery of its objectives does not rely only on the work of the MoA or any other single body, but on everyone involved in the provision of the organic farming sector in Jordan.

1.3. Aim and objectives

The overall aim of this study was to evaluate the opportunities and potential for organic farming in Jordan's arid lands and, based on this, to develop an action plan for the adoption of organic farming. To achieve this, the following supporting seven objectives were identified:

1. Examine and assess the development and trends of organic farming including international and national means, practices and information requirements for the establishment of certified organic farming systems, and its potential in arid lands,
2. Investigate key issues relating to the Jordanian agricultural sector, and the situation of organic farming and its implementation in the framework of the Jordanian agricultural policy,
3. Investigate the current farming practices used by farmers, including pest control and soil fertility management methods, and the knowledge of farmers regarding non-chemical and organic farming practices,
4. Analyse and assess the perception and attitudes of farmers and other stakeholders to organic farming and their interest in converting to organic farming systems,
5. Identify and assess the potential barriers to the adoption of organic crop farming in Jordan's arid lands,
6. Evaluate the opportunities to the adoption of organic crop farming in Jordan's arid lands,
7. Develop and propose an action plan for the adoption of organic farming for Jordan utilising the diffusion of innovation theory

1.4. The thesis structure

The thesis is divided into eight chapters (Figure 1.1) that meet its overall aim and objectives. Chapter 1 gives an introduction to organic farming, outlines the research scope including its aims and objectives, and outlines the thesis structure.

Chapter 2 gives a wider literature review of issues related to organic farming and its development. It explains the development of organic farming and examines the major factors that have helped its development, and discusses the organic farming movement step by step, including background, history, definition, principles, regulations, barriers, potential and environmental impact. It also examines how organic farming differs from other farming systems, discusses the application of diffusion of innovation theory in organic farming research and finally investigates whether or not organic farming has potential in arid lands.

Chapter 3 describes and discusses general issues related to Jordan's agricultural sector and organic farming, including economy, environment, and development of the agricultural sector, and explains why organic farming is required for Jordan. It also describes the study area and why this area was chosen for this research.

Chapter 4 focuses on the methods and fieldwork activities used to gain the primary and secondary data for this research and also provides a description of the data analysis instruments. The Chapter is divided into two stages: the first stage covers the diagnostic phase, which explains the questionnaire content and its construction, interview procedures used during the fieldwork, discussion groups and field observations that were used to investigate barriers and potential for organic farming in Jordan. The second stage is the organic farming action plan development phase, which provides a description of the methods used for the development of the plan, including conducting a national workshop in Jordan attended by the Minister of Agriculture and stakeholders and the theoretical approach used.

Chapter 5, 6 and 7 present the research results. Chapter 5 gives a thematic analysis of the current farming practices used in the study area and investigates whether this system is organic or not, what non-chemical farming methods are employed by farmers, the use of extension resources and how farmers learn, and the main farming barriers in the study area. It also provides a description of the data analysis instruments and it continues by examining the impact of the current farming system on jobs and the environment.

Chapter 6 investigates Jordan's conventional farmers' and other stakeholders' perspectives on the barriers to, and potential for, the adoption of organic farming, using a multi-disciplinary approach. This chapter investigates the main technical, economic, cultural, marketing and institutional barriers and also examines the farmers' response to the adoption of organic farming. It also presents the potential and opportunities for organic farming in Jordan.

The results in Chapters 5 and 6 help to inform Chapter 7, which presents an action plan for the adoption of organic farming in Jordan and also for other countries wishing to adopt organic faming, and explains how this plan could be made operational.

Finally, the thesis ends with Chapter 8, which summarises and discusses the main findings of this research and draws conclusions and suggestions for government policy and future research work to be conducted.

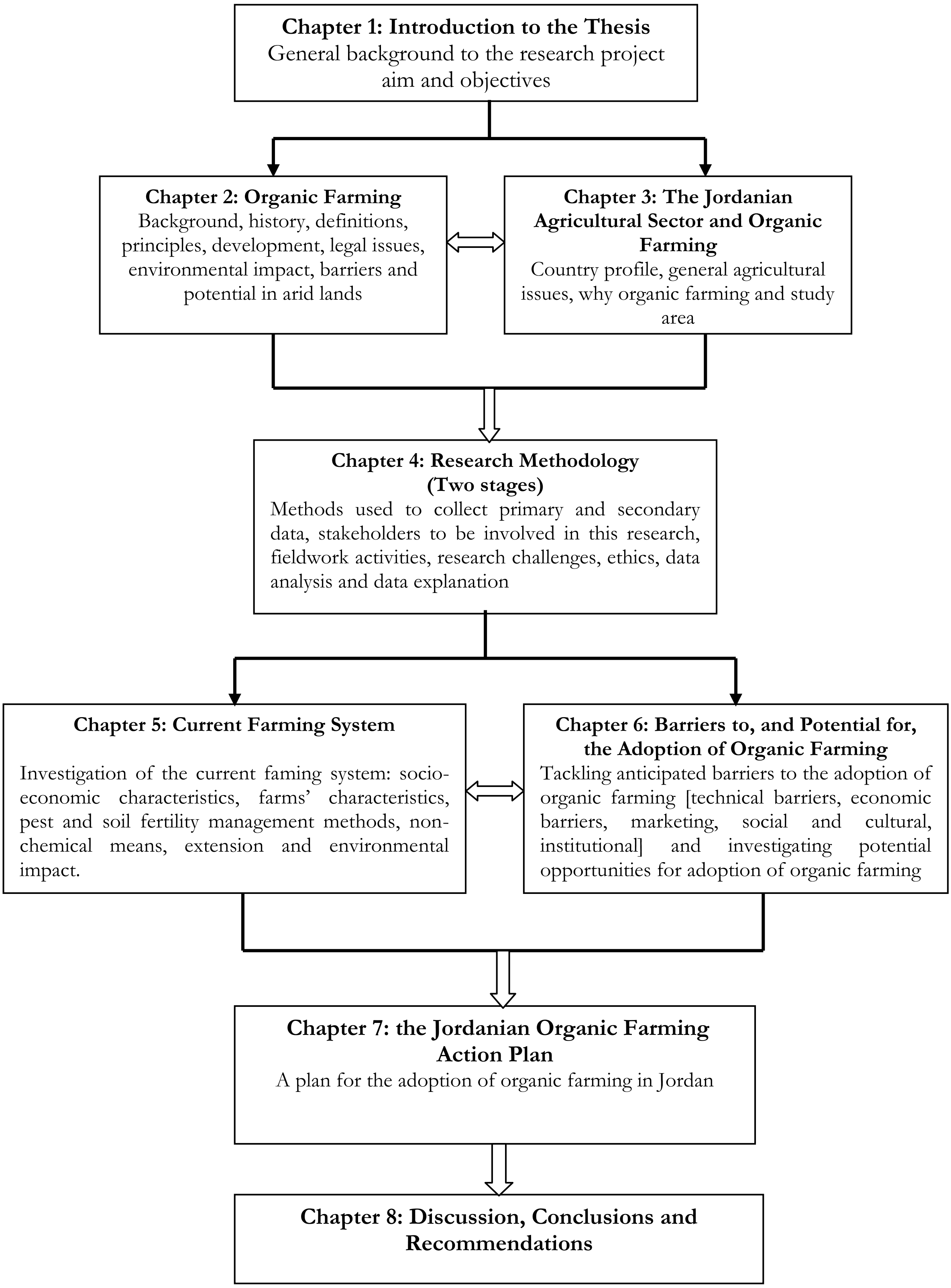

Figure 1.1: The structure of the thesis

CHAPTER TWO: ORGANIC FARMING

CHAPTER TWO
Organic Farming

2.1. Introduction

This chapter aims to examine and assess the development of organic farming and to investigate the major factors that have helped its development. Therefore, the chapter discusses the organic farming movement step by step which includes a broad perspective of background, history, definition, regulations, barriers, potential and environmental impact. The chapter examines the concept and definition of organic farming and what is required to make the concept clear to the public. Moreover, the chapter discusses the environmental impact of organic farming and how its principles meet health regulations, work in harmony with the environment, build biological diversity and foster healthy soil and growing conditions. It also examines the practice of organic farming worldwide and how it differs from other farming systems in terms of production methods, regulations and certification. The chapter continues by examining the main barriers to the adoption of organic farming and the importance of policy environment and motivations for organic farming. Finally, the chapter examines the potential of organic farming in arid lands and why there is a need to adopt organic farming in such areas.

2.2. Agriculture: from hunting societies to organic farming

Customers today in many countries are able to obtain all types of food throughout the year. For example, they can always find grapes, strawberries or fresh vegetables, and some do not even need to go to shops for the food, since in many countries they can purchase online. Past generations, however, struggled to reach the stage that the customers of today have achieved. Therefore, it is important to appreciate how agriculture has developed over time and whether there still remains a need for newer and better production systems.

Biologists and archaeologists have showed that people survived for million of years by hunting wild animals, fishing and gathering wild plants (Smith 1998, Wild 2003). As hunters-gatherers, they were moving from one place to another looking for the best place with good water resources and a good season for hunting animals and gathering plants (Wild 2003). But about 10000 years ago a slow change began, from hunting societies to permanent settlements, which were established mainly in seven regions (Figure 2.1) of the world (Smith 1998, Wild 2003). These settlements were established at water places and started storing food in order to allow for times of shortage (Wild 2003).

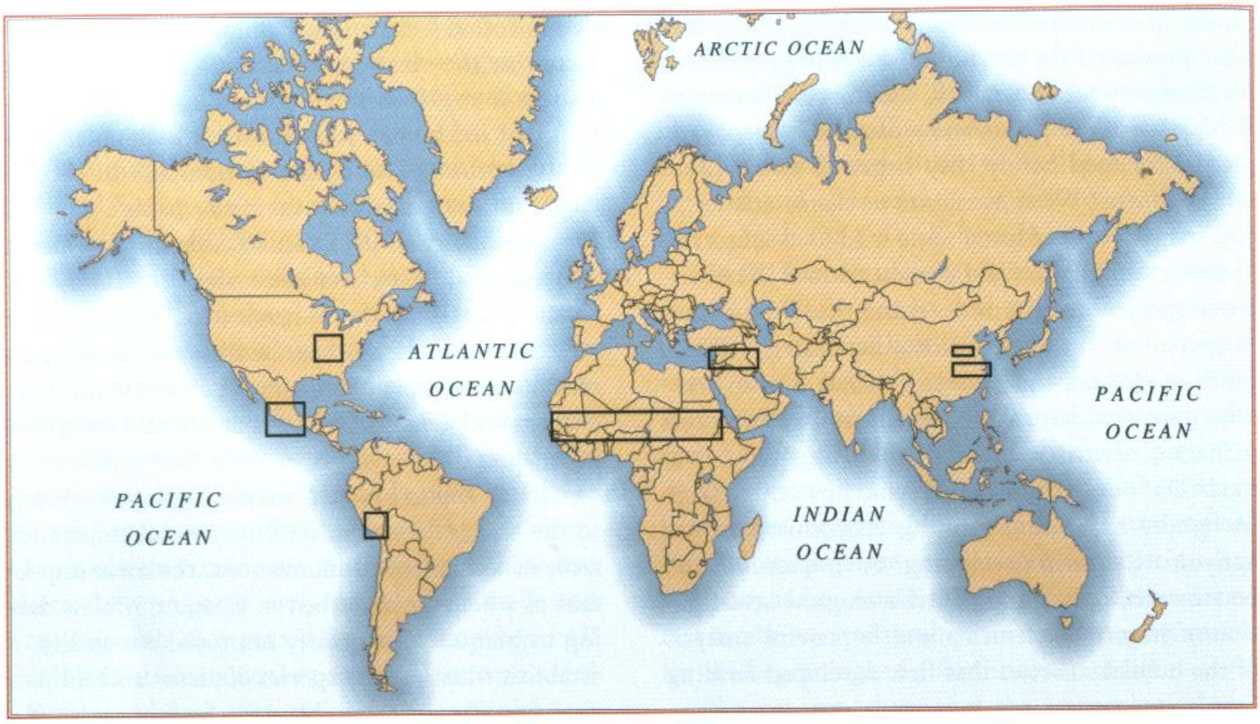

Figure 2.1: The seven areas of the world of permanent settlements which led to the emergence of agriculture (Smith 1998)

In these settlements, hunting decreased but continued to provide food (Wild 2003), and the societies started domesticating some plant and animal species and developed agricultural economics, which is considered to be the first turning point from a hunting way of life to a farming, settled way of life (Smith 1998, Wild 2003). One of the main domesticated plants was wild emmer wheat (*Triticum dicoccoides*), which was harvested for the first time in Palestine, and the grain was ground to flour (Wild 2003).

The change from a hunting to a farming system is known as the 'Neolithic or Agricultural Revolution' because it had an impact on human society which led to population increase and more people needing higher productivity from the land (Wild 2003). At the beginning of this population increase, the needs for more food were met by cultivating new land and domesticating new plants and animals, until the nineteenth century. Increasing the hectarage under cultivation can increase agricultural food production, also achieved by increasing crop yields (Glantz 1994, Wild 2003).

However, cultivating new lands was not enough to meet the increased food requirements, therefore, in the nineteenth and twentieth century new techniques and methods were applied in agriculture to increase food production to meet the demand (Dahama 1997, Wild 2003). These techniques and methods include irrigation techniques, intensification in the use of pesticides, herbicides and fertilisers, using high-yield varieties, labour-saving, intensive machinery, research and scientific methods (Glantz 1994, Wild 2003), concentrates in feed and treatment in animal production (Dahama 1997). This made agriculture one of the most effective production systems in the economy, where the aim is to maximise the food production on less land and with decreasing labour (Wild 2003). This approach is known as a productivist agricultural system (Kings 2005).

There is no doubt that the application of the methods and techniques mentioned above has helped in the development of modern agriculture to increase food production and labour efficiency to meet demand (Dahama 1997), but this has also led to unexpected environmental changes that work against the prospects for a sustainable increase in food production (Lampkin 1990, Glantz 1994, Dahama 1997, Kings 2005), and also to social problems which have appeared as a result of this development (Dahama 1997). This can be explained because at the beginning of the agricultural development, the negative environmental impact was unimportant (Dahama 1997). The result was that the misuse of agricultural technologies have led to several problems: a negative impact on natural resources, loss of heritage landscape and of biodiversity, decline in agricultural population in rural areas (which led to major structural change and combined with above-average unemployment rates and difficult social conditions in formerly agricultural regions (Dabbert, Häring, and Zanoli 2004)), increased soil salinity, increased soil erosion, problems of water availability, health problems from pesticides, and finally ground and surface water pollution (Scialabba and Hattam 2002). For example, the intensification in the use of pesticides in plant production led to a decrease not only in the number of plant species but in the whole biodiversity, when only one or two high yielding grass species were grown (Dahama 1997). Besides the negative environmental impacts, intensification also had an influence on soil and animal fertility, a problem which is of serious concern to farmers the world over (Dahama 1997).

Realising the environmental and social problems has encouraged scientists and policy-makers to look for a more sustainable farming system which can provide food for an increased population and in the meantime [this system] can work with the prospects for sustaining the environment, and which should be regulated by national and international regulations to be sustainable (Dahama 1997, Scialabba and Hattam 2002). Organic farming, with its principles and regulations, is a way in achieving a sustainable farming system (Dahama 1997, Sharma 2001, Scialabba and Hattam 2002).

The idea of organic farming was developed to make the farm a system which makes use of its own resources as much as possible and only draws on external resources when necessary or appropriate (Lampkin 1990, Dabbert, Häring, and Zanoli 2004). Its idea also aims to use both appropriate modern technologies and traditional technologies (Lampkin 1990, Dahama 1997, Dabbert, Häring, and Zanoli 2004), to avoid inputs that are risky to the environment, and not to separate farming from its natural environment (Lampkin 1990, Dabbert, Häring, and Zanoli 2004).

2.3. Organic farming background and history

Interest in organic farming increased in the twentieth century among farmers, politicians and consumers worldwide, and especially in Europe (Lund and Algers 2003). Lampkin (1990), Browne *et al.* (2000), Sharma (2001), Scialabba and Hattam (2002), Soil Association (2003) and Kings (2005) have attempted to define organic farming as an environmentally and socially sustainable approach that deals with all components of the production system used to produce and deliver the product to the ultimate consumer. Moreover, its production methods and components protect and respect the environment, from the production stages through handling and processing (Scialabba and Hattam 2002), leading to the achievement of a sustainable ecosystem, safe food, good nutrition, animal welfare and social justice (Dahama 1997, Scialabba and Hattam 2002, Soil Association 2003). In other words it is a systematic approach based on the perception that tomorrow's ecology is more important than today's economy (Sharma 2001).

Consequently, a question can be posed, as to 'whether or not organic farming is a holistic production management system'. Several authors and studies (Pretty 1995, Dahama 1997, Sharma 2001, Scialabba, Grand, and Henatsch 2003, Soil Association, 2003, Borell and Sørensen 2004) emphasise that it is a holistic production management system. Their argument is that organic farming preserves the environment through the minimisation of chemical use and maximisation of natural inputs, enhances the ecosystem's health including soil biological activity and soil fertility, minimises pollution of the environment, and involves a wider consideration of agricultural system social impacts. Accordingly, organic farming becomes a form of a sustainable farming system (Pretty 1995) which includes the whole farming management system, not only the certification of organic farms or products; and it depends on natural inputs rather than external inputs to increase the agriculture productivity (Dahama 1997, Stocker 2001, Scialabba and Hattam 2002). Thus, it can be argued that the objective of sustainability lies at the heart of organic farming (Burton, Rigby, and

Young 2003), where it aims to create a sustainable agroecological system based on local resources (Dahama 1997, Lund and Algers 2003):

> Organic farming is perceived by many to offer some solutions to the problems of environmental degradation, depletion of non-renewable resources, food safety and other problems associated with conventional agricultural practices in industrial countries
>
> (Burton, Rigby, and Young 2003: 29)

Organic farming considers livestock including, fish farming systems, as one of its main components since integrating livestock and crops in organic farming is a holistic approach to organic farming (Dahama 1997, Sharma 2001, Scialabba and Hattam 2002). In this approach, organic farming emphasises that different characteristics are addressed in livestock organic farming systems to ensure that health and welfare issues are optimised (Younie 2000, Sharma 2001, Scialabba and Hattam 2002). The characteristics require that livestock should have access to adequate space, fresh air, outdoors, daylight, shade, and shelter for inclement weather, suitable to the species and climatic conditions, and a balanced nutritional programme using primarily organic feeds (Scialabba and Hattam 2002). On the other hand, livestock has an important role in organic farming systems in maintaining and improving soil fertility by producing manures to improve the soil fertility and by providing intelligent traction (Lampkin 1990, Harris *et al.* 1998, Sharma 2001, Parrott and Marsden 2002, Borell and Sørensen 2004, Sharma 2001) as well as in allowing a balanced rotation based on leys and arable cropping (Lampkin 1990: 279). The role can be seen in terms of the profitable utilisation of legumes in the rotations, while facilitating the recycling of nutrients through manures (Lampkin 1990: 67). The livestock role is also important in utilising the leys and arable crop residues and as being a source of manure for transferring fertility to crops on the farm (Younie 2000). The nutrients and organic matter contained in their manures come from grazing over a large grazing area and from purchased and conserved feed (Lampkin 1990: 67).

Livestock also plays an important role in relation to the general principles of organic farming in terms of supporting biological cycles within the farming system and diversifying production (Borell and Sørensen 2004) and an economic role (Lampkin 1990). Manures have potential to provide plants with nutrients (Adediran *et al.* 2003, El-Araby 2004), and have been of recent interest with the increase in the cost of inorganic fertilisers and the decline in soil fertility (Lekasi *et al.* 2001). Manures make an important contribution to sustainable agriculture and soil fertility, and are attributed a major role in soil fertility maintenance (MAFF 1998). The use of manure has potential not only in improving soil productivity and crop yields but also in improving the physical, chemical and microbiological properties of the soil (Adediran *et al.* 2003). Parrott and Marsden (2002) state that the manure produced by livestock in some areas is as important to farmers as the protein from meat and dairy production. In Jordan for example, manures create additional income for livestock farms (Abu-A'moud 2003).

Organic farming developed for several years before it became important in mainstream agricultural research, and it went largely unnoticed by the public (Dabbert, Häring, and Zanoli 2004). It is important to bear in mind that organic farming is an old farming system, common before the widespread use of agrichemicals, and that the ideas behind it have been around since the 1920s (Lampkin 1990, Dabbert, Häring, and Zanoli 2004):

> The organic farming movement is clearly established and here to stay. It is heralding a change in agriculture which is occurring simultaneously in every developed agricultural nation in the world. Far from being a return to the past, organic farming is an agriculture for the future, our future.
>
> (Lampkin 1990: 10)

There is no doubt that organic farming is not new, and its first guidelines were developed as early as 1924, to elaborate an alternative to conventional production (Borell and Sørensen 2004). Farmers had an option to farm without using agrichemicals before World War II (WWII), but some technologies used in WWII became helpful for farming production. In this section two examples are mentioned. The first example is ammonium nitrate, which was used for munitions during WWII and then developed into ammonium nitrate fertiliser. The second example is organophosphate nerve gas production, which led to the development of powerful insecticides (ISU 2006). However, before WWII there were several pioneers who helped to develop the organic farming guidelines. These guidelines were first developed from the biodynamic movement, based on the anthroposophical principals founded by the pioneer Rudolf Steiner in 1924 (Tate 1994, Willer and Yussefi 2001) and his course on the biodynamic farming in Germany (Willer 2005). In the thirties and forties there were other pioneers to develop organic faming: Hans Müller in Switzerland, Lady Eve Balfour and Albert Howard in Britain and Masanobu Fukuoka in Japan (Dahama 1997, Willer and Yussefi 2001, Yussefi and Willer 2002). Accordingly, the development of the organic farming movement can be divided into three periods during the last seventy years:

1. 1924-1970: a financially difficult period to establish organic farming in a hostile environment; in this period the core works were written
2. 1970-1980: organic symbol schemes were set up as consumer demand increased, and green awareness grew; retail outlets multiplied
3. From 1980: organic farming gained acceptance; national and international standards were set, and governments introduced organic aid schemes for farmers

(Tate 1994: 11)

2.4. The concept and definition of organic farming

This section aims to explain the concept of organic faming. Moreover, the section suggests a definition for organic farming to be used in this research, and recommended to be used by others. The term 'organic farming' was first used by Lord Northbourne in 1940, a practitioner of biodynamic farming, and the author of the book '*Look to the Land*' (Boehmer 2003). The literature shows that four main definitions have been used for this term, and they can give a similar impression of the concept. The first one is cited in Lampkin (1994a), in which organic farming is defined as an approach to agriculture where the aim is to:

> Create integrated, human, environmentally and economically sustainable agricultural production systems, which maximize reliance on farm-derived renewable resources and the management of ecological and biological processes and the interactions, so as to provide acceptable levels of crop, livestock and human nutrition, protection from pests and diseases, and an appropriate return to the human and other resources employed.
>
> (Lampkin 1994a: 4-5)

The second one is by the Soil Association, where organic farming is:

> A defined systems-based form of production designed to produce food of optimum quality and quantity using sustainable management practices to avoid the use of agrochemical inputs and which minimise damage to the environment and wildlife.
>
> (Soil Association 2003: 2)

The third one is the definition by the United States Department of Agriculture (USDA), which was cited by several authors (Harris e*t al.* 1998: 1-2, Parrott and Marsden 2002: 12, Sharma 2001: 14), in which organic farming is defined as:

> A production system which avoids or largely excludes the use of synthetic compounded fertilisers, pesticides, growth regulators, and livestock feed additives. To the maximum extent feasible, organic farming systems rely upon crop rotations, crop residues, animal manures, legumes, green manures, off-farming organic wastes, and aspects of biological pest control to maintain soil productivity and tilth, to supply plant nutrients, and to control insects, weeds, and other pests.'

The fourth one is the definition by IFOAM, in which organic farming is defined as follows:

> Organic agriculture is an agricultural system that promotes environmentally, socially and economically sound production of food, fiber, timber etc. In this system, soil fertility is seen as the key to successful production. Working with the natural properties of plants, animals and the landscape, organic farmers aim to optimize quality in all aspects of agriculture and the environment. Organic agriculture significantly reduces external inputs by avoiding the use of chemo-synthetic fertilisers, pesticides and pharmaceuticals. Instead it works with nature to increase both agricultural yields and disease resistance. Organic agriculture also includes social considerations in its holistic approach, recognising that people are as important as the organic system. Organic agriculture adheres to globally accepted principles which are implemented in specific social, economic, geo-climatic and cultural contexts. The principle aims of organic production and processing are outlined in the IFOAM Basic Standards. These set out an international framework for organic production and processing.
>
> (Chubb *et al.* 2005: 3)

It can be noted that the four definitions of organic farming involve different techniques, which also can be applied in conventional farming systems. For example, crop rotation and animal manures are applied in both organic and conventional farming systems. It can also be noted that organic farming not only prohibits synthetic agrochemical inputs but also the term 'organic farming' is protected by law and regulations (Scialabba and Hattam 2002, Dabbert, Häring, and Zanoli 2004) which protect consumers and producers, and ensure that organic products are sold as 'organic' (Dabbert Häring, and Zanoli 2004, Hasbani 2004). The rules ensure that only certified organic products are sold as organic (Lampkin 1990, Dabbert, Häring, and Zanoli 2004) but cannot ensure that organic products are completely free of residues, due to general environmental pollution (Scialabba and Hattam 2002). Another issue to be considered is the use of synonyms for the term 'organic farming'. These synonyms are 'natural' and 'biological', as in Germany. Therefore, this research suggests the use of the definition by IFOAM as a common definition, but adding to this definition the legal element which is that organic farming is regulated by international law and regulations to protect both consumers and producers by ensuring that products are produced and sold as organic farming products.

2.5. Principles of organic farming

Organic production and processing is based on a number of principles (Lampkin 1990, IFOAM 2002, Borell and Sørensen 2004) that constitute a radical break with the productivist concept (Cabaret 2003). The principles are divided into four main principles: the principle of health, the principle of ecology, the principle of fairness, the principle of care (Box 1.1) and each principle is articulated through a statement followed by an explanation (IFOAM 2007). The principles are to meet all health regulations, work in harmony with the environment, build biological diversity and foster healthy soil and growing conditions (Lampkin 1990, Dahama 1997, Sharma 2001, Borell and Sørensen 2004). In another word, they articulate the contribution that organic farming can make to the world, and a vision to improve all agriculture in a global context (IFOAM 2007). The principles include agricultural, environmental, food processing and social issues (Dahama 1997, Browne *et al.* 2000, Sharma 2001, Stocker 2001, UKROFS 2001, Soil Association 2003).

The principles make organic farming a 'proper' strategy, applying all production components in one approach, while other ecological farming systems such as integrated pest management (IPM), integrated plant nutrition systems (INPS) and conservation tillage are not (Dahama 1997, Sharma 2001, Dabbert, Häring, and Zanoli 2004). In these systems one component is applied, such as pest ecology, plant ecology or soil ecology, while in organic farming all these components are applied in one approach (Sharma 2001). This approach means that organic farming focuses on the food web relations and element cycling, aims to maximise the agro-ecosystem's stability and homeostasis (Scialabba and Hattam 2002), and has the potential to provide various benefits such as environmental protection, conservation of non-renewable resources, improved food quality, reduction in output of surplus products, and the reorientation of agriculture towards areas of market demand (Lampkin 1994a: 3).

Box 1.1: Organic farming principles (IFOAM 2007)

Principle of Health	Principle of Ecology
Organic Agriculture should sustain and enhance the health of soil, plant, animal, human and planet as one and indivisible. This principle points out that the health of individuals and communities cannot be separated from the health of ecosystems-healthy soils produce healthy crops that foster the health of animals and people. Health is the wholeness and integrity of living systems. It is not simply the absence of illness, but the maintenance of physical, mental, social and ecological well-being. Immunity, resilience and regeneration are key characteristics of health. The role of organic agriculture, whether in farming, processing, distribution, or consumption, is to sustain and enhance the health of ecosystems and organisms from the smallest in the soil to human beings. In particular, organic agriculture is intended to produce high quality, nutritious food that contributes to preventive health care and well-being. In view of this it should avoid the use of fertilizers, pesticides, animal drugs and food additives that may have adverse health effects.	Organic Agriculture should be based on living ecological systems and cycles, work with them, emulate them and help sustain them. This principle roots organic agriculture within living ecological systems. It states that production is to be based on ecological processes, and recycling. Nourishment and well-being are achieved through the ecology of the specific production environment. For example, in the case of crops this is the living soil; for animals it is the farm ecosystem; for fish and marine organisms, the aquatic environment. Organic farming, pastoral and wild harvest systems should fit the cycles and ecological balances in nature. These cycles are universal but their operation is site-specific. Organic management must be adapted to local conditions, ecology, culture and scale. Inputs should be reduced by reuse, recycling and efficient management of materials and energy in order to maintain and improve environmental quality and conserve resources. Organic agriculture should attain ecological balance through the design of farming systems, establishment of habitats and maintenance of genetic and agricultural diversity. Those who produce, process, trade, or consume organic products should protect and benefit the common environment including landscapes, climate, habitats, biodiversity, air and water.
Principle of Fairness	**Principle of Care**
Organic Agriculture should build on relationships that ensure fairness with regard to the common environment and life opportunities. Fairness is characterized by equity, respect, justice and stewardship of the shared world, both among people and in their relations to other living beings. This principle emphasizes that those involved in organic agriculture should conduct human relationships in a manner that ensures fairness at all levels and to all arties – farmers, workers, processors, distributors, traders and	Organic Agriculture should be managed in a precautionary and responsible manner to protect the health and well-being of current and future generations and the environment. Organic agriculture is a living and dynamic system that responds to internal and external demands and conditions. Practitioners of organic agriculture can enhance efficiency and increase productivity, but this should not be at the risk of jeopardizing health and well-being. Consequently, new technologies need to be assessed and existing methods reviewed. Given the incomplete understanding of ecosystems and agriculture, care must be taken.

Continued

consumers. Organic agriculture should provide everyone involved with a good quality of life, and contribute to food sovereignty and reduction of poverty. It aims to produce a sufficient supply of good quality food and other products. This principle insists that animals should be provided with the conditions and opportunities of life that accord with their physiology, natural behaviour and well-being. Natural and environmental resources that are used for production and consumption should be managed in a way that is socially and ecologically just and should be held in trust for future generations. Fairness requires systems of production, distribution and trade that are open and equitable and account for real environmental and social costs.	This principle states that precaution and responsibility are the key concerns in management, development and technology choices in organic agriculture. Science is necessary to ensure that organic agriculture is healthy, safe and ecologically sound. However, scientific knowledge alone is not sufficient. Practical experience, accumulated wisdom and traditional and indigenous knowledge offer valid solutions, tested by time. Organic agriculture should prevent significant risks by adopting appropriate technologies and rejecting unpredictable ones, such as genetic engineering. Decisions should reflect the values and needs of all who might be affected, through transparent and participatory processes

These principles mean that organic farming also gains different advantages such as the fact that the market price for such products is higher (Scialabba and Hattam 2002); the methods of production involve less intensive use of land (Dahama 1997, Sharma 2001) there is a better balance between supply and demand, a better quality of food products (Scialabba and Hattam 2002, Hasbani 2004), better protection of the environment, and it is more labour-intensive than conventional farming providing on-farm employment (Sharma 2001). The advantages can be divided into natural capital and human capital (Wolf 2001). The natural capital advantages include improvement in the structure and fertility of the soil, operation of closed cycle systems using local resources, livestock conditions that conform to their needs, maintenance and encouragement of wildlife and their habitats, reduction in the use of non-renewable resources and pollution. The human capital advantages include production of food of high nutritional quality in sufficient quantity, enabling producers to earn a living and to develop their potentials, systems that are aesthetically pleasing, and decentralised systems for local processing, distribution and marketing (Wolf 2001). Another advantage is that organic farming does not ignore the knowledge of farmers. This knowledge is down-valued and dismissed in the productivist paradigm (Cabaret 2003). Cabaret (2003) argues that the process of organic conversion involves farmers in a new set of relationships in which their local knowledge is respected and harnessed. It can be maintained that farmer actions are primarily knowledge-based and divided into four types of knowledge:

1. Know-what: knowledge of facts;
2. Know-why: scientific knowledge of principles and laws of nature;
3. Know-how: this refers to the ability to do something;
4. Know-who: this involves information about who knows what and who knows how to do something.

(Cabaret 2003: 105-106)

Organic farming, on the other hand, has some downsides. Rigby, Young, and Burton (2000) concluded that organic farming practices could be associated with different problems such as yield reductions; higher weed, pest and disease infestation; lower livestock performance, lack of marketing opportunities and premium prices; refusal of loans or insurance for organic production; and lack of legislation, subsidies and certification bodies. In organic farming pesticides are eliminated, therefore, some crops can suffer losses due to the problems of diseases and pest infestation (Stacey 2004). Research studies have also demonstrated that without proper management, organic farming practices can create environmental problems as conventional farming practices do. Potential environmental concerns associated with the practice of organic farming have been traced to the transition period from conventional farming to organic farming practices, unmanaged applications of manure, improper timing of green manure plowdown and improper storage of manure or compost materials (Bellows 2002). Problems might also arise when general organic farming management concepts are implemented in a prescriptive manner that does not account for the local context. Moreover, Bellows (2002) pin-points five environmental problems that may be associated not only with conventional farming but also with the merely prescriptive implementation of organic farming practices. These are: nutrients leaching and runoff, soil erosion, pathogens transport into water bodies, pesticides leaching or runoff, and heavy-metal accumulation in soil. Litterick, Watson, and Atkinson (2002) confessed that crop protection in organic farming systems is not a simple matter. They further stressed that weeds, pests, diseases control could be some of the problems militating against organic farming practices. For instance weeds are more prevalent on organic farming systems (Stacey 2004). Another related issue is that some botanical pesticides used in organic farming systems are toxic to non-target organisms. For example, Rotenone is toxic to fish and pyrethrum kills beneficial as well as disease-causing insects, while Diatomaceous earth controls insect pests because of its irritant, physically-disruptive properties, however it can also be a strong irritant of human lung tissue if not handled with care. Also if plant nutrients and substances with relatively low toxicity are applied at excessive rates, they would be contaminants specially if they were close to water sources, or during times when heavy rainfall or flooding is expected (Bellows 2002).

2.6. Organic farming and the environment

> Today, the adoption of high-yielding, uniform cultivars and varieties has led to a considerable reduction in the number of plants and animals used in agriculture. Only 120 cultivated plant species and 14 mammalian and avian species provide 90 percent of human food supply.
>
> (Scialabba and Hattam 2002: 36)

The statement mentioned above [by Scialabba and Hattam (2002)] emphasises that there is a critical risk facing biodiversity and the environment as a result of the production systems used in agriculture. Therefore, there is a need for serious thinking about having a production system that safeguards the environment and feeds humans at the same time. Several authors (Lampkin 1990, Lampkin 1994a, Sharma 2001, Scialabba and Hattam 2002, Burton, Rigby, and Young 2003) have emphasised that this system is ‘organic farming’, which benefits the environment through aiming to stop degradation and to re-establish natural balance. In this system, it is not allowed for farmers to use synthetic agrochemicals, and this safeguards biodiversity and ecological diversity, and limits the disruption to the environment caused by other food production systems (Lampkin 1990, Scialabba and Hattam 2002, Soil Association 2003). This means that food production in organic farming does not rely on chemicals (Scialabba and Hattam 2002), while in conventional farming it depends largely on the use of fossil fuel-based inputs such as fertilisers, pesticides, herbicides and labour-saving but energy-intensive farm machinery (Dahama 1997, Sharma 2001). Scialabba and Hattam (2002) argue that only organic farming has succeeded in providing ecosystem functions and socio-economic goods, while other ecological farming schemes have not. This can be explained because organic farming as a production system combines several aspects such as pest ecology, plant ecology and soil ecology and other farming management elements in one approach to achieve ecological farming. These aspects are considered individually in other farming systems, such as IPM, IPNS and conservation tillage (Scialabba and Hattam 2002). As a result it can be said that organic farming as a holistic approach is more friendly to the environment than conventional farming (Sharma 2001, Scialabba and Hattam 2002, Pacini *et al.* 2004, Kings 2005) since it has the potential to provide benefits in terms of environment protection, improving food quality and conservation of non-renewable resources (Lampkin 1994a, Sharma 2001, Scialabba and Hattam 2002). Therefore, a question can be raised: 'does organic farming benefit the environment only because agrochemicals are prohibited?'. This question has been answered by several authors (Lampkin 1990, Lampkin 1994a, Sharma 2001, Scialabba and Hattam 2002, Burton, Rigby, and Young 2003, Dabbert, Häring, and Zanoli 2004) who emphasise that organic farming benefits the environment not only because agrochemicals are prohibited but also because organic farming aims to stop degradation and restore natural balance through its principles and its regulations, which are discussed below. As a result, organic farming cannot be a source of risk of agrichemical pollution of ground and surface waters (Sharma 2001, Scialabba and Hattam 2002). This argument cannot be generalised because organic farming, like any farming activity, affects the natural environment (Lampkin 1990, Hasbani 2004), simply '-within agriculture, as within nature-everything affects every thing else' (Lampkin 1990: 5).

In general, organic farming has a positive impact on the environment, but scientific evidence is required to prove this. Therefore, several studies have been conducted to evaluate this impact. One of these studies (Table 2.1) was conducted in Germany and the Netherlands, and showed that under Western European conditions nitrate leaching rates per hectare are significantly lower in organic farming than in conventional farming systems (Scialabba and Hattam 2002).

Table 2.1: Nitrate leaching rates per hectare from organic agriculture compared to conventional agriculture systems- assessed by different authors (Scialabba and Hattam 2002)

Reduction rates	Author
50%	Smilde (1989)
> 50%	Vereijken (1990)
57%	Paffrath (1993)
40% (sand) / 0% (loam)	Blume *et al.* (1993)
50%	Reitmayr (1995)
40%	Berg *et al.* (1997)
64%	Haas (1997)

It is not possible to present all of these studies in this research. Therefore, a famous study on the impact of organic farming on the environment is presented and explained below (Table 2.2). This study shows that to prove that organic farming benefits the environment, there must be indicators [to be used] to find whether organic farming has a positive environmental impact or not. The study is a comprehensive environmental impact assessment study carried out by Stolze *et al.* (2000) comparing organic farming with conventional or integrated farming in Europe. The study compared organic farming with conventional farming in most categories of performance. Table 2.2 shows the final average assessment and the confidence interval of this study under the European conditions. The study included an extensive analysis of the environmental impacts and the conclusion from this study was that organic farming has a less detrimental environmental impact than conventional farming per hectare (Dabbert, Häring, and Zanoli 2004). Accordingly, organic farming performed better than conventional farming in several categories. The study concluded that there was no conclusion for two categories, climate and air, and animal health and welfare, which both require more research (Dabbert, Häring, and Zanoli 2004). The study shows that organic farming benefits the environment more than conventional farming.

Table 2.2: Indicators of organic farming on the environment (Modified from Stolze *et al.* 2000 and Scialabba and Hattam 2002)

	Organic agriculture performance				
Indicator	**Much better**	**Better**	**The same**	**Worse**	**Much worse**
A. Biodiversity and landscape		S			
• Floral diversity		S			
• Faunal diversity		S			
• Habitat diversity			S		
• Landscape			S		
B. Soil		S			
• Organic matter		S			
• Biological activity	S				
• Soil structure			S[a]		
• Soil erosion		S			
C. Ground and surface water		S			
• Nitrate leaching		S			
• Pesticides	S				
D. Climate and air			S		
• CO_2		S			
• N_2O			S		
• CH_3			S		
• NH_3		S			
• Pesticides	S				
E. Farms input and output		S			
• Nutrient use		S			
• Water use			S[a]		
• Energy us		S			

a: assessment difficult due to lack of data
S= subjective average assessment
Shaded area is confidence interval

The positive impact of organic farming on the environment has encouraged several governments to issue regulations to promote organic farming, a process which is discussed below. For example, the EU implemented the regulation EC Reg. 2092/91 and 2078/92 to promote organic farming, which is discussed below (Dabbert, Häring, and Zanoli 2004).

2.7. Development and state of organic farming

The development of organic farming over the periods mentioned above (Section 2.3) is not only in terms of land and number of farms but also in legal development as well. In Europe, for example, organic farming started with a number of farms converting to organic farming during the sixties (Willer and Yussefi 2001, Yussefi and Willer 2002). During the seventies and eighties organic farming was able to gain political and state support and subsidies for environmental reasons, which led to the development of markets for organic farming products by the end of the 1980s. As a result, it can be said that the legal development of organic farming had started by the 1990s and became an agricultural policy instrument after being in opposition to the agricultural policy establishment for many years (Dabbert, Häring, and Zanoli 2004).

2.7.1. Land area under organic farming management

Organic farming has increased rapidly in terms of land area and number of farms (Table 2.3), and it is practised in nearly all countries of the world (Dabbert, Häring, and Zanoli 2004, Yussefi 2005). And if it is not applied as a certified organic farming system, it can be assumed that some of its methods such as crop rotations are practised where no statistics are available (Yussefi 2004). These methods such as crop rotations can be applied in organic farming and also in conventional farming (Dabbert, Häring, and Zanoli 2004). It is also believed that the future trend is for continued growth of organic farming, not only in terms of land area but also in market size (Hamm, Gronefeld, and Halpin 2002, Dabbert, Häring, and Zanoli 2004, Sahota 2005, Yussefi 2005, Yussefi 2006). A remarkable growth has been reported in the EU where the area under organic farming management increased significantly, by 43.9% between 1993 and 2000 (Hamm, Gronefeld, and Halpin 2002). In Asia the area increased 90% between 2000 and 2006 (Yussefi 2006). The latest organic faming statistics show that it is practised in about 120 countries of the world (Figure 2.2) covering a cultivated area of ca. 31 million hectare, representing 623174 farms, while the wild certified area is approximately 19.7 million hectares (Yussefi 2006).

Table 2.3: Number of farms and land area under organic farming management per continent (Modified from: Yussefi and Willer 2002, Yussefi 2003, Yussefi 2004, Yussefi 2005)

Continent	Year 2002		Year 2003		Year 2004		Year 2005	
	Farms	Area ha	Farms	Area ha	Farms	Area ha	Farms	Area ha
Africa	12800	59567	39375	235825	71352	320943	118428	435154
Asia	16256	94174	60394	590810	61595	881511	736312	65992
Europe	143070	4252930	175816	5149162	174257	5566599	166731	6284234
Latin America	34301	3718519	75799	4743813	142622	5821792	189813	6211184
North America	38190	1325876	45047	1523754	10459	1428700	15315	1446921
Oceania	2367	7705389	2373	10567903	2190	10050465	2170	11334465

Two points can be noted from Table 2.3. The first is that there is no relation between the area of organic farming and the number of farms: for example, Oceania in 2005 had the largest area of organic farming (ca. 11334465 ha) but the lowest number of farms, 2170, while Asia had the lowest organic faming area (ca. 3% of the total) but has 21.2% of the total organic farms. This can be explained by the fact that most of the organic farming area in Oceania is extensive grazing land, while in Africa and Asia organic production is mainly of cultivated crops. The second point is that the extent of the organic farming land area does indicate whether organic production is enough for a country. For example, Australia has the largest area, ca. 11.3 million hectares, but Australia has to import organic products from other countries (Yussefi 2003). However, Australia also has the highest share of world organic livestock with 10% of cattle, 30% of sheep and 1% of pigs (Borell and S⌀rensen 2004). Arable land comprises less than half of the world organic land area: the organic land in Australia and Argentina is extensive grazing land, where extensive livestock systems are very suitable for dry land conditions (Yussefi 2003).

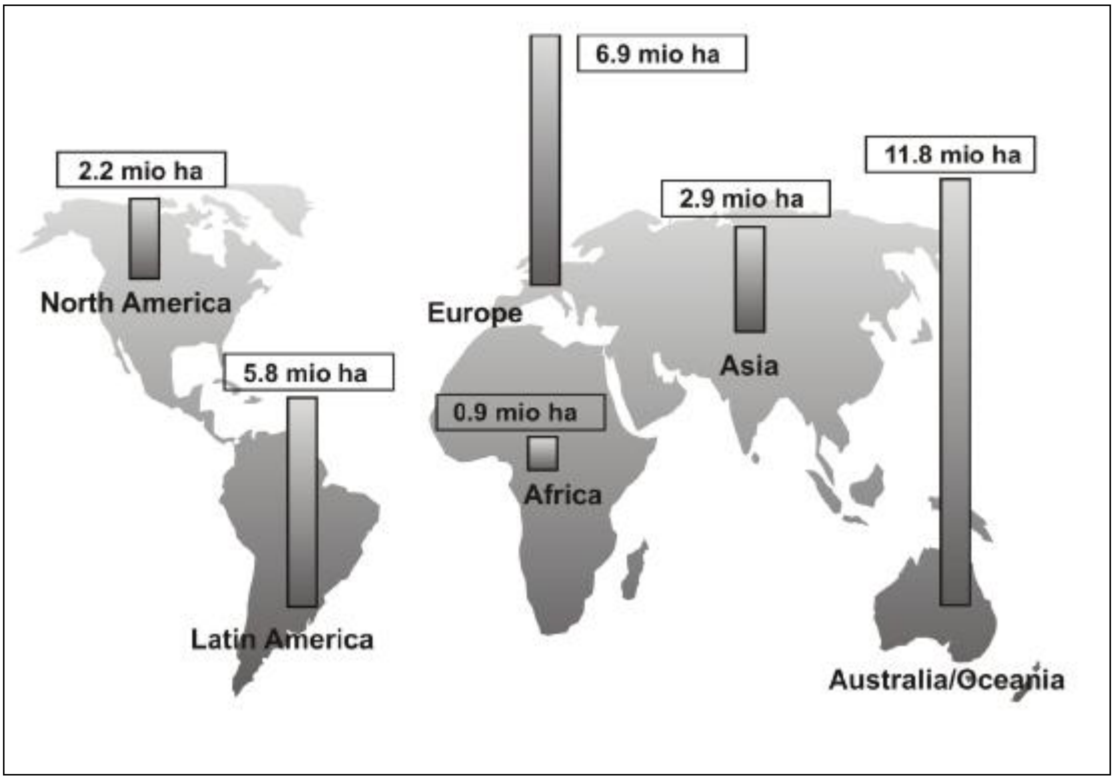

Figure 2.2: Distribution of organic farming per content (Source: Yussefi and Willer 2007)

According to these statistics, the largest organic farming area in 2006 was in Oceania ca. 39%, Europe 21%, Latin America 20%, North America 4%, Asia 13% and Africa 3% (Figure 2.3).

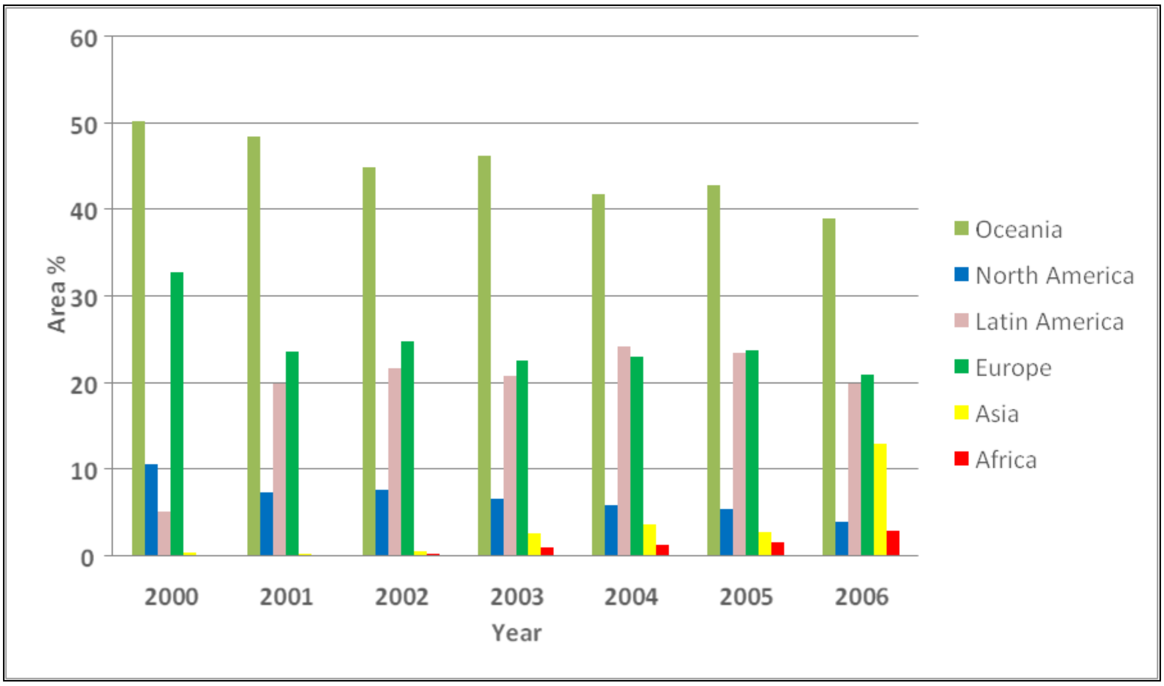

Figure 2.3: Development of organic farming area according to continent (Modified from: Willer and Yussefi 2000, Willer and Yussefi 2001, Yussefi and Willer 2002, Yussefi 2003, Yussefi 2004, Yussefi 2005, Yussefi 2006)

Figure 2.3 shows that there has been a decline in the area percentage share in Oceania, North America, and Europe because of a significant increase in Latin America, Africa and Asia. Borell and Sørensen (2004) and Niemeyer and Lombard (2003) believe that there are two important factors contributing to the increase in the growth of organic farming: the consumer awareness of food safety issues and environmental concerns, and government policy support in terms of environmental impact. But Yussefi (2005) suggests that these are not the only reasons for this increase: the apparent increase in the organic land area also resulted from more access to better and updated statistical information. Other important factors are the motivation by farmers to maintain and build soil fertility on land threatened by degradation and erosion, and growth in demand in industrialised countries, which has encouraged the growth of organic farming in other parts of the world, such as Africa (Yussefi 2005).

Organic faming statistics have been collected by the Foundation Ecology and Agriculture (SÖL) since 1999, and since the publication of the 2003 results collaboration has been made with the Research Institute of Organic Agriculture (FiBL) and IFOAM to collect such information (Yussefi 2006). Access to information on land use was also greatly improved by the SOEL-FiBL survey sent to a list of organic farming experts and conference participants updated every year to provide more information about certified and non-certified organic farming production in their countries (Sthamer 2007).

2.7.2. Organic farming market

The organic food and drinks market has had a remarkable growth (Figure 2.4) and is increasing rapidly in both developed and developing countries (Barrett *et al.* 2001, Dabbert, Häring, and Zanoli 2004, Rosati and Aumaitre 2004, Sahota 2005, Sahota 2006, Yussefi 2006). It was estimated that this market increased by 43% between 2002 (US$ 23 billion) and 2005 (US$ 33 billion) (Yussefi and Willer 2007). Figure 2.4 shows the estimated increase in the global organic food market between 2000 and 2006, of which Europe was the largest market, US$ 17 billion, and the USA was the largest single country market, US$ 14.9 billion (Sahota 2007). This remarkable growth is due to growing demand within developed countries and domestic markets in developing countries (Dabbert, Häring, and Zanoli 2004, Sahota 2005, Sahota 2006), the increase in consumer awareness (Sahota 2006), the change in consumer preferences towards better health, and the environmental awareness of products from sustainable production systems (Niemeyer and Lombard 2003, Rosati and Aumaitre 2004, Taher 2004), and to consumers' attitudes to buying high quality and ethical products, to taste, nature conservation, animal welfare and non-Genetically Modified Organisms (non-GMO) (Harper and Makatouni 2002, Herrmann 2004b). In some countries such as China and Malaysia increased education and purchasing power are important factors in the market development (Sahota 2006).

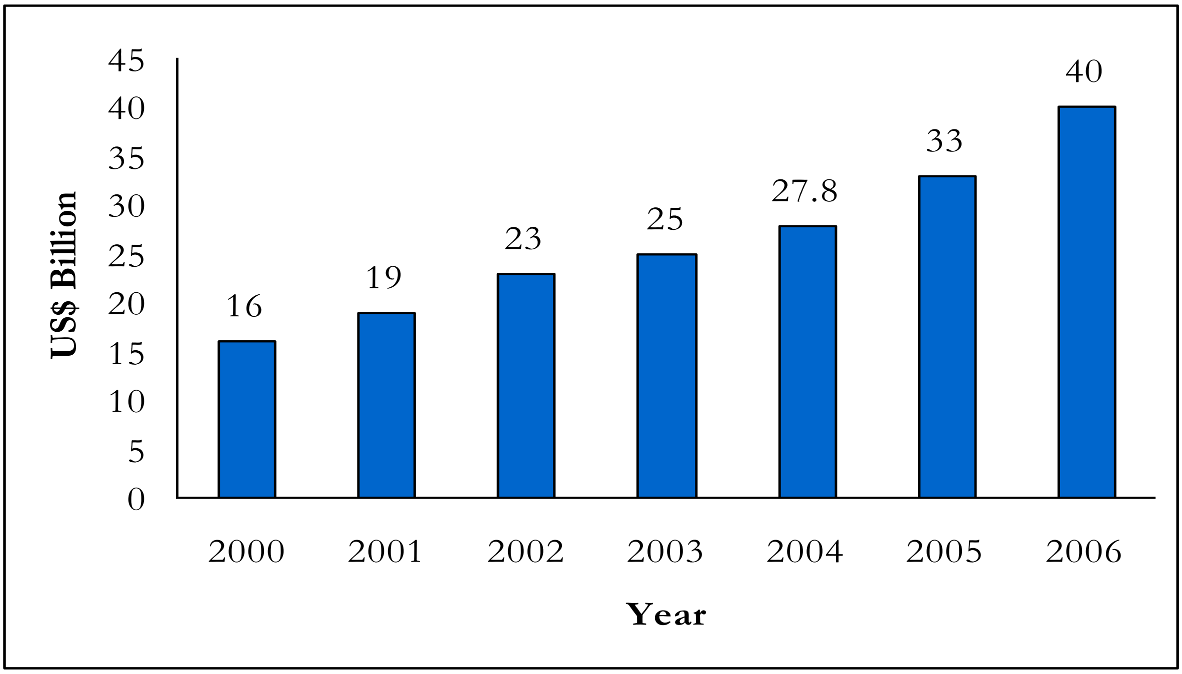

Figure 2.4: Growth of the global organic food and drinks market 2000-2006 (Modified from: Willer and Yussefi 2000, Willer and Yussefi 2001, Olesen 2003, Sahota 2004, Sahota 2005, Sahota 2007)

Consumers' awareness has played an important factor in increasing the market. This can be clearly seen in Europe, where consumers have more experience of the quality and meaning of organic food (Rosati and Aumaitre 2004). This awareness developed as a reaction to problems with conventional food products, including animal products, such as *Listeria, Salmonella, Escherichia coli*, BSE, tuberculosis, swine fever, and foot and mouth disease (Rosati and Aumaitre 2004), which have encouraged consumers to buy more organic food (Rosati and Aumaitre 2004, Sahota 2006). A typical consumer of organic food is said to have the following attributes:

1. Location–lives in urban areas, usually in a big city
2. Buyer Behaviour–discerning towards food and drink purchases, considering factors like quality, provenance and production methods
3. Demographics– typically well-educated and belongs to middle-high social classes
4. Purchasing Power–in a medium to high-income household with relatively high purchasing power

(Sahota 2004: 21)

The estimates of the market depend on the trade estimates of retail market sizes due to the lack of official foreign trade statistics (Yussefi and Willer 2002). It was estimated by the ICT that the retail market (in 16 European countries, USA and Japan) was US$ 10 billion, US$ 16 billion, US$ 19 billion in 1997, 2000 and 2001 respectively (Olesen 2003). In 2002 the global organic market was valued at US$ 23 billion (Sahota 2004) and in 2003 increased by 7-9 % to reach US$ 25 billion (Sahota 2005). It increased by a further 9% to reach US$ 27.8 billion in 2004 (Sahota 2006). In 2004, this market was divided as US$ 13.7 billion in Europe, US$ 13 billion in North America, US$ 750 million in Asia and US$ 250 million Oceania (Sahota 2006).

This shows that in general there is a growing demand for organic products, but this is not distributed equally. It is mainly concentrated in North America and Europe, which in total is about 96% of the total global market (Figure 2.5). It can be noted from Figure 2.5 that there is no relation between area under organic farming management and the market size. It can be also noted that a region's population is not an important factor for market growth. This can be seen from Asia which is 60% of the world population but the Asian organic food market is only US$ 750 million. Two factors are reported by Sahota (2005) to be responsible for the concentration of the revenues in the most affluent countries of the world:

- The price premium of organic products restricts demand to countries where consumers have high purchasing power. This explains why most sales are in countries where there is a sizeable middle-class population. This is also a reason why large cities represent most sales in many Asian countries.

- Education or awareness of organic products is important. As consumers become more educated and informed of agricultural and food issues, they are more inclined to buy organic products whether it be because of factors like food safety, concern for the environment, or health reasons.

(Sahota 2005: 22)

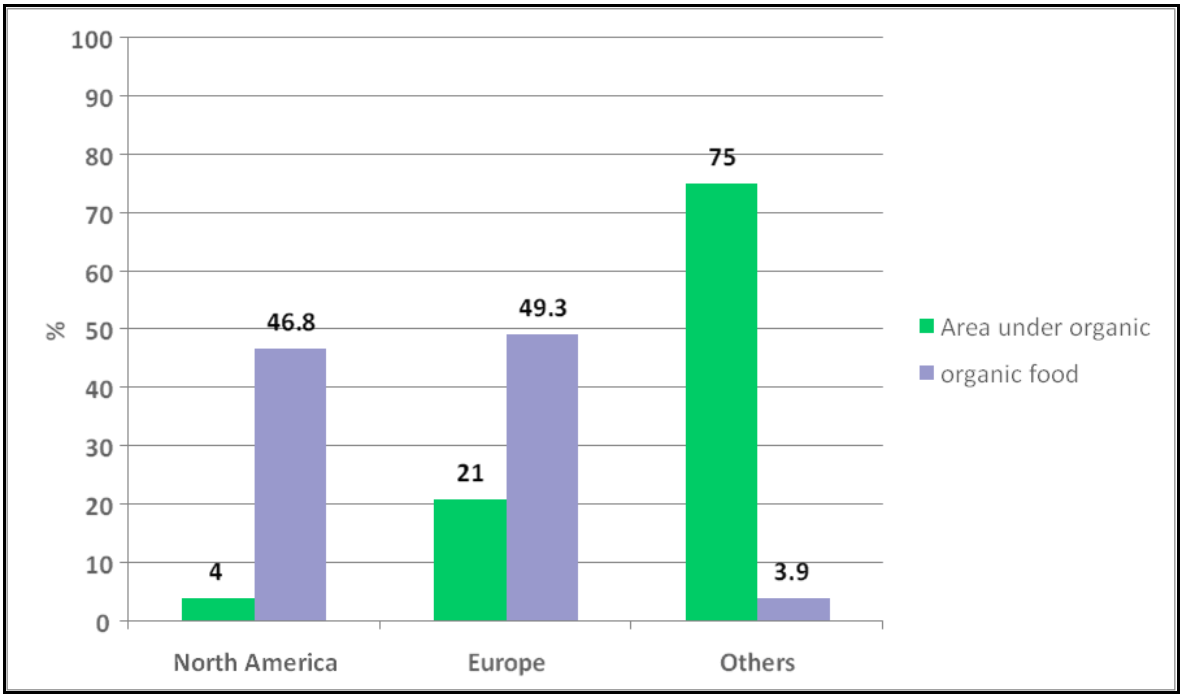

Figure 2.5: Comparison of the global food market (2004) with the area under organic management (Modified from: Yussefi 2006, Sahota 2006)

Despite the remarkable growth of this market, there are still some significant barriers which make this market small in some parts of the world. For example, in Africa lack of awareness, low income levels, lack of local organic standards and other infrastructure for local market certification result in small markets for organic produce (Parrott *et al.* 2006). In Europe and North America these factors are not such barriers to the development of the market. For example, price is a concern for European consumers, but they are more concerned about quality, health, and diet issues (Rosati and Aumaitre 2004).

In Europe, organic supply continues to lag behind demand, which can be met by importing from elsewhere, including developing countries (Rosati and Aumaitre 2004). For example, in the UK around 70% of organic food sold in 2001 was imported (Barrett *et al.* 2001). The rapid growth of markets also has been attributed to consumers' concerns with the quality and safety of food [health] and environment protection issues (Scialabba and Hattam 2002). The growth in consumers' demand for organic food has been attributed to a response to various food-scares including widespread concern and resistance to the introduction of genetically modified organisms in the food chain (Padel and Foster 2005: 609). For example, the crisis over dioxin-contaminated food and livestock diseases (such as Bovine Spongiform Encephalopathy (BES) and foot-and-mouth in Europe) further increased demand for organic food (Scialabba and Hattam 2002: 6). The health reasons as motivation for consumers to buy organic food have been mentioned in several studies (Padel 2001, Harper and Makatouni 2002, Padel and Foster 2005, Sharma 2005, Tarkiainen and Sundqvist 2005) and one of the reasons for consumers to shift to organic faming is the health issue (Sharma 2005). In particular, consumers believe that organically grown foods are free of chemical residues (Harper and Makatouni 2002, Padel and Foster 2005). However, it cannot be generalised that organic products are completely free of residues, due to general environmental pollution (Scialabba and Hattam 2002).

Scientific evidence about the superior quality of food organically produced has been reported, for example by Lampkin (1990: 7) who reported that there is growing scientific evidence about the positive quality aspects of organically produced food, for example higher dry matter and vitamin content and improved storage. Another example, is a study in the USA on vegetables found that on an average the mineral levels in food organically produced was about twice that of conventionally, and the study found that on an average organic apples, potatoes, pears, wheat and sweet corn had 63% more calcium, 78% more chromium, 73% more iron, 118% more magnesium, 178% more molybdenum, 91% more phosphorus, 125% more potassium and 60% more zinc comparable to food conventionally produced (Navdanya 2006). However, Padel and Foster (2005:609) showed that the main driving force behind expected health benefits for consumers could be the absence of residues, but that altruistic motives (such as concerns for the environment and animal welfare) are becoming important. Having said that, consumers still have barriers to buy organic products. Tarkiainen and Sundqvist (2005) suggested two important barriers to buying organic food: the high price and availability. This has been also reported by Harper and Makatouni (2002), Rosati and

Aumaitre (2004), and Padel and Foster (2005). Other barriers reported by Padel and Foster (2005) were lack of information, visual product quality and presentation, access and availability. Although organic products do have a higher price, many consumers consider this to be justified (Rosati and Aumaitre 2004). However, despite the price being important, Padel and Foster (2005: 623) conclud that it is possible that the price significance could be diminished, if consumers were made more aware of the reasons for the higher price and convinced that organic food is a value-for-money choice. As for availability, Rosati and Aumaitre (2004) report that among consumers in the EU who are non-buyers, there are many with problems finding organic food. Rendering organic food more available will change, almost automatically, some non-buyers into buyers. Therefore, greater availability of the products is needed to improve the organic food market (Rosati and Aumaitre 2004, HDRA 2006).

2.8. Organic farming regulation framework and standards

Organic farming differs from other farming systems not only because of its production methods, but also because it is defined and practised according to specific regulations. In this respect, it is also different from many other alternative farming systems in that it has a history of regulation (Cabaret 2003). According to its regulations both producers and processors must work according to certain standards to sell their products as organic (Herrmann 2006). The regulations are introduced to ensure the authenticity of organic farming production. The regulations have developed into a comprehensive framework to cover all the organic production components: crops, livestock, inspection procedures, labelling, processing, marketing, and the export and import of organic products from and into countries (Kilcher, Huber, and Schmid 2004). Accordingly, the important thing on the organic farming standards is:

> The recognition that standards cannot hope to define the end product in terms of chemical residues or other quality characteristics, as some national governments have tried to do. Standards for organic produce must be based on the production

> system- it is that which is being guaranteed, not the end product as such. This also means that accurate labelling is essential; descriptions such as 'produce from organic farming system' and 'organically grown food', although less snappy than 'organic food', are less likely to cause confusion and misunderstandings
>
> (Lampkin 1990: 448)

Organic farming regulations ensure that consumers are protected from pseudo-organic products and producers are protected from unfair competition, and they also help to facilitate trade (Kilcher, Huber, and Schmid 2004). Therefore, several countries have implemented or are in the process of drafting regulations (Yussefi 2004). According to Kilcher, Huber, and Schmid (2004) the regulations can be divided into:

1. International: includes the International Federation of Organic Agriculture Movements (IFOAM) Standards and the Codex Alimentarius, discussed below;
2. National and supranational: includes the EU Regulation on organic production and other national regulations, discussed in Section (2.8.2).

2.8.1. IFOAM

IFOAM is the International Federation of Organic Farming Movements (Lampkin 1990, IFOAM 2002, Yussefi and Mitschke 2003, Kilcher, Huber, and Schmid 2005, Baraibar 2006) having about 770 members in about 108 countries (Baraibar 2006). IFOAM aims to promote organic farming (Harris *et al.* 2003), sets the baseline standards and common regulations in which national bodies can develop their own standards (Lampkin 1990, IFOAM 2002, Kilcher, Huber, and Schmid 2006), safeguards organically-produced foodstuffs, protects consumers (Dabbert, Häring, and Zanoli 2004), and provides accreditation to certification bodies that meet IFOAM standards (Barrett *et al.* 2002).

The IFOAM standards are called the IFOAM Basic Standards (IBS) (IFOAM 2002, Kilcher, Huber, and Schmid 2005, Kilcher, Huber, and Schmid 2006), which help to provide a framework for certification bodies and standard-setting organisations worldwide to develop their own certification standards, and cannot be used for certification on their own (Kilcher, Huber, and Schmid 2006, IFOAM 2002). They were published for the first time in 1980 and they are subject to biennial review and republication (Kilcher, Huber, and Schmid 2005). In some cases, the standards are used by countries to decide whether produce grown to one set of national standards are acceptable for import (Lampkin 1990). IFOAM has also different activities such as conferences, research seminars and a multi-lingual magazine, the IFOAM Bulletin, to encourage the exchange of information and ideas (Lampkin 1990).

The IBS presented as:

a) General Principles:

Are the intended goals of organic production and processing. The principles are written as positive statements, using words such as "is" or "are". For example "Organic livestock husbandry is based on the harmonious relationship between land, plants, and livestock; respect for the physiological and behavioral needs of livestock and feeding of good-quality organically grown feedstuffs".

b) Recommendations

Are practical suggestions for operators to implement in organic farm, food, and fiber systems. IFOAM promotes the recommendations as desirable practices, but does not require operators to use them. They are written with the word "should". For example "Handlers and processors should identify and avoid pollution and potential contamination sources."

c) Basic Standards

Are the minimum requirements that an operation must meet to be certified organic. All of the Standards applicable to the particular farm and enterprise must be met before the operation may be certified as organic. Basic Standards use "shall". For example "All ruminants shall have daily access to roughage.

d) Derogations

Are the exceptions made to specific sections of the Basic Standards that may only be applied under clearly defined conditions.

(IFOAM 2002: 8-9)

2.8.2. The Codex Alimentarius

Organic farming has not been considered only by private bodies, IFOAM and state authorities, but also by the UN organisations FAO and WHO through a joint food standard programme called Codex Alimentarius (CA) (Codex Alimentarius 2001, Kilcher, Huber, and Schmid 2004, Kilcher Huber, and Schmid 2005). The CA programme began in 1991 (Kilcher, Huber, and Schmid 2004), and is considered as a global reference point for producers, consumers, processors, governments, national food control agencies and the international food trade (Harris *et al.* 2003). FAO is interested in organic farming because it has three reasons consistent with the FAO's objectives. These reasons consider that organic farming is:

- A mode of production that aims at utilising natural resources in a sustainable way, which is an objective of the FAO.
- Based on technologies that prevail in parts of the developing countries and can provide employment and income for poor farmers who gain access to these market opportunities.
- Pursued with the declared objective of contributing to food quality and safety, which is a concern of FAO.

(de Haen 1999)

The CA committee on food labelling has developed international guidelines for organic farming production to protect consumers, facilitate trade and help governments wishing to develop their own standards, especially developing countries or countries in transition (De Castro, Fersino, and Petruzzella 2002, Codex Alimentarius 2003, Kilcher, Huber, and Schmid 2004, Kilcher, Huber, and Schmid 2006), through formulating and harmonising food standards and ensuring their global implementation (Harris *et al.* 2003). The first guidelines were produced on plant production by the Codex Commission in June 1999, while guidelines on animal production were approved in July 2001 (Kilcher, Huber, and Schmid 2006). It is important to report here that the requirements in Codex Guidelines are in line with IBS and with the EU Regulation 2092/91 and 1804/99, which are discussed below (Kilcher, Huber, and Schmid 2004). The guidelines set rules to regulate organic production and labelling of organic products in all countries. The aims of these guidelines are to:

- Protect consumers against deception and fraud in the market place and unsubstantiated product claims;
- Protect producers of organic produce against misrepresentation of other agricultural produce as being organic;
- Ensure that all stages of production, preparation, storage, transport and marketing are subject to inspection and comply with these guidelines;
- Harmonize provisions for the production, certification, identification and labelling of organically-grown produce;
- Provide international guidelines for organic food control systems in order to facilitate recognition of national systems as equivalent for the purposes of imports and

- Maintain and enhance organic agricultural systems in each country so as to contribute to local and global preservation.

(Codex Alimentarius 2003: 4)

2.8.3. EU regulation on organic production

In addition to the international regulations discussed above it is important to understand the EU regulations on organic farming. This is because the EU regulations lead the world, are well developed, updated, and have exercised a strong influence on the development of organic regulations in other parts of the world (Dabbert, Häring, and Zanoli 2004).

Organic farming in the EU is governed by strict regulations in which foods cannot be labelled as organic if the regulations are not followed (Borell and Sørensen 2004). The strict regulations are introduced by the EU to protect organic farming from fraudulent practices (Tate 1994, Stolze *et al.* 2000, Stocker 2001, Cabaret 2003), consumers from unfair competition and from pseudo-organic products (Kilcher, Huber, and Schmid 2006), and also to define the nature of organic produce and protect consumers and producers from misleading claims about products' quality and production methods used (Kilcher, Huber, and Schmid 2004). The EU regulations govern both plant production by EU Reg. 2092/91 and animal production by 1804/99 (Kilcher, Huber, and Schmid 2006, Harris *et al.* 2003). The EU organic farming regulations are applied at two levels, a) EU regulation and b) national regulations (Cabaret 2003). The national regulations are based upon the EU Reg. 2092/91 and IFOAM, but tend to be more specific than IFOAM Standards or EU Reg. 2092/91 (Stolze *et al.* 2000).

i. EU Reg. 2092/91

The EU Reg. 2092/91 was approved by the EEC Council in June 1991 (Browne *et al.* 2000, Barrett *et al.* 2002) and came into force in 1993 to govern the labelling of plant products as organic (Kilcher, Huber, and Schmid 2005). The EU Reg. 2092/91 (Barrett *et al.* 2002, Kilcher, Huber, and Schmid

2006) provides a legal framework for organic farming within the EU based on the subsidiarity principle and for its implementation through which organic produce is produced and processed, labelled, controlled and marketed (Stolze *et al.* 2000, Barrett *et al.* 2002, Kilcher, Huber, and Schmid 2005). It is also a legal framework which regulates organic products whether they were produced within the EU member states or imported (Stolze *et al.* 2000, Barrett *et al.* 2002, Cabaret 2003, Harris *et al.* 2003, Kilcher, Huber, and Schmid 2006). The EU Reg. 2092/91 is implemented in each member state by a national 'competent authority' (Harris *et al.* 2003) which is also important both for export and the development of local markets to support consumer culture and trust (De Castro, Fersino, and Petruzzella 2002). Therefore, all imported products have to meet the EU Reg. 2092/91 and be labelled as organic, a point which is discussed below (Kilcher, Huber, and Schmid 2005).

ii. EU Reg. 1804/99

The EU Reg. 2092/91 provides the determining standards for organic plant production within the EU, but did not provide standards for organic animal husbandry until August 1999 (Stolze *et al.* 2000). Therefore, in 1999, the EU adopted legislation for organic animal husbandry under EU Reg. 1804/99 (Lund and Algers 2002, Harris *et al.* 2003, Kilcher, Huber, and Schmid 2005). The EU Reg. 1804/99 updated EU Reg. 2092/91 (Harris *et al.* 2003) and became law in 2000 (Harris *et al.* 2003, Kilcher, Huber, and Schmid 2006).

iii. EU Reg. 331/200

The Reg. EEC 331/2000 was introduced in 2000 for the recognition of a logo for organic production to be used by organic producers throughout the EU according to the EU organic regulations. Using logos helps consumers to recognise organic products (Dabbert, Häring, and Zanoli 2004). According to the EU Reg. 2092/91 the logo may only be used on organic products where 95% of the ingredients are organic products that originate from the EU and have been processed, packaged and labelled in the EU, or on imports from countries with an equivalent inspection system. But the use of the symbol is voluntary, and it may also be used in conjunction with national government or private logos for identifying organic products. So far only few companies, especially in Southern Europe, are using the EU logo, and their market impact is low (Kilcher, Huber, and Schmid 2005).

2.8.4. Importing into the EU

Organic farming products may be traded freely within the EU member states but strict regulations must be met to import from a non-EU country. To regulate imports from non-EU countries, the EU included Article 11 in EU Reg. 2092/91. This article contains specific rules which must be met to import goods from non-EU countries (Barrett *et al.* 2002, Harris *et al* 2003, Kilcher, Huber, and Schmid 2005). Under Article 11 of EU Reg. 2092/91 (Harris *et al.* 2003), organic products exported to the EU from third countries must be produced, processed, inspected, certified and documented according to equivalent standards of the EU regulation (Harris *et al.* 2003, Kilcher, Huber, and Schmid 2005). This means that the standards must prove comparable effectiveness, but does not mean that the standards must be identical to the EU standards (Harris *et al.* 2003). According to the EU regulations, developing countries are divided into two categories (Table 2.4) to access the EU market:

(a) Access via the list of third countries (Art. 11, paragraphs 1-5) Annex (EEC) 94/92, otherwise referred to as the 'front door' (Harris *et al.* 2003). In this case, a country or certification body may apply to be included in the list of third countries via its diplomatic representatives in Brussels (Kilcher, Huber, and Schmid 2004). To be added to this list, the applicant country must already have enacted organic farming regulations and must have inspection and certification bodies recognised by the EU (Harris *et al.* 2003, Kilcher, Huber, and Schmid 2004).

Table 2.4: Access to the EU market (Modified from Kilcher, Huber, and Schmid 2004)

Access	Country
Access via the list of third countries (Art. 11, paragraphs 1-5)	Argentina, Australia, Costa Rica, Israel, New Zealand and Switzerland
Access via import permit (Art. 11, paragraph 6)	All countries not included on the list of third countries

(b) Access via import permit (Art. 11, paragraph 6), referred to as 'by the back door' (Harris *et al.* 2003). This is for any country not on the list of third countries (Table 2.4), which includes the vast majority of imports into the EU (Kilcher Huber, and Schmid 2004). The general rule applied in this article is that certification bodies operating at the level help importers and exporters to put together all the information and evidence needed to accompany the application for an import permit (Kilcher, Huber, and Schmid 2004). However, under this article, the importing criteria into the EU differs from one EU member to another (Harris *et al.* 2003, Kilcher, Huber, and Schmid 2004). Therefore, import authorisation must be investigated and approved by the national 'competent authority' (Harris *et al.* 2003, Kilcher, Huber, and Schmid 2004).

Importing companies need to apply for import permits from an EU 'competent authority' before they can import products into the EU. To do so, they need to sign an inspection contract with a European certification body and to provide documentation with their applications proving that both organic production standards and certification are EU-equivalent (Harris *et al.* 2003, Kilcher, Huber, and Schmid 2004). There are also two important points to be mentioned here. The first one is that permits are issued for a limited period of time, and the second is that products may not enter the EU before these permits are issued. This can be a significant barrier to organic farming products (see 'Barriers' below), but once the products have reached the EU they can be re-exported to another EU member without further authorisations (Harris *et al.* 2003).

2.8.5. USA regulations

Organic farming in the USA is regulated by the National Organic Program (NOP) which was implemented fully in 2002. According to the NOP regulations, all products are required to be labelled as organic to meet the US standards (Kilcher, Huber, and Schmid 2005). According to these regulations, products must be certified by the USDA and accredited by a certifying agent (Harris *et al.* 2003). However, there are some differences between the EU and the US regulations (Kilcher, Huber, and Schmid 2004). For example, according to the EU regulations imported products should have equivalent production standards and certification and inspection systems, as discussed in the EU regulations above (Kilcher, Huber, and Schmid 2005). But in the case of the US, the regulations are more precise, in that imported products are required to fully meet the NOP provisions and inspectors must be trained on the NOP to conduct the inspection. Moreover, certification bodies should be accredited by USDA to issue certificates but this does not mean that the certification body should be based in the US (Kilcher, Huber, and Schmid 2006).

2.9. Certification and inspection

Certification is defined as a "procedure by which a third party gives written assurance that a clearly identified process has been methodically assessed, such that adequate confidence is provided that specified products conform to specified requirements" (IFOAM 2002: 9). Since the beginning of the 1990s certification has been undertaken by governments, but it was developed first by farmers and private organisations in the 1980s (Herrmann 2004a, Herrmann 2005). It is conducted by a certification body with its own rules, procedures and management for carrying out certification of conformity (IFOAM 2002). This is required since organic farming is regulated by international regulations (Barrett *et al.* 2002, Parrott and Marsden 2002, Dabbert, Häring, and Zanoli 2004), and gives consumers confidence that organic products are produced according to specific standards monitored by private associations or companies, certification bodies, or the state (ITC 2004). Certification can offer other benefits in addition to the assurance that products are produced according to certain procedures. For example, certified organic production potentially offers many livelihood benefits to the farmers involved in the trade (Barrett *et al.* 2002). Complying with the certification regulation would help farmers in developing countries to benefit from the rapid growth of the organic products market in the EU states (Barrett *et al.* 2001). Certification also has another benefit in developing local organic markets and local fresh food markets, which could lead to an increase in cash income from reduced inputs, while a premium price would improve livelihoods through access to health, education and hired labour (Barrett *et al.* 2001).

However, certification carries with it several barriers. It can be demanding for some farmers, traders and processors (Barrett *et al.* 2001, Barrett *et al.* 2002), and thus a significant barrier to entering the organic food market (Parrott and Marsden 2002, ITC 2004). Certification can also be expensive (Dubgaard and Holst 1994, Padel and Lampkin 1994, Barrett *et al.* 2001, Schneeberger, Darnhofer, and Eder 2002), limiting the involvement of smallholders in the organic export trade, as seen in Africa (Barrett *et al.* 2001). The cost becomes a barrier especially when inspection and certification is conducted by foreign organisations (Barrett *et al.* 2001, Parrott *et al.* 2006). Other barriers include lack of national regulations as seen in some of the Mediterranean countries (Al-Bitar 2006). Another certification barrier is the requirement of annual inspection to keep the certificate valid (Barrett *et al.* 2002).

Certification means that both producers and processors are expected to be certified and must meet the required standards to be able to sell their organic products (Kilcher, Huber, and Schmid 2005, ITC 2004). On the other hand, the certifiers and inspectors must also be evaluated and accredited (Herrmann 2004a). Accreditation means a 'procedure by which an authoritative body gives a formal recognition that a body or person is competent to carry out specific tasks' (IFOAM 2002: 9). Therefore, if organic farming is to develop in countries such as Jordan, it is important to reduce the barriers to certification. Moreover, 'certification (including inspection and accreditation) should be reasonably designed to support the credibility of the organic system rather than to spoil it by overburdening it with more and more bureaucratic details' (Herrmann 2005:38). As a result, the IFOAM accreditation programme was established with a goal to achieve harmonisation and to reduce the costs, bureaucracy and duplication of work (Kilcher, Huber, and Schmid 2004).

The latest statistics from Herrmann (2006) show that certification is conducted by 419 certification bodies, most of them in the developed countries (Table 2.5). It can be noted from Table 2.5 that the number of these bodies has increased but it can be also noted that they are distributed unevenly, for example, in 2005 only seven of them were in Africa while Europe had 157 certification bodies (Herrmann 2006). It can be also noted that the number of certification bodies decreased from 419 in 2005 to reach 395 in 2006. This decline is due to the changes in the Japanese organic regulation and a requirement for re-registration of certification, which led to a decline from 69 to 35 organisations (Rundgren 2007).

Table 2.5: Number of certification bodies per continent 2003- 2006 (Herrmann 2006, **Rundgren 2007**)

Continent	**2003**	**2004**	**2005**	**2006**
Africa	7	9	7	8
Asia	83	91	117	93
Europe	130	142	157	160
Latin America and Caribbean	33	33	43	43
North America	101	97	84	80
Oceania	10	11	11	11
Total	**364**	**384**	**419**	**395**

Certification as organic requires several steps to be achieved by producers. These steps are explained in the following Table 2.6.

Table 2.6: Steps for organic farming certification (Modified from: Kuepper 2002**,** Hamdi 2004, and Soil Association 2005)

Step	**Clarification**
Choose a suitable certifier	Membership of prominent and valuable organizations having market recognition of the certifier logo. Accredited by international certification bodies such as IFOAM with appropriate costs of certification
Request and submit the application form	Producers fill the application form, which typically includes an organic farm plan questionnaire, and send it back to the certifier. Also, in this stage the fee form has to be completed and the fee paid
Review the completed form	In this stage the certifier reviews the application to make sure it meets the standards. Producers are asked to submit any additional information required. Then the certifier will start the arrangements for the inspection to take place
Inspection	The certifier assigns an organic inspector and arranges a date for inspection which can be carried out by an inspection body based in or near the producer's country. The inspector looks for all indications that the producer is operating according to their organic plan and is in compliance with organic standards
Inspection report	The inspector reviews with the producer all identified non-compliance issues at the end of the inspection and submits a detailed report to the certifier on all findings. The completed report is signed by the producer and the inspector
Review the inspection report	An individual or certification committee with expertise in organic farming and certification standards (reviews the report). There can be several outcomes of the review: approval for organic certification, actions to be taken, further information required, denial of certification
Issue an organic certificate	On approval the producer can be certified as an organic producer

Certification also requires that organisations in different countries should have a logo to guarantee to consumers that organic products are produced according to specific standards. This also helps consumers to distinguish organic farming products from conventional ones (Figure 2.6).

Figure 2.6: A selection of organic logos used in different countries (ITC 2004)

2.10. Conversion to organic farming and the diffusion theory

The previous sections have shown that organic farming world wide has diffused widely in terms of land area, number of farms, and market size. This potential rapid growth of organic farming has triggered researchers to study its adoption/diffusion, factors affecting its adoption, and the characteristics amongst adopters. Diffusion of an innovation can be described within the framework of the diffusion of innovation theory, which was developed by the rural sociologist Everett M. Rogers since the 1960s to explain the process of innovation adoption and can provide an inventory of the factors that affect the adoption rate of an innovation (Vindigni, Janssen, and Jager 2002). Rogers is well known in the area of diffusion research, and his book, Diffusion of Innovations (fifth edition 2003) is recently the most often cited work dealing with diffusion.

Rogers says some innovations are adopted quickly by the members of a social system, while other innovations require many years to be diffused (Rogers 2003). According to this theory, innovativeness is 'the degree to which an individual or other unit of adoption is relatively earlier in adopting new ideas than other members of a system' (Rogers 2003: 22). Diffusion is the process in which an innovation is communicated through certain channels over time among the members of a social system (Roger 2003: 5), while an innovation is an idea, practice, or object that is perceived as new by an individual or other unit of adoption (Roger 2003: 12). The theory considers four main elements of the diffusion of innovations: the innovation itself, communication channels (the means by which messages get from one individual to another), time, and a social system (a set of interrelated units that are engaged in joint problem solving to accomplish a common goal). In this theory, adopters are divided into five categories based on their innovativeness who follow a standard deviation-curve: *innovators* (2.5%) adopt the innovation in the beginning, *early adopters* making up 13.5% a short time later, *early majority* making up 34%, *late majority* 34% after some time, and finally *laggards* make up for 16% (Rogers 2003). The cumulative number of adopters appears as a typical s-shaped curve which starts to rise slowly when the first innovators adopt the innovation, then it rises faster to some extent due to the early adopters (Vindigni, Janssen, and Jager 2002) and when the adoption reaches 15-20% of the community, it is assumed that the adoption process will continue (Padel 2001). As the innovation is adopted successively by early majority and late majority, the curve becomes precipitous and slows when the laggards adopt the innovation (Vindigni, Janssen and Jager 2002). According to the theory, the characteristics of innovators and early adopters are different from other adopters. Innovators are venturesome and eager to try new ideas which leads them away from local peer group and into more cosmopolitan relationships (Rogers 2003); a group of other innovators have common communication patterns and friendships despite considerable distances apart they must be able to cope with a high degree of uncertainty about an innovation they adopt (Padel 2001, Rogers 2003). Early adopters are a more integrated part of the local social system, appear to weigh their personal needs more, have a higher aspiration level, have the highest degree of opinion leadership and are more actively search for information (Rogers 2003), whereas early majority adopters (deliberate) adopt new ideas just before the average number of a system and late majority (skeptical) adopt new ideas just after the average number of a system. Laggards (traditional) are the last to adopt an innovation in a social system. The rate of adoption is defined as the speed with which an innovation is adopted by the individuals of a system.

The theory is important and can be utilised to describe and predict the diffusion of an innovation and its adoption rate by individuals (Vindigni, Janssen, and Jager 2002, López, Giménez, and Requena 2005). This could be reviewed on personal characteristics, time factor, and the characteristics of the innovation itself (Padel 2001). However, Rogers (2003) states that diffusion of an innovation is affected by five perceived attributes-relative advantage, compatibility, complexity, trialability, and observability- which have a great deal to do with its rate of adoption, in which most of the variance (49-87%) in the rate of adoption is explained by these perceived attributes. *Relative advantage* is the degree to which an innovation is perceived as being better than the idea it supersedes (Rogers 2003: 229). Therefore, for an innovation to be adopted, it should have distinct advantages which are often expressed in terms of economic profitability, social prestige (Vindigni, Janssen, and Jager 2002, Rogers 2003) or in other ways, for example, in organic farming relative advantage can be environmental benefits or soil fertility, human health or animal health (Padel 2001). The general principle is that the relative advantage of an innovation, as perceived by members of a social system, is positively related to its rate of adoption (Rogers 2003: 233).

Compatibility is the degree to which an innovation is perceived as consistent with existing values, past experience, and needs of potential adopters (Rogers 2003: 241). Accordingly, the higher the compatibility is, the higher the adoption rate (Vindigni, Janssen and Jager 2002). In this research for example, farmers reported that organic farming is incompatible with their existing experience, which would retard its adoption rate.

As for *Complexity,* it is the degree to which an innovation is perceived as relatively difficult to understand and use, and the principle is that the complexity of an innovation, as perceived by members of a social system, is negatively related to its rate of adoption (Rogers 2003: 257) and it has a negative effect on the rate of the diffusion (Vindigni, Janssen, and Jager 2002). Therefore, the complexity-simplicity continuum of an innovation affects its rate of adoption, and can be a very important barrier to adoption of new ideas (Rogers 2003).

Trialability is the degree to which an innovation may be experimented with on a limited basis (Rogers 2003: 258). Therefore, divisible innovations can be adopted more rapidly and easily than those that are not (Padel 2001, Vindigni, Janssen and Jager 2002), and the general principle is that the trialability of an innovation is positively related to its adoption rate (Rogers 2003).

Observability is the degree to which the results of an innovation are visible to others, and the principle is that the observability of an innovation, by members of a social system, is positively related to its rate of adoption (Rogers 2003: 258).

In organic farming, studies on adoption have looked at socio-economic characteristics such as education, farming experience and background, income, age, social relationships, and on-farm characteristics, and also at barriers and motivations to organic farming (Padel 2001). A relationship between socio-economic status such as education, income level, farm size, commercial orientation and innovativeness can be generalised from many adoption studies in the adoption theory, and the conversion or adoption studies match the diffusion innovation theory in some aspects such as education and age, while relative farm size varies between countries and over time (Padel and Lampkin 1994: 299).

Therefore, 'the theory could provide a useful framework for understanding the social aspects of conversion to organic farming and for developing strategies to encourage more widespread adoption of organic farming' (Padel and Lampkin 1994: 299). In organic farming, it can also be useful to analyse the factors affecting the diffusion of organic farming in a country and based, on the results, important implications could be taken for policy design to motivate the diffusion of organic farming as seen in the study of López, Giménez, and Requena (2005).

The conception of the theory has been utilised in different organic farming studies (Padel 2001, López and Requena 2005, López, Giménez, and Requena 2005) to describe the diffusion/adoption of organic farming and factors affecting its adoption. For example, the diffusion of organic farming practices in the south of Spain has encouraged López and Requena (2005) to study the factors related to the adoption of organic farming within the framework of the diffusion theory. The study compared organic olive orchard farmers with their conventional counterparts looking at farmers' characteristics (including age, education, dedication to agriculture, opinions and attitudes toward organic farming) and farms' characteristics (yield, size, varieties) to understand which are related to the adoption of organic farming practices. The study found that the mean farm productivity of the organic olive orchards was lower than the conventional and organic farmers were younger and had less experience to farming than conventional farmers. Results showed that organic farmers had more part-time involvement in agriculture, were more involved in management and administration of the holding, attended more courses, were more commonly members of agricultural associations, received more information, had a more negative opinion regarding the use of chemicals, and believed that organic agriculture required more time and effort but provided greater returns. The outcome of the study using the diffusion theory was helpful to construct a logit model based on which specific strategies were presented for potentiating the diffusion of organic olive growing in Andalusia and similar areas.

As for the adopter category, categorisation of organic farmers depends on when studies on organic farmers were undertaken. According to Padel (2001: 43), 'the earlier studies of organic farmers were undertaken when organic farming was at a very early stage of diffusion. The first organic farmers studied would therefore have fallen into the categories of innovators or, in some later studies, potentially in the category of early adopters'. A study by López, Giménez, and Requena (2005) used early adopters as their categorisation. In this study, with regard to innovativeness and factors related to it, it was found there was no difference between farmers in their level of education or specific agricultural training, which is in contrast to the theory; but early adopters had less experience, and were risk-takers adopting organic farming, and were more idealistic, being aware of producing healthy products and of certain environmental problems. According to the three studies mentioned in this section it can be said that organic farmers have a high level of general academic education, are younger farmers, have less farming experience (Padel 2001, López and Requena 2005, López, Giménez and Requena 2005), have urban backgrounds (Padel 2001) and are more part-time in their involvement in agriculture (López and Requena 2005).

As for farm size, López, Giménez, and Requena (2005) showed there was no influence on adoption, but Padel (2001: 45) put the general hypothesis that 'the average of organic farm size increases during the process of diffusion, but it is possible that is related to changes in the structure of the agricultural industry in general and that a point of stabilization of farm size may occur, and further research across a wider range of countries would be needed to confirm this'.

The time factor is important in the diffusion theory and its inclusion in diffusion research is one of its strengths, but the measurement of time has been criticised (Rogers 2003). In organic farming the time factor was difficult to predict, despite the available information about organic faming in Europe. Padel (2001) stated that it is difficult theoretically to determine how many farmers may convert to organic farming in the future, as diffusion may stop at any level.

For organic farming to be adopted as an innovation, it should be simple, could be tried on a small scale, and should have relative advantage. However, Padel (2001) described organic farming as a complex system and conversion to organic farming affects the whole faming system, not only single enterprises (for example design of crop rotation has an influence on forage production, fertility building and weed and pest control). As for trialability, Padel (2001) says trying organic farming on a small scale leads to some difficulties, for example trying organic farming in one field of the farm will not show the full performance under organic farming management at that specific location if no fertility-building phase is incorporated. Also most organic standards do not allow certification of individual fields. Organic farming has relative environmental advantage, but as for economic advantage, the conversion period in many cases can be costly, and not always leads to profits returns.

Therefore, the review and the conclusions of Padel (2001) provide a framework from which to examine how diffusion theory can be applied or used to the adoption of organic farming in Jordan. Padel (2001: 54) concluded that 'organic farming in many ways [is] not a typical innovation. However, nothing in the theory itself seems to imply that it cannot be applied to such a complex, bottom-up innovation, but it is likely that this implies a very slow diffusion rate, which has indeed historically been observed in most countries, rather than a complete rejection of the model'. Also, 'instead of just focusing on the personal characteristics of the farmers, more attention should be paid to the economic, structural and institutional environment of farming in general as this is likely to influence individual adoption decisions. This point is clearly relevant to any application of the diffusion theory and equally to the diffusion of organic farming' (Padel 2001: 55).

Therefore, using the five perceived attributes of innovations can be helpful in looking at the technical issues, structural and institutional environment of organic farming on Jordan. The five attributes are conceptually distinct but each of them is interrelated with the other four (Rogers 2003) and the relationship between each of them and the intention to adopt an innovation is positive, with the exception of the complexity, which bears a negative relationship to the intention to adopt an innovation (Hernandez and Mazzon 2007). They have been most extensively investigated and have been found to explain about half of the variance in innovations rate of adoption, and according to the theory, individuals' perception of these attributes predicts an innovation's rate of adoption, as will be seen later in this research (Rogers 2003). Padel (2001: 56) also concluded that the theory can be used to gain some further understanding of the diffusion processes of organic farming and individual adoption or conversion decisions.

2.11. Barriers to the adoption of organic farming

In spite of the relative environmental and economic advantages of organic farming mentioned above, organic farming is not an easy innovation that can be diffused quickly between farmers. Its production management system differs technically from the conventional one (Rosati and Aumaitre 2004). Therefore, it requires a high level of commitment (Lampkin 1990, Freyer, Rantzau, and Vogtmann 1994), and careful planning is necessary to avoid financial problems during conversion (Freyer, Rantzau, and Vogtmann 1994). As a result, farmers who want to be organic can expect to face several barriers, especially at the early stages of conversion. The conversion process is not easy and the decision to convert to organic farming has a high risk, due to lack of information for farmers and uncertainty for the financial viability of the farm (Lampkin 1990). Moreover, certified organic farming can end in failure due to the unavailability of market outlets, lack of technical experience, the costs associated with organic inspection and lack of investment (Rigby and Young 2000, Rigby, Young, and Burton 2001).

Farmers are expected to face certain financial barriers before they can sell their products as organic (Freyer, Rantzau, and Vogtmann 1994) because (a) products are sold mostly at conventional prices, (b) there is a reduction in yields, (c) there are yield losses during conversion, (d) there are extra labour costs and (e) certification costs (Dubgaard and Holst 1994, Padel and Lampkin 1994, Schneeberger, Darnhofer, and Eder 2002). The research shows that barriers are not only financial but could be also technical, social/cultural and economic, and they differ from continent to continent and from country to country (Table 2.7). For example, Barrett *et al.* (2001) found that certification cost was a significant barrier to increasing the involvement of smallholders in the organic export trade in Africa. Therefore, relying on foreign standards and certifying bodies can be a crucial barrier, as seen in Africa by Parrott *et al.* (2006). In another study conducted by Niemeyer and Lombard (2003), it was found that high costs of initial certification and the annual inspection were significant barriers to organic farming in South Africa. Other barriers are lack of a regulatory framework and national laws regulating the certification and inspection systems, all of which were reported in the Mediterranean (Al-Bitar 2006).

A barrier could be significant in one country but not relevant in another country: a good example is labour, which is a significant barrier in the EU where labour is expensive (Schneeberger, Darnhofer, and Eder 2002, Niemeyer and Lombard 2003) but not in South Africa where there is enough labour to meet the high requirement of organic farming (Niemeyer and Lombard 2003). Another example is high illiteracy rates, which can be a barrier to organic farming because organic farmers are requested to keep records of the farm activities (Yussefi and Willer 2002). Several authors report that lack of regulations and legislation are significant barriers for organic farming (Yussefi and Willer 2002, Niemeyer and Lombard 2003, Al-Bitar 2006). It is not only the costs of certification but also the problems of infrastructure, maintaining links with distant markets and the vagaries of world markets which are external barriers, as in Africa (Parrott *et al.* 2006). Niemeyer and Lombard (2003) reported that lack of advice was a major problem because organic farming is a new sector in South African agriculture. It was found in this study that the involvement of advisory and extension services, the national press and official agricultural institutions in South Africa is still small. It is also true that the lack of national or regional support policies, either direct or indirect (De Castro, Fersino, and Petruzzella 2002, Al-Bitar 2006), make the conversion to organic farming difficult in some countries. Conversely, the application of Regulation (EEC) 2078/92 in Europe has produced better results than expected (Dabbert, Häring, and Zanoli 2004).

Barriers continue to involve the knowledge of farmers. Cabaret (2003) states that one of the many barriers to converting to organic farming is lack of knowledge; for example, the measures farmers take to prevent or control diseases become a key factor of success. Lampkin (1994a) reported that perceived high costs make farmers reluctant to convert to organic farming, and so do the risks which are involved, even if there is a premium price for the organic products. Freyer, Rantzau, and Vogtmann (1994) show that conversion does not always end with full organic certification. Availability of premium prices can also be a barrier. For example, in Africa there are many traditional farming techniques but farmers do not get the same price given to organic products in some markets (Scialabba and Hattam 2002).

Table 2.7: Barriers to organic farming (Adapted from Padel and Lampkin 1994: 297-298)

Type of barrier	Barrier
Technical	Lack of technical information; yield reductions-yield losses or crop failure; feed shortage due to higher pest; disease and weed infestations; soil infertility; reduced livestock yields; lack of alternative pest control methods; lack of alternative soil fertility inputs
Extension, information and advice	Lack of advice and detailed information; disparaging extension agencies; inadequate training; time required to set as much information as possible assembled; difficulties gaining access to information which is available only through non-traditional sources (books, magazines, neighbours, family and friends and particularly other organic farmers); lack of knowledge; high illiteracy; extension sources devoted in most cases to conventional farming practices
Financial, economic and marketing	Refusal of loans, insurance or grant applications for organic production; high production costs; labour requirements and the increase in workload; costs of initial certification and the annual inspection; few marketing opportunities; lack of possibilities for premium prices
Policy, institutional support, regulation and legislation	Lack of government policy support; lack of national legislation, regulations, standards and cost; lack of trade liberalisation; additional documentation to fulfil marketing requirements
Cultural and social	Resistance within family; lack of support of family members, friends, farm workers and neighbours who have an interest in the financial wellbeing of the farm; level of training and willingness to carry the risks of conversion; local social structures; negative images of organic farmers as hippies or hobby farmers; fear of becoming an outsider or intergenerational conflicts

2.12. Policy environment and motivations for organic farming

The previous section has shown that organic farming is not an easy option to adopt as a whole system. There are some motivations and support that could help farmers to convert to organic farming, such as family, close friends, neighbours or farm workers who have a significant influence on running the farm and have an interest in the financial wellbeing of the farm (Lampkin 1990: 526).

But such incentives and individual farmers' efforts are not enough to cause organic farming to be adopted on a national scale; therefore, governments wishing to adopt organic farming should have policies to support and motivate farmers. Developing policies regarding organic farming is justified not only to support farmers to overcome barriers but also because its principles create environmental, social and economic benefits (Dahama 1997, Pykh and Pykh 2003, AFPOSG 2004), which comply with government policies to preserve the natural resources (Dahama 1997, IFAD 2001). According to several studies (Lampkin 1990, Dubgaard and Holst 1994, Freyer, Rantzau, and Vogtmann 1994, Schmid 1994, Schneebereger, Darnhofer, and Eder 2002, Dabbert, Häring, and Zanoli 2004, EC 2004, Wai 2006), implementing such policies are a crucial factor in encouraging farmers to convert to organic farming and would lead to rapid development of organic farming worldwide. These studies have shown also that it is crucial for governments to develop their own support policies to ensure the sustainability of their organic farming sector.

There are a number of government examples showing that developing a policy is a significant factor for the introduction of organic farming development. These examples include both developed and developing countries. A famous example is the European Union, which by setting up policy instruments in the 1990s had a significant influence in encouraging farmers to convert to organic farming through regulation and financial support during and after conversion to an organic farming system (Dabbert, Häring, and Zanoli 2004, Willer 2005). This policy support includes the legal framework which covers standards and certification systems, as well as subsidies for organic farming production under the EU Reg.2092/91 (Dabbert, Häring, and Zanoli 2004, Willer 2005), and the launch of the European Action plan on organic farming and food in 2004 (Willer 2006). Examples from developing countries include Brazil, which has issued a plan called an inter-ministerial *pro organico* to stimulate organic farming, research, marketing and research; Costa Rica, which also has official funding for research and teaching; and Argentina, which has official export agencies helping producers to attend international fairs and print product catalogues (Lernoud and Piovano 2006). In the Mediterranean countries the policy support differs from one country to another: for example in Tunisia, Malta and Cyprus, farmers receive direct subsidies through financial aid; while in Turkey they receive direct and indirect subsidies by loans on favourable terms; while Syria is already elaborating some support strategies (Al-Bitar 2006).

The lack of a policy regarding organic farming is considered to be a significant barrier to its development (Scialabba 2001, Parrott and Kalibwani 2005, Willer 2005). This barrier can be seen in Africa, where the potential of organic farming has not been recognised by the majority of African countries (Parrott and Kalibwani 2005, Parrott *et al.* 2006). Only Tunisia has had a policy which helps to develop its own standards (EU compatible), through which certification and inspection systems have been developed (Parrott *et al.* 2006), and which provides farmers with subsidies directly (Hasbani 2004).

It is not only important to have a policy regarding organic farming, but it is most important that governments should examine the priorities of the intended beneficiaries so that they meet the government policy objectives to ensure the success of the policy (IFAD, ANGOC, and IRRR 2001). It is also crucial that policy makers should discuss their proposed objectives with the beneficiaries as a foundation for specific policy measures (Dabbert, Häring, and Zanoli 2004). Moreover, stakeholders' participation should be considered in developing a policy regarding organic farming, because the stakeholders' participation in policy formulation and implementation of government projects can serve as a good measure for ensuring the relevance and appropriateness of government programmes (Panyakul and Wai 2005). Using this approach, governments should develop, support and assist policies involving beneficiaries in order to initiate organic farming. Organic farming policy should also provide the regulatory framework for all economic and political measures designed to influence the organic sector and should also provide financial support and development systems (Dubgaard and Holst 1994, Scialabba 2001). In organic farming, developing a theoretical policy support is not enough. It is the implementation of policy which is also a crucial factor in developing the organic farming sector. This can be recognised through four examples, the Tunisian, Austrian, Danish and Swiss programmes regarding organic farming (Appendix A).

2.13. Organic farming in arid lands

The definition of an area as an arid land varies according to the purpose of the enquiry or the location under consideration (Thomas 1997) but, in general, the criteria used for scientific definitions for arid lands are based on water stress, where the mean annual rainfall (including snow, fog and hail) is lower than the total amount of water evaporated to the atmosphere (IUCN 2006). The criteria also include erosion processes, drainage patterns and climatic criteria based on plant growth (Thomas 1997). However, all the definitions consider the moisture availability to be the main factor in defining arid lands based on the aridity index (AI), where AI = P [annual average precipitation]/PET [potential evapotranspiration]. According to this relationship, the area is considered as arid when the mean annual ratio of P/PET is significantly less than one, in which case 'arid lands' are divided into four categories (Thomas 1997) as shown in Table 2.8.

Table 2.8: Classification of arid lands (Modified from: Thomas 1997)

Category	**AI value**
Arid sub-humid	0.50-<0.65
Semi-arid	0.20-<0.50
Arid	0.05<-0.20
Hyper-arid	=<0.05

Accordingly, arid lands are distributed all over the world (Figure 2.7), covering one third of the earth with a population over a billion in about 100 countries (Mortimore 2006).

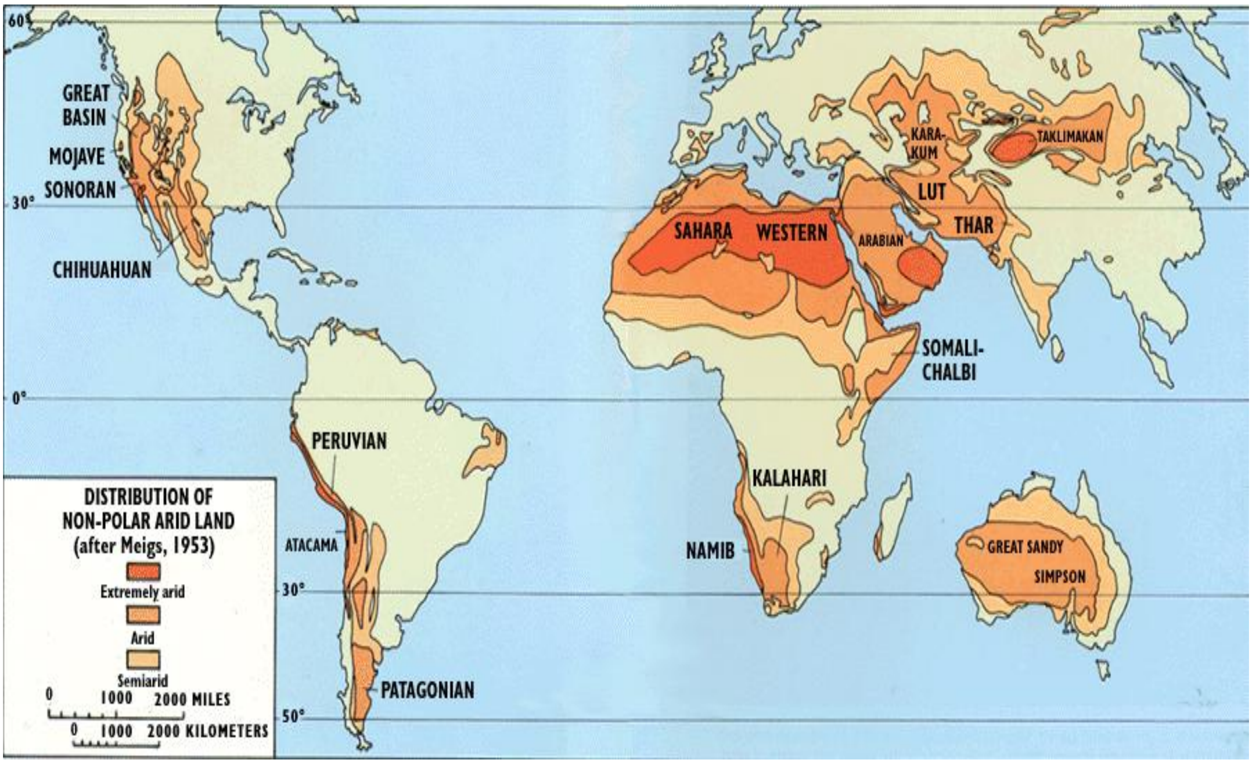

Figure 2.7: Distribution of arid lands (IALC 2005)

Arid lands are characterised by lack of surface water, limited food outputs, low mean annual rainfall, high evaporative demand, climatic extremes and variability (Thomas 1997, Mortimore 2006), low and erratic rainfall (Dahama 1997, Al-Ansari and Baban 2001), lack of vegetation cover, soil which is less protected, low moisture availability and high variable temperature (Bullard 1997). In arid lands, rainfall varies from 20-200 mm with four main moisture sources: rainfall, coastal fog, dew and groundwater (Bullard 1997). These characteristics have made arid lands environmental areas to be avoided, and unfavourable places for habitation for many years except for resourceful hunter-gatherer and pastoral nomadic people or persecuted population groups (Thomas 1997).

However, human occupation of these lands increased during the twentieth century as a result of the increase in discovering water resources, better health care and the introduction of new technologies (O'Hara 1997). As a result, arid lands are occupied by a fifth of the world's population and have became a source of food for millions of people, and contribute to the economy of many countries

(Mortimore 2006); a good example is the arid lands in Jordan, where 80% of the total area of the country is arid land and characterised by low soil fertility, and low and erratic rainfall (Al-Ayyash 2002, Shahbaz, Al-Oun, and Ras 2006). However, introducing new technologies to this area, such as improved soil and water conservation methods, adequate fertiliser use and new crop varieties, helped to make this area the main food basket, water source and one of the most important areas to secure jobs (Abu-A'moud 2003).

Arid lands have witnessed human activities such as agriculture. One of the agricultural activities is conventional farming as seen in Jordan (Al-Adamat 2002). This system has helped in the development of modern agriculture to increase food production and labour efficiency to meet ever-rising demand (Dahama 1997, Kings 2005), but it also has led to unexpected environmental changes that work against the prospects for sustainable increases in food production (Glantz 1994, Dahama 1997, Kings 2005). It is the agricultural mismanagement and the application of inappropriate techniques which have led to the environmental impact (Sharma 2005). For example, deep ploughing has led to soil erosion, while overuse of fertilisers and pumping of groundwater has made soil salinity a common agricultural problem (O'Hara 1997, Al-Adamat 2002). The adoption of organic farming is one solution, because it is considered as a holistic production management system that preserves the environment through minimisation of chemical use and maximisation of natural processes and techniques (Lampkin 1990, Scialabba and Hattam 2002, Soil Association 2003, Sharma 2005).

It might therefore be assumed that there is no potential for organic farming in arid lands, but in fact figures from Australia, Egypt, Morocco and Tunisia show that organic farming has a great potential in arid lands (Yussefi 2006) and it cannot be argued that arid lands cannot produce organic products (Kenny 2004). Arid lands have potential factors, which can make conversion to organic farming easier (Kenny 2004, Taher 2004, Sharma 2005). One of the factor is that farming systems in arid lands are traditionally mix of animals, crops, trees etc and such systems have been found efficient in nutrient recycling, and restoration of soil fertility, minimizing pest incidence, which comply with the basic standards of organic farming (Sharma 2005). Another factor is that they include wild areas where synthetic inputs have not been used, which could be easily managed as organic (Taher 2004, Sharma 2005). The climate and the geographical position of arid lands is suitable and competitive for international markets (Taher 2004). Other factors include the temperature, which helps to decompose organic matter to produce organic fertilisers in a shorter time than in cold areas; and the low moisture level in arid lands, which can reduce pest infestation, especially fungal diseases (Kenny 2004). Arid lands also have been less affected by high input agriculture and thus have lower residues of pesticides and less time required for conversion, and also the economic conditions of arid land farmers are also comparatively poor and they are not able to purchase high cost input; on the other side, they can carry out labour intensive operations, and both are requirements of organic farming (Sharma 2001: 53). Table 2.9 shows the area of organic farming in some of the arid lands. Organic farming has also some significant constraints such as lack of agricultural policies supporting organic farming (Taher 2004), the lack of national regulations and the absence of local certification and inspection systems, which might allow to exploit productions and to create a domestic market for this category of products, an essential condition for the sector expansion (Al-Bitar 2004).

Table 2.9: Organic farming in some of the arid lands (Yussefi 2006)

Country	**Organic land area (ha)**	**Organic area in % of the total agricultural area**
Egypt	24548	0.72
Lebanon	1039	0.32
Morocco	20040	0.07
Tunisia	155323	1.59

It is also important to recommend organic farming for arid lands for the reasons shown in Table 2.10:

Table 2.10: Reasons to have organic farming in arid lands (Modified from: Mortimore 2006)

More than 1.2 billion people live in arid lands, most of them in developing countries
About 44% of all cultivated land area lies within arid lands
Arid land populations suffer from the poorest economic conditions worldwide
Scarcity of water limits access to clean drinking water and adequate sanitation, leading to poor health

A good example showing the practice of organic farming in arid lands is Egypt, in which organic farming started in 1977 in the desert near Belbeis as a pioneer experience by an association called Sekem, which started as a biodynamic farm of about 70 ha where medicinal plants and aromatic herbs were grown (Al-Bitar 2006). Sekem is certified as an organic farm, managing more than 300 ha and exporting to various countries including Europe (Al-Hadad 2004). The experience of Sekem shows that there is a potential for organic farming in arid lands.

However, organic farming is not an easy option for farmers in arid lands to adopt. Therefore, this research investigated the potential for, and barriers to, organic farming in arid lands in Jordan as a case study, and developed an action plan to help producers and policy makers to adopt organic farming. The potential and barriers are discussed in Chapter 6, while the plan is explained in Chapter 7.

2.14. Summary

Organic farming was an established farming system before the widespread use of agrochemicals, and the ideas behind it have been around since the 1920s. Organic farming is now practised in most of the world's countries, including arid lands, according to specific regulations, and it has its principles which together make it differ from other farming systems. There is also a rapid growth in its global market produce, and developing countries, including those with arid lands, have a great opportunity to benefit from the expansion of this market as demand is greater than supply. However, organic farming is not easy to adopt, therefore farmers and producers have to overcome several barriers before adoption.

Organic farming has potential in arid lands as seen, for example, in Egypt, Tunisia and Australia, and it is recommended to adopt organic farming because these lands have limited resources. However, there is a need to investigate the potential and opportunities for organic farming, and then to develop a method for its adoption.

CHAPTER THREE:

THE JORDANIAN AGRICULTURAL SECTOR

AND ORGANIC FARMING

CHAPTER THREE

The Jordanian agricultural sector and organic farming

3.1. Introduction

This chapter aims to fulfil the second objective of this research. It provides general information related to Jordan including climate, population and economy. The chapter examines the role of the agricultural sector in the country's economy, examines its contribution to the Gross Domestic Product (GDP) and discusses the main constraints facing this sector. It continues by examining the current faming systems, the historical changes which have happened in this sector, and also examines the sustainability of this sector.

As for organic farming, Chapter 3 examines the experience of Jordan in applying low input farming systems, whether or not organic farming is practised in Jordan, organic farming in the framework of the agricultural policy, and questions whether there is a need to adopt organic farming in Jordan. Finally, the chapter describes the study area, gives the main reasons for choosing this area, and the last section provides a summary of the chapter.

3.2. A profile of Jordan

Jordan is a developing country and is considered as an arid land, covering an area of ca. 90,000 km^2 (Al-Ansari and Baban 2001, Al-Adamat 2002). The historical development shows that the Emirate of Transjordan was declared a political entity in 1923 (eL-Hurani 1985a) ruled by the Hashemite Prince Abdullah I, under a British High Commission mandate which ended on May 22, 1946. On May 25, 1946, the country became the independent Hashemite Kingdom of Transjordan and in

1950, the country was renamed the Hashemite Kingdom of Jordan, which remains its name to this day (Wilson 1987).

The total land area of Jordan is about 88,778 km^2 (MoA 2003), while the area of water bodies is about 482 km^2, which includes the Dead Sea and the Gulf of Aqaba. Its altitude ranges from less than -400 m (below mean sea level) at the surface of the Dead Sea up to the 1750 m of Jebel Rum (MoEn 2006). The country is bordered on the north by Syria, on the south by Saudi Arabia, on the east by Iraq and Saudi Arabia, and has the Jordan River and the Dead Sea to the west (Figure 3.1).

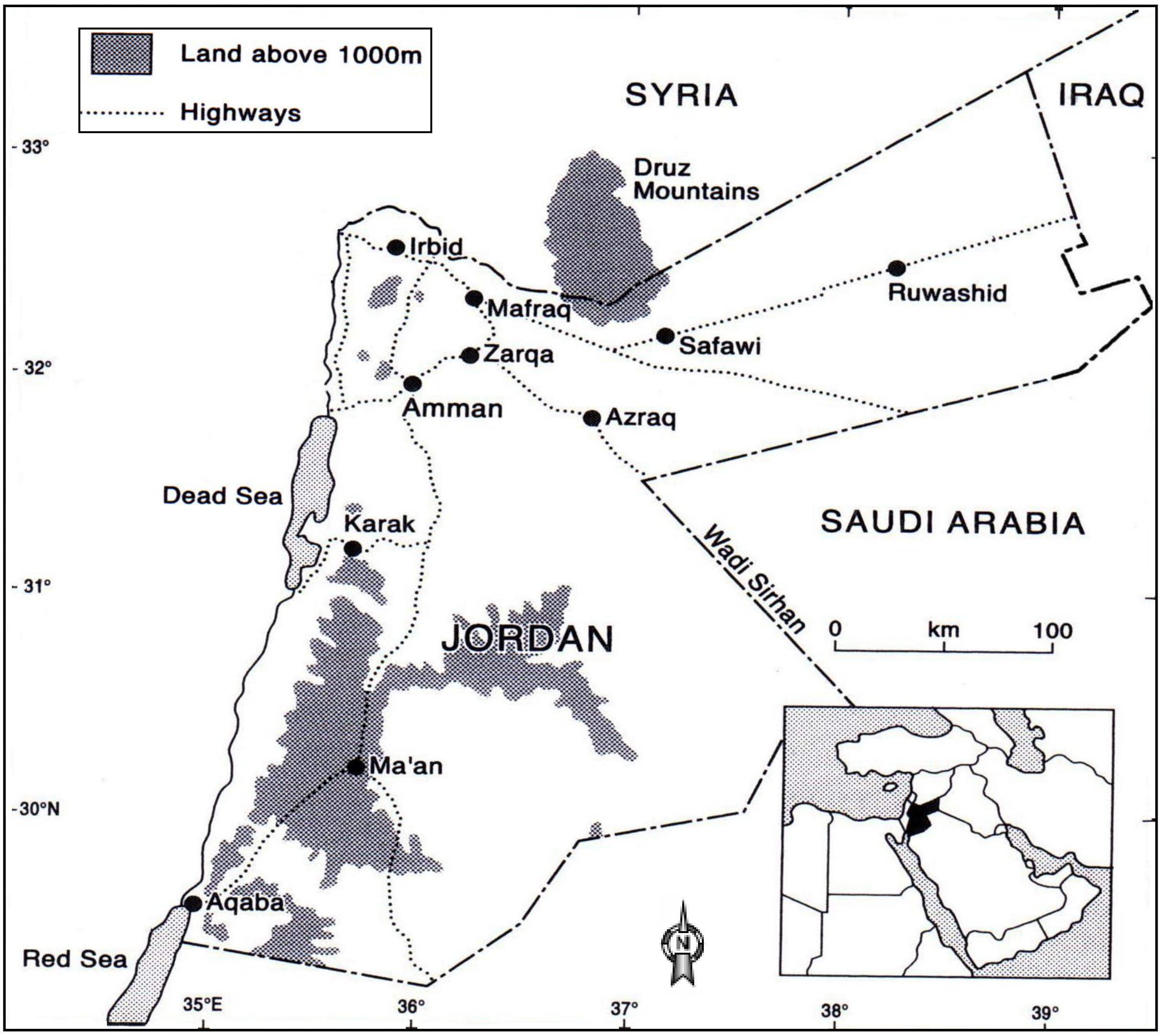

Figure 3.1: Map of Jordan (Allison *et al.* 1998)

3.3. The climatic zones of Jordan

The country can be divided into four major distinctive climatic zones (Figure 3.2) (Allison *et al.* 1998):

1. Jordan Valley and Southern Ghour (660 km^2): extends from Lake Tiberius in the north to the Gulf of Aqaba in the South. It is a strip zone and below sea level. The Jordan Valley is the main area for cultivation of citrus in an irrigated farming system. This area is used mainly for the production of vegetables and fruits.
2. Highlands (ca. 4,400 km^2): this zone is a mountainous area adjacent to the Jordan Valley varying from 600 to 1500 m above sea level.
3. The steppe zone (eastern hills) (ca. 9,000 km^2) is located around and to the east of the highlands, and comprises relatively plain lands with a gradual slope down towards the east. The steppe zone is dominated by an ecologically fragile system with vulnerable soils caused by climatic variation and overgrazing.
4. The Badia (ca. 72,000 km^2) extends from north to south in the eastern part of Jordan covering more than 80% of the country's total area.

The word 'Badia' means the place where Bedouin people live (JBRDC 1994) and it is characterised by an arid climate receiving less than 200 mm precipitation (Allison *et al.* 1998, Baban and Al Ansari 2001, Al-Oun 2001, Al-Adamat 2002). It is divided into three areas: the Northeastern Badia which represents 35.5 % (25600 km^2), the middle Badia with an area of ca. 9700 km^2 (13.5%), and the southern Badia, which represents 51% (36,700 km^2) of the total area (Allison *et al.* 1998, Al-Oun 1997, Al-Oun 2001). The Northeastern Badia of Jordan, where this research was conducted, covers a total area of ca. 25930 km^2 and comprises ca. 29% of the total area of the country (Allison *et al.* 1998, Al-Ansari and Baban 2001).

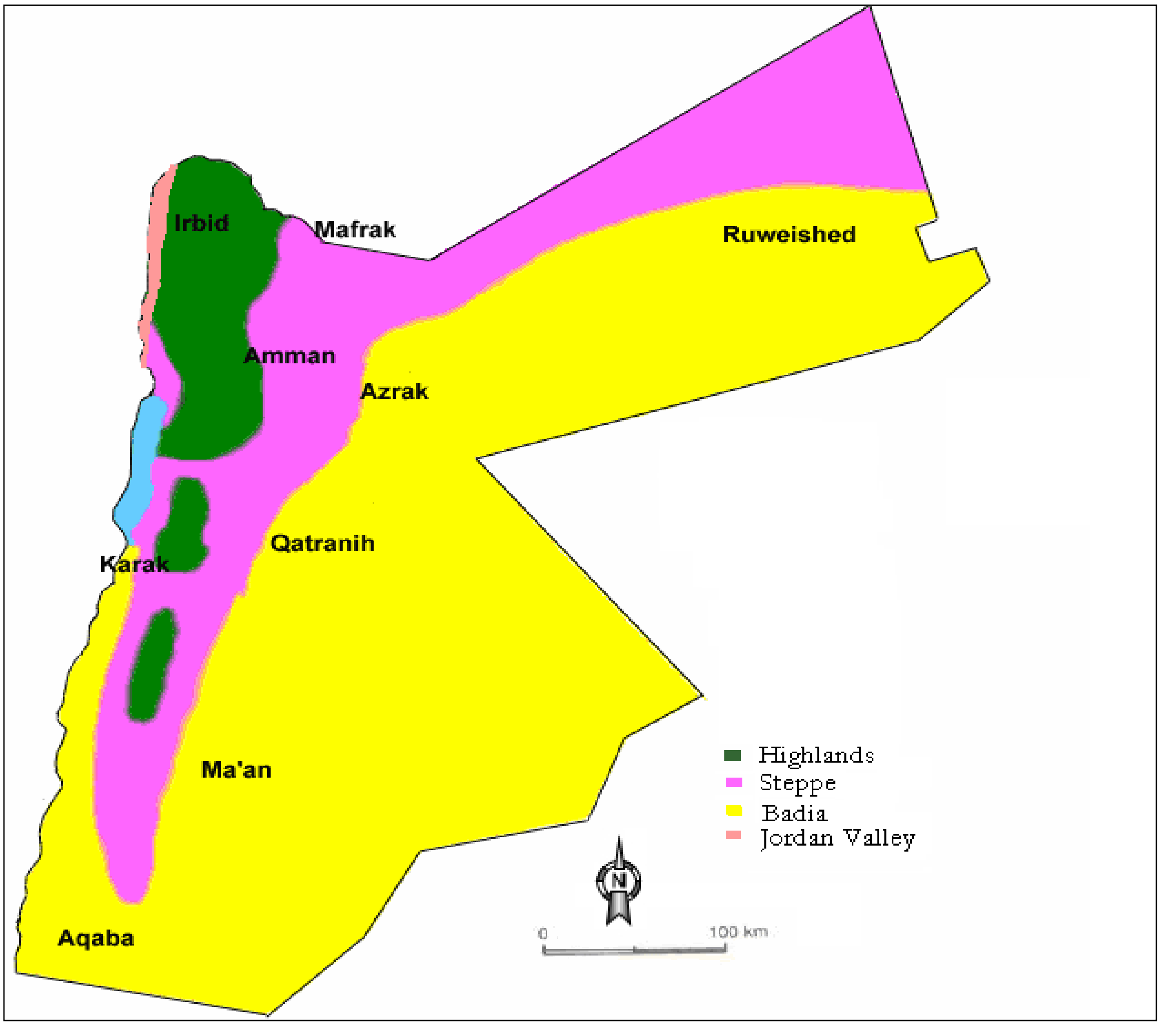

Figure 3.2: Map of the climatic zones of Jordan (JBRDC 1994)

The climate of Jordan varies from Mediterranean in the west to desert in the south and east (Shahden 1991) where two main seasons are recognised: winter, from November to April and summer from May to October (Natur 1985). During these seasons January is the coldest month, while July and August are the hottest months. The temperature gradually increases from February to July and starts to decrease from August to December. In winter, the minimum temperature reaches about –5 °C with annual minimum temperatures as low as 2 °C to 9 °C, while in summer, mean annual maximum temperatures reach 35 °C to 38 °C in August and the maximum temperature reaches 46° °C (Allison *et al.* 1998, Baban and Al-Ansari 2001).

As for rainfall, Jordan is characterised by low and unevenly distributed rainfall (Natur 1985), with about 80% of the country classified as arid or semi-arid lands (Natur 1985, JBRDC 1994). The rainfall distribution over the whole of Jordan is divided into seven regions (Figure 3.3), varying from 50 mm in the east of the region to more than 500 mm in the north-west. Most of the rainfall occurs between October and April with the maximum rainfall in December or January. More than 80% of the country's area receives less than 200 mm (Natur 1985, Allison *et al.* 1998, Al Ayyash 2002).

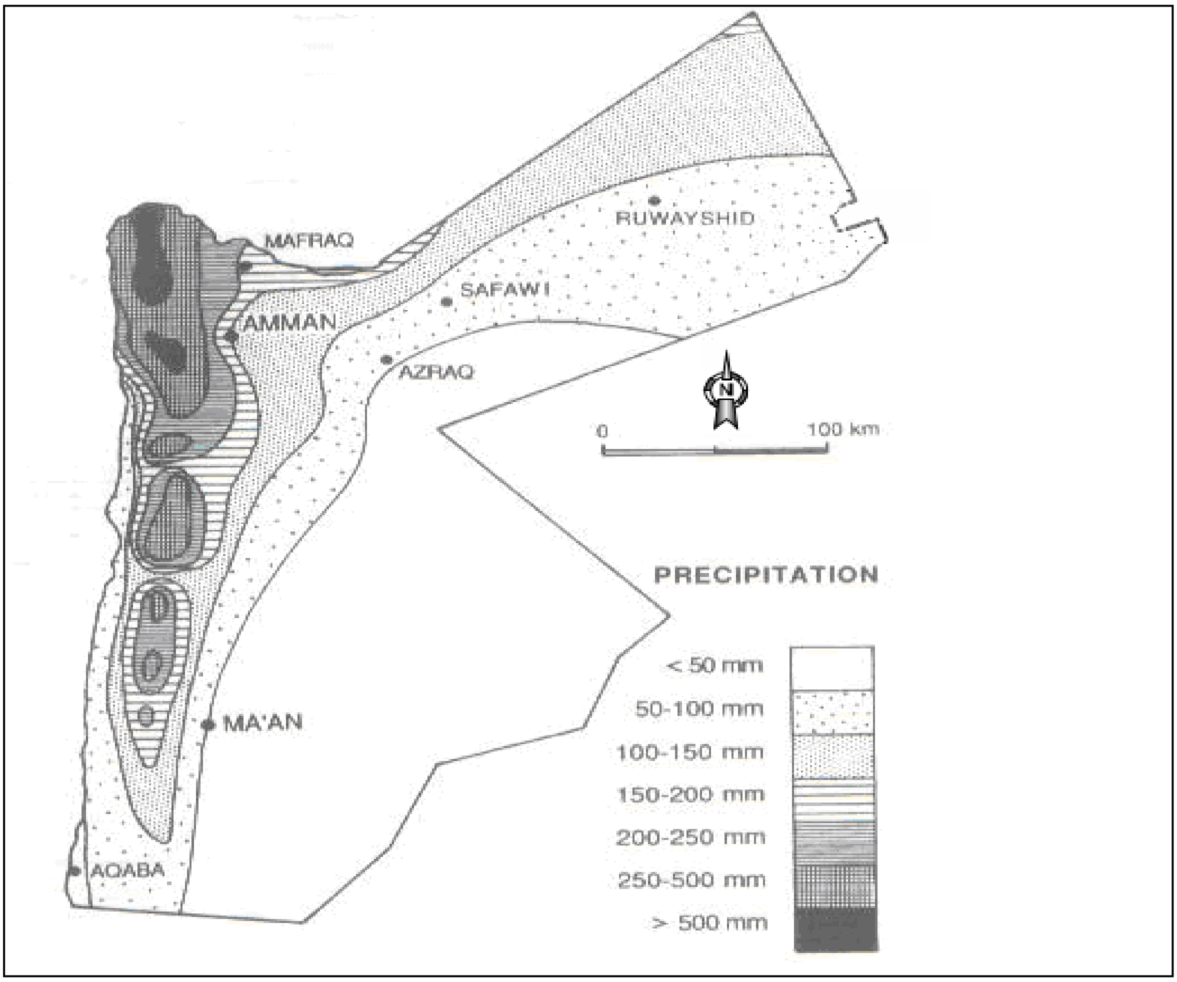

Figure 3.3: Map of the rainfall distribution over Jordan (Allison *et al.* 1998)

3.4. The population of Jordan

The population of Jordan is a mixture of different religious groups, of which Muslims comprise the largest group (92%), Christians are the second group, making up 6%, and there is a small number of other communities (2%) also present including Armenians, Chechens, Circassians and Gypsies.

Jordan has a population of 5,473,000, 90% of whom reside in 10% of the total area of the country. The population growth rate stood at 2.3% in 2005, literacy at 91% and life expectancy at approximately 71 years (DoS 2006). The population of Jordan has very distinctive features (eL-Hurani 1985a) since the country is classified as having one of the highest birth rates in the world and this has doubled in the last 20 years (Findlay and Maani 1998, Maani, Hunaiti, and Findlay 1998). However, the fertility rate decreased from 4.4 children per woman in 1997 to 3.7 children in 2005 (DoS 2006). Jordan has also a critical problem in that its population is distributed unevenly, with 38.8% of the population living in one city, Amman, and one third of the population (32.6%) living in two other cities, namely Irbid and Zarqa, while the rest of the population (28.6%) live in the remaining nine governorates (Dos 2006). This uneven distribution is due to jobs, services, education and transport being available in these cities (Maani, Hunaiti, and Findlay 1998), which creates other problems for the country such as pollution and pressure on natural resources (MoA 2005a).

It is argued that the rapid growth of this population is not mainly due to natural growth but is due to regional events such as the Arab-Israeli wars in 1948, 1967 and 1973, the Gulf crisis in 1990-1991 (Al-Oun 1997, Al-Meshan 2005), the Iraq war-induced recession of 2003, and recently the Lebanese-Israeli war 2006 (DoS 2006). Because of its location, Jordan has been obliged to absorb waves of Palestinian refugees from Palestine and the Gulf countries (mainly Kuwait) (Al-Oun 1997, DoS 2006). For example, the 1948 war resulted in a trebling of the population in a short period of time with no corresponding measurable rise in material resources; in 1967 again a large number of refugees fled to Jordan (Saket 1985); and in 1991 the Gulf war caused more than 300,000 Palestinians to flee to Jordan (Al-Oun 1997, Al-Meshan 2005, DoS 2006). Recently, the Iraqi war of 2003 caused more than 800,000 Iraqis to settle in Jordan. These refugees had a significant impact on the country's available resources and placed a high demand on them, especially on water.

3.5. Agricultural sector

3.5.1. Role of agriculture in the economy

Jordan has limited natural resources especially when it is compared with its neighbouring countries (Saket 1985, MoA 2005a). In fact, one of its major limited resources is water (Natur 1985, Saket 1985, Salameh 2001, Al-Adamat 2002). However, Jordan has some important resources such as cement, phosphates, gypsum, limestone, salt, potash and other minor natural resources such as iron, lead, sulphate and copper (Wilson 1991). Phosphate is considered to be the most important natural resource in Jordan and is produced in large amounts and for export (Saket 1985, Wilson 1991). Table 3.1 shows the quantities of raw materials produced by major industries in Jordan (CBJ 2005).

Table 3.1: Quantities produced by major industries (CBJ 2006)

Industry	Unit	2001	2002	2003	2004	2005
Mining and Quarrying						
Phosphate	1000 t*	5878.1	7107.2 6	762.3 6	222.9	6374.7
Potash	1000 t	1962.6	1956.2	1961.1	1929.0	1829.1
Manufacturing						
Fertilisers	1000 t	670.5	695.3	634.0	779.1	790.3
Chemical acids	1000 t	1407.5	1649.1	1499.3	1650.6	1613.6
Clinker	1000 t	2896.4	3222.1	3170.1	3401.3	3374.7
Cement	1000 t	3173.3	3557.5	3514.9	3907.6	4045.9
Petroleum products	1000 t	3596.8	3627.2	3694.6	3946.5	4213.7
Electricity	**Mill** kWh	**7365.7**	**7864.9**	**7721.4**	**8708.9**	**9359.3**

t: metric ton

Jordan has a limited economy of $US 9.12 billion per annum and a per capita income of $US 2325 (MoP 2006), with high levels of unemployment reaching about 15% in 2005 against 12.5% in 2004 (CBJ 2006, DoS 2006). Moreover, the economy of Jordan is controlled by many constraints such as a lack of natural resources, the increase in global oil prices, the decline of foreign aid (Saket 1985, CBJ 2006) and rapid population growth resulting from regional events (see above). Accordingly, limited natural resources and the limited economy create a severe imbalance in Jordan between domestic production and domestic consumption (Saket 1985, Al-Oun 1997, Abu-A'moud 2003), which gears the country to a high level of imports, particularly oil and food, to meet its rapid population growth (CBJ 2006, DoS 2006).

However, Jordan's Gross Domestic Product (GDP) has witnessed a remarkable growth in 2006, recording a growth rate of 7.2% with an inflation rate of 6.2% (CBJ 2006). This growth is due to the positive growth rates in all economic sectors (Table 3.2) except mining and quarrying, which declined by 1.2% in 2005 (CBJ 2006). This growth was combined with an increase in the Consumer Price Index, which reached 6.24% in 2006 compared to 3.4% in 2005, mainly in two items, transport and communications, and fuel and light. Consumers have felt that the increase was greater than was reported by the government and, as an observation for this research, there is a tremendous increase in all product prices in Jordan. The research does not specifically tackle this issue but it is worth mentioning that this increase in prices could be a major barrier to a local market for organic farming products because consumers in Jordan are concerned about prices more than in the past (Chapter 6).

Table 3.2: The growth rates of economic sectors (%) 2002- 2005 (CBJ 2006)

Sector	**2002**	**2003**	**2004**	**2005**
Agriculture, hunting, and forestry	25.0	12.3	2.2	5.5
Mining and quarrying	14.1	-2.7	-4.2	-1.2
Manufacturing	19.3	2.8	16.3	11.3
Electricity and water	0.8	3.8	13.1	6.9
Construction	8.8	0.1	12.3	9.0
Total commodity- producing sectors	**16.0**	**3.0**	**11.9**	**9.0**
Trade, restaurants and hotels	2.1	4.5	7.1	8.8
Transport, storage and communications	0.8	7.3	12.1	7.7
Finance, real estate and business services	7.8	2.9	2.9	5.1
Social and personal services	10.9	2.8	6.5	6.6
Producers of government services	3.1	3.8	2.2	3.7
Producers of private non-profit services to households	8.1	-0.6	0.0	0.8
Domestic services of households	8.9	11.0	5.0	3.5
Total services sectors	**2.2**	**4.8**	**6.1**	**6.2**
GDP at constant basic prices	**6.4**	**4.2**	**8.0**	**7.2**

As for its contribution to the economy, the agricultural sector was in a unique situation in that it dominated the economy of the country for many years until the 1960s and provided a relatively high employment rate, 33% of the labour force. This dominance has been reduced by other sectors (Figure 3.4) such as services and industry (eL-Hurani 1985a, Saket 1985, Al-Oun 1997, Abu-A’moud 2003, MoA 2003). The change has brought about a remarkable and continuous decline in the agricultural sector in terms of its contribution to the GDP: for example, in 1971 the agricultural sector accounted for 14.4% of the GDP, while in 1975 it declined to 8.3%, in 1980 to 7.1%, 6% in 1995 (Abu-A’moud 2003, MoA 2005a), and in 2005 it fell to 3.8% (MoA 2005a).

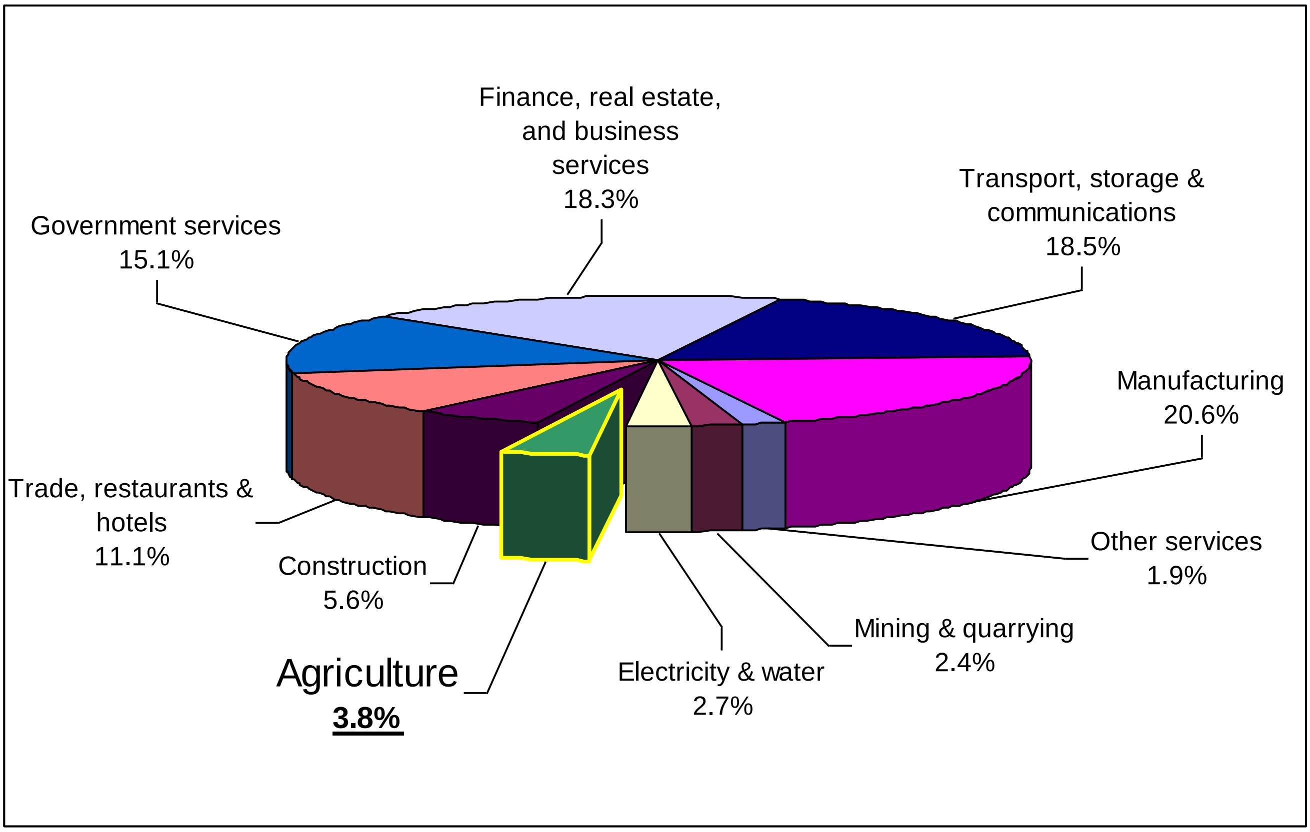

Figure 3.4: The contribution of economic sectors to GDP (Modified from: CBJ 2005)

It is clear from Figure 3.4 that agriculture's relative contribution to the GDP is less than that of sectors such as manufacturing and transport (CBJ 2005), and this makes it less than is found in any other countries similarly considered as agricultural countries (Al-Oun 1997). It was estimated that its contribution to the GDP in 2005 was about 3.8%, and together with agri-business, 27% (DoS 2006). Although the contribution of this sector to the economy is small, it still has a relatively important impact on the national economy by providing a livelihood for about 20% of the population and employs about 7% of the labour force excluding family labour (MoA 2006). It is worth mentioning that there is no accurate information which shows the actual percentage of the labour force employed by this sector. Therefore, the 7% represents only those who are registered with the Civil Service Bureau, but does not represent many people who have full or part-time family jobs in the agricultural sector, including women, which means that this sector employs at least 30% of the labour force. Another issue to be mentioned is that there is no accurate information about the contribution of the agricultural sector to the GDP. This is because the contribution of agricultural commodities to the GDP depends on products sold in the central and export market; and not products sold at local markets or between people (Al-Tallawi 1994, MoA 2003). As Table 3.2 shows, the sector witnessed a slowdown in the last two consecutive years, but in 2005 it has shown significant growth by 5.5% compared to 2.2% in 2004 (CBJ 2006).

The agricultural sector generates about 13% of total exports mainly in the form of food commodities, including vegetables, fruit, live animals (goats and sheep), dairy products and eggs (DoS 2006, MoA 2006). It is important to bear in mind that Jordan's agricultural exports depend greatly on the nature of the external markets, particularly the Gulf state markets, on prevailing prices at these markets, weather conditions (rainfall) (Haddad 1985, Abu-A'moud 2003) and the regional political situation (Abu-A'moud 2003). It is also worth mentioning that the value of agricultural exports has risen steadily in 2005, by 36.9%, compared with a 28.2% increase in 2004. This increase was mainly due to the increase in quantity and price indices of agricultural exports in 2005, by 30.9% and 7.1% respectively, against the growth of the former by 26.2% and the decline of the latter by 1.2% in 2004 (DoS 2006).

As for imports, Jordan's agricultural imports have increased in value and type over the period 1973-2005 (MoA 2006). The imports accounted for 16% of total imports of which cereals (wheat and barley) ranked highest among agricultural imports followed by plant oils (DoS 2006). The increase in Jordan's agricultural imports is mainly due to major factors such as the increase in the population and the increase in per capita income level.

It is true that the importance of the agricultural contribution to the GDP has fallen, but this decline is due to several reasons out of the control of the sector itself. For example, the arrival of Palestinian refugees (mentioned above) increased the labour force shift to other sectors such as services and construction (Saket 1985, Al-Oun 1997); the migration of Jordanian workers to Gulf states as a result of the oil revolution led many Jordanians to leave agriculture to work in the Gulf countries and to come back to build new houses on their cultivable lands (Saket 1985); as well as the fact that there have been big investments in other sectors (MoA 2003). Other important reasons reported by the MoA include:

- The increase of urban activities on agricultural lands (random construction outside urban planning zones),
- The fragmentation of agricultural lands between family members,
- The conversion of larger parcels into small production units unsuitable for mechanised agriculture, resulting in larger area of uncultivated land every year,
- The deterioration of the rangelands (poor management of rangelands, the destruction of plant cover, overgrazing),
- The lack of water resources (the fluctuation of rainfall from one season to another, and decline in the quantity and quality of fresh water available for agriculture; groundwater depletion resulting from over-pumping),
- The continued encroachment on forest land through uncontrolled grazing and illegal tree cutting,
- And the shortage of rehabilitation and social care programs for the agricultural labourers

(MoA 2005a: 16)

It has also been noted in this research that there is insufficient statistical information about this sector to give an accurate estimation of its contribution to the GDP.

Moreover, in Jordan efforts are not in place to maintain the agricultural sector and to increase its contribution to the GDP. This is because new development in Jordan brought about a major shift in the agricultural production area from its original lands to less fertile lands with lower rainfall (MoA 2002). For example, construction outside the urban planning zones led to the use of fertile land for new buildings, and of arid lands (rangelands) for agricultural production (MoA 2005a). This has led to loss of, for example, the main cereal production areas. As a result, the arid lands which used to be the preserve of sheep herdsmen have become a potential land for agriculture due to a combination of boreholes and new irrigation techniques (Blench 2001).

Despite the existence of agricultural law and regulations to protect agricultural land, these are not rigorously enforced (Rukkaibat 2005). It has also been noted in this research that there are many reports, studies, agendas and proposals to protect the agricultural sector and its lands, but in fact these documents remain in libraries or on government office shelves. Another important factor is that public expenditure in the agricultural sector has declined (Blench 2001, Abu-A'moud 2003), and also this sector is not given priority as are other sectors in Jordan. For example, the tourism sector is well supported and insured by the government, and the same applies to the construction and service sectors (Magableh 2005). A recent problem is that the government has put tough restrictions on bringing foreign labourers to work in the agricultural sector; but on the other hand the government makes it easy for other sectors, and this led the head of the Farmers Union to resign from the labour immigration committee (Odeh 2006).

3.5.2. Agriculture and water consumption

Jordan has one of the lowest levels of water resources in the world on a per capita basis, in which the share of water is ca 175 m^3 per capita[1]. Water in Jordan is available from two main sources, groundwater and surface water (Natur 1985, Salameh 2001), 400 MCM and 305 MCM respectively, in which about 70 MCM is pumped from non-renewable fossil water in the southeast of the country (Salameh 2001). This makes Jordan one of the ten poorest countries in the world in terms of water resources per capita (Al-Adamat 2002), according to figures for Bahrain, Jordan, Kuwait, Libyan

[1] A country is classified as water-poor when the per capita water production is below 1,000m^3

Arab Jamahirya, Maldives, Malta, Qatar, Saudi Arabia, United Arab Emirates and Yemen (FAO 2005a).

As regards water consumption, agriculture consumed in 2005 the highest percentage of water, 72%, followed by 24% for drinking and 4% by industry (Figure 3.5) (MoWI 2006). Water is considered also as a limiting factor for agriculture, particularly for irrigated crop production, because the available water is not enough for the land that can be beneficially irrigated (Natur 1985, MoA 2003, MoA 2006). It can be also noted from Figure 3.5 that the anticipated annual water consumed by the agricultural sector will decrease from 72% in 2005 to 61% in 2020 because the government has established a master-plan with tough restrictions to reduce the amount of water used for agricultural purposes and to increase the allocation of water for other sectors. The reduced amount of water (11%) in agriculture will be used for the municipal use (8%) and for tourism (3%).

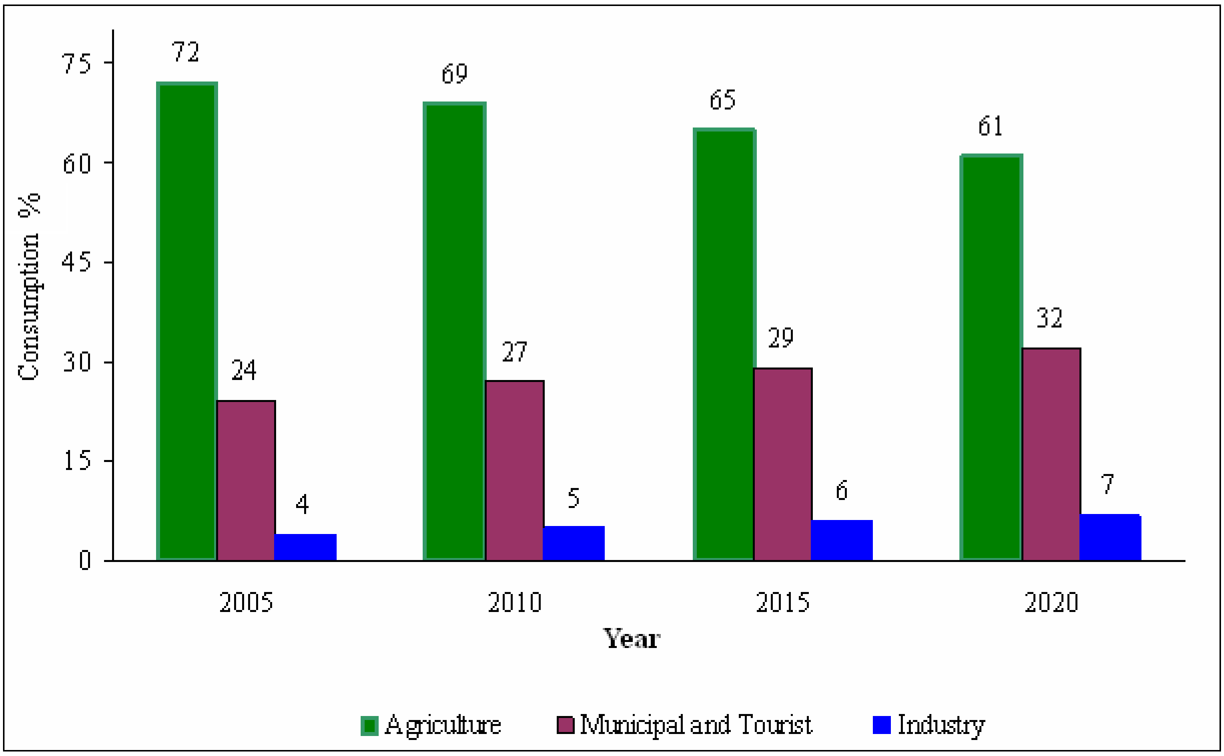

Figure 3.5: Jordan's water demand projections per national sector (Modified from: MoWI 2006)

Therefore, it is important for farmers to adopt new farming systems and techniques that would help them to sustain their farming by using less water to comply with the government plans. One of the suggested farming systems in this research is organic farming (discussed below).

3.5.3. Plant production

Agricultural production in Jordan is limited by the lack of water resources, poor soil fertility, pest and disease, by the fact that there is a small cultivable area of ca 0.9 million ha (3.4% of the total country's area), by expensive inputs and remarkable population growth (Al-Tallawi 1994, MoA 2003, MoA 2005a, MoA 2006). Another significant problem realised in this research is the lack of accurate agricultural statistical information which hampers decision making which might improve this sector.

However, there are important crops (Table 3.3) grown under two major farming systems, namely the rainfed farming system and irrigated farming system (eL-Hurani 1985a, Kirk 1998, al-Hussein 2000, MoA 2005b, MoA 2006).

Table 3.3: Main agricultural crops 2001-2005 (MoA 2006)

Crops	**Production (1000 t)**				
Field crops	**2001**	**2002**	**2003**	**2004**	**2005**
Wheat	19.3	43.8	42.5	13.2	34.4
Barley	17.3	56.8	25.8	21.0	32.0
Tobacco	1.3	4.3	0.0	0.3	0.10
Lentils	1.9	1.7	0.5	0.6	0.8
Maize and sorghum	10.6	13.8	11.3	19.2	36.0
Clover	57.3	230.6	115.6	296.2	265.0
Vegetables					
Tomatoes	310.2	359.8	415.9	449.5	599.0
Eggplant	36.7	59.4	51.2	82.9	99.0
Cucumbers	78.1	120.3	102.3	102.4	166.0
Cauliflowers and cabbages	30.0	88.2	64.7	121.4	106.5
Melons	85.8	108.3	131.9	107.9	85.0
Potatoes	101.3	105.3	122.4	165.3	172.0
Zucchini	57.5	47.7	60.0	55.6	72.0

Continued

Fruit trees					
Olives	65.7	180.9	118.0	160.7	113.0
Grapes	58.0	34.8	28.1	32.4	34.0
Citrus fruits	136.6	124.2	147.2	127.8	57.0
Bananas	24.3	47.4	21.4	37.1	32.18
Apple	37.1	39.2	41.8	42.4	45.57
Peach	8.1	14.0	8.7	13.1	13.0

In the rainfed farming system, crops are grown mainly in highland areas with rainfall greater than 250 mm through the winter period, and this system represents 70% (1,673,415.5 ha) of cultivated land in Jordan but provides about 10% of the total production (Figure 3.6) (MoA 2006). The main rainfed crops are wheat, barley, legumes and olives, which are import-replacement products, and their production varies from one year to another depending on the rainfall (Duwayri 1985, MoA 2003, MoA 2006). In most years the rainfall is not enough to give good yields; therefore, crops have to be fed to animals (Duwayri 1985).

As for the irrigated farming system, crops (olives, vines, fruit trees and vegetables) are grown with irrigation during the summer period or all year round (Abou Howayej 1985, al-Hussein 2000, MoA 2006). This type is practised in the Jordan Valley and Badia and represents about 30% of the cultivated land in Jordan, and can be divided into three categories that are devoted to growing: fruit trees, vegetables or mixed products (MoA 2006). Although irrigated farming represents 30% (800,451.5 ha) of the cultivated land (MoA 2006), its outputs play a major role in agricultural exports (Abou Howayej 1985, MoA 2006), and moreover its share has increased steadily to represent about 90% of the total agricultural production and about 90% of agricultural exports (Figure 3.6) (MoA 2006). It can also be noted from Table 3.3 above that the production of crops grown under the rainfed system increases some years and decreases other years due to rainfall fluctuation, while the production of crops under irrigation has increased, except for citrus trees which need more water, and melons which depend on new cultivated land (Chapter 5).

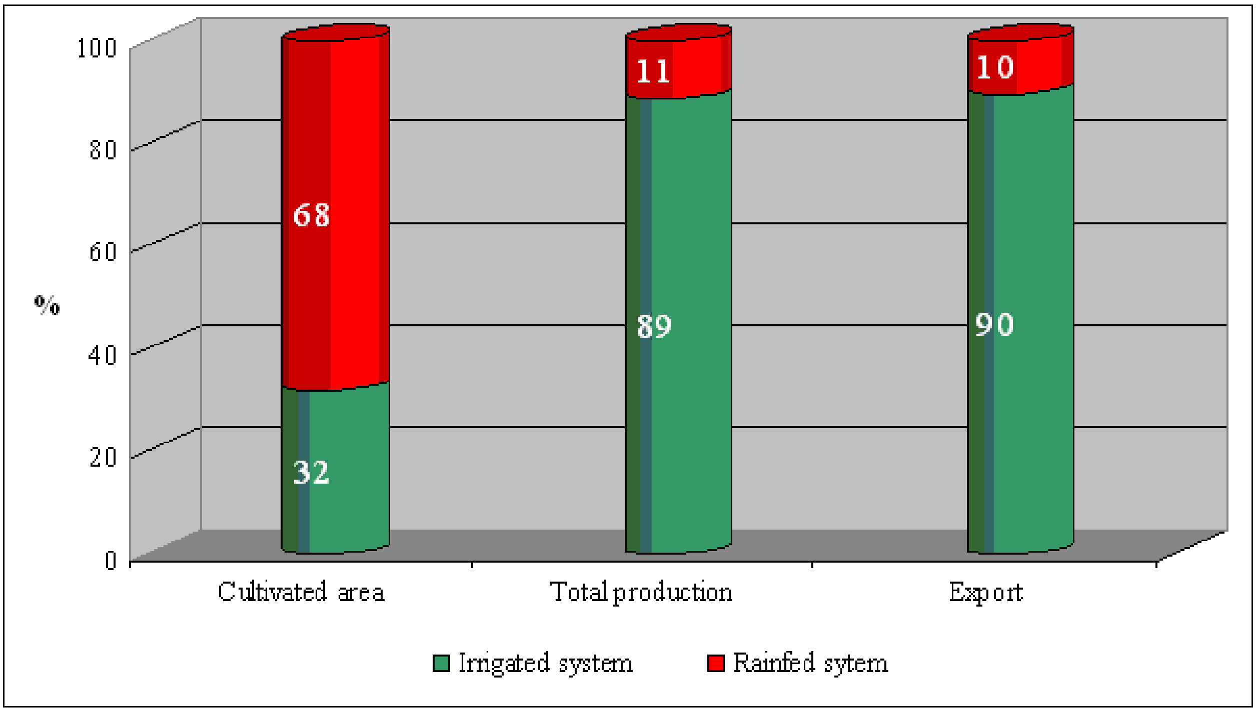

Figure 3.6: A comparison of irrigated and rainfed farming systems (Modified from: MoA 2006)

Moreover, the irrigated agricultural type is the main income source for farmers who practise it and takes more than 98% of agricultural investment (MoA 2006). Because of this, this system should be managed carefully in a sustainable way. It is very clear that the population is increasing and the cultivated area and its production are decreasing, and that there is a need to achieve a balance between the rapid increase of the population and domestic consumption. Therefore, the Government of Jordan should plan carefully to support agricultural systems that maintain this type of farming, to provide its population with a reasonable supply for domestic need, and for exports.

3.5.4. Animal production

Animal production is also an important component of agriculture and provides an important link between and within the different farming systems in Jordan (Duayfi 1985, Al-Oun 1997, MoA 2005a, MoA 2006). Animal production includes sheep, goats and cattle, which are the main red meat and milk sources (Table 3.3), while poultry is the main source for eggs and white meat (Duayfi 1985, Al-Oun 1997, MoA 2006) (Table 3.4). It is important to state that sheep and goat production still depends on traditional techniques while cattle and poultry production depend highly on improved technology (MoA 2005a).

Table 3.4: Number of livestock and its production in Jordan 2005 (MoA 2006)

Category	Number (1000 heads)	Red meat (1000 ton)	Milk (1000 ton)
Sheep		7.2	32.3
Goats		2.8	20.6
Cows		5.89	177.8
Camels		0.3	-

Table 3.5: Number of poultry and its production in Jordan 2005(MoA 2006)

Category	Number of farms	Capacity (1000 birds)
Eggs		
Meat		
Meat mothers		
Egg hatch		

The importance of animal production as an agricultural component has changed. For example, sheep and goat production used to be the major source of income for the majority of farmers (Al-Oun 1997, Al-Sharafat 2001, MoA 2002), but this has changed for several reasons: sheep and goats are mainly fed on expensive imported conventional feed; fluctuation of rainfall; lack of grazing lands; rangeland fragmentation; closed borders with the neighbouring countries; the removal of feed subsidies; animal diseases; and low prices for livestock products (Al-Sharafat 2001, Al-Tabini 2001, MoA 2006). As a result, the animal production system has changed from an extensive pastoralism system to intensive and semi-intensive systems, where sheep and goats are managed under semi-extensive management systems while cattle and poultry are kept under intensive systems. It is poultry production that occupies the highest rank and has a special importance due to its economic significance to big business companies, closely followed by dairy production (MoA 2006). Poultry production also makes a good link with plant production by providing poultry manures to improve soil fertility especially to vegetable farmers as will be seen in Chapter 5. The use of manures should be considered as a form of recycling of nutrients as explained in Chapter 2 Section 2.3. In Jordan, most of the nutrients and organic matter contained in the poultry manure are derived from imported feedstuffs (barley, wheatbran, straw and grains) which when recycled release nutrients for soil fertility building (Al-Tallawi 1994). The rapid growth of poultry production in Jordan is mainly due to consumer demand for broiler meat and eggs as animal protein in their diets and secondly due to the continued increase in the price of red meat produced locally (Duayfi 1985, MoA 2006).

It is worth mentioning that the employment situation in animal production has also changed. For example, women used to have a great role in sheep and goat production activities through assisting in raising livestock, animal feeding, sheep milking and produce processing (Al-Oun 1997, Al-Sharafat 2001). The research shows that this role has changed and many of these women have changed their role to work in vegetable and fruit farms (Chapter 5). Men have also started to change their jobs from livestock keepers to vegetable and fruit farmers, or to work in plant production farms (see study area below and Chapter 5) (Arab 2004).

As for self-sufficiency, the productivity of agricultural land in Jordan has been low due to lack of water resources, lack of scientific knowledge, poor soil fertility and traditional farming systems (Abou Howayej 1985, Wilson 1991, al-Hussein 2000, MoA 2006). Therefore, the government has encouraged farmers through low interest loans to buy agricultural inputs (seeds, pesticides, fertilisers, tractors, etc) to increase the annual food productivity growth rate by using external inputs to meet the high annual population growth rates (eL-Hurani 1985b). The government has also given loans with low interest rates to farmers to cultivate new lands in order to increase production (eL-Hurani 1985b, Al-Tallwai 1994, Kirk 1998, MoA 2006). Consequently, the sector was able to meet some of the consumption needs and unable to meet others. For example, Jordan is self-sufficient in vegetables, fruit (except citrus and kiwi) and in poultry meat and eggs, and sometimes the production capacity exceeds the consumption needs of the local market, while livestock provides only about 30% of Jordan's demand for red meat, 53% for milk and dairy products, 7.7% for fish and 20-30% for honey. Production is also insufficient in cereals (particularly wheat and barley) and animal feeds (MoA 2006).

3.6. The sustainability of the Jordanian agricultural sector

The discussion above shows that Jordan's agricultural sector is an important component of the economy and provides an important link between and within the different economic sectors. However, the sector is facing several constraints and its sustainability is at risk. The research has noted (Figure 3.6) that the most dangerous risk is that Jordan depends mainly on about 30% of its cultivated land (with the irrigated system) to meet its population's consumption needs. It is important to point out that this has not been noted before by any researcher or any institution in Jordan. Moreover, most of this area is located in the arid part of the country, which is degradable and will not sustain itself for long periods because conventional farming in this area has led to more environmental problems (al-Hussein 2000, Al-Adamat 2002). There are two examples supporting this argument, namely the Adulail area and the Alkhaldiah area. These areas used to be the main areas to produce vegetables, but because of conventional farming (overuse of fertilisers and pesticides, deep ploughing, overuse of groundwater), these areas are not sustainable any more and it is hardly possible now to grow a crop successfully there. Regrettably, they have become good examples of unsustainable farming systems (Toaimah 2004). This means that Jordan would have less cultivated area which means less production and a serious impact on its food security. Having less production means that Jordan will be forced to import more products to meet the consumption needs, which is easy to do but would be very expensive for consumers. Moreover, according to the Jordanian national water master plan (MoWI 2006), the available amount of water for the agricultural sector will be restricted and less than it used to be (Figure 3.5 above). Jordan also cannot depend on rainfall to grow crops because of the rainfall fluctuations (discussed above). Therefore, it would be better for decision-makers and farmers to rethink the concerns of this sector and employ more sustainable farming systems.

As a result, it can be concluded that there is a need to start immediately applying more sustainable and ecological farming systems. Decision-makers should also start developing policies to adopt sustainable systems, particularly in the newly cultivated areas such as the study area, to avoid the experience of the Adulail area and the Alkhaldiah area. Therefore, the research investigates organic farming as a holistic production system (Chapter 2) to maintain Jordan's agricultural sector and to increase its contribution to GDP. First, it is important to investigate whether Jordan does farm organically and the justification for proposing organic farming. Based on this, there is a need to develop a research methodology also to investigate the potential and opportunities for organic farming in Jordan (Chapter 4).

3.7. Does Jordan farm organically?

The majority of farmers until the 1960s grew their crops without using synthetic inputs due lack of information, lack of synthetic inputs and lack of cash to buy external inputs (Abou Howayej 1985, Al-Tallawi 1994). It is the government which encouraged and supplied farmers through low interest credit to buy agricultural inputs including pesticides, fertilisers, seeds and machinery produced locally or imported (Abou Howayej 1985) to increase agricultural productivity (Saket 1985, eL-Hurani 1985b). Before this encouragement, farmers used to grow winter crops in winter periods and summer crops in summer periods, which meant that they used to eat seasonally. This system had changed to a new 'conventional' farming system under private farms that depended greatly on external synthetic inputs to produce for both local markets and to export products sold at good prices, mainly to the Gulf countries (Abou Howayej 1985, Al-Tallawi 1994, Abu-A'moud 2003).

Various MoA documents and reports such as the Agricultural Policy (MoA 1996), Agricultural and Environment in Jordan (Al-Tallawi 1994) and Agricultural Situation (MoA 2005b) show that the majority of Jordan's farmers use synthetic fertilisers and pesticides and that Jordan's agricultural production system is greatly dependent on external inputs and is classified as commercial production. However, there are certain areas (rainfall >250 mm) where some farmers use more ecological approaches to grow certain crops under rainfed conditions as a non-certified 'organic farming system' (i.e. naturally). But this system is technically not feasible and would not provide sustainable yields (MoA 2005a). For example, olives can be cultivated in the highlands under a rainfed system (rainfall >250 mm) with less use of pesticides and fertilisers, and in some cases they are cultivated without using any type of chemicals. But the yield is very low due to pest attacks and lack of nutrients. Another example is wheat and barley which are grown naturally in different areas of Jordan where the rainfall is more than 200 mm, but in most cases the rain is not enough to produce wheat or barley for commercial purposes. However, conventional farmers in Jordan use several organic farming practices, although they consider these as part of their conventional farming due to the lack of knowledge of organic farming (see chapter 5).

The components of the current farming system in Jordan show that this system is conventional and is dependent on external inputs. For example, all seeds and seedlings used in Jordan for commercial use are not organic, and are imported according to the Reg. 1/bz/1997 which is set by the MoA (DPP 2005). Seeds used by farmers are treated with some chemicals and packed in special packages to ensure a high percentage of purity and emergence. However, some seeds can be found in local shops for home gardens, but not for commercial farms, and farmers are aware of the need not to mix between the two types for hygiene reasons.

As regards pesticides use, there is hard evidence that pesticides are widely used by farmers in Jordan to control pests and disease in order to increase production and to reduce any damage incurred (Abou Howayej 1985, Al-Tallawi 1994, MoA 1998, Al-Adamat 2002), and farmers do not have alternatives to current pesticide uses (Bahdoshah 2003). In Jordan, pesticides can be produced or imported by private sector companies through a permit from the MoA Pesticides Committee (Al-Tallawi 1994, MoA 1998). According to the MoA there are eight imported and exported categories of pesticides (Table 3.6) used in Jordan and the total number of the registered pesticides in 2002 was 734 (MoA 2003).

Table 3.6: Amount of registered pesticides 2005 imported and local production (M.Ton)
(DoS 2006)

Category	No. of registered Pesticides	Imported (M.Ton)	Local Production (M.Ton)	
			Local use	Exported
Insecticides	258	278.6	217.6	744.2
Fungicides	289	641.5	109.7	611.2
Acricides	92	102.8	30.9	194.5
Herbicides	84	93.8	132.0	263.6
Soil, Store & Seed Fumigant	31	99.6	5.1	6.2
Public Health	145	31.2	121.9	219.4
Oil	17	54.0	40.7	7.2
Rodenticides & Molluscicides	30	19.4	270.2	73.9
Household Insecticides	47	0.0	3.0	0.1
Deserte locust	7	0.0	27.1	12.5
Stickers	12	32.7	0.0	0.0
Nematodes	5	0.3	0.0	0.0
Snakes Repel	1	0.0	0.0	0.0
Total	1018	1353.6	958.2	2132.8

In general, there is an increase in the amount of pesticides imported to Jordan (Figure 3.7), and it can be noted from Figure 3.7 that there are annual fluctuations in the amount of imported pesticides. According to Al-Tallawi (1994) this is due to several reasons: there are many importing bodies, there is a lack of procedures to control the importing process, there is a lack of information about the cultivated area and a lack of information about pesticides left over from previous years. These factors also lead to price fluctuations.

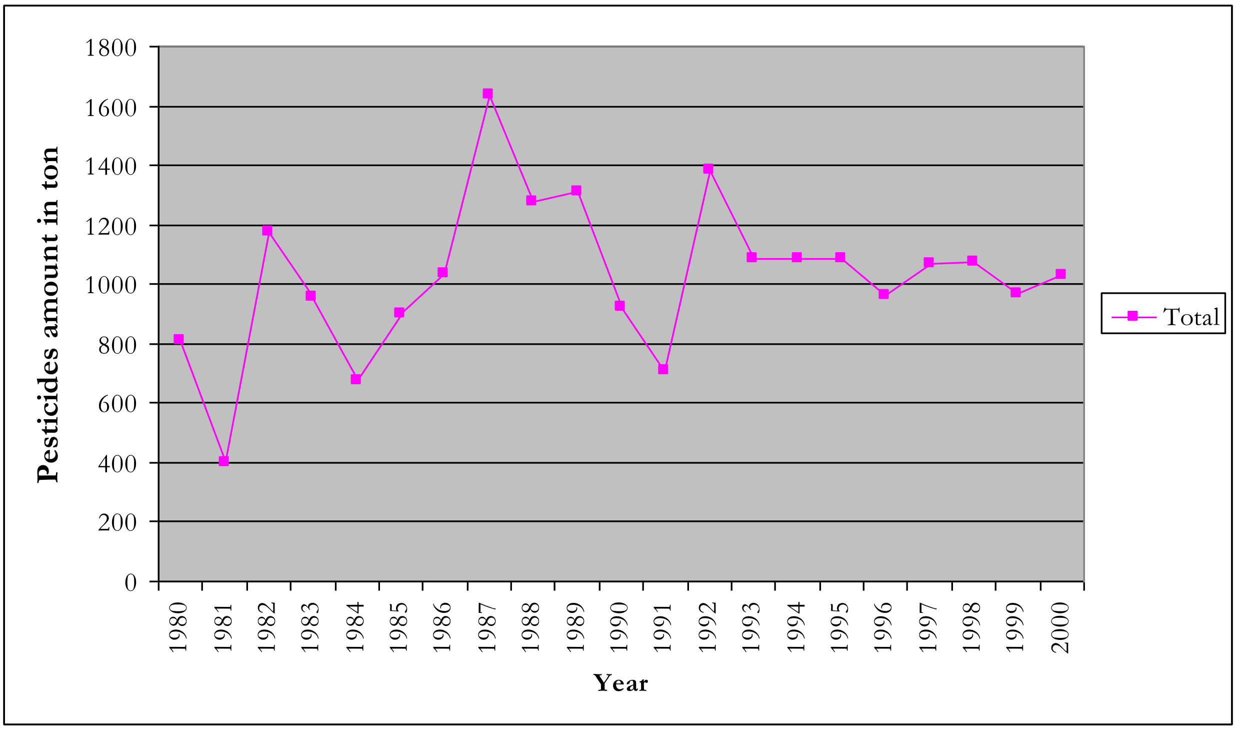

Figure 3.7: The amount of pesticides imported to Jordan between 1980 and 2000 (Modified from: DPP 2002)

Moreover, farmers use pesticides more than they need and try to buy stronger pesticides to control resistant pests and disease (Al-Adamat 2002). Farmers also use large amounts of pesticides, for example, if a Jordanian farmer wants to spray 3 ha of tomato plants at the age of two months then he/she needs to use a pesticide solution of about 60,000 l. Usually this solution contains at least 18 kg of a pure pesticide (Motaw'a 2004). At times farmers in Jordan mix insecticides, fungicides and acaricides to prepare the solution, not knowing if there will be a reaction between these chemicals, which can produce new compounds, and which do not control pests but are harmful to crops, human health and the environment (Omoush 2005) (discussed below). The spray process needs three workers and a tractor driver to spray the 60,000 l in one day, preparing and mixing the solution in the same day. They take a break between sprayings to drink tea, to smoke or to eat, without washing their hands properly. Furthermore, some people use empty pesticide containers to keep sugar, tea, salt or food, unaware of the dangers of this practice (discussed below) (Omoush 2005). Much of the same story happens with fertilisers in which farmers use different types of fertilisers to increase their agricultural productivity. Moreover, in Jordan there is an overuse of fertilisers (Al-

Adamat 2002). Most farmers do not perform a soil analysis, and they use their own judgment and knowledge and depend on the private sector for the plant fertilisation programme (Okour 2004). Farmers add more fertilisers to the soil than is recommended, for example, they add about 400 kg N ha^{-1} whereas the recommended amount is less than that. And using extra fertilisers or chemicals will have an environmental impact and place additional costs on farmers. Moreover, farmers use organic manure less than the recommended amount to sustain the best soil biological activity (Al-Adamat 2002). The amount of fertilisers imported to Jordan in 2003 was 33,000 tons (solid), 264,000 l (liquids) and 19,000,000 l growth media at a total cost of £8 million (DoLI 2003).

It is very important to bear in mind here the absence of reliable information and technical advice that has led farmers to overuse agricultural inputs. This problem was highlighted by Abou Howayej in 1985 and reported again by Al-Adamat (2002). Abou Howayej (1985) argues that this absence makes farmers use their own judgement for the application of agricultural inputs or crop rotation, and that they do not necessarily adopt proper methods to utilise their potential resources, which causes economic losses and deterioration of agricultural resources.

Livestock production also depends largely on conventional feed resources to feed animals due to the lack of green forage, rangeland and insufficient locally-produced feed, which is an important constraint on livestock production in Jordan (Al-Tallawi 1994, Al-Oun 1997, Blench 2001, MoA 2003, MoA 2006). The main feeds are barley, wheat bran and straws in addition to some salts and vitamins, and farmers use medicines and vaccines to treat their animals. More than 75% of livestock feed requirement is met by imports, with a high cost (MoA 2005a). As a result, livestock produce, including manure, can be considered as conventional produce because livestock production inputs do not comply with organic farming regulations.

It is not only the farming components that are conventional but also agricultural extension. It has been noted in this research that the extension methodology is devoted to conventional farming, in which the MoA extension leaflets and tools promote conventional farming and high external inputs. These publications are often poorly-designed and not suitable for all farmers. It was hard to find a leaflet designed for organic farming techniques, including those leaflets designed for rainfed systems, which advise farmers to use supplementary fertilisers and some pesticides.

Moreover, the history of extension in Jordan shows that the extension activities started were set up to encourage conventional farming activities but not organic or low input systems. The history shows that the first agricultural extension station in Jordan was established in 1952 through a joint programme between Jordan and the British Overseas Development Administration (ODA) to work on cereal crops. In 1954, the station was used, through a USAID technical assistance programme, to start up conventional extension activities through the MoA and foreign private companies from the USA and the UK. These activities aimed to introduce pesticides, fertilisers, new vegetable varieties, and new stone and pome-fruit varieties introduced from Europe (Qasem 1985). It can be said this was the first change from natural or traditional farming to conventional farming.

Agricultural machinery is also widely used by farmers in Jordan, and this has helped also to cultivate new areas and to reduce labour costs. Machines are used for ploughing, spraying and food transport. However, use of these machines has led to various problems, for example, using bulldozers for deep ploughing to cultivate new areas (Kirk 1998).

As for marketing, there has been no special market for organic or natural products in Jordan, except an unsuccessful IPM shop (discussed in Section 3.8 below). In general, farmers have to sell their products in two ways: (a) as wholesale to the central wholesale market or the export market through commission agents; or (b) to retailers at farm gates (Arabiat 1985, Abu-A'moud 2003). Farmers prefer to sell their products to the export market to be sold to the Gulf countries at premium prices, while selling at the central wholesale market may not cover their costs. In these markets the main concern is to have good product quality without any concern about the production system used. On the other hand, consumers in Jordan are concerned about price as the main factor in purchasing (Chapter 6). Therefore, it can be concluded from this section that the farming system in Jordan is conventional farming and is highly dependent on external synthetic chemicals.

3.8. Has Jordan ever tried organic farming or low input systems?

The previous section has shown that Jordan's farming system is conventional. However, there has been an experience in Jordan with IPM, but not organic faming. This experience was conducted by a GTZ project to reduce the use of pesticides in Jordan. The project was a 7-year GTZ IPM project (January 1995-December 2001) to develop a more sustainable, environmentally-friendly and less chemically-dependent farming system. This project aimed to enable farmers to use more environmental and economical plant protection methods by establishing contracts with the target farmers. To do so, the project proposed the following objectives to:

1. develop economically advantageous pest management methods suitable for both large and small scale farmers,
2. stimulate demand for fresh fruit and vegetables grown under environmentally-friendly IPM-technology among wealthy and poor consumers,
3. promote the availability of inputs needed for IPM
4. promote marketing of IPM produce and create consumer awareness through media, seminars and campaigns,
5. adapt agricultural legislation and policy to provide conditions conducive for the introduction of the IPM

(GTZ 2000, NCARTT 2003)

The project also trained some plant protection experts from the MoA on IPM, helped to establish a retail shop called AMAN to sell certified IPM produce, and funded 15 research projects at Master's level (i.e. university) concentrating on IPM in Jordan. IPM products were produced and sold at the retail shop (NCARTT 2003). However, the project could not sustain and more than 98% of its products were sold as conventional products because of the low demand for IPM products (more details Chapter 6). The AMAN company could not sell more than ca 1000 kg day^{-1} of the IPM products brought to the shop by farmers, which did not cover the cost of one employee. It was also found that IPM farmers were selling most of their IPM products as conventional in other shops, not in AMAN (see Chapter 6).

3.9. Organic farming in the framework of the Jordanian Agricultural Policy

The key principles of the Jordanian Agricultural Policy (JAP) are environmental integration, rural development, delivering environmental benefits and sustainable development (MoA 2005a), which complies with organic farming. Such key principles have encouraged various countries to integrate organic farming into their agricultural policies: a good example can be obtained from the EU where several members have implemented action plans to integrate organic farming into the CAP, which has contributed to the growth of organic farming (EC 2004). In Jordan, proposals for organic farming have been considered (MoA 2003, MoA 2005a), but reviewing JAP brings into sharp focus that there has been no official government policy to support organic farming, although the current JAP aims to establish an environmentally-friendly farming system (MoA 1996, MoA 2003, MoA 2005a). This lack of official support for organic farming is consistent with the overall government policy of minimal direct involvement in agriculture (see above, Section 3.5.1).

3.10. Why propose organic farming for Jordan?

Proposing organic farming for Jordan is sensible because the aim of Jordan's government is to develop more sustainable, environmentally-friendly, less chemically-dependent agricultural systems, all of which can be achieved by organic farming (MoA 2003). There are also several factors supporting the argument for organic farming being adopted by Jordan, as follows:

3.10.1. Jordanian Water concerns

It was discussed above that Jordan has limited water resources and that, therefore, the government has introduced new regulations to control the amount of water allocated for agricultural purposes as explained above in Section 3.5.2. According to these regulations, it is not allowed for farmers to pump more than 150,000 m^3 $farm^{-1}$ $year^{-1}$, and if farmers exceed this amount then they have to pay £0.10 for every pumped cubic meter. But Motaw'a (2005) reported that this limit is not enough for a farm of about 25 ha because the minimum required to water this area is about 300,000 m^3 $year^{-1}$. Therefore, there is a need to introduce farming systems that have higher water use efficiency and taking advantage of crops and cropping patterns that would maximise the benefit from each unit of water (Khairallah 2006). Organic farming would help farmers in this regard in two ways. First, organic farming aims to introduce crops that are adapted to the environmental conditions, including water requirements (Scialabba and Hattam 2002). For example, a comparative study in Jordan showed that one cubic meter of water generates one US$ when irrigating tomato, but it generates 4-6 US$ when it is used to produce crops adapted to the local environmental conditions such as herbs (Batikhi 2001). In addition, using some organic methods such as compost would help to maximise the benefit form the use of water because it increases the soil water holding capacity (Dahama 1997). Therefore, adopting organic farming would help farmers to overcome the restrictions that have been set up by the government. Secondly, because farmers use an environmentally-friendly farming system (organic farming), then it is very important for the government to allow those farmers to use the required amount of water if they adopt organic farming, which would reduce the other environmental impacts and achieve the goals of the government to have better ecological farming systems in Jordan (See 'Organic Farming Principles', Chapter 2 Section 2.5). However, the research does not consider that adopting organic farming would solve the water problem in Jordan completely, but considers that organic farming would be one of solutions to solve this problem. The research also emphasises that there still a need to conduct research on the water use efficiency in organic farming under the Jordanian environmental conditions, which is covered in Chapter 8.

3.10.2. Environmental concerns

Environmental concerns are also important reasons to adopt organic farming. In Jordan, conventional farming has led to several environmental problems (GTZ 2000, Al-Adamat 2002). For example, the excessive use of pesticides and fertilisers in this system has led to deterioration in the underlying groundwater qualities (Salameh 2001, Al-Adamat 2002, NCARTT 2003). The problems include also soil fertility decline, salinity increase, groundwater over-pumping (Al-Adamat 2002), increase in soil erosion (Kirk 1998, Al-Hussein 2000), groundwater pollution, pesticide resistance and biodiversity problems, in which many species have disappeared including natural enemies of pests (GTZ 2000). There are also other environmental problems, discussed in Chapter 5. These problems can be reduced by applying organic farming in Jordan: as Chapter 2 (Section 2.6) showed, organic farming can benefit the environment and reduce environmental problems not only because agrochemicals are prohibited but also because organic farming aims to stop degradation and restore natural balance through its principles and its regulation. Moreover, Chapter 2 (Table 2.2) showed that there are several indicators such as biodiversity and landscape, soil, ground and surface water, climate and air and farm input and output, showing that organic farming has less impact on the environment than conventional farming. These indicators make organic farming a solution for problems resulting from conventional farming for many countries, including Jordan.

3.10.3. Health concerns: The use of pesticides and their health impact

Pesticides are an integral part of the farming system, but there are costs as well as benefits of these (Jaghabir and Al-Saket 1997). The excessive use and misuse of pesticides constitutes a potential impact on the health of farm workers (Dahama 1997, GTZ 2000), on biodiversity, groundwater and wildlife (Dahama 1997, Pykh and Pykh 2003), and also has the potential to harm the environment and poses an ecological risk to ecosystems (Dahama 1997, GTZ 2000). The effect of pesticides on human health is divided into two types:

- A short-term effect, which includes acute poisoning caused by misuse, overuse, and exposure to pesticides
- A long-term effect, including birth defects and cancer.

(White 1995)

For example, it was estimated that in the USA about 300,000 spray workers each year suffer from illness related to pesticides. Yearly, twenty-five incidents result in death and about 10% of the poisoning cases are acute (White 1995). It is estimated around the world that yearly one million cases of poisoning by pesticides cause about 20,000 deaths, mostly in the developing countries (HDRA 2001).

In Jordan, pesticides are used widely among farmers to control pests in order to increase crop productivity, as mentioned above. Pesticides have led to the rapid growth of production in Jordan, but have also had a potential impact not only on costs but also on health. It has been noted in this research that some risky behaviour of Jordanian farmers includes applying dangerous pesticides without using any protective clothing or overalls, using their hands to mix and to prepare the spray solution, and smoking or eating while working. Farmers are unaware of the harm they cause to their health. It was noted also that many farm owners hire workers to spray their crops. Workers sometimes are students less than eighteen years of age who work in the summer or during their holidays. Usually the farm owners do not employ their sons to spray pesticides because they are vaguely aware of its dangers, but in some cases they do not have enough money to pay sprayers and will use their sons.

Whatever the impact of pesticides, little research covers this issue. An important study was conducted by Jaghabir and Al-Saket (1997), who found that in Jordan the precautions taken are not sufficient to limit exposure to pesticides, and workers are in need of intensive health education regarding their effects. Furthermore, the study showed some practices such as those put in place by the IPM project can reduce farm workers' exposure to pesticides, and also that there is a need to adopt environmentally-friendly farming systems. Using pesticides has resulted in a critical health problem where many poisoning cases by pesticides have been reported. During the period 1973-1985, at least 329 deaths resulted from poisoning by pesticides (Jaghabir and Al-Saket 1997). Having said that, Jordan, as a member of the Prior Informed Consent (PIC), coordinates with exporting and importing countries to protect its environment and human health from the harmful effects of certain hazardous chemicals being traded internationally (MoA 1998). Moreover, Jordan prohibited at an early stage the use of certain hazardous pesticides. For example in 1981 the MoA prohibited chlorinated hydrocarbonated pesticides that have long life persistence, such as DDT (Al-Tallawi 1994). However, being a member of the PIC is not enough to reduce the impact of pesticides, therefore pesticides can only be reduced through adopting environmentally-friendly farming systems such as organic farming. As explained in Chapter 2, synthetic pesticides are not allowed to be used in organic farming.

3.10.4. Global market trends and GDP contribution

Organic farming is growing rapidly worldwide and the organic food market is now big business in both developed and developing countries. Therefore, Jordan as a developing country could have the potential to supply this market with organic products because there is a demand for organic produce and supply continues to lag behind (Chapter 2.7.2). Moreover, Jordan has established international agreements with different countries to liberalise its agricultural exports. One of the most important agreements is with the European Union (MoA 2006). Jordan has finished its negotiation with the EU on deepening liberalisation of trade in agricultural products, and the agreement was launched in early 2006 (Chapter 6).

It was also discussed above (Section 3.5.1) that Jordan's agricultural sector makes only a low contribution to the GDP (3.8%). One of the main objectives of the present MoA Minister is to try to adopt a new farming system that could add value to agricultural products to increase their contribution to the GDP and to help farmers to make a better profit (MoA 2006). This can be achieved through adopting organic farming because the prices of organic products are usually about 20% above conventional ones.

3.10.5. The MoA is interested in organic farming

One of the main factors in proposing organic farming is also the interest of the MoA. This interest led the MoA in 2002 to establish an organic farming unit (OFU) within the Department of Plant Production (DPP) to set up a plan for organic faming in Jordan. The OFU plans for its activities to cover the whole Kingdom's area, including the Badia. It plans also to train farmers and agricultural extension agents in organic farming techniques, raise awareness regarding organic farming, provide consumers with enough information about organic farming, and establish national organic farming legislation. The OFU also has other important goals, which can be summarised as follows:

- To collect various technical and legal information regarding organic farming and set up a specialist organic farming library
- To transfer and deliver technical information to the target groups: farmers, exporters, extension agents, researchers and consumers.

- To seek training opportunities for the target groups through cooperation with international and Arabic organisations,
- To achieve cooperation between this unit and the private sector,
- To put in place the legal framework and the required standards for this type of production and establish a unit for monitoring and issuing certificates for organic products.
- To establish some demonstration sites at the Ministry stations.

(OFU 2003)

However, the unit has several barriers including lack of information, lack of trained staff and insufficient budget to maintain its sustainability. Moreover, the unit needs an appropriate methodology to help farmers adopt organic farming. Therefore, the researcher contacted the unit staff in the early stages of this research to build up close collaboration to provide the unit with results that can help in the adoption of organic farming in Jordan. The outcomes of this research will also be given to the unit to develop the organic farming adoption system, and this 'applied' aspect has helped to inform the methodology for this research, as explained in Chapter 4.

3.10.6. Organic farming complies with the objectives of the NASD 2002-2010

The government of Jordan through the MoA in 2003 established a strategy known as the National Strategy for Agricultural Development (NSAD) 2002-2010 that should respond to the development needs for a holistic and sustainable farming system. This desire is to achieve: (a) a balance between the economic, social, and environmental dimensions of development, (b) the development of rural areas, (c) an increase in the economic returns and enhancement of social and economic equity through prioritizing public investment in rural areas, (d) a sustainable system with less environmental impact, and (e) product quality (MoA 2003, MoA 2006). Reviewing the strategy shows that the current conventional farming system discussed above does not completely achieve all the objectives of the strategy, and the MoA is looking desperately for a holistic production system. This is very clear from the objectives of the strategy given in Box 3.1. The objectives comply with and meet the principles of organic farming, which must encourage the government to adopt organic farming. Therefore, reviewing organic farming (Chapter 2) as a system (its definition, principles, regulation, environmental impact, social issues, etc) shows that the adoption of organic farming could help to realise the objectives of this strategy shown in Box 3.1.

Box 3.1: Objectives of the NSAD 2002-2010 (MoA 2005a)

Protect agricultural resources from all forms of deterioration and improve their present use for sustainable agricultural productivity with support integration between plant and livestock production reducing the risks facing sustained agriculture
Maximise the socio-economic returns from the agricultural resources and products taking into account the environmental concerns
Protect the environment, the agro-biodiversity, irrigation water resources, surface and groundwater, natural rangelands; and conserve agro-biodiversity and use it for rangeland development, and expand the establishment of natural and rangeland reserves
Improve the quality of agricultural produce, achieving high quality to meet external market standards and specifications.
Grazing management, and developing the productive capacity of rangeland resources
Encourage farmers to establish associations to assist in organising and improving agricultural production and marketing
Establish marketing systems that are efficient and fair to producers and improve the management of local fruit and vegetable markets and their performance.
International and regional cooperation with countries regarding water resources, water quality and the protection of the environment
Increase the efficiency of rain-fed agriculture (natural) and increase its economic returns and its contribution to overall agricultural development
Encourage crop diversification by introducing high-value cash crops and maximizing integration of plant and livestock production.
Promote production for agricultural processing and export to achieve integration and to contribute to increasing the added value of products.
Create job opportunities for rural populations, specifically women, to reduce unemployment and limit rural migration
Improve the performance of Government and ensure on an institutional basis participation of private sector organizations, farmers and other stakeholders involved in the agricultural process in Jordan (marketing, planning, development)
Promote market-oriented production, and enhance the relationship between the marketing and the production sectors.

However, in the NSAD 2002-2010, Jordan's organic farming was not addressed as a production system but as a technique within the rainfed sector strategies, to improve this sector and to protect the environment, biodiversity and product quality (MoA 2003). Reviewing the strategy shows also that there is a misunderstanding about the concept of organic farming. In fact, the perception of organic farming is still not clear for the majority of people in Jordan (discussed more in Chapter 6). As a result, this research emphasises that the government should consider organic farming as a holistic production system in order to achieve the objectives of the strategy, in all areas of the country.

3.10.7. JBRDC development strategy

Jordan Badia Research and Development Centre (JBRDC) was established in 1992 under the umbrella of the Higher Council for Science and Technology (HCST) and the Royal Geographical Society (RGS) in the UK, with a mission to improve the quality of life of people through a sustainable development approach. It also aimed to link the Badia's economy (80% of the total country area) with the national development policies and plans. Its strategy is working with local communities, aiming to achieve sustainable development for their area as well as improving their standard of living. To do so, JBRDC has presented in its mission framework several scientific themes: human resources, water resources, land resources, livestock, geology, mineral resources, renewable energy resources, information management and documentation. Moreover, the development process involves contributions from the local communities, decision-makers and researchers into the research process, in order to conserve the natural resources for the benefit of the inhabitants (JBRDC 1994).

The JBRDC has realised that organic farming, with its principles and global market, can benefit farmers in Jordan and in the meantime can help to conserve natural resources. As a result, the JBRDC discussed the issue of organic farming in a workshop held at the JBRDC Centre at Safawi on the 15th July 2003 in the Northeastern Badia with sixteen farmers from different areas of Jordan. The discussion focused on organic farming, its potential, opportunities and how it can be adopted in Jordan. At the end of the workshop a decision was taken by the participants to conduct research on this issue in collaboration with Coventry University. Thus, this research has direct relevance to both the JBRDC and national development goals in Jordan.

3.11. Farming potential in the study area

It was discussed in Chapter 2 Section 2.10 that organic farming has several barriers on it before it can be adopted and therefore that several steps must be taken before adoption. In this research it was decided first to choose a potential area in which to investigate the opportunities for, and barriers to, organic farming in Jordan. The study area is located in the Northeast Badia (NEB) which is located in the Mafraq Governorate (Figure 3.8). It is bounded by Syria to the north (Dutton 1998, Allison *et al.* 1998, Baban and Al-Ansari 2001), and to the south by the Mafraq-Safawi road, which joins the Amman-Baghdad highway to the east (al-Hussein 2000).

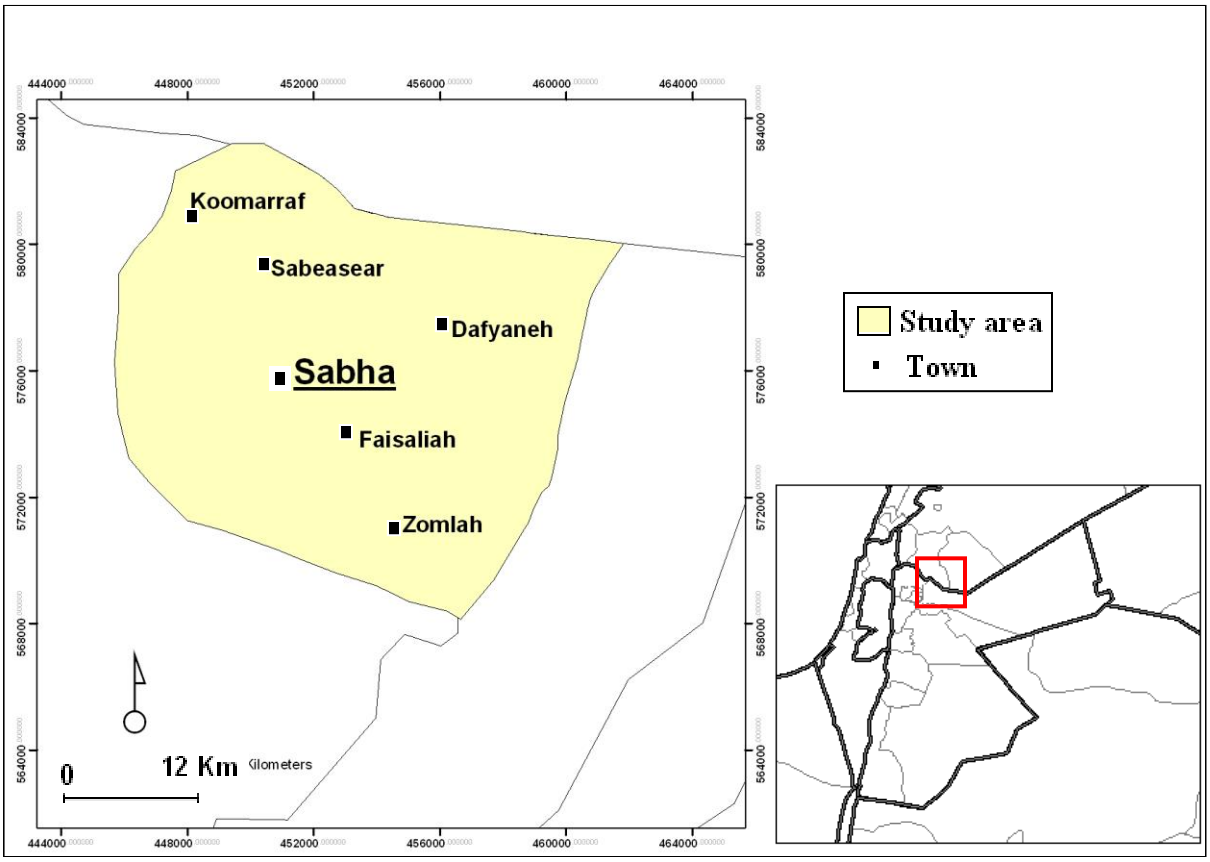

Figure 3.8: The location of the study area

There are a number of reasons to select this area to conduct organic farming research which can be summarised as follows:

- The area is considered as one of the most important agricultural production areas in Jordan (discussed below); also important are its production diversity (vegetable farms; mixed farms-vegetable/fruit; fruit farms) and the large agricultural investments it can command. Moreover, it is connected to three neighbouring countries (Syria, Iraq and Saudi Arabia), which gives development in this area a regional impact.

- The workshop mentioned above, which took place on the 15th July 2003 at which sixteen farmers attended, recommended the selection of this area as the first step towards organic farming adoption.

- The farmers in this area can be seen as representative of Jordanian farmers, since they practise agricultural activities common in other areas of Jordan. There is a social issue in that they like to copy what other farmers have done, whatever the cost or the results are. For example, if there is a new fertiliser or a pesticide most farmers will adopt it even if they do not need it. A major current example is the growing of new fruit tree varieties, which was not accepted before. Until few years ago in the north Badia there were not more than two fruit tree farms, but now there is competition between farmers in the north Badia to obtain and grow fruit trees, and to choose the best new varieties. This would suggest that the adoption of organic farming by a few farmers would encourage other farmers to follow suit.

- Farmers in the study area are willing to apply any natural technique that could increase their production. Al-Oun (2003) showed that farmers in this area were interested in using honeybees for the flower pollination of vegetables (watermelon, squash) and fruit trees (pear, peach and apricot), and were willing to pay to get beehives on their farms to increase the pollination process.

- Another reason is that farmers in this area can switch easily from one system to another when it is profitable. For example, Blench (2001) showed that people in this area were able to switch from camels to sheep in the period 1970-1995.

- There is availability of field logistic support from JBRDC, since the area lies within its mandate and the research is funded by the JBRDC.

In addition, the researcher knows the farmers in this area very well because the researcher lives there and has good relations with them and can understand the dialect used in this area which saved time and cost. It was also easy to assure locals that the researcher is not working on behalf of the government (Bennett 2002), as the researcher is from the same area and has social relations with farmers which facilitated the fieldwork and gave him invaluable access to information.

The study area has a daily mean temperature of 10° C, mean maximum of 24.5° C and an average daily temperature of 17.5° C. Sometimes the minimum temperature reaches about –5° C while the maximum reaches 46° C. It receives about 200 mm rainfall (Allison *et al.* 1998). It has two soil units, Sabha (SAB) and Zumlat (ZUM). The SAB is a silty and sandy clay loam and contains 50% silt, 28.7% clay, 21.3% sand and 1.22% organic matter. The ZUM has the same percentage of silt and organic matter but less clay, 26.7%, and more sand. Both soils have a thermic temperature and xeric-aridic moisture regime (MoA 1994). The study area is occupied by a population of 16,000 distributed in five towns (More information Chapter 5).

As for agriculture, the study area is considered as one of the most important cultivation areas in Jordan, especially in terms of vegetables and peach production (Abu-A'moud 2003). Although it was classified as a rangeland area, since 1980 intensive agriculture cultivation activities have been undertaken by digging groundwater wells and pumping water to grow vegetable and fruits under a drip irrigation system (Kirk 1998, al-Hussein 2000, Al-Adamat 2002), while wheat and barley are produced under a rainfed system (al-Hussein 2000) and some farmers use supplementary irrigation (field observation). The government was giving the farmers low interest loans to dig private boreholes up to 500 m depth to reach down into the basalt aquifer to get the water (Kirk 1998, Al-Adamat 2002, Abu-A'moud 2003). The water is abstracted from the Zarqa Basin (Figure 3.9) and used not only for crop irrigation but also for watering livestock and for domestic supplies (al-Hussein 2000). The process of this abstraction is very expensive and involves large investments, not less than £100,000, and many of these farmers have not yet paid back anything to the government (Abu-A'moud 2003).

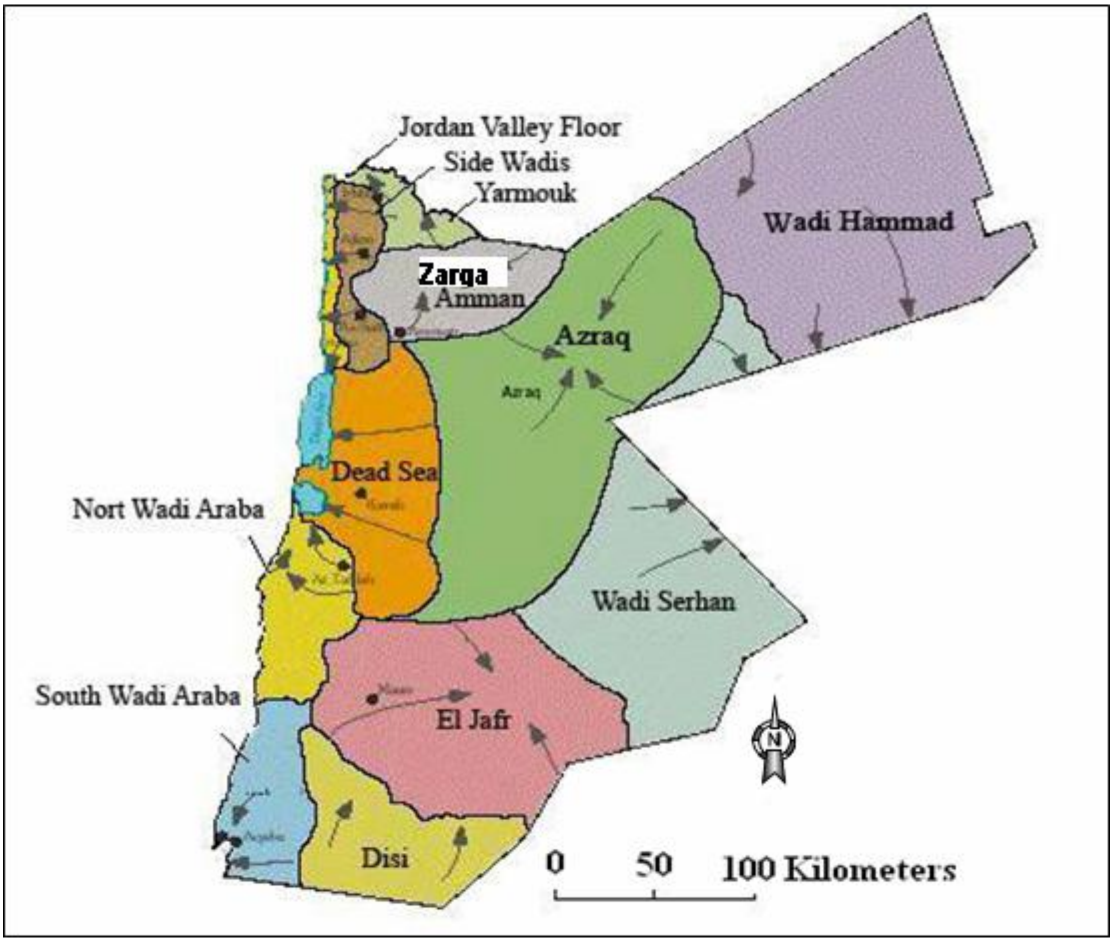

Figure 3.9: Groundwater basins in Jordan (Modified from OMEWR 2007)

Digging wells had changed the agricultural system in the study area from a rainfed system (barley and wheat) and sheep grazing to an irrigated agricultural system depending on the groundwater (Kirk 1998, al-Hussein 2000, Blench 2001, Al-Adamat 2002), and it is a more recent phenomenon than rainfed agriculture (al-Hussein 2000). The decision of farmers to change from a rainfed system to an irrigated agricultural system is due to the following reasons:

1. It is difficult to earn a living from grazing sheep and goats on rangelands
2. The restriction of living close to the border
3. The government has given loans to the local people to dig private wells to establish settled agriculture

(al-Hussein 2000)

Farmers were very pleased to see a watermelon fruit weighing 25 kg or more grown on land that used to be for sheep grazing and a little barley cultivation, which led many people in the area to change their job from livestock keepers to vegetable farmers, or from other jobs like teaching or trading to becoming farmer (Arab 2004). Some of them were working in the Gulf countries and came home with an appreciable amount of money and found the best way to invest their money was, as people in their community do, in agriculture (Affash 2004). According to Arab (2004) the aim of those people was to find new sources of income without having had any previous experience in agriculture and without considering any environmental impact. When farmers started growing vegetables and fruits, they did not understand the proper methods or how to deal with the new agricultural technology. They faced many problems in choosing the best plant varieties to be cultivated under the specific Badia conditions. A major problem for Badia farmers was how to control pests (diseases, insects, weeds and mites), including diagnoses of the pests, damage caused, and the best way to control them. Therefore, farmers had to rely on the private sector as their only source of information and supply due to the absence of the MoA extension agents during the period from 1980-1996. The main aim of the private sector was profit maximisation, and it encouraged the sale of agricultural inputs in lieu of alternate means of farming. Moreover, the private sector advised Badia farmers to use only agrichemicals to control pests or to improve their soil fertility.

After many years the farmers realised that there are many barriers facing them in continuing farming. Therefore, some of them changed from vegetable farming to fruit farming because the soil fertility declined, some of them sold their farms to repay loans and accumulated bills, and others lost their farms because the wells collapsed (Chapter 5). In addition to this, the current farming has caused significant environmental problems.

3.12. Summary

Jordan is a developing country which is considered as one of the poorest countries in the world in terms of water resources. Its total area is about 90,000 km^2, where 90% of this area receives less than 200 mm precipitation. The country's population is about 5,473,000, with a high annual growth rate of 2.3% which is due not only to natural growth but rather to regional events mainly wars. This high growth rate is combined with a small economy, $US 9.12 billion per annum, and a per capita income of $US 2,325, where the agricultural sector accounted in 2005 for a small contribution, 3.8% to the GDP. This low contribution is due to various constraints such as lack of water resources, poor soil fertility, pest and disease, small cultivable area ca 0.9 million ha (3.4% of the total country's area), and lack of official support with the overall government policy of minimal direct involvement in this sector. These constraints put the sustainability of this sector at risk. The country is self-sufficient in vegetables, fruit, and in poultry meat and eggs, and insufficient in red meat, milk, dairy products, fish, honey and cereals (particularly wheat and barley) and animal feeds.

The farming system in Jordan is conventional and farmers depend highly on external synthetic inputs. The sustainability of this system is at risk and therefore there is a need to adopt a holistic approach to maintain this system. This holistic approach is epitomised by organic farming, which complies with the objective of the MoA to achieve a sustainable agricultural system. However, there has been no official government policy to support organic farming, although the current JAP aims to establish a sustainable and an environment friendly farming system. But there are a number of reasons which suggest that proposing organic farming to Jordan is necessary. One of the main reasons is that the aim of Jordan's government is to develop more sustainable, environmentally-friendly, less chemically-dependent agricultural systems, which can be achieved by organic farming. Reasons also include Jordan's water policy concerns, environmental concerns, health concerns and global market trends and GDP contribution. Another two important reasons are that organic farming complies with the objectives of the NASD 2002-2010, and organic farming with its principles meets the sustainable development strategy of the JBRDC. However, it is important first to investigate the potential and barriers to organic farming, and the following chapter explains the methodology used to achieve this.

CHAPTER FOUR: RESEARCH METHODOLOGY

CHAPTER FOUR
Research Methodology

4.1. Introduction

This chapter focuses on the methods used to gain the primary and secondary data required for this research. The chapter is divided into two stages: the first stage is the diagnostic phase, which explains the questionnaire content and its construction, interview procedures used during the fieldwork, discussion groups, and field observations that were used to investigate the barriers, to and potential for, organic farming in Jordan. The second stage is the organic farming action plan development phase, which provides a description of the methods used for the development of the plan, including conducting a national workshop in Jordan attended by the Minister of Agriculture and stakeholders and the theoretical approach used. The chapter also provides a description of the data analysis instruments. The methodology approach used in this research is shown in Figure 4.1.

As mentioned in Chapter 1 the overall aim of this research was to evaluate the opportunities and potential for organic farming in Jordan's arid lands and, based on this, to develop an action plan for the adoption of organic farming in Jordan. To achieve this, the research questions addressed were based on this overall aim and specific objectives, which can be summarised as follows:

1. How organic farming developed worldwide and what are the main trends behind its development, and its potential in arid lands?
2. What is the current situation of organic farming, its practices and its implementation in the framework of Jordanian agricultural policy?
3. What are the current farming practices used by farmers including pest control and soil fertility management methods?
4. What is the perception of organic farming among farmers and other stakeholders, and their interest in converting to organic farming systems?
5. What are the potential barriers and opportunities to the adoption of organic crop farming in Jordan?

6. How can the empirical evidence and a relevant theory be used to inform an adoption methodology for organic farming on a Jordanian national level?

4.2. The research challenge

The research is considered to be the first in Jordan to involve farmers in making a decision regarding a new production system proposed by the government. In general, the MoA staff devise a strategy or a plan without consultation with farmers. The MoA documents review showed that there was no established or accepted methodology to obtain direct information from farmers in Jordan, which created a challenge for the researcher, especially in that organic farming is new for Jordan. This challenge is not only a challenge for researchers in developing countries, but also for the developed world. For example, Walz (1999) emphasised in his report on the Third Biennial National Organic Farmers' Survey in the USA that the quantity of information provided by the report created a variety of presentation challenges, and he stated that:

> There are not many professional social researchers (including those within the USDA and agricultural universities) asking direct questions about organic farmers and farming, and no other individual or institution has conducted similar work at this scale. As advocates of organic farming practices, and because organic farming is little understood by the research community, these results include not just highlights, but virtually the full complement of information provided by respondents and this is just the tip of the iceberg.
>
> (Walz 1999: 1)

Therefore, this research touched on these challenges by asking both farmers and decision-makers direct questions about organic farming and farming practices. The research also utilised visual aids as tools to obtain information from farmers. There are two other challenges arising from the discussion in Chapter 3: most agricultural research in Jordan is directed to conventional farming not to organic farming; and secondly there is no central information centre for agricultural information. The research challenges included the use of an appropriate research approach to generate the required data.

In general, research methods are divided into two distinctive approaches: qualitative and quantitative (Bouma and Atkinson 1995, Kitchin and Tate 2000, Robson 2002). Qualitative approaches deal with data that are not obtained through statistical procedures or other quantification methods, but could be coded and analysed quantitatively (Bouma and Atkinson 1995). They help to provide information about people's lives, their stories (Bouma and Atkinson 1995), and also on context and participants; they act as a source of hypotheses; and may aid scale construction (Robson 2002). Qualitative approaches include various techniques to collect data such as case studies, interviews, group interviews and discussion groups (Kitchin and Tate 2000, Robson 2002), observing people (Bouma and Atkinson 1995, Kitchin and Tate 2000, Robson 2002), picture, sounds, undertaking secondary analysis of archival sources (Kitchin and Tate, 2000), and people's own spoken or written words (Bouma and Atkinson 1995). The important characteristics of qualitative data are that it is unstructured (Bouma and Atkinson 1995, Kitchin and Tate 2000) but subjective, intuitive and deep (Bouma and Atkinson 1995, Robson 2002). However, two disadvantages are associated with qualitative approaches: the quality of data is affected by the respondents' characteristics, such as their memory, experience, knowledge and personality; secondly, responses do not always reflect their real attitudes and beliefs accurately (Robson 2002).

By contrast, quantitative approaches deal with numerical or measured data that consist of numbers or empirical facts and are analysed using statistical methods (Kitchin and Tate 2000, Robson 2002). They are used to generate data that cannot be addressed by purely qualitative approaches (Kitchin and Tate 2000, Robson 2002) and the results can be displayed using tables, charts, histograms and graphs (Robson 2002). Quantitative approaches are structured, logical, measured, wide (Bouma and Atkinson 1995) and also simple when gaining general information from all types of human populations about their attitudes, values, beliefs and motivations; and with a high degree of data standardisation (Robson 2002). A good example of quantitative techniques is surveys which use questionnaires to generate quantitative data (Kitchin and Tate 2000). Surveys can be postal, telephone or face-to-face interviews (Kitchin and Tate 2000, Robson 2002) (discussed below).

In this research it was appropriate to integrate quantitative and qualitative approaches since they complement each other. Integrating the two approaches is a useful approach to allow data triangulation from interviews, observations, survey, and documents (Robson 2002). For example, in this research, the perception of organic farming in Jordan was examined through different groups of respondents: farmers, key players, private sector people selling agricultural inputs, MoA officials and an academic. Integrating quantitative and qualitative methods is useful and there is no law that states that these methods should be used in isolation from each other (Kitchin and Tate 2000). It is a valuable and widely-used strategy which allows researchers to use a wide range of techniques, such as observations, questionnaire surveys, discussion groups, and structured and unstructured interviews. Moreover, using such an approach helps in the reduction of inappropriate certainty and helps to improve validity. However, the disadvantage associated with this method is the time and resources required to use it to a professional standard (Robson 2002).

The following sections explain and discuss the techniques used for generating data and the justification for the use of these techniques.

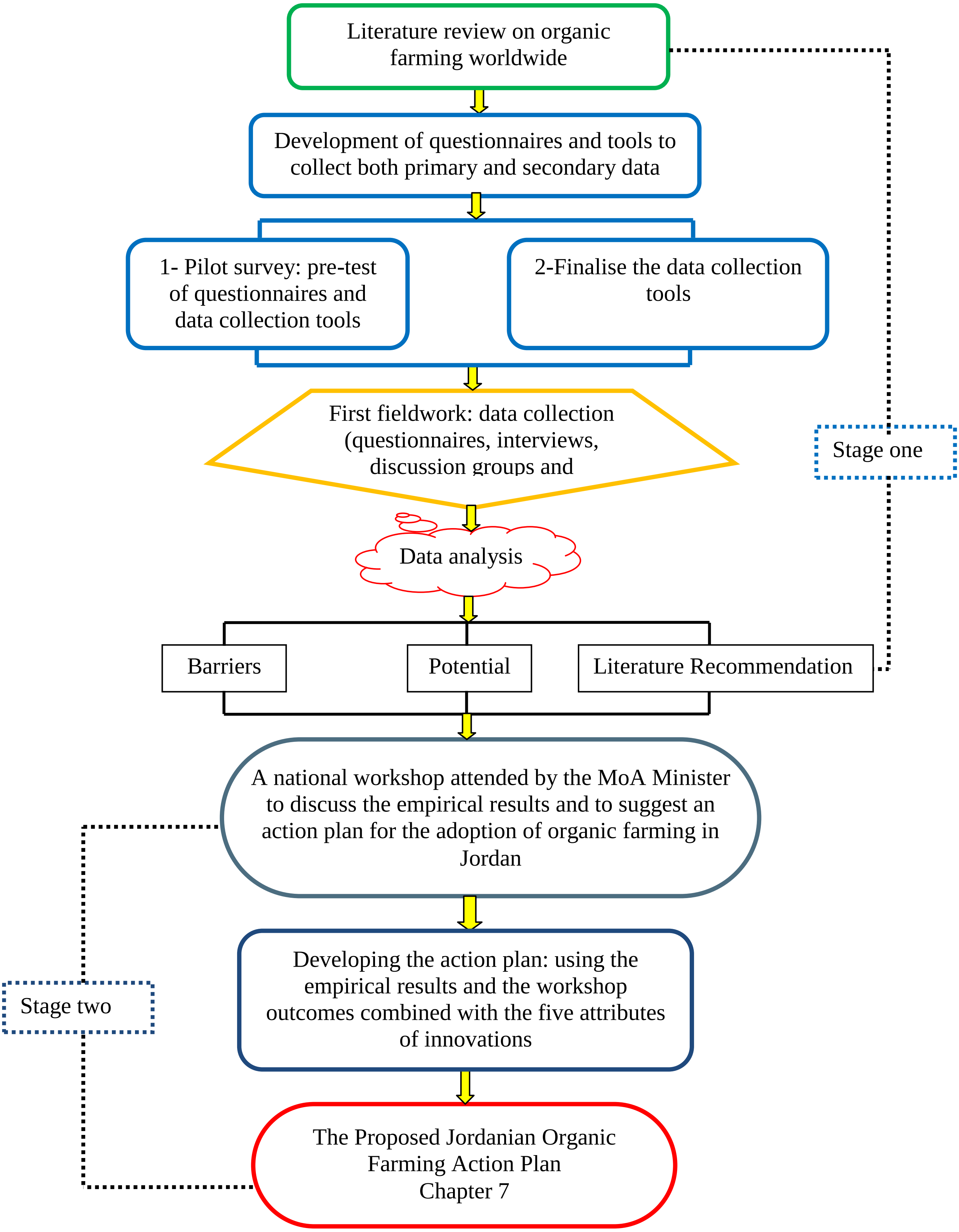

Figure 4.1: The methodology approach used in the research

4.3. Stage one

This stage aimed to determine and evaluate the barriers and potential for organic farming in Jordan, to understand the farming practices, farming situation, policy applied by the government and willingness for the adoption of organic farming. It was achieved through collecting and analysing substantial secondary and primary data, which required a review of the published literature including international and national sources for the establishment of certified organic farming systems (Chapter 2 and 3); the definition of the project area; a homogenous area with similar agro-ecological conditions and production systems (Chapter 3 study area); and conducting interviews with key informants (Table 4.1).

4.3.1. Secondary data

Secondary data is the data that has been generated by people other than the researcher (Kitchin and Tate 2000). Secondary data includes collection of national and international data related to organic farming from papers, a literature review, annual reports, books and observations and also from online reports. Secondary data included also data to describe the study area, the agricultural system in Jordan in general, and data related to Jordan's organic farming sector. These data were collected during two periods of fieldwork, April to September 2004 and July to September 2005, from visits to Jordanian organisations and continued during the research period through emails and online reports. Organisations that provided data were Jordan Ministry of Agriculture (MoA), Jordan National Centre for Agricultural Research and Technology Transfer (NCARRT), the German Technical Cooperation Agency (GTZ), Jordan Institute for Standards and Metrology (JISM), Jordan Agricultural Engineering Association, Jordan Badia Research and Development Centre (JBRDC) and Jordan University.

4.3.2. Primary data

Primary data is data generated by the researcher which is considered more context-dependent by the researcher, more related to the research purposes; and the researcher knows exactly how it is produced and whether any problems arose (Kitchin and Tate 2000). A literature review showed that primary data must be collected to evaluate the barriers to and potential for organic farming in a country. Therefore, two studies were utilised to inform the primary data collection strategy for this research. The first study was by Schneeberger, Darnhofer, and Eder (2002) who did a study on barriers to the adoption of organic farming by cash-crop producers in Austria. Schneeberger, Darnhofer, and Eder (2002) aimed to (a) identify barriers to the adoption of organic farming by conventional arable cash crop farms in Austria, and (b) derive efficient strategies for increasing the number of organic cash-crop producers. The study collected information on the perception of and barriers to organic farming through a written survey using a four-page questionnaire. Data included land use and farm characteristics, general information on respondents and their perception of organic farming, and a list of 28 items representing potential barriers to the adoption of organic farming. The questionnaire was mailed to 1000 randomly selected farms. Respondents were asked to classify items as barriers or not barriers. The total completed questionnaires received were 383. Some questions were also not answered because farmers did not have opinions. The second study by Harris *et al.* (1998) "Organic agriculture in sub-Saharan Africa: Farmer demand and potential for development", used a postal survey of 213 community development groups in 24 sub-Saharan countries. The desk study was complemented by fieldwork in Ghana and Kenya using semi-structured interviews and small group discussions to survey farmers in three agro-ecological zones in each country.

The primary data required to fulfil the overall aim and the objectives of this study included background information on farmers, the current farming system, perception of organic farming, barriers and potential to organic farming in Jordan. The target respondents of the primary data were:

- The farmers of the study area,
- The Private Agrichemical Suppliers (PAS)
- Key players who have an important role in the present and future development of organic farming in Jordan
- Decision-makers
- Sekem-Egypt: regional experience
- Stakeholders, all of whom participated in a national workshop to develop the action plan for organic faming.

The choice of a multiple respondents' source enabled triangulation to be utilised to achieve the objectives of this research. Using this approach enriches the data and eliminates some biases and inaccuracies (Oppenheim 1992, Robson 2002) which has given strength to the research and helped to give a better understanding of the organic farming situation in Jordan (Table 4.1).

Table 4.1: Summary of the data collected during the fieldwork

Part	Data provider	Data required	Method	Type of data
A) Farmers	Farmers (N=46)	Questionnaire and observation formats (Appendix B)	Open questionnaire and observation	Primary
B) The Private Agrichemical Suppliers (PAS**)**	PAS (5 groups) (N= 26)	Topics covered (Appendix C)	Discussion group and observation	Primary
C) Key players	The Ex-General Secretary (MoA) (N=1)	Potential for and barriers to organic farming	Interview	Primary
	Yarmook University Vice Chancellor (N=1)	Potential for barriers to organic farming	Interview	Primary
	Aman company manager (N=1)/ GTZ	History, the idea behind the company, products sold at the company, current economic situation, barriers facing the company, opportunity for organic farming products, future planning	Interview and observation	Primary
D) Decision makers	Organic farming unit (OFU) (N= 5)	Different data related to organic farming, available data about the organic farming sites	General meetings and discussion	Primary and secondary
	Secretary General (MoA) (N=1)	Contribution of the government to help farmers to convert, regulation and legislation achieved, standards responsible body, farmers' involvement in developing the organic farming policy	Interview	Primary
	Director, Policy and Economic MoA Unite (N=1)	Perception, definition of the organic, acceptance by farmers, authorised body in Jordan to develop national organic standards	Interview	Primary
	Head, Food Jordan Institution for Standards and Metrology (JISM) (N=1)	Regulations and standards	Interview	Primary and secondary
	Jordan National Centre for Agricultural Research and Technology Transfer (NCARRT)	Anything related to organic farming, IPM	Visit the library and department to collect information	Secondary
E) Regional experience	Sekem staff	Verification of a regional model and experience	Interviews and observations	Secondary and primary
F) Stakeholders-national workshop	Stakeholders	To come up with suggestions and recommendations to develop the plan, participating in its development to ensure a solid base for the plan	National workshop	Secondary and primary

The data mentioned above (Table 4.1) required a strategy of data collection involving various methodologies. It was not appropriate to use a postal survey as used by Walz (1999) or Schneeberger, Darnhofer, and Eder (2002) to achieve the objectives of this research, for reasons shown in Box 4.1.

Box 4.1: Reasons for not using a postal survey for this research

- It is impossible to mail a questionnaire to farmers in Jordan working in remote areas with no mail services, faxes, emails or fixed addresses;
- Schneeberger, Darnhofer, and Eder (2002) recorded a low response rate (about 38%) to postal survey, while Walz (1999) recorded (26%) and some questions were not answered;
- In the Schneeberger, Darnhofer, and Eder (2002) study, farmers were asked to classify items as “barriers” or “not barriers”. This method does not provide enough data to achieve the objectives of the study.

The method used by Harris *et al.* (1998) was more helpful for this research. It was found helpful to employ interviews in the research but to avoid the postal questionnaire, for the reasons mentioned above. This also helped to investigate topics covered in this research such as current cropping systems, constraints and opportunities of organic farming.

i. Field observations

Observations were used in this research to collect much useful data. Observational methods include a mixture of writing, drawing, mapping, video recording, and photography (Martin 1996). However, Martin states that video recording is sometimes sensible but that it is better to use photography instead of video recording. It is important to report here that the main advantage of this method is its directness, in which researchers watch respondents, or objects, rather than just ask questions (Robson 2002). Also “direct observation permits a lack of artificiality which is all too rare with other techniques” (Robson 2002: 311). But to get good observations it is suggested to produce a way for recording field observations related to the study rather than recording everything that is going on (Martin 1996). An observation format was produced to record the field observations and to explore the current farming system (Appendix B). Observations were used in this research not only to describe farmers but also to describe land preparation, planting, pest control and management, fruit collecting, packaging and marketing, farms layout, irrigation and fertilising systems. Observations were also used to describe the IPM shop in the central vegetable market.

ii. Questionnaire survey

A questionnaire was designed for interviews with farmers in the study area and contained six topics: (a) farm information, (b) pest control and management, (c) extension, (d) soil fertility management, (e) environmental impact and (f) organic farming understanding (Appendix B). It is important to mention that the six topics were chosen because they form the basis of plant production systems and they are the main categories for the establishment of an organic farming system. In questionnaire surveys there are three types of questions: (i) closed or fixed-alternative, (ii) open (or open-ended), and (iii) scale items which are of closed or fixed- alternative type (Robson 2002). Respondents in closed questions are offered written answers, which force them to select from two or more fixed choices: in other words they choose the closest answers to their views, or predetermined answers (Rose and Sullivan 1993, Kitchin and Tate 2000, Robson 2002). They provide a quick way to separate high and low priority topics (Walz 1999). The advantage of closed questions is that they are easier to analyse than open questions (Nichols 1991, Oppenheim 1992, Kitchin and Tate 2000, Pallant 2001, Robson 2002, Pallant 2004), while open questions give respondents freedom to express their ideas and views in their own language with no predetermined answers. These also have no restrictions on the answers, and answers have to be reported in full; but the disadvantage is that open questions are more difficult and time-consuming to analyse than closed questions (Nichols 1991, Oppenheim 1992, Rose and Sullivan 1993, Kitchin and Tate 2000, Pallant 2001, Robson 2002, Pallant 2004). Open questions also give a wider picture which allows respondents to provide a fuller range of opinions and beliefs (Walz 1999).

Accordingly, open questions were chosen for this research because they give the researcher the ability to explore the full range of responses (Rose and Sullivan 1993, Wilson 1996, Kitchin and Tate 2000, Robson 2002). Another important reason is that organic farming is built on farmers' experience. As a result, it was important to let farmers put forward their opinions and ideas rather than let them choose from prepared answers. Also, organic farming is new to Jordan, which makes using prepared answers difficult for respondents.

In this research, a face-to-face scheduled interview was employed with farmers to administer the questionnaire survey. A face-to-face interview offers the "possibility of modifying one's line of enquiry, following up interesting responses and investigating underlying motives in a way that other questionnaires cannot" (Robson 2002: 275). In this method, respondents are asked the same questions in the same wording and same order (Hughes 1996, Wilson 1996). This method helps to cover complex topics (Oppenheim 1992, Thomas 1996, Robson 2002), and also gives a higher response rate than mail questionnaires; it helps avoid misunderstandings and is inclusive of respondents with limited literacy (Oppenheim 1992).

iii. Pilot survey

A pilot survey can be identified as:

> A small-scale trial before the main investigation, intended to assess the adequacy of the research design and the instruments to be used for data collection; piloting the data-collection instruments is essential, whether interview schedules or questionnaires are used.
>
> (Wilson 1996: 103)

Choosing the questionnaire type, designing the questionnaire and choosing a method to administer it are important steps in conducting a survey, but it is also crucial to try out the questionnaire before collecting the main data. Wilson (1996) states that it is essential to carry out a pilot questionnaire on a sample representing the target research population. Oppenheim (1992) also emphasises that questionnaires have to be composed and tried out, improved, and then can be used to collect the required data. Moreover, conducting a pilot survey can help to derive a good method for field observation recording (Martin 1996) and to gauge the length of time that the final survey takes to administer (Wilson 1996

The pilot survey for this research was undertaken outside the study area with 15 farmers representing the target population. Those 15 farmers were in the northwest Badia and had the same agricultural system. The aim of the pilot was to make sure that (i) the questions used in the questionnaire were clear to farmers, (ii) the interview took a reasonable time, (iii) questions that could not be answered were dropped or re-phrased, and (iv) the most convenient time for interviewing farmers was determined. After the pilot survey was finished it was found that the questions were clear to farmers, but two questions were dropped. The first one concerned the annual waste materials produced per farm. This was dropped because it was very difficult for farmers to determine these amounts. The second one concerned the available organic fertilisers that farmers do not use. This was dropped because it was included in another question on organic manure. It was also found that when the farmers were asked what were the non-chemical strategies used either to control pests or to improve the soil fertility, most of them answered that they did not use non-chemical strategies for either. But the researcher did observe that they were using some non-chemical strategies. As a result, the researcher produced two checklists concerning non-chemical strategies used either to control pests or to improve the soil fertility (Appendix B).

During the pilot survey with farmers the question, "Have you heard about organic farming? What is the best translation for it?" raised an important point about farmers' perception of organic farming. It was found that the term "organic farming" was not clear. Therefore, it was decided to keep the question as it was, but to give an explanation after farmers had answered the question. This was a good question to investigate the perception of the term by farmers and other parties, and to provide the MoA with the responses which could help to work on the organic farming terminology and to avoid any words that could be misunderstood in the future.

The pilot survey found that the interview took approximately one hour to administer. There were two periods of the day which proved convenient for farmers, namely 09.00–12.00 and 15.00-18.00.

The researcher aimed to make the questionnaire simple and attractive to farmers. This is because a questionnaire must be easy for the respondent to answer fully, with suitable wording, and be attractive so that respondents are motivated to continue to answer further questions and continue to cooperate (Oppenheim 1992, Wilson 1996). Therefore, in this research visual aids were produced for two questions: one about pesticide use and the second about inorganic fertiliser used from preparing land to harvest (Appendix B). The visual aids were helpful in attracting farmers and letting them participate rather than just giving information. As a result, farmers were also motivated to continue to answer further questions.

iv. Carrying out the questionnaire

The research's target group were all conventional cash-crop farmers using a drip irrigation system in the Sabha District area in the Northeastern Badia of Jordan. The JBRDC has chosen this area to be the first area for adopting organic farming in the Badia of Jordan (Chapter 3, Study Area).

A visit was made in May 2004 to the North East Badia Agricultural Directorate (NBAD) with the aim of obtaining a list of farmers and their contact details. The list contained only the location of the farm and the name of the owner, but no other information. It was found that from the NBAD's list the total number of farmers eligible to be interviewed was 78 farmers (NBAD 2002). The researcher divided the study area into six sub-areas (Table 4.2) according to the farms' sites: (i) Sabha, (ii) Faisaliah, (iii) Dafyaneh, (iv) Koomarraf, (v) Zomlah, and (vi) Sabeasear. All of the 78 farms were visited and it was discovered during the fieldwork that the NBAD list contained eight farms outside the study area.

It was also found that five farms in the study area were not listed by the MoA. As a result, the total number of farms found in the study area was 75 (Figure 4.2 A), of which 17 (Figure 4.2 B) were not working for the following reasons:

1. Seven farms not working for financial reasons
2. Ten not working because the water pump system had collapsed

Accordingly, 58 farms were working, which were owned by 47 farmers (Appendix F). Out of these, 46 (98%) farmers agreed to be interviewed and to provide information, while one farmer (2%) refused, which shows a high response rate. Information collected about farms in the study area included numbers, types, number of owners, working status, farm area, crops grown, livestock, jobs existing on the farm and family income (Appendix B). This would help to describe the study area, and also to document the farming system in the study area.

A Geographical Position System (GPS) was also used to take the farm's well coordinates (Appendix F), to produce maps (Figure 4.2) showing the positions of these farms including the ones not working. The maps (Figure 4.2) are considered as the first maps in Jordan showing the farm positions and their distribution in the study area. This is useful for different Jordanian organisations, such as the MoA, Farmers' Union and JBRDC.

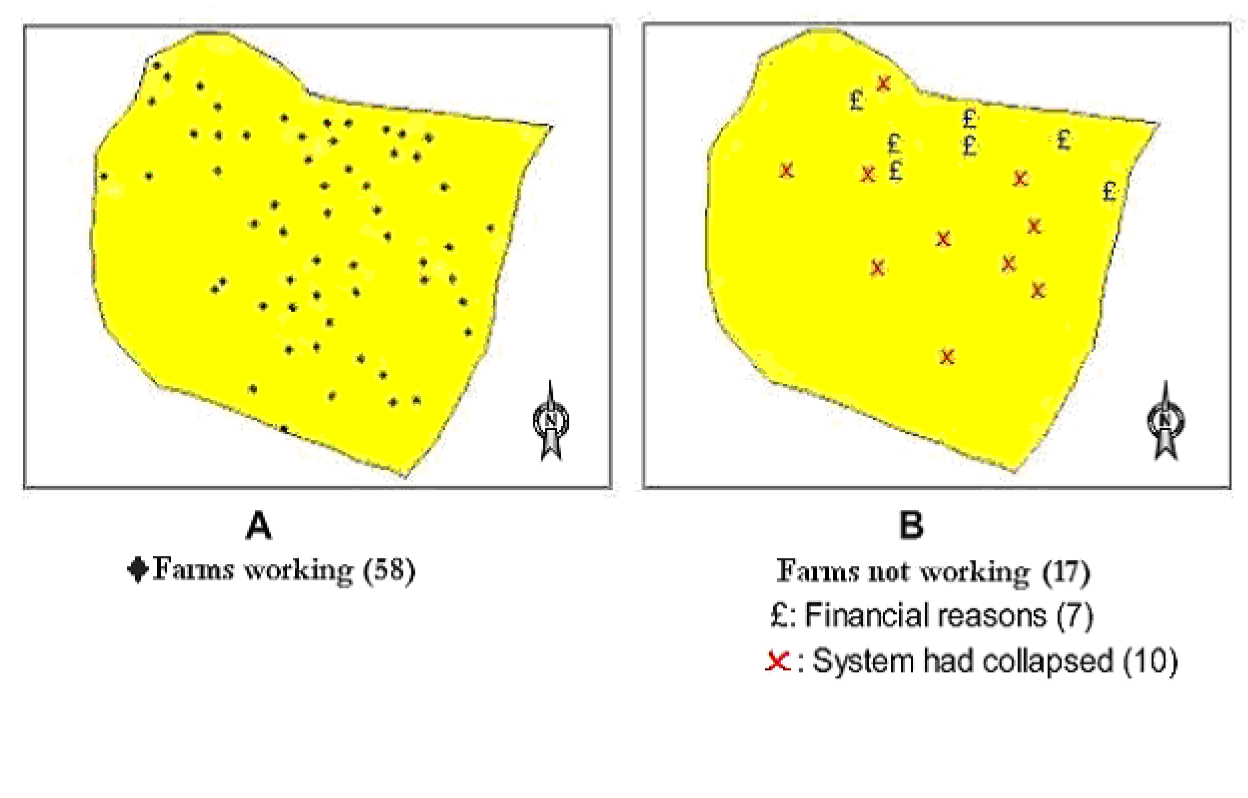

Figure 4.2: Distribution of farms in the study area

The research discovered that some of the farmers lived in one town and their farms were in another town. The results showed that 46% of them lived and had farms in Sabha, as is shown in Table 4.2. This suggests that some of the local people lost their land ownership by selling their land to other people from other villages, which is discussed in Chapter 5.

Table 4.2: Farmer's home village name and farm site (village)

	Farm site (village)						
Farmer's home village name	**Sabha**	**Faisaliah**	**Dafyaneh**	**Koomarraf**	**Zomlah**	**Sabeasear**	**Total**
Sabha	17	2	2	0	0	0	21
Faisaliah	0	2	0	0	0	0	2
Dafyaneh	0	0	3	0	0	0	3
Koomarraf	0	0	0	3	0	0	3
Zomlah	0	0	0	0	1	0	1
Sabeasear	0	1	0	0	0	4	5
Amman	4	1	0	0	3	1	9
Irbid	1	0	0	1	0	0	2
Total	22	6	5	4	4	5	46

The interviews were carried out with farmers (Figure 4.3) at their farms between May and September 2004.

Figure 4.3: The researcher interviewing a vegetable farmer (Photo by: Naser 2004)

4.4. Research confidentiality and ethics

Information concerning personal and farm information was left to the end of the interview. It was inappropriate to start asking farmers personal information before building up trust and convincing them that the information would be used only for the research. During the fieldwork period also the government decided that the permitted amount of pumped groundwater would be 150,000 m^3 $year^{-1}$ $farm^{-1}$ to irrigate crops in Jordan in general and particularly in the Jordan Badia. The government decided that any amount exceeding this would be charged at £ 0.10 m^{-3} (Chapter 3). As a result, personal and farm information were highly sensitive aspects to start the interview with. Leaving the personal information to the end of the interview is a procedure also supported by Oppenheim (1992), who recommends that personal information should (a) always come at the end of the questionnaire, by which time respondents are convinced that the research is genuine, and (b) be introduced by a short explanation. Moreover, Burgess (2001) emphasises that it is important to explain both at the beginning and throughout what the research is about to respondents, especially when asking personal questions, and at the end to ask:

> Finally could you give us a few bits of information about yourself so that we can put your other replies in greater context.
>
> (Burgess 2001: 14)

In this research the decision was to give more explanation about the aim of the study, the study topic, and to finish the interview by saying:

> Thanks for the great information you provided but still one page to be answered: it contains personal information about you and your farm. It is up to you to answer these questions but it would be helpful to answer them as they will be used just for the research.

4.5. Farmers' reaction to the questionnaire

It was discussed above that the researcher left the personal and farm information to the end of the interview. This technique showed that the decision was helpful to get the data, and gave a high response rate. It also gave farmers the opportunity to talk about their opinions, experiences, and problems. The technique also showed that time can be saved in conducting an interview with farmers; in other words, asking people personal questions takes time, they need to think before they reply, which leads to leaving some questions not answered or having a long interview. Farmers were asked what they thought about this technique. A farmer said to the researcher:

"If you started asking me questions about me and my farm I would not answer or I would give you wrong answers. But starting the interview with questions which have no relation to personal information will let be farmers more cooperative". He said: "farmers prefer to be asked about their experience, problems, and what they do rather than starting asking them personal questions, then they would make sure that the research has a goal not just gathering some statistical information"

[Another farmer said]:

"Sometimes people either from the MoA or from the Department of Statistics come to collect information. Those people do not tell us what is the purpose of their research; they start directly asking us about age, farm's size, etc. Moreover, they come at any time even when we are busy. We know that they have to collect the information. As a result, farmers provide them with incomplete information, or in most cases farmers apologise to cooperate. Today I was surprised by the first questionnaire methods. I found it was attractive and new, which encouraged me to give all of the information, and I am sure all of farmers will have the same feeling and answer all of the questions".

All the farmers appreciated the technique used to interview them; also, they appreciated the time and the length of the interview. It is suggested here for all researchers who are going to conduct a questionnaire (with farmers) in the Jordan Badia or similar area is to leave the personal information to the end of the interview in order to get better information.

4.6. The Private Agrichemical Suppliers (PAS)

In Jordan all farmers buy their agricultural production inputs from Private Agrichemical Suppliers (PAS). Each PAS must be registered and certified by the Ministry of Agriculture and the manager of any PAS store must be a member of the Jordan Agricultural Engineers Association. The owners of the stores employ Agricultural Engineers and provide them with good facilities to reach farmers at their farms to sell the store products. It was found that the PAS play an important role in the study area by having an impact on agriculture activities and a long experience of the area. Moreover, it was found from the fieldwork that when farmers have technical problems regarding their crops, they contact the PAS rather than the MoA (Chapter 5). The PAS provide farmers with information, extension and agricultural inputs, which include pesticides, fertilisers, and other materials, without down payment. Thus there is no role for the government in providing or selling any agricultural products to farmers. It was observed that the PAS approach farmers at farms because they have good facilities, and good transport and communication systems, which the MoA does not have. This explains why farmers prefer the private sector rather than the MoA.

The researcher found it was important to investigate the opinions of the PAS about organic farming through the means of discussion groups. A discussion group, sometimes referred to as a focus group, can be used as a qualitative research method to collect information from two or more people who are brought together for any reason in a meeting (Bedford and Burgess 2001). It can be used with other methodologies such as interviews and questionnaires to cover various issues and is considered a useful method for collecting a variety of different groups' attitudes toward certain geographical locations, or their opinions about environmental or social issues (Bedford and Burgess 2001). It aims to encourage a collective response and to identify various opinions, arguments and different points of view (Pratt and Loizos 1992, Bedford and Burgess 2001). It involves a conversation where the group members have a dialogue and are free to challenge the interpretation or assumptions of each other (Bedford and Burgess 2001). As a result it was concluded that using a discussion group would be better than using either closed or open questionnaires to get information from suppliers.

The discussion groups were conducted with five PAS in June 2004: two of them represented the biggest two agrichemical companies in Jordan, namely Shekhtean and Megdadi (Table 4.3). Bedford and Burgess (2001) emphasised that it is important to have the time and a place to conduct a group meeting. In this research all the meetings were conducted between 14.00 and 16.00 at each store because it was the best time for the groups to be available after finishing work and visiting farms.

Table 4.3: Discussion groups of the private agricultural suppliers (PAS)

Date of group	Name of the store	Town	Number of participants
16/06/2004	Birds	Amrah we Umerah	4
17/06/2004	Sahara	Rawdhah Basma	5
19/06/2004	Aghadeer	Almafrag	6
20/06/2004	Shekhtean	Almafrag	6
23/06/2004	Megdadi	Almafrag	5

Moreover, it was important in this research to make sure that the group members were homogeneous and felt comfortable, so as to have successful group meetings (Pratt and Loizos 1992, Bedford and Burgess 2001). All of the groups' members were Agricultural Engineers with good experience of the study area and good friendship with each other. The researcher started the meetings with a short introduction about the research being carried out and the reasons for the group discussion, and finished the meetings by thanking the groups for their cooperation (Bedford and Burgess 2001). Topics discussed in the meetings (Appendix C) were:

1. Organic farming: perceptions, barriers (technical, cultural, economic),
2. Potential factors for organic farming in Jordan,
3. Other information included organic pesticides, organic pesticides and some observations about the stores .

4.7. Key players

The fieldwork showed there were three key players to be interviewed who have good knowledge about the study area, agricultural farming and agricultural policy in Jordan and marketing. Those were the Yarmook University Vice Chancellor, the ex-Secretary General of the MoA and Aman Company Manager (IPM products). Face-to-face interviews were carried out with these three key players to investigate their perceptions of organic farming, the main institutional barriers to it, the government role, academic work regarding organic farming and recommendations to establish an organic farming system in Jordan. The interview details for each key player are explained in Appendix (D).

4.8. Decision makers

MoA officials

It was important to meet and interview people who have a connection with the organic farming movement in Jordan. These included the Secretary General of the MoA, the Head of Agricultural Policy Unit, and MoA Organic Farming Unit (OFU) staff. A checklist for topics to be discussed with them was prepared before each interview (Appendix E). It was also important to find out what the connection was between these people regarding organic farming, what is the interaction between them, and if there were any institutional barriers facing organic farming at the MoA.

Head of Food at Jordan Institute for Standards and Metrology (JISM)
The visit here was made after interviewing the Secretary General of MoA, who advised the researcher to visit the Jordan Institute for Standards and Metrology. The researcher interviewed the Jordan Food Standards Officer. The interview focused on adoption of organic farming by JISM, standards created for organic farming in Jordan, and regulations and legislation made to establish organic farming in Jordan by JISM.

4.9. Regional experience

The researcher made a visit to Egypt in August 2004 to explore the experience of Sekem-Egypt, which has established organic farming techniques in similar environmental conditions to Jordan (temperature, rainfall, humidity, groundwater and employee salaries). These techniques included both animal and plant production which could be used for Jordan. During the visit, interviews were conducted with the Director of Sekem-Egypt and his colleagues, who were happy to provide information about Sekem and its mission, and to help in developing Jordan's organic farming. Observations were also used to look at different aspects in Sekem, such as technical (compost production, crop rotation design, soil fertility analysis and management, seed production and animal care) administrative (certification, inspection, packaging, labelling and transporting), marketing and labelling.

4.10. Data analysis of stage one

4.10.1. Analysis of the farmers' questionnaires

Open questions gave farmers and other respondents the opportunity to answer in their own words rather than selecting from prepared answers. In order to analyse the questionnaire, responses of each question were categorised (Rose and Sullivan 1993, Carey, Morgan, and Oxtoby 1996, Walz

1999). Categorising the responses is a way to facilitate coding and data analysis (Rose and Sullivan 1993, Carey, Morgan, and Oxtoby 1996). The researcher categorised answers by reading responses for the same question from all of the interviews (Carey, Morgan, and Oxtoby 1996). Then, responses were categorised according to the question using a codebook (Rose and Sullivan 1993, Carey, Morgan, and Oxtoby 1996), and each category was given a numeric code (Rose and Sullivan 1993; Carey, Morgan, and Oxtoby 1996). According to Rose and Sullivan (1993), the codebook is an intermediate stage between the interview and analysable data, which is used to transform data into the computer. Coding is an inductive task, based on interviewees' responses (Carey, Morgan, and Oxtoby 1996), and it is the first step in preparing data for computer analysis (Rose and Sullivan 1993*)*. Coding also makes the data analysis more systematic and builds up an understanding through a series of stages (Jackson 2001). After the responses had been coded by assigning numeric codes, they were entered manually into the Statistical Package for Windows (SPSS) in variables, and reviewed for accuracy during the data entry process (Rose and Sullivan 1993; Walz 1999; Carey, Morgan, and Oxtoby 1996). It is very important also that variables have "(a) name, (b) clear definition of categories, and (c) strong procedure which guarantees the mutual exclusiveness and exhaustiveness of categories" (Rose and Sullivan 1993: 42). It is also important when reviewing open-ended response tabulations to consider that:

1. The context of more complex responses is broken down by this process into component parts.
2. The assignment of responses into categories is often subject to a decision-making process by the reviewer.

(Walz 1999)

Rose and Sullivan (1993) reported that coding open questions leads to the loss of some information as a trade-off for the advantages of computer analysis but offers the possibility to compare different responses on the same scale. In this research the researcher worked to minimise loss of information by presenting every response category down to single individual responses (Walz 1999) and not omitting any response. Also, the size of the sample helped to categorise all of the responses.

Once the responses were coded using SPSS, a descriptive analytical method was used to summarise the coded responses as frequency analysis presented in tables, in order to describe and compare the results.

4.10.2. Analysis of the individual interviews and the discussion groups

A standard method was used to analyse both the individual interviews and the discussion groups in which responses were summarised manually according to the predetermined topics of the research rather than using a computer package. The responses were written up from notes taken during the interviews and analysed according to predetermined topics. The results were tabulated and then compared to the farmers' opinions.

4.10.3. Producing the study area maps

A GPS was used to record the coordinates for each farm visited (Appendix F). The coordinates were recorded in DMS system (degree, minutes, seconds), and were converted to decimal degrees (DD) according to the following equation (FAO 2005b):

Decimal degrees = degree + minute/60 + second/3600

All of the decimal degrees were projected into digital maps provided by the JBRDC using the GISArcmap software provided by Coventry University.

4.11. Stage two

Once stage one was accomplished, a thorough analysis was carried out of the empirical data collected through questionnaires, discussion groups, interviews, and secondary data. Stage one identified the situation of organic farming in Jordan, organic faming perception, the main barriers and potential factors to the adoption of organic farming in Jordan, and some farmers' suggestions to adopt organic farming. Following this, there was a need for a second stage to develop an action plan for the adoption of organic farming in Jordan. The second stage required conducting a national workshop as participatory approach to encourage different stakeholders to come up with suggestions, recommendations, solutions, priorities and institutional changes to develop the action plan. The final plan development required further analysis using empirical evidence from stage one, outcomes of the workshop (stage two) and the application of diffusion theory-the five perceived attributes of innovations: relative advantage, complexity, trialability, compatibility and observability, explained in Chapter 2 Section 2.10 (discussed below and in Chapter 7).

4.11.1. The national workshop methodology

This section explains the workshop methodology used to involve participants (stakeholders) to identify needs, and to suggest recommendations and priorities to adopt organic farming in Jordan.

Identification of stakeholders (participants)

A workshop is a participatory forum that can be used to establish action plans or strategies, which implies a role in decision-making (IFAD 2000). It is important in such a participatory approach that all stakeholders are involved to get the best decision regarding a project (IFAD 2000, Joseph 2005), including those in opposition (IFAD 2000). A stakeholder can be defined as 'any group or individual who can affect, or is affected by, any initiative undertaken by a project' (IFAD, ANGOC, and IRRR 2001: 103), where they have the right and capacity to participate in the development process and are impacted on by the development of a project (IFAD 2000, Aas, Ladkin, and Fletcher 2005). They play an important role in the development of any project and it is crucial that they are involved in decision making and adopting new systems, where they are absolutely essential for sustainable solutions (IFAD 2000, Joseph 2005) and can be consulted to develop strategies for maintaining agricultural production and safe food supplies (IFAD 2000, Aas, Ladkin, and Fletcher 2005).

Involving stakeholders is very important and must take into account their opinions and ideas to modify protocols (IFAD 2000, Jessel and Jacobs 2005). It is not only that their participation in a project development is important, but it is also vital that they are involved in the early stages of the development to ensure (a) a common understanding of the issues that a project expects to address, (b) capacity-building of would-be implementers and all other stakeholders in the process and (c) fostering beneficiaries and other stakeholders' ownership of the project concepts and methods (IFAD 2001:108). To have a successful participatory forum leading to best decision-making it is important to involve the right mix of stakeholders at the right time, using the most appropriate method (IFAD 2000).

Based on the discussion above and for the purpose of this research, stakeholders were identified as those who are affected by the development of organic farming, positively or negatively, and must represent his/her community. The community of this research can be defined here in terms of legal issues and a common interest in organic farming in Jordan, which means that the stakeholders are those who have an interest in organic farming and engage in work which is legally linked or affected by the adoption of organic farming (Table 4.1). The right mix of stakeholders was identified through a stakeholder analysis approach where its basic objectives are to (a) identify all those people, groups or institutions who might be affected by an intervention or could affect its outcome, and (b) identify local institutions and processes upon which to build (IFAD 2001).

Accordingly, stakeholders were identified through the two periods of fieldwork carried out in Jordan in 2004 and 2005. During the fieldwork visits were made and interviews conducted at different organisations, and these people nominated organisations and individuals who should participate in the action plan development. Also, personal communication was used. As a result, the identified stakeholders included: farmers, MoA officials including the Minister of Agriculture, people from the private sector, MoEn officials, academics, Head of Farmers Unions, and representatives from

JEDCO, JOFS, JISM, the EU Mission to Jordan and Jordan River Foundation. In all 42 people (Appendix G1) attended the workshop. It was crucial to ensure the involvement of those who represent the government for two reasons: (a) they have power and know more about government regulations and procedures, and (b) from a social perspective, those people like to be consulted and involved in adopting new systems as they hold influential positions.

The reasons for involving a wide range of stakeholders derives from the NSAD 2002-2010, which says that one of the main policies and management constraints of sustained agricultural development in Jordan is due to:

> Inadequate cooperation and coordination among Government organisations involved in agricultural development, due to weak administrative and technical capacity and the absence of joint programs of work. This hinders integration and effective and lasting mechanism for cooperation and coordination among them.
>
> (MoA 2005a: 19)

Absence of cooperation and coordination within government organisations means that there is then no cooperation between the government organisations and the stakeholders. As a result, Jordan's government organisations should not only work with stakeholders but be part of the stakeholders, to ensure sustainability for organic farming adoption. This has been emphasised by Dabbert, Häring, and Zanoli (2004) who state that to develop a vision for organic farming, governments should work with stakeholders in the agricultural sector. This vision could be modest (organic farming as a niche market) or ambitious (20% of farming to be organic in 2020), and could see organic farming primarily as:

- An environmental instrument or as a market opportunity, or
- Base support on maintaining the viability of a technological option outside a GMO-oriented and chemically intensive agriculture.

(Dabbert, Häring, and Zanoli 2004: 125)

The workshop procedures

Once the stakeholders were identified, it was crucial to have the right time and most appropriate method for their participation, and to schedule the participatory meeting when and where it is convenient for the stakeholders (IFAD 2000). To achieve this, it was concluded that the best way was to have a one-day workshop in a convenient and accessible place to enable the stakeholders to participate and to ensure that their opinions, suggestions, recommendations, concerns and interests were heard. However, in Jordan it is not an easy job to conduct a national workshop attended by different people from different organisations, especially officials. This issue can be sensitive if not handled carefully and can bring undesired results. To avoid this, the researcher discussed with the President of the JBRDC the best way to conduct such a national workshop under the auspices of the MoA Minister. The discussion resulted in the special procedures required to invite the MoA Minister to give some weight to the workshop and also to invite the stakeholders (Appendix G2).

The workshop was conducted on 18th August 2005 at the Holiday Inn Hotel in Amman. The aim of the workshop was for participants to come up with suggestions, priorities and recommendations on what can be done to develop an action plan to adopt organic farming in Jordan. This was achieved through presenting the empirical results of stage one of the research, and through extending the involvement and participation of the stakeholders in decisions on the development of the plan. The aim was also to promote awareness and interest in the wider application of stakeholders' involvement in the formulation of strategies for organic farming adoption. The workshop also served to increase awareness of organic farming and to gather information from stakeholders to establish contacts for helping with organic farming development in Jordan.

One of the procedures of the workshop was to ensure that participants felt that they had the same treatment: they had the same badge, a file containing the workshop programme, and participants were seated in a U-Shape (Figure 4.4) to make them feel that they were on an equal footing. Also, as a political procedure it was important that the JBRDC President welcomed the MoA Minister and the participants, and invited the researcher to start the workshop.

Figure 4.4: Participants seated in a u-shape (Photo by: Al-Khaldi 2005a)

The researcher aimed to clarify the main aim of the workshop, 'to develop an action plan for the organic farming adoption in Jordan in a participatory manner'. A PowerPoint presentation was used in the workshop to highlight the aim and objectives of the research and to present the empirical results of the research: opportunities, barriers, and potential of organic farming, and farmers' interest in converting to an organic farming system. To trigger stakeholders to participate in developing the action plan the researcher presented a diagrammatic overview (Figure 4.5) derived from results obtained from stage one and asked participants:

<u>Based on results presented today: what comments, opinions, recommendations, and suggestions do you have to develop an action plan for the adoption of organic farming in Jordan?</u>

To manage the workshop discussion, the procedure was that the JBRDC President worked as facilitator. The facilitator asked the participants: based on the results and findings presented by the researcher 'what can be done to develop the action plan?'. The facilitator managed the discussion and directed comments and questions to the researcher for clarifications. To ensure that participants made suggestions during the workshop, every participant was encouraged to give at least a recommendation or an idea on how organic farming could be adopted in Jordan. Moreover, the 42 participants were divided for part of the day into 14 groups sitting on the same table. Each group was made of three people discussing factors required to develop organic farming between themselves, and one of the group members was nominated by the group to read the recommendations made and to put them on the flipchart board provided. All comments, questions, suggestions and answers were recorded on the flipcharts by a volunteer from the JBRDC and were given to the researcher at the end of the workshop day.

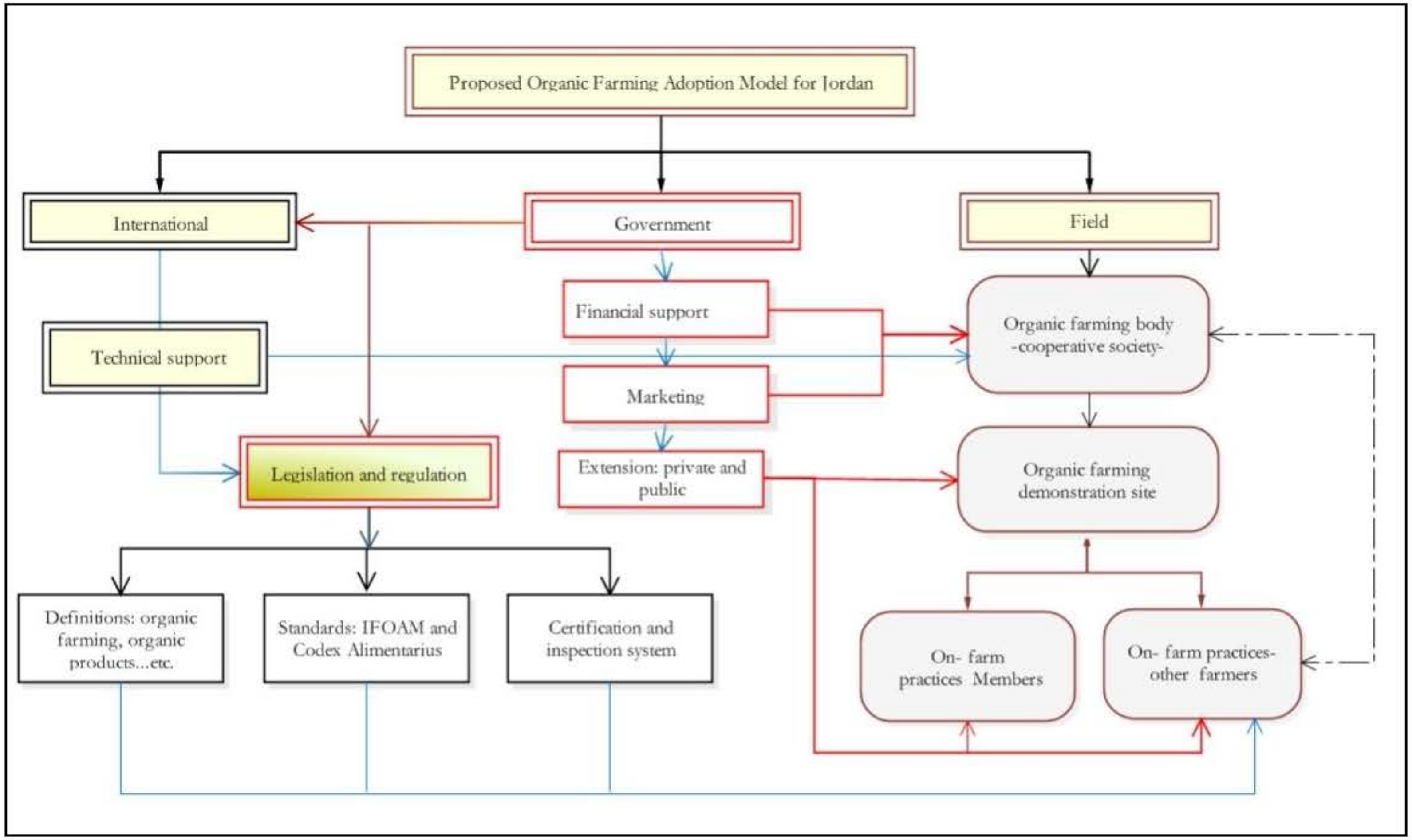

Figure 4.5: A diagrammatic overview to trigger stakeholders to participate in developing the action plan

Once the workshop finished, the participants' comments, suggestions and recommendations were collected from the volunteer. The workshop outcomes were categorised manually according to the recommendations and suggestions made by participants and then were tabulated as shown in Appendix J. The outcomes of the workshop were used with the empirical results from stage one for further analysis to develop the action plan as explained in Chapter 7.

4.11.2. Observations on the workshop

Presence of policy makers

The workshop aimed to involve decision and policy makers at a high level to promote and encourage stakeholders to adopt organic farming and to accelerate the adoption decision by the government. Therefore, the researcher aimed to invite the Minister of Agriculture to attend the workshop. It was a great achievement for this research that the workshop was conducted under the auspices of the Minister who gave full support for the outcomes of the workshop, as is explained below. It was not only the Minister who attended, but also the Secretary General of the Higher Council for Science and Technology (HCST) and the JBRDC President. The presence of policy-level decision makers served to encourage the use of this plan in future national development policy.

In addition to the welcome he made above, the President of the JBRDC emphasised that the agriculture sector in Jordan is considered to be a main income source for the family in rural areas of Jordan. According to him, the official figures indicate that there is a decline in the contribution of the agricultural sector to the GDP. It has been estimated that the contribution is about 3.8%, but in fact this contribution is miscalculated, because the agricultural input revenues in other sectors are not included:

> It is essential to do a study to find the potential contribution of this sector to the GDP. We need to concentrate on the agricultural production quality to benefit from the promising markets as we have trade agreements with EU and USA. Therefore, we encourage producers to produce organic foods as the markets are growing rapidly especially in EU and USA and the second point is the environmental issues. Barriers to organic farming in Jordan are a) legal framework, b) technical and standards framework and c) institutional, all

of which covered in this workshop. I hope today we can formulate the organic farming directions to adopt organic farming which contributes to our economy. This is built on farmers' participation in four workshops. The study area (North Badia) was chosen because of the potential factors it has a) pure natural resources availability, b) virgin lands to apply organic farming. Finally, I wish today that the Minister would agree to announce that the North Badia province to be the organic farming production area in the kingdom. To achieve this, collaboration work is needed from all of you (stakeholders).

(The JBRDC President 2005)

The MoA Minister emphasised that:

The agricultural sector is important even if it is not given consideration. The Jordanian agricultural sector is considered to be the most positive sector that provides practical solutions regarding the poverty problem in Jordan. Today, I see organic farming as an integrated solution towards the agricultural sector and other sectors. Applying organic farming would solve the poverty problems, can also solve problems resulted from conventional farming, simply it prohibits the use of chemicals and GM products. What I can say is that we as the MoA are ready to accept the workshop recommendations taken today and to adopt the research results. We need specific recommendations regarding the implementation of organic farming and we are ready to translate these recommendations into practical work. Again I am ready and waiting the outcomes of this workshop.

(The MoA Minister 2005)

Participation and feedback

All participants had the chance to participate in the workshop, where their comments and suggestions were heard. It was also observed that during breaks open discussions in small groups were used to address the problematic issues identified by the plenary stakeholders and explore alternative approaches for dealing with them and to take the opportunity to talk to the Minister (Figure 4.6). The TV also interviewed some of them during the breaks and after the workshop, to give more information about organic farming. Information from the workshop was used to form the basis of this, and an advisory (ad-hoc) organic farming committee was formed.

Figure 4.6: Farmers talking to the Minister of Agriculture (Photo by: Al-Khaldi 2005b)

The media (TV and newspapers) were helpful techniques to tell more Jordanian people about the initiative of organic farming in Jordan. Jordan TV and all Jordanian newspapers reported the workshop and its outcomes. Figure 4.7 is an example of one of the newspapers (Alghad 2005). It is also important to mention here that the media helped the JBRDC to receive feedback on the workshop. The feedback was that many people who read the newspaper or watched the TV asked the JBRDC how to get more information about organic farming. It is also worth noting that other feedback was that other people complained they were not invited to the workshop. The researcher and the JBRDC explained that it was difficult to invite everyone to a workshop bearing in mind that the work in this field is still in its early stages and also that those people were represented by their organisations.

Figure 4.7: A report by Alghad Newspaper on the workshop day (Alghad 2005)

The newspaper report was on 19/08/2005 one day after the workshop day. The report gives an idea about the workshop's aim and goals and that it was organised by the BRDC to discuss developing an action plan for the adoption of organic farming in Jordan. The report says that the MoA Minister supports the outcomes of the workshop and the proposed action plan by this research

4.11.3. The action plan development

The final objective of this research was to develop and propose an action plan in order to promote the adoption of organic farming in Jordan. The development of the action plan and the recommendations it contains, are based on the empirical results of stage one (questionnaire, interviews, the PAS discussion groups) and stage two (the workshop outcomes) as presented in

Chapter 7, and utilises the five perceived attributes of innovations: relative advantage, complexity, trialability, compatibility and observability. In this research, attention was paid to the five perceived attributes of innovations since they are important in explaining the rate of adoption of an innovation, and have been most extensively investigated and have been found to explain about half of the variance in innovations' rate of adoption. Another reasons is that they are devoted to analysing innovation differences which are valuable in predicting the reactions of people to an innovation, and the reactions which can be modified by the way in which an innovation (organic farming-in this research) is named and positioned, and how it is related to the existing beliefs and past experience of potential adopters (Rogers 2003). Another reason for the use of the five attributes is that they can help in assessing the adoption of organic farming as a new innovation in Jordan and to suggest a method to increase the adoption of organic farming by farmers. The time factor is important in the innovation-diffusion process, but since organic farming in Jordan is a new concept and still in the infant stage, it is difficult to predict how long it will take for a farmer to convert to organic farming and how many farmers will adopt it, and also not all farmers will be potential adopters. Padel (2001) found that even though there was information about organic faming in Europe, the theoretical prediction of how many farmers will adopt was difficult.

Therefore, in this research the attention was paid more to institutional issues, economic issues, and perception of organic farming instead to personal characteristics as suggested by Padel (2003) which could be achieved through these five attributes.

4.12. Summary

This chapter has developed a comprehensive research method divided into two phases to generate the required data. The research method integrated quantitative and qualitative approaches to gain primary and secondary data. The chapter also has discussed and explained techniques used to generate these data and the methods employed for data analysis. Techniques included observation, questionnaires, structured and unstructured interviews, and a national workshop, and utilises the five perceived attributes of innovations: relative advantage, complexity, trialability, compatibility and observability. This methodology has been designed to evaluate the opportunities and potential for organic farming in Jordan's arid lands based on participation of farmers, policy makers, private sector, key players, as well as institutional participation. The methodology adopted a participatory manner whereby farmers and stakeholders were involved in developing a contemporary organic farming system in Jordan. This methodology contributed to the knowledge of organic farming in arid lands and could serve for other countries also wishing to develop organic farming.

The next chapters describe and discuss the findings of the research and give more information about data analysis and findings.

CHAPTER FIVE: CONVENTIONAL FARMING WITH ORGANIC FARMING METHODS

CHAPTER FIVE
Conventional Farming with Organic Farming Methods

5.1. Introduction

This chapter focuses on the current farming practices in the study area and aims to investigate whether the farming system is organic or not. It also investigates if farmers employ non-chemical methods in their farms either to control pests or to improve soil fertility. The chapter provides comprehensive information on the socio-demographic characteristics of farmers, farm characteristics and production procedures. Moreover, it explains and discusses the knowledge of farmers regarding non-chemical and organic farming practices, and investigates the best extension resources and how farmers learn, how farmers differ in their cropping patterns, and the main farming barriers in the study area, including livestock and manure availability. The chapter investigates the sustainability of the current farming system and its environmental impact on soil, water and livestock. It also provides a description of the data analysis instruments, and it continues by discussing the impact of the current farming system on jobs and environment. Finally, the chapter concludes by suggesting what could be done to maintain the sustainability of the farming system.

5.2. Socio-demographic and economic characteristics

5.2.1. Farmers

In spite of the potential activities in the study area and the impact of these activities (economic, social and environmental), there has been a lack of socio-economic studies of the study area, which was a significant barrier to this research. The research is the first research which provides socio-demographic information about the 46 farmers who were interviewed and who made up the basis of this research (Table 5.1). It has been noted in this research that the society of these farmers is highly socially accountable and that there are strong social bonds within and between farmer communities, which can be as an advantage to encourage farmers to adopt organic farming.

The analysis of farmer characteristics showed a number of differences between them (Table 5.1). Some interesting findings were that all farmers were males and had an average age of *ca*. 51 years old (range 42), that farming in Jordan in general and particularly in the study area is dominated by male farmers, and that there is clear evidence that female farming ownership does not exist (Appendix F). The research also shows that the typical Jordanian household is an extended family having relatives and permanent inhabitants, but that due to the change in the lifestyle now in Jordan, there are two family types: extended and nuclear families. In this research farmers had 31 extended and 15 nuclear families with a total population of 1216 people. It was very important to find out this number in order to find farmers' expectations of the impact of organic farming on labour and jobs (Chapter 6). The population of the extended families was greater than nuclear families simply because farming was the main job for those extended families. Table 5.1 shows that farmers have a range of educational backgrounds: while the majority finished their secondary school, two of them have a BSc in Agriculture and are well-trained, and one has a PhD in Agriculture and was formerly the Vice Chancellor of Yarmook University.

As for farm ownership, it was found that 79% of the farmers had one farm, 17% had two farms, and 4% had three farms. Meanwhile, about 67% of them had one wife, 24% had two wives and 9% had three wives (Table 5.1). From the fieldwork observations it was noticed that farmers who had more than two wives had more than two farms and had a better financial situation. This also shows that the questionnaire technique was helpful, because farmers agreed to give more personal information. A very important point to present here is that only 76% of farmers were originally from the study area and 24% were from urban background the area and had bought farms there

(Appendix F). This result is showing that there has been a change in the farmer's community structure, which is discussed below. The farming calendar activities are explained in Appendix H.

Table 5.1: Socio-demographic characteristics of farmers interviewed in the study (n=46)

Characteristic	N	%	Total number in family	Average
Gender				
Male	46	100.0		
Female	0	0.0		
Age (years)	46			51
Marital status				
Married	46	100.0		
One wife	31	67.4		
Two wives	11	23.9		
Three wives	4	8.7		
Divorced	0	0.0		
Family type				
Extended	31		955	31
Nuclear	15		261	17
Qualification obtained by farmers				
Secondary school	43	93.0		
BSc in Agriculture	2	4.0		
PhD in Agriculture	1	3.0		
Number of farms/farmer				
One farm	36	78.7		
Two farms	8	17.0		
Three farms	2	4.3		
Place of origin				
Badia	35	76.0		
Urban background	11	24.0		
Land owned/cultivated				
Total hectares owned	**2153.0**			
Total hectares cultivated	**1486.6**			

5.2.2. Job and income created by current farming system

Although government reports say that the agricultural contribution to the country's economy is small (Chapter 3 Section 3.5.1), this research shows that agriculture makes a significant contribution, especially in the study area. Farming in the study area has secured a number of paid jobs and created new income resources that the government could not create. Farmers were asked to list jobs existing on the farm and wages paid. Results showed there were three types of jobs: permanent male, temporary female and temporary male jobs. The total number of permanent jobs was 349. Those who had permanent jobs were males and most of them were Egyptian workers. Their work was running the farm, which included the farm power systems, irrigation, spraying and guarding the farm. They were provided with accommodation on the farm and were paid £120 per month. They had to have a work permit from the government because they were not Jordanian. The cost for that was £ 200 year^{-1}, of which half was paid by the farmer and half by the worker.

However, the results in Table 5.2 show that female temporary jobs were more numerous than male temporary jobs. The female temporary jobs were seeding (sowing), transplanting and picking fruit (Figure 5.1). The male temporary jobs were mainly heavy ones, which included carrying boxes, loading trucks, weeding, spraying, establishing irrigation systems and ploughing.

Table 5.2: Jobs existing on the farm (n=46)

	Farm type			
Job	**Fruit**	**Mixed**	**Vegetable**	**Total**
Permanent male	110	120	119	349
Female temporary	290	504	838	1632
Male temporary	72	132	211	415

Figure 5.1: Women planting tomato seedlings in the study area

Both female and male temporary jobs were paid the same wages. The wage for the temporary jobs was equivalent to £ 3 per 8 hours per day, while the working period was 5 months. The following equation was used to calculate the total amount of money created for paid temporary workers in the study area.

Total money created = wage per day X number of working days X number of jobs

= £ 3 X 150 days X 2047 workers

= £ 921150

This amount of money can be considered a significant contribution to the area. For example, the government pays an unemployed family of five members about £ 840 year^{-1}. This amount of money is the equivalent of government support for 1100 families (921150/840).

Farmers were asked to identify how many of their family members depend on on-farm or off-farm income. The results in Table 5.3 show that most farmers depend on on-farm income. Moreover, the results show that about 86% of the households of the extended families have only on-farm income, while 63% of the nuclear families do. This indicates that the main income for those families is the income created by farms. It was found that on average that in both family types one person was responsible for earning income for 11 people.

Table 5.3: Main sources of incomes of family members

Family type	On-farm		Off-farm	
	Household (n)	%	Household (n)	%
Extended (n=955)	91	86	15	14
Nuclear (n=261)	19	63	11	37

It can be concluded that if there is any impact on the agricultural production in this area, it would have a significant impact not only on farmers but also on many other people in the study area, such as drivers, shopkeepers and blacksmiths. Therefore, applying new systems or any policy regarding this sector should take into account the impact on jobs created by this sector. An example to be mentioned here is the feed subsidies removal decision. The Government of Jordan in 1996 removed feed subsidies, which resulted in many poor families selling part of their flocks to feed their remaining animals, and resulting in less livestock jobs (Al-Sharafat 2001). Therefore, the introduction of organic farming should carefully take into account the impact of organic farming on these farmers (this is covered in the Organic Farming Barriers, Chapter 6).

The research shows that conventional farming has caused not only environmental problems, but also social changes in which farmers have rented land. The research discovered that the owners managed only 76% of the farms, while 24% of the farms were rented to people from urban background (Table 5.1). Local farmers rent their farms because they were losing money for many years because they did not have enough knowledge to deal with the conventional agricultural system they had. This system requires good knowledge of agricultural inputs: fertilisers, new varieties, pesticides, best cultivation periods, diagnosing and controlling pests, and marketing. This can be explained because local farmers come from different backgrounds: sheep farming, army and other government jobs, but not fruit or vegetable farming. Losing money led them to accumulating bills for the electricity company, agricultural companies and the Jordan Agricultural Credit Corporation (ACC). According to farmers, it was easy to delay paying the ACC but not the electricity company or the agricultural companies. Moreover, the electricity company has the right now to come to the farm at any time to cut off the electricity if the bill is not paid, which means the crops will die because the irrigation system works by electricity. As a result, it was easier for those farmers to rent out their farms instead of running their farms. According to farmers, renting out a farm in the Badia is a dangerous option for two reasons:

1. Losing ownership: farmers could lose ownership of their land. It is expected that some of the local farmers will start selling their farms and lands. The research observations and expectations were right: for example, during the data analysis in December 2004 one of the rented farms was sold to the farmer who had rented it. The researcher through a telephone call tried to investigate why the farm had been sold. The response showed that the financial commitments to the three parties mentioned above were the main reasons. The farm was sold at a price of £ 150,000, of which £ 60,000 was paid to the Jordan Agricultural Bank, £ 30,000 to the agricultural companies, £ 25,000 to repay loans, and the farmer got only £ 35,000. The sad result was the farmer lost land with an area of 35 ha and the farm's equipment, which was worth more than the value which was paid. Moreover, it was a cultural shock for this farmer to sell the farm, and he could not show his face to other farmers for at least a few months. However, one case is not enough to give enough information about the impact on a farmer who lost his farm ownership.

2. Environmental impact: according to farmers, farmers who have urban background come to invest their money in the Badia for about 10 years using chemicals and water more than the local farmers, which could have environmental impact on soil and increase the pollution.

5.3. Farm characteristics

5.3.1. Farm size and type

To gain information about farms, farmers were asked to provide information about their farm's area. A cross tabulation was used to analyse the data, in which farms were divided into three types: 14 fruit farms owned by 10 farmers, 14 mixed farms (vegetables and fruit) owned by 12 farmers, and 29 vegetable farms owned by 24 farmers (Table 5.4). Results show that the total farms included in the survey had an area of 2153 ha, while the total cultivated area was of 1486.6 ha. The farms had an average size of 37.1 ha but the average size of the cultivated area was of 25.7 ha. Field observations showed three important issues. The first issue was that the difference between the farms' average size and the cultivated average size (i.e. about 70% of the farms' area was cultivated). The reason for this difference was that farmers leave the remainder (30%) of their land for crop rotation purposes. The second issue was that farms were very close: in some cases less than 1 km apart (Figure 5.2). The third was that vegetable farms occupied the highest percentage of the cultivated area (i.e. 37%), mixed farms 36% while fruit farms occupied 27%. The explanation for this is that farmers always look for quick revenue, which cannot be achieved by establishing fruit farms. According to farmers, it takes at least three years after establishment to obtain revenue from fruit farms, while it needs about three months in the case of vegetables.

Table 5.4: Types of farms and their cultivation area

Farm data	Fruit	Mixed	Vegetable	Total
Number of owners	10	12	24	46
Number of farms	14	14	29	57
Percentage	24	26	50	100
Cultivated area ha	396	542	551	1489
Total land area ha	425	882	846	2153

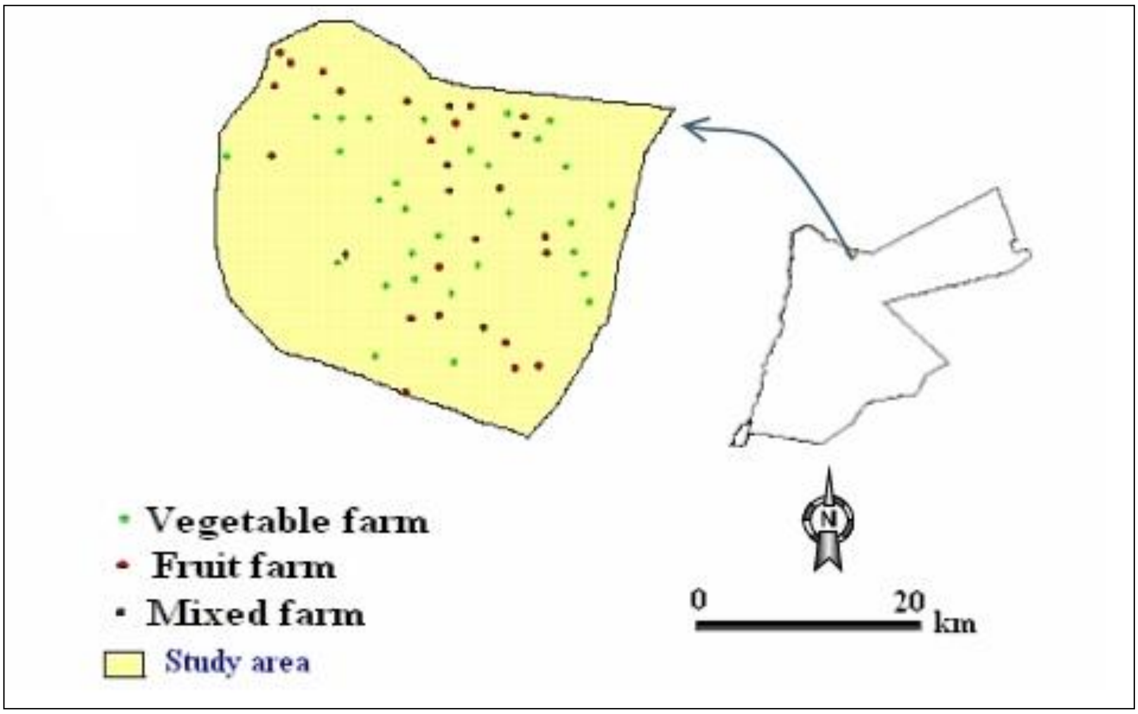

Figure 5.2: Farm type in the study area

As for crops, farmers were asked to provide information about their crops. The aim was to describe the farming system and to find if there were crops currently cultivated organically, or which could be cultivated organically. The general principle for the choice of crops and varieties in organic farming by IFOAM (2002: 19) and according to Sharma (2001: 46) is that:

> All seeds and plant material are certified organic; also, species and varieties cultivated should be adapted to the soil and climatic conditions and be resistant to pests and diseases. And plant varieties should be selected to maintain genetic diversity.

Despite the fact that the area is arid land, several crops were cultivated in the study area (Figure 5.3) as conventional crops, and the general principle mentioned above was not applied. It was found that tomatoes occupy the highest percentage (i.e. 33%) of the total cultivated crop area and the largest cultivated area among farm types (Figures 5.3 and 5.4). The reason behind this, as farmers say is that: 'the tomato never makes a loss because of its high production and the long harvesting period it has, which means there is always a chance to get a good price in comparison to other crops which have one harvesting time'. It was also found (Figure 5.3) that stone fruit and olives occupied about the same percentage, 22%. But it is expected in the near future that the area of stone fruits will increase, for three reasons: (a) the price of and demand for the stone fruit products is higher than for olives, (b) olives need more water and labour, which is expensive, and (c) the decline in the soil fertility which prevents growing vegetables.

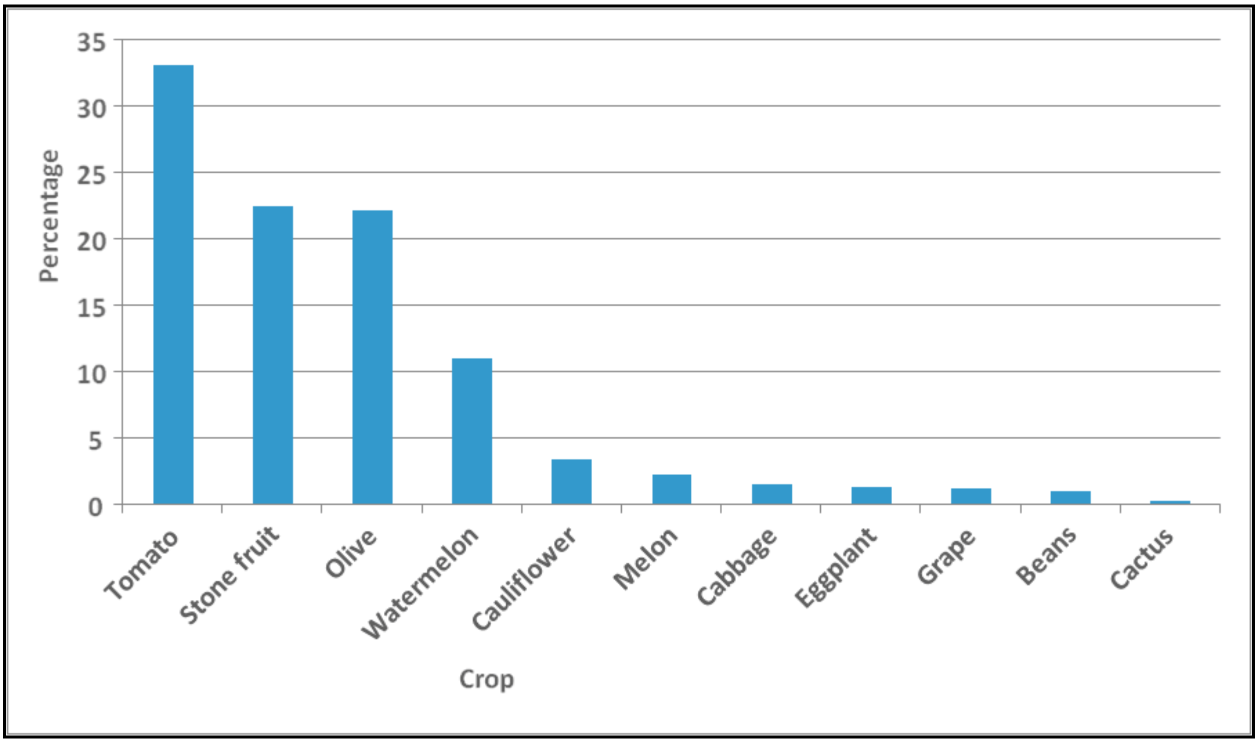

Figure 5.3: Percentage of land area devoted to crops cultivated in the study area

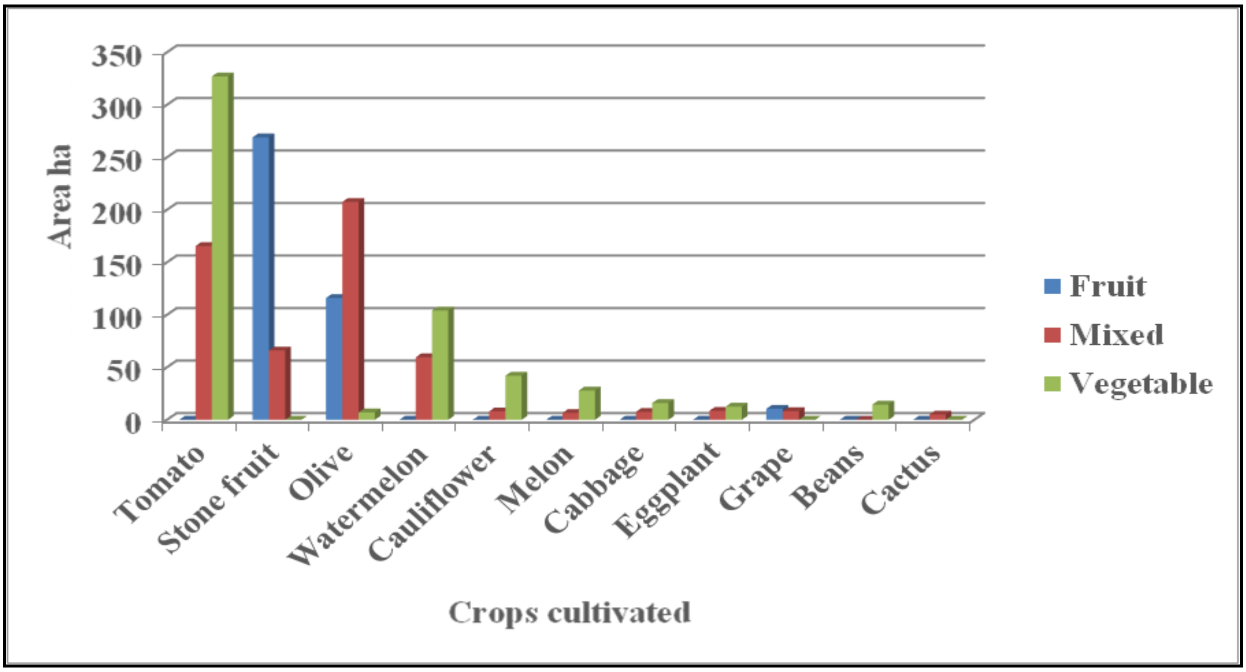

Figure 5.4: Area of crops cultivated in the study area

Farmers reported that all the vegetable varieties that they used were F1 hybrid and were very susceptible to pests and diseases and not well adapted to the soil and climatic conditions. As a result, farmers used pesticides and fertilisers to gain good yields. There were no crops in the whole of Jordan certified as organic. It was found that only two crops were grown naturally (organically), olive and cactus (Indian fig: *Opuntia* spp.). The researcher was encouraged to visit the cactus farm to investigate the experience of growing cactus in Jordan (Appendix I).

5.3.2. Livestock types

In this research, livestock husbandry is not discussed because the research focuses on plant production rather than on animal production. However, it was important to collect information on livestock to find out (a) types of livestock, (b) if they could provide a significant amount of organic manure, (c) if farmers could use the manure as organic manure, and (d) what is the relationship between livestock and farms in the study area.

The results (Table 5.5) showed that farmers had sheep, goats or both together. The total number of the livestock was 4540 animals, while sheep the largest number at 3630, goats 860, and mixed 50. Farmers preferred to keep sheep for three reasons:

- Sheep do not cause as much damage to the farm as goats,
- Sheep always command a better price than goats, and
- Sheep can survive better than goats in the environment of the area, especially in winter.

Table 5.5: Livestock types and numbers

Farm's type	**Goats**	**Sheep**	**Both**	Total
Fruit	80	30	0	110
Mixed	360	2250	0	2610
Vegetable	420	1350	50	1820
Total	860	3630	50	4540

From Table 5.5 it can be seen that the average animal number per farm was about 80, while the number of animals per hectare was three. This shows that the number of animals is very low and is not enough to produce manure for the cultivated area, which is a barrier for both conventional and organic farming. Animals also were fed on conventional feed, which means that the manure cannot be used as organic manure. The total amount produced by animals was 1112.5 t year^{-1} (Equation: CSU 2005).

The amount of manure produced by livestock can be calculated as follows*:

$$= \frac{\text{Average manure production values (lb/day/1,000 lb of animal)} \times \text{Average animal weight (lb) X 365 days/year X number of head fed/year X ton}}{\text{2000 lb}}$$

$$= \frac{14.5/1000 \times 92.6 \times 365/year \times 4540}{2000} \quad \mathbf{= 1112.5\ tons\ manure\ year^{-1}}$$

It was also discovered that mixed farms had the largest numbers of animals. This can be explained because mixed farms can provide more feed than other farms since they have two types of by-product, (a) vegetable by-products and (b) fruit by-products. As Jordan is classified as an arid land and has not enough grazing land, then these by-products can reduce the cost of animal feeding in the study area, which helps farmers to raise more animals. Farmers who had livestock fed the by-products to their animals, and those who did not have livestock sold the by-product to livestock keepers. As a result, by-products cannot be used as organic fertilisers because the farmers' priority concerning by-products is to feed them to the animals due to the lack of green feed.

5.4. Extension

Adoption of organic farming needs a national effort to provide farmers with information on organic farming (Sharma 2001, Niemeyer and Lombard 2003). Therefore, lack of advice or extension becomes a major barrier for organic farming; such a barrier has been reported by Niemeyer and Lombard (2003) as a major problem for organic farming in South Africa. Therefore, adoption of

* The average manure production value is 14.5 lb day^{-1}, while the average animal weight in Jordan is 92.6 lb.

organic farming requires national efforts to provide farmers with appropriate extension services and suitable information about organic farming practices. It was important in this research to investigate the field situation of extension to find the main source of information that farmers used regarding their agricultural production. To do so, farmers were asked 'What is the best resource to get information regarding your agricultural production?', and specifically to rank the extension resources they used. The results (Figure 5.5) show that 61% (28) of them responded that if they needed information they would ask the PAS, 37% (17) would ask other farmers and 2% (1) would ask MoA extension agents. In summary, farmers learn and develop their farming skills mainly through:

- Own experience from previous years trial and error or from other expert farmers
- Demonstration experiments which is used by the private sector to introduce new ideas such as using new pesticides, crops, fertilisers. In this method, a company makes an agreement with a farmer to try a new crop variety, a pesticide or a fertiliser in part of his farm less than 5%. The company pays for all costs and the revenues are for the farmer. In this method different farmers visit this farmer to see the results. According to the success of the results farmers decide to adopt the new idea.

Al-Adamat (2002) also showed in his study that there was a lack of extension services in the north Badia provided by MoA and that farmers prefer to use private and farmer extension resources. Even in the USA, Walz (1999) showed that organic farmers ranked the Cooperative Extension advisors, state agricultural departments and USDA national or regional offices as the least useful personal contacts.

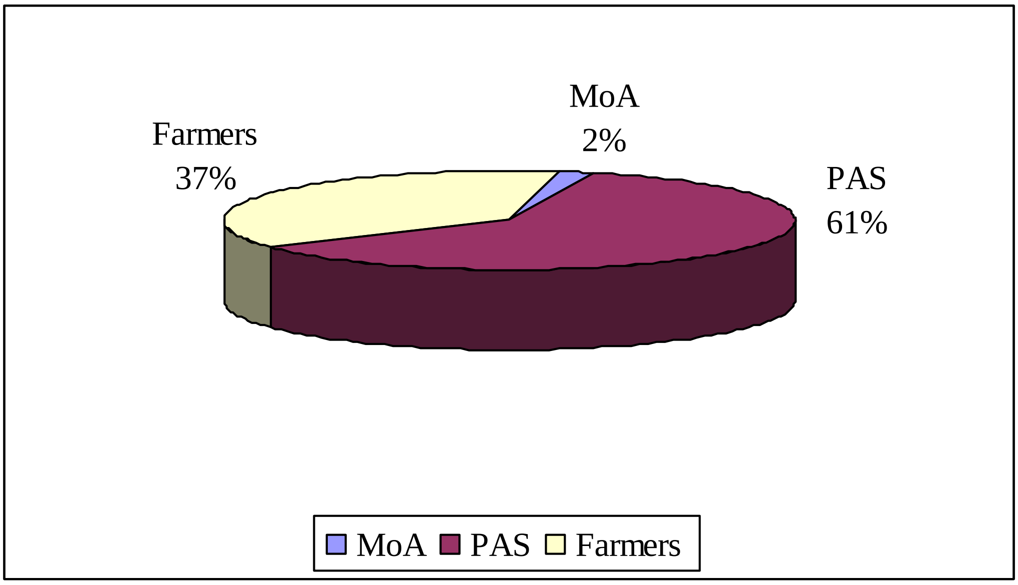

Figure 5.5: Farmers' extension sources

From the results above, it can be concluded that the MoA extension agents were the least useful information provider for the farmers. The results show that if organic farming is to develop in Jordan, then the priority for an organic extension resource is to involve PAS at an early stage of the adoption of organic farming (Chapter 7) since they play an important role in the agricultural sector in Jordan (Chapter 4 Section 4.6). This is consistent with Bitar and Al-Rimawi (2005) who found that to develop environment friendly technologies and to promote public awareness of environmental issues, there is a need to involve the private agricultural companies in the agricultural extension process, and the extension resources should be available to train the private sector to deliver extension services. However, applying organic farming in Jordan means that PAS will lose part of their sales. Therefore, it is recommended that the PAS should be compensated by providing extension services, paid by the government from the extension budget, and should be encouraged to sell organic farming inputs such as compost, manures, new varieties adapted to the local environmental conditions, and natural pesticides and fertilisers. This would help the PAS to generate some income and sustain their business. The other issue to involve the PAS in the organic farming extension process is that the MoA does not have the facilities to follow up with farmers. The MoA extension offices are in the main cities and far away from farms. Therefore, it would be easier for the MoA to involve the PAS a paid extension service (see Chapter 7).

5.5. Pests, diseases and their management

One of the objectives of this research was to catalogue and describe the current farming system used by farmers, including pest and disease control. Documenting the main pests helped to provide a database about the main pests and diseases in the study area based on farmers' experience, to introduce a control strategy if organic farming is employed. This part was divided into three topics: pests, pesticides used, and non-chemical strategies used to control pests.

Farmers were asked to list the main pests and diseases that attack their crops and the control method(s) used, in their own words. The question was aimed at identifying pests and diseases and the level of difficulty of controlling them. In order to analyse this question, cross-tabulation was used between the pest's name and the farm type. The answers were analysed among the total respondents. The results in (Table 5.6) show that there were 11 pests attacking crops, divided into four categories (a) diseases (b) insects (c) weeds and (d) other.

Table 5.6: The main pests and diseases in the study area (n=46)

		Farms type						Among the total number of respondents	
		Vegetable		Fruit		Mixed			
Category		**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Disease	Powdery mildew	24.0	100	9.0	90.0	12	100	45.0	97.8
	Virus	3.0	12.5	0.0	0.0	0.0	0.0	3.0	6.5
	Blights	14.0	58.3	2.0	20.0	8.0	66.7	24.0	52.2
Pests	Spiders (*Tetranychus urticae*)	24.0	100	8.0	80.0	11.0	91.7	43.0	93.5
	Mite*(Aculops lycopersici)*	16.0	66.7	5.0	50.0	6.0	50.0	27.0	58.7
	Aphid	3.0	12.5	7.0	70.0	2.0	16.7	12.0	26.1
	Thrips	0.0	0.0	3.0	30.0	4.0	33.3	7.0	15.2
Weeds	Orobanchae	12.0	50.0	0.0	0.0	10.0	83.3	22.0	47.8
Other	White worms	13.0	54.2	0.0	0.0	7.0	58.3	20.0	43.5
	Nematode	0.0	0.0	1.0	10.0	0.0	0.0	1.0	2.2

(N: number of respondents)

It can be seen that powdery mildew was the most problematic pest and the most difficult one to control on all farm types. The explanation for this is that the area is hot and dry, which is a good environment for powdery mildew, and also crops were suitable hosts for the powdery mildew. The second main pest was spiders, because the area is hot and dry, there are suitable hosts, and there is dust in summer. It is important to mention that spiders do not attack or cause damage to crops. The spider here is the red spider mite, but the 'spider' name was widely used among farmers. Investigations showed that pesticide companies used this name to attract farmers to buy pesticides, and it was easier to use one word rather than three words for the pest.

Orobanchae, a parasitic plant, was a problem for vegetable farms (50%) as well as mixed farms (83.3%). Farmers reported that the main reason behind this problem was using the same crop, tomato, in the same land for many years with not enough fallow periods or a good crop rotation, and because the weed seeds are transferred by grazing sheep through the manure. Vegetable farmers expected that the study area would be severely infected with orobanchae in the near future, which may prevent many of them from growing tomato and means that they will have to change to other crops, such as fruit trees. Farmers say they cannot use herbicides to kill this weed because using herbicides can easily kill their crops. This weed was not found in the fruit farms because there was no host.

An important pest in the fruit farms was aphid during the flowering period between April and May. It was found that only one farmer reported nematodes as a problem. This farmer had three fruit farms and did a pest survey every two years to make sure that the pest population was always under the threshold level. The farmer recorded many nematode infections in his farms, with the cooperation of a private laboratory. In addition, the researcher noticed that there were nematode infection symptoms on most fruit farms. Farmers did not report nematodes as pests for two reasons: (a) it was very difficult for them to investigate it, and (b) any tree dying back was attributed to nutrient deficiency or to rocks under the tree root system.

The ‘white worm’ was reported many times especially by farmers who had vegetables (Figure 5.6). It was reported that the ‘white worm’ lasted a short time, about two weeks, and before sowing the seeds. They used insecticides and urea through the irrigation system to control it. Many farmers asked the researcher to tell them what the ‘white worm’ was. The researcher collected three worm samples representing the pest as it was described by farmers. These samples were taken and kept in an optimal environment to find what it was. The results showed that the worms were houseflies and this was reported back to farmers. These are not plant pests.

Figure 5.6: Soil sample containing white worms

From the discussion above it can be concluded that there were several pests and diseases in the study area and farmers reported that they were unable to control them without using pesticides. It can also be concluded that there was a strong relationship between crops and pests. This relation was for three reasons:

- The crops mentioned above were susceptible,
- There was a diversity of crops within the farm, and
- Crops were grown at the appearance time of the pests

The results show that there is a challenge for farmers who wish to convert to organic farming systems (Chapter 6). This challenge requires a clear strategy for what crops can be grown without using pesticides, and how to control pests attacking crops using alternative methods. This can be achieved within an action plan developed for adoption of organic farming in Jordan which includes research and other action plans (Chapter 7).

As for control, the pests and diseases mentioned above create a challenge for farmers. Fieldwork observations and the pilot survey showed that farmers were using chemical methods to control these pests and diseases. Results showed that 98% of the farmers emphasised that all the pests, except orobanchae, were controlled through using pesticides. They had tried different means to control orobanchae but they failed. They reported that the best way to avoid the orobanchae problem was by using virgin land to grow tomato, or simply not to grow tomato. Some of them used more urea to compensate for the loss in nutrients due to orobanchae.

As for amount of pesticides used, farmers were asked to rank the use of pesticides according to the amount of use in their farms. The researcher provided them with six hand-drawn images representing the pesticides that were available in the study area and used by farmers (Appendix B). The images were for insecticides, acaricides, fungicides, nematicides, herbicides, and a blank image to write the type of the pesticides if not included. It was found that farmers were happy to use the images and to rank them. It is also recommended that other researchers who conduct a survey use images to collect some of their data, as this encourages respondents to participate more in the research.

The results show that farmers gave different answers about the amount of pesticides that they use. For example, among vegetable farmers, 29% ranked the amounts in the order F>A>I, 29% F>I>A, 29% A>F> and I>F>A 13% (Table 5.7). The researcher discovered that herbicides were not used in the study area. It was also found that only one farmer (2%) did not use any pesticides and he had an olive farm, while 98% of farmers used pesticides. These pesticides were insecticides, acaricides, fungicides, and nematicides. The nematicides were used only in the fruit farms and by one farmer.

Table 5.7: Pesticides used in the study area (n=46)

	Farm Type							
	Vegetable		Fruit		Mixed		Total	
Order of the amount of pesticides	N	%	N	%	N	%	N	%
I>A>F>Ne	0.0	0.0	2.0	20.0	1.0	8.3	3.0	6.5
F>A>I	7.0	29.2	1.0	10.0	4.0	33.3	12.0	26.1
F>I>A	7.0	29.2	1.0	10.0	4.0	33.3	12.0	26.1
A>F>I	7.0	29.2	1.0	10.0	2.0	16.7	10.0	21.7
I>F>A	3.0	12.5	4.0	40.0	1.0	8.3	8.0	17.4
None	0.0	0.0	1.0	10.0	0.0	0.0	1.0	2.2

I: insecticides, A: acaricides, F: fungicides, Ne: nematicides

The field observations showed that the spray-men did not use precautions to protect themselves and that some of them used their hands to mix pesticides (Chapter 3 Section 10.3).

5.6. Non-chemical strategies to control pests

The research aimed to catalogue and document the pest management techniques used in the study area and to find out whether farmers use organic farming strategies or not. To achieve this, farmers were asked first to list what non-chemical strategies they used to control pests. The results (Table 5.8) showed that 72% of them answered that they used only synthetic pesticides. Meanwhile, 28% (13 farmers) of them reported that they did use some non-chemical strategies to control pests. This low percentage shows there was a lack of knowledge among farmers about the concept of non-chemical strategies used to control pests. This can be explained due to a lack of extension provided by the public sector (see Figure 5.5), and by the fact that the private sector plays an important role in concentrating on pesticides as the only method to control pests.

Table 5.8: Response of farmers concerning the non-chemical strategies used to control pests (n=46)

Response	N	%
Mentioned method(s)	13	28.3
Did not mention any method	33	71.7
Total	46	100

The answers of the 13 farmers (Table 5.8) who mentioned non-chemical methods included using resistant varieties, capnodis collection (hand picking) because the insect size is big enough to be collected by hand, and weeding.

Therefore, the researcher did not stop at these answers (Table 5.8), for two reasons:

- The pilot survey enabled the researcher to produce a checklist containing non-chemical strategies used by farmers to control pests in the study area, and
- Observations showed that there were some non-chemical strategies used by farmers to control pests in every farm that was visited.

The research revealed that various non-chemical strategies were used by farmers to control pests and diseases. The research also revealed that the stratigies included some permitted preventive inputs (chemicals) such sulphur, summer and winter oils (Table 5.9). It was discussed with farmers which of these strategies they employed in their farms. In order to analyse the responses, cross tabulation was used between the farm type and the strategy used. This analysis was used because some of the strategies were employed on vegetable farms but not on the fruit farms, or the reverse.

Table 5.9: Non-chemical strategies used to control pests (n=46)

	Among farm types						Among the total number of respondents	
	Vegetable		Fruit		Mixed			
Strategies	N	%	N	%	N	%	N	%
Crop rotation	24	100.0	0	0.0	12	100.0	36	78.3
Fallow periods	24	100.0	0	0.0	12	100.0	36	78.3
Mulching (black plastic sheets)	22	91.7	0	0.0	12	100.0	34	73.9
Tillage and irrigation management	24	100.0	10	100.0	12	100.0	46	100.0
Summer and winter oils*	0	0.0	6	60.0	8	66.7	14	30.4
Live barriers	17	70.8	10	100.0	10	83.3	37	80.4
Sulphur*	22	91.7	6	60.0	12	100.0	40	87.0
Resistant varieties	10	41.7	4	40.0	4	33.3	18	39.1
Weeding	24	100.0	10	100.0	12	100.0	46	100.0
Handpicking	0	0.0	7	70.0	3	25.0	10	21.7
Timely planting	23	95.8	0	0.0	12	100.0	35	76.0
White sand	12	50.0	9	90.0	4	33.3	25	54.3
Clean stock/Sanitation/ Good hygiene	24	100.0	10	100.0	12	100.0	46	100.0
Pruning	0	0.0	10	100.0	12	100.0	22	47.8
Water	24	100.0	10	100.0	12	100.0	46	100.0

* Permitted preventive inputs (chemicals)

It was found that crop rotations, fallow periods and mulching were not used at any of the fruit farms. Fruit farms had been established for many years on the same land, which meant that crop rotations and fallow periods were not applicable. Mulching was designed to be used only for vegetables to control weeds and prevent evaporation, but was not appropriate for fruit farms. These strategies were employed on vegetable farms, and on mixed farms for vegetables. All farmers reported that the fallow periods used to be more than 10 years but were now shorter, which is an interesting result and shows that the current farming techniques have made an impact on the cultivated area. This is because vegetable farmers have utilised most of the land in the study area, which has forced many farmers to change from vegetable farming to mixed or fruit farming. It was found that the mean of the fallow period was ca 3.87 (4) years. This result has implications for soil fertility and explains why ca 35% of vegetable farmers and 40% of mixed farmers did not grow watermelon, even though it is a high value crop, because it needs virgin land or a fallow period of more than 6 years to give good yields because it is a very sensitive crop to soil-borne diseases. This result means that within a few years it will be hardly possible to grow watermelon in any of the study area. The results also showed that there was a strong relationship between pest management and soil fertility management. Farmers used crop rotations and fallow periods to control weeds, pests and diseases and also to improve the soil fertility, while the plastic mulch was used to control weeds and control water evaporation. The three strategies are discussed and described in detail in the Soil Fertility Management (Section 5.7) below. This shows that farmers have developed some strategies to control pests and diseases which can be used in organic farming. It can be seen from Table 5.9 that the following four strategies were employed in all farm types:

1. Tillage and irrigation management: farmers reported that the study area is considered as an arid land, which makes it difficult for their crops to grow. They used tractors to plough the land by cross ploughing. The ploughing process was the same in all farm types, but they used rotary disk to break the soil crust to enhance vegetables growth. All of them used drip irrigation systems and watered their crops every 48 hours to keep plants in good condition to avoid the harsh conditions and to reduce infection, especially with white powdery mildew.

2. Weeding: it was found that all farmers in all of the farm types used mechanical weeding. They employed workers to do the job rather than using herbicides. They believed that herbicides would be cheaper and quicker to control weeds, but would have phototoxicity to their crops. It was observed that the collected weeds were fed to animals and cannot be used for composting or to improve soil fertility.

3. Clean stock/Sanitation/ Good hygiene: all farmers used clean stock as seeds, transplants and rootstocks. In the case of vegetables, they buy F1 hybrid seeds and make sure that the seeds are packed and not subject to a source of infection, while in the case of trees they buy rootstocks from trusted nurseries, guaranteeing that the rootstocks are free of infection.

4. Water: it was found that all farmers used water to reduce the infection rate, especially the infection rate of powdery mildew. Farmers reported that in summer the soil becomes very fine and dusty around, and inside, the farm from the movement of cars, animals and people. They said when the wind comes, it takes the dust to the crops. Dust is a critical factor for increasing pest infection especially that of powdery mildew and red spider mite. They sprayed roads surrounding farms or inside farms with water to keep the dust to a minimum. This technique was expensive because it needs a tractor with tank capacity of 5-7 m^3, a driver and water. The technique was preventive and very effective in reducing the infection rate. Results also showed that 50% of the vegetable farmers, 90% of fruit farmers and 33% of mixed farmers used white sand for the same purpose. All farmers wished to cover the dusty roads surrounding or inside farms with white sand, but it was expensive.

It was found also that two live barriers were used: maize was used in 71% of vegetable farms, olive trees used in 100% of fruit farms, and 83% of the mixed farms used both live barriers. Some vegetable farms did not have barrier maize because it can be a good host for pests such as aphids. Olive trees are used as a live barrier because olive has two benefits: it is a good live barrier with no side effects and less competition with the surrounding crops, and it has a good yield. It was found that only ca 39% of the farmers used resistant varieties. Farmers did not believe in resistant varieties, and even those who used them reported that those varieties lose their resistance within two years.

Two strategies were used only on fruit farms: (a) Capnodis (*Capnodis tenebrionis)* handpicking because the insect attacks trees and its size is large enough to be collected by hand, and (b) summer and winter oils because they are produced to be used for trees.

Timely planting was used in vegetable and mixed farms only. Farmers used this strategy to avoid the appearance time of the white fly, which is the carrier of a virus called tomato yellow leaf curl virus (TYLCV). This virus can reduce tomato yield by 90% if the infection stage is not avoided. Farmers try to grow their tomato seedlings before 15th June each year to reach one-month age by 15th July, the time of the white fly appearance. Farmers said that when tomato plants reach one month old they are tolerant of the infestation.

As for organic materials, it was found that sulphur only was widely used in most of the farms as a permitted organic preventive input for powdery mildew, used by 87% of the farmers. Farmers found that powdery mildew had become resistant to many pesticides, including Bayfidan 250 wp (Triamedinol-Triazol) from the Triazol group, so they developed the idea of using sulphur as a dust for vegetable plants and as a suspension in the case of fruit trees. Results showed that the pruning strategy was employed on all fruit farms and on mixed farms. This strategy was used only for trees and not for vegetables.

5.7. Soil fertility management

The research results show that farmers use mainly chicken manure and that some of them also use sheep manure for trees, and they add this manure to the soil after the tillage process and before installing the drip irrigation network, although only 26% of them did soil analysis before they grew their crops. After they install the drip irrigation network they cover it with a black plastic mulch with holes for the seedlings (Figure 5.7). The distance between the holes is about 35 cm. After that they irrigate the land for about 10 h to make the soil wet before planting the seedlings, but if they are going to sow seeds they do not irrigate. When they are sure that the soil is in good condition they start transplanting the seedlings. This process (Figure 5.1) is done by women who work from 06.00 until 13.00 and get paid £3 a day. Farmers apply manure to the tree crop in winter when the temperature is cold and plants are dormant. Farmers in the study area also use inorganic fertilisers with all crops starting with urea (46% N) and finishing with a combination such as N-P-K 0-5-46.

A: Drawing showing how farmers add the manure to vegetables. The distance between the seedlings is 35 cm.

B: Applying manure on trees

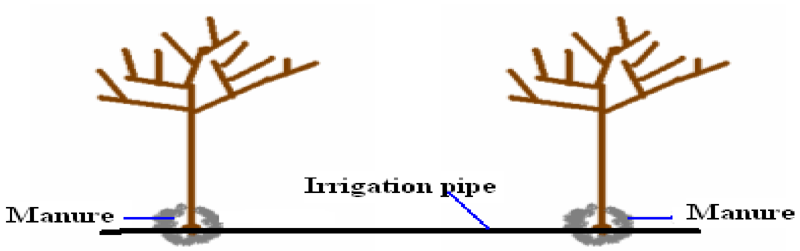

Figure 5.7: Application of manure on vegetables and fruit trees

As for land preparation, fieldwork showed that there were general principles used by farmers to prepare their land for growing crops. These principles are presented in the following Table 5.10.

Table 5.10: General principles of the land preparation in the study area

	Farm type		
Step	**Vegetable**	**Fruit**	**Mixed**
Virgin land	Preferable	Not necessary	Preferable on vegetables
Clean the land of stones, plant residues	Applied	Applied	Applied
Deep ploughing	Applied	Applied	Applied
Cross tillage	Applied	Applied	Applied
Use the rotary hoe	Applied	Not Applied	Applied on vegetables
Make a trench to put in the manure	Preferable	Not applied	For vegetables
Manure	Mostly chicken	Mostly sheep	Both
Cover the manure	Preferable	Not necessary	For vegetables
Drip irrigation system	Applied	Applied	Applied
Mulching to minimise water evaporation and control weed	Applied	Not Applied	Applied on vegetables
Irrigation before planting	Applied	Not Applied	Applied on vegetables
Add inorganic fertilisers	Applied	Applied	Applied
Crop rotation and fallow period	Applied	Not applied	Applied on vegetables

Observations showed that there was a difference in land preparation techniques used between farm types. Therefore, farmers were asked individually 'What are the main steps that you take to make sure that your land is ready to grow crops?'. This question included information about soil analysis, moisture and evaporation, pH and soil amendments. Table 5.11 shows the variations in applying the general principles between farms.

Table 5.11: Variations of responses relating to the soil fertility management (n=46)

Step	Farm type							
	Vegetable		Fruit		Mixed		Among the total number of respondents	
	N	%	N	%	N	%	N	%
Use of plastic mulch to prevent water evaporation and to control weed	22	92	-	0	12	100	34	74
Did soil analysis	2	8	8	80	2	17	12	26
Used virgin land*	10	42	-	0	6	50	16	35
Knew about soil pH	5	21	7	70	2	17	14	30
Used humic acid	18	75	6	60	12	100	36	78
Used manure	20	83	10	100	12	100	42	91
Made a tunnel to put the manure in and covered it with soil	12	50	-	-	4	33	16	35
Covered the manure ploughing without making tunnel	8	33	-	-	7	58	15	33

*Small area used to grow watermelon

Results showed that plastic mulch was used in 92% of the vegetable farms, 100% of mixed farms for vegetables, but not at all on fruit farms. Only two vegetable farmers did not use the black plastic mulch because it was very expensive, while in the fruit farms it was not used because it was not designed for trees. It was found that fruit farmers were more aware than vegetable farmers of soil analysis and pH. Results showed that 80% of them did soil analysis and 70% of them knew that pH has an effect on their crops, while results were 8%, 21% in the vegetable farms and 17%, 50% in the mixed farms, respectively. Results showed that soil fertility analysis was undertaken by only 26% of farmers, suggesting a lack of knowledge about the soil fertility.

There are two important points to be made here. Firstly, that 42% of vegetable farmers and 50% of mixed farmers used virgin land to grow crops. This indicates there was a decline in this type of land and that most of the cultivable land has clearly been used, because farmers moved from one area to another, which explains why the area of cultivated watermelon was small (Section 5.6 above). The second point is that 78% of the farmers used humic acid to improve the soil fertility. Discussion with farmers showed that humic acid was not used in the area until four years ago. Farmers say that using humic acids improves the soil by reducing the soil compaction, which enables plants to take up minerals. Farmers know only the name of this material, but they do not know how it works or its chemical composition. The researcher collected useful information about humic acid products which is presented in Table 5.12, which shows there are different formulations of humic acid used in Jordan. The research highly recommends the study of both the need for and the environmental impact of this material before it creates a problem that cannot be eliminated.

Table 5.12: Humic acid used in Jordan by farmers (DoLI 2003)

Trade name	**Chemical composition**	**Registration No.**	**Expiry registration date**
Manvert Terra	20% total humic extract		1/1/2007
Humate HUMIC Acid	Humic acid 12%		29/5/2007
LIQHUMUS	Humic acid 18% w/w		17/7/2007
POW HUMUS	Humic acid 85% w/w		17/7/2007
Humigreen	Humic acid 18%		1/9/2007
Humic acid (powder)	Humic acid 80%		1/9/2007
AMCOHUME	Humic acid 15%, nitrogen 1%, potassium 2%		1/9/2007
Amcohume plus	Humic acid 14%, potassium 2.5%, zink 2%		1/9/2007
Humigreen 85	85% Humic acid		30/10/2007
Enersol 15%	15% Humic acid		21/12/2007
Humic acid	15% Humate and fulvate		21/12/2007

Results showed that 91% of the farmers used manure. Only four vegetable farmers did not use manure for two reasons: (a) lack of cash to buy it, or (b) because it could increase the pest infestation rates. Results showed that only 35% of the farmers made a trench to put the manure in and only 33% of them covered the manure with soil. These two steps were used only by farmers who had vegetables. Manure is discussed in detail in Section 5.7.2 below.

5.7.1. Inorganic fertilisers

Farmers were asked which inorganic fertilising programme they used from the land preparation to the harvesting stage. They were provided with a sheet (Appendix B) on which to write the programme they used. It was found that ca 98 % (45) of the farmers used inorganic fertilisers and had two fertilisation programmes: (a) the farmers' programme (b) the engineers' programme, as shown in Tables 5.13 and 5.14. It can be noted that the farmers' programme was divided into four stages while the engineers' programme is a specific formula used all year round. Table 5.14 shows that most of the vegetable farmers (ca 92%) and mixed farms (75%) used the farmers' programme, while 60% of the fruit farmers used the engineers' programme. The explanation for this is that it was difficult for those who used the farmers' programme to take a risk using the engineers' programme because they had not enough knowledge of how to use it, and also they could not offer money to pay for a contractor.

Table 5.13: Description of inorganic fertilisation programmes

A- Farmers' programme			
Stage 1	**Stage 2**	**Stage 3**	**Stage 4**
Urea	NPK with high percentage of phosphorus 12-40-12 or 12-60-0	NPK 20/20/20	NPK with high percentage of potassium
B- Engineers' programme			
MAP-(12-62-0)-(2-1-1) Plus KNO_3 and K_2SO_4			

Table 5.14: Number of farmers using the programme (n=46)

Fertilisation programme	**Farm type**							
	Vegetable		**Fruit**		**Mixed**		**All**	
	N	%	N	%	N	%	N	%
Farmers' programme	22	92	3	30	9	75	34	74
Engineers' programme	2	8	6	60	3	25	11	24

The fruit farmers employed or contracted engineers to supervise their farms. For example, it was found that two fruit farmers contracted the Bayer AG Company in Jordan. The company found that a tree needs about 62 g $year^{-1}$ of phosphorus to give good production. It was found also that one of the fruit farmers (10 %) did not use either of the programmes.

Vegetable farmers start adding fertiliser through the irrigation system when the plants are ca 20 days old. The first fertiliser they start with is urea 46% N, and then they start adding other fertilisers, as outlined in Table 5.13. In the case of fruits, farmers start adding fertilisers through the irrigation system between April and July (Table 5.13). They provide the trees in the first and second years with fertilisers to enhance the tree's growth, and in the third year they start adding fertilisers to increase flowering, fruit set, and the fruit's size. The fertilisers used in the third year include urea, MAP, AN, AS, KNO_3, K_2SO_4.

5.7.2. Organic manure

In this research it was important to find out what types and amounts of organic fertilisers are used in the study area and how farmers have access to the manure. Farmers were asked to list types and amounts of organic fertilisers that they used. It was found that farmers did not use any certified or non-certified organic fertiliser. They used manure produced by livestock fed on conventional feed.

The results in Table 5.15 show that only 8.3% of the vegetable farms and 8.3% of the mixed farms used commercially available compost made from sheep and poultry manure. Those farmers used this compost because they were dealing with the same agricultural company. Only 16.7% of vegetable farmers (four farmers) did not use any type of manure. One of them did not use manure because manure increases the pest infestation rate. The other three did not have the cash to buy manure when they started their land preparation, even though they knew the importance of the manure (manure constraints). Sheep manure was used mainly for fruit trees. The average application of the sheep manure was of *ca.* 51 kg $tree^{-1}$, while chicken manure was mainly used for vegetables. Table 5.14 shows the types and the amount of manure used by farmers.

Table 5.15: Manure types and amounts used in the study area

	Farm type							
					Mixed (n=12)			
	Vegetable (n=24)		Fruit (n=10)		Vegetable		Fruit	
Manure type	%	t ha^{-1}	%	kg $tree^{-1}$	%	t ha^{-1}	%	kg $tree^{-1}$
Laying manure	66.7	5.0	0.0	0.0	75.0	5.0	0.0	0.0
Sheep manure	0.0	0.0	100.0	51.0	8.33	3.5	83.3	50.0
None	16.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Compost	8.3	6.0	0.0	0.0	8.33	8.0	8.33	60.0
Broiler manure	4.2	4.0	0.0	0.0	0.0	0.0	0.0	0.0
Cow manure	4.2	4.0	0.0	0.0	8.33	4.0	8.33	40.0

%: Farmers use manure

It can be seen that the main types of manure used were sheep manure for trees in winter and laying poultry manure for vegetables in spring. Most farmers did not use manure produced by broilers even though there was a huge amount available at a cheap price or even free. Farmers say that this type of manure cannot be used because of its low quality, which resulted from wood shavings and immaturity when collected, while laying poultry manure is one year old when collected and has good quality. The average of laying poultry manure used by farmers was *ca.* 5 t ha^{-1}. Al-Adamat (2002) reported that the amount of manure used by farmers was less than the requirement to sustain soil life activity. Al-Adamat (2002) put forward two possible reasons for this, either lack of extension or because farmers do not have enough access to the manure. Results showed the conclusions of Al-Adamat (2002) were misplaced because:

1. Farmers know that they use less than the recommended level.
2. Farmers use the manure just around the plant. In the case of vegetables, they add the manure in strips about 1m width X 50 m length and they install 100 strips in a hectare, which means that the fertilised area is 0.5 ha per ha (Figure 5.5). In the case of trees, farmers add the manure in the basin of the tree, and the area of the basin is between 1 and 1.5 m^2. Field observations showed that farmers put about 500 trees in a hectare, which means the area used for the manure is less than a hectare.

Farmers say it is dangerous to add the recommended amount because manure is hot and can easily kill the plants if more manure is added than the average mentioned above. Farmers say there are two things which have to be available in order to add the recommended amount of manure to their soil: first, the manure has to be fermented or composted, and secondly more water is needed. However, neither is available. As a result, farmers, through experience, have found that *ca.* 5 t ha^{-1} for vegetables is enough to a produce good yield. Farmers say there is no problem with adding manure to trees because the adding time is in winter when it is very cold.

It was found that all farmers bought manure for their farms. The price was ca £ 25 t^{-1} for laying manure, £15 t^{-1} for sheep and compost, while the broiler manure was free or less than £ 5 t^{-1}. Farmers use their trucks to transport the manure from the livestock farms to their farms. They hire Egyptian workers to upload manure from the livestock farms and to unload manure close to the area to be cultivated. It was found that most of the Jordanian workers do not like to do this job because of the smell or perceived health risks. The workers start placing the manure in sacks weighing 25 kg after the manure is unloaded close to the area to be cultivated. The workers carry the sacks filled with manure and distribute the manure in strips if the area is for vegetables or around the tree if it is a fruit farm, as was described in Figure 5.5 above.

5.7.3. Reasons to use organic fertilisers

From the previous section it was found that farmers did not use 'organic fertilisers' (fertilisers produced on organic farms): they used mainly conventional manure (produced on conventional farming). Here it is important to mention that manure can be called organic manure in Arabic because of its origins. Farmers were asked to give up to three reasons for using manure. They reported that manure is important to grow crops and that they cannot get a good yield without it. All of them except one agreed that manure has an important role in agriculture. Table 5.16 shows their reasons for using manure. Five farmers reported that they tried to cultivate a small part of their land without using manure, but the result was very poor output, even when they used more chemical fertilisers. One farmer did not use manure because he believes that manure increases the pest infestation rate. Observations showed that his farm was not in good condition as the productivity was very low and the growth of the crops themselves were below the standards of the other farms that were using manure. Results showed that 91% of the farmers consider that using manure can increase water-holding capacity because their soil is poor and can lose water quickly, while 87% believed that manure increases the surface temperature around the plant root system which protects the plant from cold. Eighty-five percent of them also reported that from the experience gained, they found that manure increased the plant growth and that without manure, they could not get good yields. Another reason for using manure is because manure improves the soil. It was found that 80% of the farmers believe that manure decreases the soil compaction while 78% of them use manure to solve the salinity problem in their soil, which can be decreased by using manure.

Table 5.16: Reasons for using manure (n=46)

Reasons to use manure	**N**	**%**
Increase the soil water holding capacity	42	91
Warm the root system (soil surface temperature)	40	87
Enhance the growth	39	85
Decrease the soil compaction and enhance the elements uptake by plants	37	80
Improve the soil salinity soil physical properties (pores)	36	78

5.7.4. Constraints to use manure

Farmers were asked to give up to three constraints to the use of manure. Results showed there were three constraints: white worms (57%) (discussed in Section 5.5), water (70%) and the availability of cash (55%). Seventy percent of farmers reported that one of the constraints to manure use is the need for more water. They said that because manure is not fermented or composted, its temperature is too hot. As a result, farmers try to use the amount that can improve the soil without harming the plants.

Results showed that 55% of the farmers reported that one of the constraints is the availability of cash to buy the manure. The time to buy manure is February and March. In this time usually farmers do not have cash to buy the manure. Results in the manure section showed that three farmers did not use manure because they did not have money in cash. Moreover, cash helps to buy a better quality manure. Results show also that farmers were unable to produce enough manure for their cultivation area from the livestock they kept. Results show that the average manure application rate used by farmers is 5 t ha^{-1} for vegetables and 51 kg $tree^{-1}$. It was found that the amount of manure produced by animals in the study area is 1112.5 t $year^{-1}$ (Section 5.3.2), which is not enough for both the cultivated vegetables and the trees grown in the study area. The following calculations show that farmers have to purchase about 14731 t of manure in addition to the amount produced by their livestock for their cultivated area.

Amount of manure required for the cultivation area
= (Cultivated vegetables area ha X manure application rate t ha^{-1}) + (Number of trees grown X manure application rate 51 kg $tree^{-1}$)
= (800 ha X 5 t ha^{-1}) + (232,230 tree X 51 kg $tree^{-1}$) = 4000 t + 11843730 kg
= 4000 t + 11843.730 t
= 15844 t $year^{-1}$

Amount of manure to be purchased= required amount (15844 t $year^{-1}$) - produced amount (1112.5 t $year^{-1}$)
= 14731 t $year^{-1}$

5.7.5. Non-chemical strategies used to improve the soil fertility

Farmers were asked to list what non-chemical methods they used to improve soil fertility. Results showed that farmers responded to this question just the same as they responded to the question regarding to the non-chemical methods used to control pests (Section 5.6 above). It was found that only 43.5% (20) of them reported deep ploughing and 33% of them reported using manure. The explanation for the response is the same one mentioned above in the discussion of non-chemical strategies used to control pests (Section 5.6 above).

The researcher used a checklist, produced during the pilot survey, of non-chemical strategies used by farmers to improve soil fertility in the study area (Appendix B). The procedure was the same as the one used for the non-chemical strategies to control pests. Table 5.17 shows the main strategies used by farmers in the study area.

Table 5.17: Non-chemical strategies used to improve the soil fertility (n=46)

	Among farm's type						**Among the total target population**	
	Vegetable		**Fruit**		**Mixed**			
Strategies	N	%	N	%	N	%	N	%
Deep ploughing	20	100.0	10	100.0	12	100.0	42	91.0
Manure *	18	75.0	10	100.0	11	91.7	39	85.0
Crop rotation	24	100.0	0.0	0.0	12	100.0	36	78.3
Fallow periods	24	100.0	0.0	0.0	12	100.0	36	78.3
Mulching (black plastic sheets)	22	91.7	0.0	0.0	12	100.0	34	73.9
Compost *	2	8.3	-	-	1	8.3	3	6.5

(*See section: Organic manure Section 5.7.2)

Results showed that 85% of the farmers used manure and 6.5% used compost. Results additionally showed that some of the strategies used to improve the soil fertility were also used to control pests. These strategies were crop rotations, fallow periods and plastic mulch. Seventy-eight percent of the farmers used both crop rotations and fallow periods, while ca 74% used mulch. Plastic mulch was used for vegetables only to prevent evaporation, to keep the soil humid in arid lands, and contribute to the soil fertility by: suppressing weed growth (less nutrients competition with crops), protecting the soil from erosion, conserve soil moisture and warm the soil. It was found that 91% of the farmers used deep ploughing to improve the soil fertility. Deep ploughing is very expensive because it requires the use of big tractors with large discs or a bulldozer to do the process. This technique has become common among farmers because the virgin land is shrinking and fallow periods are becoming shorter. Farmers did not think about soil erosion or any impact. They were interested in having a good yield. It can be concluded that proactive strategies are required to improve the soil rather than using non-sustainable strategies. This was also emphasised by Parrott and Marsden (2002: 74):

> Traditionally in many areas, especially in more arid land zones, soil fertility has been maintained by extended fallow periods, often in association with slash and burn techniques. However, with growing population pressures these fallow periods are in many cases becoming shorter (or non existent) and more proactive strategies for managing soil fertility are required.

5.7.6. Crop rotation techniques

After many years of growing vegetables in the Badia, farmers found that the soil fertility became poor. Kirk (1998) stated that farmers started to move from one area of land to another to get good production using a crop rotation. This rotation is used only by vegetables farmers and can be summarised as follows:

1. If the land is virgin (has not ever been cultivated): Farmers prefer to grow watermelon in March, and before 15th June they also grow tomato seedlings to be harvested by September. After the tomato season finishes they leave this land fallow till March next year to be cultivated again for tomato (second season) but not watermelon, because it will be very difficult for watermelon to give good production in the second year on the same land. After the second tomato season finishes (in December- January), they sow the land with wheat or barley for five or six months, and then leave it for 3-5 years before crops are grown again. Usually this land does not belong to the farmers but is rented at a cheap price of £15/ha/year.

2. If the land is not virgin (has been cultivated before): The first thing about this type of land is the price, which will be cheaper than the virgin land, by at least 30%. The second thing is the crop that is going to be cultivated. If the land has been fallow for more than 4 years, then it could be used for watermelon followed by tomato and then wheat or barley. But if the fallow period was less than that, then it would be used for tomato followed by cabbage or cauliflower and then wheat or barley.

5.8. Agricultural environmental impact

Farmers were asked to provide information on the environmental impact that they have seen with the practice of conventional farming. Results showed that farmers have had limited knowledge about any environmental impact. Their knowledge about the environmental impact is limited to what they see and touch, but does not include phenomena that require deeper investigation. All farmers believed that agriculture improved the environment in their area by adding some green to the area and that in the meantime this farming system must have an environmental impact. Seventeen percent of them reported that they did not know if the agriculture has a negative impact on the soil, air or water, because they never did any analysis to see if there was an impact or not.

Table 5.18 shows the knowledge of farmers about the environmental impact of the farming system they practise.

Table 5.18: Agricultural impact on environment (n=46)

Environmental impact	N	%
Black plastic mulch has impact on livestock	23	50
Soil fertility declined and salinity increased	8	17
Weed increased	7	15
Do not know	8	17

5.8.1. Black plastic mulch

Results showed that 50% of farmers say agriculture has improved the environment but also has an environmental impact, which is the residues of the black plastic mulch (BPM). These farmers say this problem has become serious for livestock keepers. BPM residues are a big problem in the study area because there is no recycling factory in the area. Farmers find themselves forced to leave BPM around their farms or to burn some and leave some without burning. That which is not burnt can be blown to other farms or rangeland and will then be eaten by livestock (Figure 5.8).

Figure 5.8: Black plastic mulch in the study area, eaten by livestock

Farmers rent the land and when they finish their season some of them leave the land without cleaning it. Some farmers say that even if there was a recycling factory the price would be too low to be worth selling the BPM. The most important problem of the BPM is when it is eaten by sheep and goats, and causes digestion problems (Figure 5.8). After farmers finish their season, they sell their farm crop residues to the livestock keepers (of sheep and goats), and let the livestock keepers bring their animals to graze the farm crop residues inside the farm. This causes a problem of livestock eating BPM with the farm crop residues. Many cases of BPM consumption by livestock have been recorded, and many animals have died from this. If the livestock keeper discovers that one of his animals has a plastic problem he takes it to the nearest veterinary clinic for surgery to remove the plastic, and this will cost the livestock keeper at least £20, which is sometimes more than the value of the animal.

5.8.2. Decline in soil fertility

Results showed that 17% of the farmers reported that the soil fertility has declined and its salinity has increased. As a result, farmers add more inorganic fertilisers than they used to. Moreover, they have started to use some humic acid, which is a new material in the Badia, to solve the soil problem. A new strategy also is to convert part of the farm into fruit production.

5.8.3. New weeds

Farmers reported that agriculture has increased the weed problem in the area. Fifteen percent of them reported that new weeds have become a problem. One of the main weeds is orobanchae which cannot be controlled (see Section 5.5).

5.8.4. Infestation with houseflies

Farmers did not report this problem but it was realised through the field observations. Many farms are near residential areas in the study area, so when farmers add unfermented manure to the soil and then irrigate the soil, this problem appears. Large numbers of houseflies appear at the beginning of the agricultural season, and people suffer from this problem. It is said that with houseflies during the day and mosquitoes during the night there is little sleep for at least 3 or 4 months. It was observed that in order to solve this problem, people started using very dangerous pesticides to kill the houseflies inside their houses or on farm sites: for example, they use LANTE 90wp (Methomyl 90%), which belongs to the carbamates group, and has a very high LD50 toxicity. Permission from the MoA is needed to buy it, although in fact anyone can do so.

MoA has just started the second campaign phase of controlling the houseflies. The control method being used involves two methods; smoking to kill the adult insect and spraying to kill the eggs and the larvae. The pesticides used for spraying the landfill sites, litter, chicken farms, cow and sheep farms are safe for the environment. According to the MoA officials some farmers do not follow the advice provided by the MoA, which states that manure must be covered and kept away from urban areas, by not doing this there will be an increase in the number of houseflies (Abeer 2003).

5.9. Summary

The current farming system in the study area is conventional and farmers are oriented to the overuse of synthetic inputs, which proves that there is neither a certified organic farming nor non-certified organic farming system, not only in the study area but in the whole of Jordan. The farming system has created potential permanent and temporary jobs, and any impact on this sector will have a significant impact on these jobs. Although, the farming system is conventional, it still has several constraints, such as potential pests and diseases, unavailable alternative methods to control pests or to improve soil fertility, insufficient amount of organic fertilisers, decline in the soil fertility and increase in pest infestation. Constraints include also the livestock numbers which are not enough to produce the required amount of manure for farming. In the meantime, in arid lands there is a potential barrier to using the recommended amount of manure because manure is hot and can easily kill the crops. This requires two things to be available in order to add the recommended amount of manure to the soil: first, the manure has to be fermented or composted, and secondly more water is needed.

As for organic farming practices, farmers do employ non-chemical methods for both pest control and soil fertility, but there is clear evidence that there is a lack of knowledge among farmers about the use of these methods. There is also no doubt that the current system has created a potential environmental impact on soil, water and livestock, but farmers do not know exactly the degree of this impact.

As a conclusion from this Chapter, there is a need to convert to a more sustainable farming system to maintain the current farming system. This conclusion supports the reasons mentioned in Chapter 3 Section 3.10to convert to organic farming. However, conversion from this system to a low input system such as organic farming requires talking to farmers and other stakeholders to find the barriers to, constraints on and potential for organic farming first. This can be achieved through a series of research methods (Chapter 4 Table 4.1) to gather information from farmers, stakeholders, policy makers, key players and other interest groups regarding the adoption of organic faming. Once barriers and potentials are determined, it will then be possible to come up with an action plan for conversion. Barriers and potentials are discussed in detail in Chapter 6, while the plan is covered in Chapter 7.

CHAPTER SIX:

BARRIERS TO, AND POTENTIAL FOR THE ADOPTION OF ORGANIC FARMING

CHAPTER SIX

Barriers to, and Potential for the Adoption of Organic Farming

6.1. Introduction

This chapter aims to analyse and assess the perception of organic farming among farmers, key players, stakeholders and MoA officials. It also aims to identify and assess (investigate) the anticipated technical barriers to organic farming through interviewing 46 farmers and the five discussion groups (PAS), and to discuss the potential cultural, marketing and economic barriers to organic farming in Jordan. The chapter also discusses other barriers, such as those related to institutional, regulation, information and advisory factors, and evaluates the organic farming work that has been achieved by the MoA. It also describes farmers' level of interest in and response to converting to organic farming systems and evaluates the opportunities for organic farming in Jordan's arid lands.

6.2. Respondents' rating of the barriers to organic farming

Since no literature exists on the conditions of certified organic farming practice in Jordan, results were compared with the international and regional literature (Lampkin 1990, Padel and Lampkin 1994, Schneeberger, Darnhofer, and Eder 2002, Niemeyer and Lombard 2003, Abd-El Moity 2004, Allal 2004, Aref 2004, Kahouly 2004, Kenny 2004). Barriers reported by respondents are divided into six groups: perception, technical, economic, cultural, marketing and institutional (Table 6.1).

Table 6.1: A Summary of organic farming barriers in Jordan

Barrier	**Summary**
Perception	The greatest number of respondents reported that organic is not clear to people in Jordan and there is no official definition used by the government
Technical	Increase in the pest and disease population, production decrease (quantity and quality), decrease in crop growth, soil fertility is poor, risk of trying, varieties are not suitable, availability of alternative inputs (biological control, organic fertilisers) long production periods, farmers' lack of experience, weather fluctuations
Cultural and social	For consumers but not for producers
Marketing and economic	Big investments, unavailable market, premium prices and subsidies
Institutional	Lack of cooperation and coordination, refusal of loans, insurance, lack of specialists and funds, perception of organic farming
Regulation and legislation	Unavailable national regulations and legislation for organic farming
Information, advisory and services	Lack of information, inadequate information and training for extension agents, information oriented to conventional farming

Results of this study show that farmers were aware that the adoption of organic farming is not easy and would necessitate profound changes in their farm organisation, which complies with Lampkin, (1990), Padel and Lampkin (1994), Schneeberger, Darnhofer, and Eder (2002) and Kenny (2004). Farmers considered that conversion to organic farming has a high risk and would impact upon their yields. Therefore, it is crucial to understand the perception of organic faming not only by farmers but by all stakeholders.

6.2.1. Perception

Information on the perception of organic farming by respondents was collected through questionnaires and interviews (Chapter 4, Table 4.1) in which respondents were asked the same question: "Have you heard about organic farming (*alzeraa'h alodweyah*)? What is the best translation for it?" (See the pilot survey). The research shows that the perception of 'organic farming' is a significant barrier to organic farming in Jordan. The research shows that the term was not clear to the majority of respondents including some of the MoA officials, who reported that organic farming means to them permaculture or Integrated Pest Management (IPM). Some farmers reported that organic farming means the use of manures while other reported that organic farming is a *Baeel* production system (cultivating crops without using any type of chemicals and depending only on rain to water the crops). Moreover, results showed that the term 'organic farming' has not been investigated by any organisation in Jordan and that this research was the first time for the term to be investigated in Jordan. The respondents' perception has been identified as a significant barrier to the adoption of organic farming, which complies with Padel and Lampkin (1994). The perceptions of 'organic farming' by respondents can be described as follows:

Farmers' perceptions

It was found that only 35% of the farmers have heard of, or knew some information about, organic farming. They were divided into two groups:

- First: 28% had heard about organic farming through attending three organic farming workshops held at the JBRDC. This group of farmers knew mainly that organic farming means cultivating crops without using pesticides and fertilisers (abandoning chemicals), and replacing them with manure and water. They knew from the workshops that some regulations have to be met in order to be 'organic', but they knew little else related to organic farming.

- Second: 7% accounted for three farmers who had heard or knew of organic farming through their work. Those farmers were the Yarmook Vice Chancellor, MoA Ex-Secretary General, and an Agricultural Engineer who exports fruits to Europe.

On the other hand, results showed that 65% have not heard about organic farming, but offered various expectations and opinions as follows:

- *Organic farming means the use of manure*

  This was reported by 35% of the farmers. It was noted that these farmers linked the word 'organic' and 'manure'. The translation for organic to Arabic is *alodweyah;* also, manure means in Arabic, 'organic fertilisers' (*Alasmedah alodweyah).* This explains why farmers thought that organic farming means using manure. This also was the perception of 60% of the discussion groups who were well educated in agriculture.

- *I have no idea about organic farming*

  This was reported by 13% of the farmers. It was the first time for them to hear about organic farming, from this research.

- *Organic farming means the minimum use of chemicals- IPM products*

  6.5% of the farmers reported that organic farming means the minimum use of chemicals, which means the IPM.

- *Organic farming means Baeel*

  This was reported by 11% of the farmers. *Baeel* is the old traditional agricultural system in which farmers used to depend on rainfall or any water source to water their crops and to use manure as a fertiliser. In this system, no chemicals were used, except sulphur. It can be said that this system is a non-certified organic farming system.

Documents at the MoA showed there was no definition for organic farming, and in the meantime the research shows that farmers in Jordan have never been consulted or asked about their idea or their perception of organic farming. Therefore, the research was aimed at talking to farmers, to find what could be a translation for organic farming and to provide this as advice to the MoA. Talking to farmers showed that 80% of them reported that the term *tabeaee* (natural) is clearer than *alzeraah alodweyah* (organic farming) and could be useful initially.

MoA officials' perceptions

The research shows that the term 'organic farming' is not only not clear to farmers, but also to MoA officials. For example, the Secretary General of the MoA stated that:

"The MoA has not produced a definition used for organic farming in Jordan and I cannot give you a specific definition now to be used in Jordan, but what I can say is that we should use the international definitions. I do agree that organic farming is not clear for producers, consumers, academics and other interested people. Therefore, it needs time for our people to know what organic farming means and I am sure soon they will understand its perception".

The Organic Farming Unit (OFU) staff also reported there has been no official definition used for organic farming. Moreover, it was found that the OFU translated the term 'Permaculture' from English into Arabic as 'organic farming'. The Head of the MoA Policy directorate stated that:

"The perception of organic farming as translated to Arabic is not clear. What I understand is that organic farming means the use of the minimum amount of chemicals and the use of manures; simply it is like the IPM. For example, I believe that olive production is organic because we use manure and very little amount of chemicals and sometimes we do not, but vegetable production is not and I do not believe that we can use organic farming (IPM) for vegetables. All agricultural systems in Jordan were Baeel, which could be non-certified organic farming".

Perceptions of other people

It was also found that the term 'organic farming' is not clear for retailers. The director of Aman company (IMP products) stated that the term:

"Organic farming is not clear and does not tell consumers what it is about. People could mix between the IPM and organic farming products because they are concerned about pesticides residues more than the production system. Jordan government also has not produced a definition for organic farming hitherto. Believe me that even universities academics do not know exactly what organic farming means, which is the same for producers and consumers. We need more information to be passed to producers and consumers, which could be achieved through government support to raise awareness regarding organic farming".

(Aman's Director 2005)

An academic respondent also said:

"Organic farming as a term is not clear to our producers, consumers, researchers and retailers. However, we have a production system called Baeel that does not use synthetic inputs, but cannot be called an organic farming system. The constraint of organic faming perception in Jordan is that our people do not know that organic farming is regulated by international regulation which includes certification and inspection. I believe this would be the first barrier to organic farming".

(An Academic 2004)

All farmers agreed that the term for organic farming (*alzeraah alodweyah)* is not clear and needs more explanation to give an idea of organic farming. This was also agreed by the five agricultural store suppliers, key informants (Table 4.1 C and D), and by the food standards officer who reported that there is neither a definition nor regulation set up for organic farming in Jordan.

From the discussion above it can be concluded that the perception of organic farming in Jordan is a significant barrier to its adoption. Therefore it is important to derive a clear term for organic farming clearly understood by producers, officials, retailers and consumers. It is suggested to translate the organic farming description used by IFOAM 1980 (Chapter 2 Section 2.4) into Arabic, but to make the definition simple.

6.2.2. Technical

To investigate the anticipated technical barriers to organic farming, the 46 farmers and the five discussion groups (PAS) were asked to list in their own words the main anticipated technical barriers to the adoption of organic farming in the study area. The barriers reported as most important by respondents were items related to pest and disease infestation, yield reductions, decrease in plant growth, poor soil fertility, limited alternative options available compared to conventional farming (resistant varieties, biological control and organic fertilisers), knowledge of farmers and the weather conditions. This complies with the studies by Lampkin (1990), Schneeberger, Darnhofer, and Eder (2002) and Hasbani (2004). There was no significant influence of farm types on organic farming barriers responses. Table 6.2 compares the responses of the two respondent parties.

Table 6.2: Technical barriers according to the farmers and discussion groups response

Technical barrier	Farmers (n=46) %	Discussion groups (n=5) %
Higher diseases and pest infestation	100	100
Yield reductions (quantity and quality)	100	100
Decrease in plant growth	91	80
Soil fertility is poor	91	60
Risk of trying	70	60
Varieties are not suitable	61	100
Biological control is not available	61	100
Long production periods	57	100
Ignorance for the farmers' experience (knowledge)	50	100
Weather fluctuations	28	40

According to the research results, there were ten technical barriers (Table 6.2) reported by farmers and the PAS. The highlighted barriers (Table 6.2) comply with the literature review (*i.e.* Rigby, Young, and Burton 2000, Schneeberger, Darnhofer, and Eder 2002, Niemeyer and Lombard 2003), while the other barriers are reported for the first time. Results show that higher pest infestation and yield reduction (quality and quantity) were reported as the most significant technical barriers. All of the farmers and all five discussion groups emphasised that practising organic farming will increase the pest infestation (insect, disease and weeds) because pests and diseases in the study area cannot be controlled without using pesticides (Chapter 5 Section 5.5). The same percentage of farmers said that they expected to have yield reductions in both quality and quantity, due to increase in pest infestation, abandoning of fertilisers and pesticides, and also due to unbalanced or insufficient nutrient supply (NPK). Respondents say such barriers also can be found in conventional farming but are less problematic because the use of chemicals to control pests and to supply nutrients. They reported that applying organic farming would make the pests and diseases (Chapter 5 Table 5.4) very difficult to control.

About 91% of the farmers and 80% of the discussion groups (Table 6.2) reported that crop growth would decrease due to insufficient nutrient supply and pest attack. They say that the main thing in the production process is having good plant growth, which leads to a good yield, while practising organic farming in their area will lead to small plant size which cannot give such yields. Results show also that 91% of the farmers listed soil fertility as a potential technical barrier, while 60% of the discussion groups considered soil fertility to be poor. Both parties believed that the soil fertility in the Badia is poor and needs fertilisers to give good production. The discussion groups know that soil fertility can be built over time and by introducing different techniques, while farmers know that soil needs at least five years to be built again (Chapter 5 Section 5.7).

About 70% of the farmers and 60% of the discussion groups say it is risky to try organic farming in the Badia. They believe that prevention is better than cure, which means they spray their crops as prevention, even if there is no pest. According to them, some farmers in the Badia tried not to spray their crops until a pest comes, but their crops were lost. Results show also that they were not convinced to stop using chemicals (Chapter 5 Table 5.5) or to start using organic farming, at least at this stage.

A significant barrier reported by respondents is crop variety. About 61% of the farmers and 100% of the discussion groups said that the crop varieties that they use (Chapter 5 Figure 5.2) are not suitable to be used as organic varieties. All of the varieties are F1 hybrids and susceptible to pests, except olive and cactus. These varieties require nutrient supply and chemical pest control. In the meantime, the same percentage of respondents reported that there are no alternative options to control pests and diseases. For instance, biological control is not available in Jordan to control pests that attack these crops, which is a significant barrier for organic farming. They reported that even if there was biological control available it would not be suitable for their open fields. This statement complies with Bahdoshah (2003), who stated that there is a lack of biological control and difficulty in applying it in open fields in Jordan. This conclusion was also reached whilst browsing the private stores and the pesticides department at the Ministry of Agriculture. The only material found is sulphur as an organic material to reduce the infection rate of powdery mildew.

Meanwhile about 57% of farmers and 100% of the discussion groups argued that applying organic farming means stopping using both fertilisers and pesticides, which leads to longer production periods. They gave the watermelon as an example which, under conventional farming, yields fruits within a period not longer than three months, but under organic farming it would be at least four months in addition to the lower quality and quantity produced. Moreover, having longer periods means losing the best market prices, which is not profitable for farmers, and this is the most important point of agriculture for farmers.

It was found also that farmers in the study area have gained good experience of conventional farming, which includes dealing with different crop varieties, pesticides and fertilisers. Fifty percent of them believe that applying organic farming will lead them to ignore their experience of conventional farming and will force them to learn new experiences which will take time, and they do not know its possible results. This result was emphasised by the five discussion groups. Nearly all of them agreed that their lack of knowledge about organic farming is a somewhat significant barrier. They also reported that the lack of advisory support and extension is considered as an important barrier to conversion. According to respondents, these barriers result in low income, because small amounts can be sold.

About 28% of farmers reported that the area has weather fluctuations, especially in late April and early May, which could have an impact on crops. The fluctuations include winds, rain and a sudden rise in the temperature. Usually farmers in this period use chemicals, either pesticides or fertilisers, to avoid any effect on their crops caused by these fluctuations. Results showed that only two discussion groups see weather as a technical barrier.

Despite the barriers mentioned above, the visit to Sekem-Egypt showed that these barriers can be overcome in an area of similar conditions. According to the Sekem technical advisor, such barriers faced Sekem-Egypt at the beginning but now they are not considered as barriers. Experience in various arid lands such as in Tunisia, Morocco and Egypt has also showed that farmers have succeeded in overcoming these barriers (Abd-El Moity 2004, Allal 2004, Aref 2004, Kenny 2004). Therefore, it can be said that these barriers face farmers at the beginning of establishing organic farming and can be overcome by improving farmers' experience.

6.2.3. The availability of nutrients

The availability of organic amendments in organic farming to provide plants with organic nutrients is very important (El-Araby 2004, El Bagouri 2004). In Jordan, results from this research show that farmers have a relatively low head-count of animals an average 3 animals ha^{-1} where the amount of manure produced was 1112.5 t $year^{-1}$, while the required amount for their cultivated area was 15844 t $year^{-1}$ which means that farmers need to purchase 14731 t $year^{-1}$. This means that most of them do not have animal manure available as a significant source of nutrients for crops. Moreover, the available manure at the current time cannot be used as organic fertiliser (fertilisers produced on organic farms) because animals are fed on conventional feed, while organic farming standards require a balanced nutritional programme using primarily organic feeds (Scialabba and Hattam 2002). This can be a significant barrier for farmers in Jordan at the early stages of organic farming adoption, because they have to find a source of nutrients for crops, which could be imported. But this would be another significant barrier because importing inputs means more procedures and more costs. Therefore, farmers in Jordan should aim to produce their own organic amendments depending on their on-farm nutrient resources, which include crop-livestock integration, growing legumes, design crop rotation and forage production.

This approach is used in Egypt by Sekem which has similar environmental conditions. Here, this barrier had been overcome through integrating crops and livestock in an integrated farming system. According to Sekem Soil Fertility Technical Advisor (2004), integrating crops and livestock is a key issue in organic farming and is helpful to building up the soil fertility and to resolve the lack, and shortfall of, on-farm nutrient resources. The advisor added, at the first year, farmers who wish to adopt organic farming could import organic amendments but should subsequently aim to produce what is required, from on-farm nutrient resources using suitable crop rotations and to establish their own livestock flocks (ruminants and non-ruminants) to produce the required manures for their crops. At the same time, forage and farm by-products would be fed to animals so the nutrients are recycled through the manures.

To overcome the shortfall of on-farm nutrient resources and to build-up the soil fertility, Sekem integrates crops and livestock, in which the livestock by-products are composted with some of the crop by-products, while some of the crop by-products are fed to animals; in addition, Sekem grows forage to feed the animals. The advisor reported that to have the required amount of organic amendments for an area of 120 ha, Sekem has a diversity of crop-livestock production approaches as shown in Table 6.3, integrated with suitable crop rotation systems. In addition, Sekem has its own compost production site and a laboratory to do some chemical analysis (Figure 6.1). Such diversity of livestock species in organic farming is recommended by Younie (2000) not only to build up soil fertility but also to reduce the disease challenge to susceptible stock: for example, the worm species which affect one livestock species do not affect other species. Younie (2000) also says a system with a diversity of livestock species and crops means that organic farming works most successfully for reasons related to livestock health, agronomy and environment. An important issue that organic farmers need to address is that livestock should have access to adequate space, fresh air, outdoors, daylight, shade, and shelter for inclement weather, suitable to the species and climatic conditions, and a balanced nutritional programme using primarily organic feeds (Scialabba and Hattam 2002). Therefore, using Sekem's approach would help farmers in Jordan to overcome the shortfall of soil organic amendments. Having said that, there is still a need to study this approach and to find what livestock numbers could be kept in an organic farming system in Jordan, livestock and their products marketing issues, if livestock numbers can be increased and what is the most effective crop-livestock integration system for Jordan.

Table 6.3: Sekem integrated crop-livestock system

Crops	Area ha	Livestock type	Number
Forage and medicinal plants	30	Diary cows (brown)	98
Fruit trees and forage	15	Calves for fattening	100
Fruit trees, palm dates and forage	19	Sheep	120
Greenhouses, open vegetable fields and medicinal plants	56	Laying chickens	10000
		Bee hives	50
	120	Pigeon towers	14

Figure 6.1: Crops-livestock integrated system at Sekem

A: Sheep grazing forage B: Cows stock C: Compost production
D: Pigeon towers E: Soil lab F: Crop drying

There are other steps that farmers can take to improve their soil fertility (Table 6.4). Lampkin (1990: 70) recommended several steps to achieve best nitrogen management practices for organic farming systems, and most of these could be utilised by the Jordanian farmers.

Table 6.4: Summary of best nitrogen management practices for organic farming systems (Lampkin 1990: 70)

- Maximum reliance on legumes for biological nitrogen fixation.
- Minimum reliance on purchased manures.
- The use of on-farm manures as a means of recycling nutrients within the system, and for a range of other purposes including crop protection, not simply as a straight substitute for conventional fertilisers.
- The use of any manures limited to a quantity equivalent to that produced by livestock at a rate of 2.5-3 livestock units per hectare.
- The application of manures targeted at those points in the rotation where there is maximum nutrient offtake, especially potash (e.g. conservation leys, vegetables).
- Storage of manures under cover (fixed or temporary) and/or in situations where runoff can be collected and utilised.
- Ploughing and seeding either in early autumn or, preferably and when conditions allow, in late winter or spring.
- The use of green manures in combination with autumn sown cereals, or as a cover crop for the winter, so that nitrogen mineralised in the winter is taken up by the crop/green manure and not left liable to leaching.
- The soil should never be left bare over winter.
- Judicious use of crop residues (e.g. straw) to lock up nitrogen in the autumn.

6.2.4. Cultural and social

In general, farmers in Jordan have neither cultural nor social barriers regarding organic farming or conventional products since they aim to make profit from their agricultural production. The fear of being an outsider, or the intergenerational conflicts cited in Padel and Lampkin (1994), were not found as barriers in this research. In this study, farmers were asked to list in their own words the main cultural and social barriers to the adoption of organic farming. The study shows that farmers have not reported any social or cultural barrier to the adoption of organic farming. Also, family resistance was not reported as an important barrier. All farmers reported that the only issue they have concern about is not to fail in their farming. Within the farmers' community, as far as social pressures are concerned, failure in farming was reported as a more important barrier than the influence of friends and families' resistance. It is considered a great mistake for a farmer to fail in his or her farming or to try a new method that all farmers know will fail. From cultural and social perspective, a farmer is either a good example or bad example: 'good' means that the farmer has good knowledge and does not fail in farming, while the 'bad' one is that the farmer keeps making mistakes and failing in farming. The 'failed' farmer would be talked about farmers and be described as a bad example. Therefore, farmers would tell their people not to do as farmer X, try to be like farmer Y who was successful last year. This shows that farmers have a social fear of failure in farming. This applies to organic farming as it is a new farming system and has not been tried before. Results (Table 6.5) show that consumers are perceived to have cultural barriers, but farmers do not have cultural barriers to producing organic products.

Table 6.5: Consumers' cultural barriers to the application of organic farming as presented by farmers (n=46)

Response	%
Fruit shape and price	95
Very few consumers would buy	80
Family size and income	80
*Brarah**	75
Consumers do not distinguish	70

***Brarah** is a Jordanian term used to describe vegetables or fruits that have small fruit size, misshapen fruits, fruits with spots, or any thing wrong with the fruits.

Results show that the great majority of farmers indicated that lack of consumers for organic food is a serious barrier. Also, the Aman Director and the Head of the MoA Policy Directorate emphasised that farmers do not have cultural barriers but think about the market first. If there is a good market, farmers will adopt organic farming, but because there is no market in Jordan for this type of production it is very difficult to adopt organic farming; the IPM experience in Jordan (Chapter 3 Section 3.8) gave them good experience about the market. This was also agreed by an academic:

> Farmers do not have cultural barriers but consumers are not aware of organic farming, do not appreciate the farmers' cost to produce organic food, and they are more concern about the price. The experience of the Safeway shop in Amman is a good example, in which consumers do not pay more for safe food

(An Academic 2004)

Results show that 95% of farmers reported that consumers' behaviour is the cultural barrier, in that consumers always look for a product having a good shape and cheap price. About 75% emphasised that consumers would consider organic products as *Brarah* (misshapen) if the quality was not good.

For example, a farmer said:

> As farmers we have no barriers and we know that it is better to have such a production system, but you know that the eye who eats, I mean customer, prefer a shining big fruit. I tried myself to grow three vegetable lines for my house but I found it was not successful even my family members did not like it. However, we do not mind to trying organic farming as we try new varieties from companies

Another farmer said:

> Farmers try to achieve their beneficial and to reduce the costs and increase the profit

Another one said:

> Farmers do not have any cultural barriers but our main barrier is our consumers' perspective regarding fruit and vegetables. They look at the shape, they look for good shape, identical size. All of my work will end with no benefit

About 80% of farmers stated that even if the products were of good quality, very few consumers would buy, because of the higher price. This was also agreed by all informants (Table 4.1). The same percentage of farmers stated that the product price and the family size have a strong relationship. These farmers explained that in Jordan, family size is large and income is low (Chapter 3 Sections 3.4 and 3.5.1), which means that the majority of consumers buy cheap products and large quantities because they have small purchasing power. This complies with Sahota (2005 and 2006) who reported that organic products are restricted to countries where consumers have high purchasing power (Chapter 2 Section 2.7.2). Another important factor is that lack of consumer awareness and knowledge of organic faming and its value is a serious barrier. The research shows that about 70% of the farmers said that consumers do not distinguish between products because they are not aware; also, there is no separate market for organic products and it would be difficult to have one in Jordan.

This result complies with Taher (2004), who stated that lack of knowledge about organic farming and its values is a significant barrier for organic farming in the Arab region.

6.2.5. Marketing

The research shows that there are potential marketing barriers to organic farming in Jordan. The greatest number of respondents (95%) indicated that lack of consumers' understanding about organic food is a serious barrier. This was followed by lack of organic marketing channels (90%), lack of premium prices (90%), and the distance between producers and market or delivery point (80%). The concern of farmers is that a market for organic produce in Jordan is very limited and the availability of conventional products will not allow farmers to make a profit from selling organic products in a conventional market. This concern complies with Padel and Lampkin (1994) and Hasbani (2004). These concerns are linked with the failure of the IPM products marketing experience in Jordan (Chapter 3 Section 3.8). Results showed that despite all the support, the company could not sustain selling IPM products because there was no demand for these products. Therefore, the company was selling more than 98% of the IPM products as conventional. The company could not sell more than *ca*. 1000 kg day^{-1} of all of the IPM products brought to the shop by farmers, which did not cover the cost of one employee. The inability of Aman to sell farmers' products forced farmers to look for other agents to sell their IPM products as conventional. This was explained by the Aman company director as follows:

> The company was losing money even it had good support from the MoA, GTZ, government, and some other international organisations working in Jordan. The IPM products sold at the company do not cover the cost of running the company. There is no good market or premium prices for the products. It was found that the company sells two products, tomato and cucumber. The total amount of tomato sold per day is ca 450 kg and cucumber is ca 500 kg. There is no law for IPM products, which allows anyone sell any product as 'IPM'. When consumers come to the market they look at the price not at the production system used. They prefer to buy conventional products rather than IPM.

(Aman's Director 2004)

It was also found that the IPM procedures which included registration, labelling and chemical tests were expensive, which also encouraged many farmers to leave this project. It is worth mentioning that what the research concluded in 2004 complies with a report published in Alrai Newspaper (Hassan 2005).

The company had changed from IPM to conventional products to make money and to cover the running cost. The company learnt from the experience of the IPM project that there is no market for such production system. The director reported that the risk in selling organic products is high, which means that the company does not have a future plan to adopt organic farming. He said, 'if there are organic products in the market, they will face the same thing which happened to the IPM products and end up sold as conventional products. Consumers are not aware about organic farming which is an important reason for the company not to adopt organic farming'. Results achieved from Aman are compatible with Walz (1999), Sahota (2005) and HDRA (2006), who all found that marketing is a constraint because of low consumer understanding about organic food and a lack of organic marketing networks. The results are also compatible with Schneeberger, Darnhofer and Eder (2002), who found that availability of marketing channels and the sustainability of premium prices are important concerns for conventional farmers to convert to organic farming.

6.2.6. Economic

Farmers were asked to list in their words "The main economic barriers that would face them in adopting organic farming" The research shows that farmers expect to face several economic barriers if they want to convert to organic farming. These include lack of premium prices, financial commitments, insufficient financial support and lack of policy support (Table 6.6).

Table 6.6: Farmers' responses concerning economic barriers to adoption of organic farming (n=46)

Economic barriers	N	%
No market or premium prices for organic farming products	45	98.0
Big investment already has been made	35	76.0
Financial commitments	24	52.2
Jobs will decrease	38	83.0

The results (Table 6.6) show that 98% of farmers reported that one of the main economic barriers is the lack of an organic market or premium price for organic products, to cover the extra costs of production. According to these farmers, all agricultural products are sold as conventional at low prices (see above). These farmers reported that the experience of farmers in Jordan in general shows that it is better to increase yields as much as possible by using chemicals, since the price cannot be predicted. This strategy helps farmers to make a profit, from which they spend more money on chemicals to yield more. Farmers believe that the amount of production under organic farming management will be less and will not cover their costs. They believe that in the short term there will not be a good price for organic products and in the meantime the government will not provide any financial support to cover the costs.

Another potential economic barrier is the investment that farmers have made already. In Jordan, farming requires large amounts of money to start up (Chapter 3 Section 3.11). Therefore, about 76% of the farmers reported that they believed organic farming would not make enough revenue or good profit from the existing investment they have made. Those farmers make farming their business and therefore try to make maximum profit from this business. The profit from this business is used to build their houses, eat, and for transport, education, and so on. Accordingly, they think that conventional farming is suitable for them for the time being. Also, farming investments create financial commitments that farmers have to meet, which can be significant barriers to the adoption of organic farming. As Table 6.4 shows, about 52% of the farmers stated this as an important economic barrier. It was found there were three major financial commitments that farmers have: to the Jordan Agricultural Credit Cooperation (ACC); to the private store suppliers; and to the electricity company. These three commitments make farmers very careful in taking any decision regarding their farming systems. Farmers say that applying organic farming means less production at the early stages and ceasing to grow certain crops or reducing the cultivated area. This means that farmers will start losing money which makes the ACC, the suppliers and the electricity company worry about loans and bills. Therefore, farmers have to farm every year to show that they are not losing money and are able to meet their financial commitments.

A visit to the ACC branch in the Mafraq Governate showed that ca 80% of the farmers had obtained loans from the ACC. The smallest loan was £20,000 and some of the loans were more than £80,000. The ACC branch Director said that most of the farmers keep up with repayments, which otherwise leads to more accumulated debt. This shows that loans from the ACC are considered as a considerable challenge for farmers in adopting organic farming. Moreover, the director said that the ACC does not offer loans for organic farming or for environmentally friendly agricultural production. This point was also emphasised by the Secretary General of the MoA, who said that "the MoA will not provide farmers with any type of subsidy to convert to organic farming." This point raises an important question: "*Would the government propose a strategy to use the ACC loans as an incentive to encourage farmers to adopt organic farming*?". If organic farming is to grow in Jordan, then it is necessary to develop a strategy to encourage farmers to convert to organic faming through financial programmes, which is discussed in Chapter 7.

According to farmers, applying organic farming will have a serious impact on the jobs created by conventional farming (Chapter 5 Section 5.2.8). The results showed that ca 83% of farmers expect that some of these jobs will be lost. The explanation is built on their understanding of organic farming. They say applying organic farming means less production, which means lower labour requirements to do harvesting, spraying and tasks to do with the application of chemicals. This will include fewer temporary jobs for women harvesting fruits and similarly fewer male temporary jobs, which will also have an impact on the private store suppliers. As a result, applying organic farming should take into consideration the perceived impact on these jobs, even though some of this perception is unfounded. This issue and the labour needs of organic farming are discussed in Chapter 7.

6.2.7. Institutional

Institutional barriers have been identified by several studies (Padel and Lampkin 1994, Niemeyer and Lombard 2003, Al-Bitar 2006). Padel and Lampkin (1994) reported these barriers as landlord objections, refusal of loans or insurance for organic farming, problems with grant applications, and legislative and certification constraints. In this research some of these have been identified as barriers and some have not.

The research shows that Jordan has well-established agricultural institutions such as MoA, NCARTT, ACC, universities and the CS, and it seems that there is no need for more organisations for the agricultural sector. It is in fact more cooperation between these organisations that is required. These institutions cover all aspects related to the agricultural sector such as legal work, extension, research, financial support and providing agricultural services. Despite these institutions having qualified people, good buildings, good infrastructure and structural frameworks, the research shows that the institutions have various problems which can be significant barriers to the adoption of organic farming.

The first problem is that these institutions do not have policies to support organic farming. Lack of policies to support organic farming is a common barrier for organic farming in the Arab region (Taher 2004). Another problem was realised through the researcher's visits to and interviews with people from these institutions: the lack of coordination and cooperation between the institutions, and lack of consulting target groups for the adoption of new proposals. For example, it was found that some of their research was conducted in the same area by two different institutions without any coordination. Farmers also reported that these institutions do not consult them over the adoption of any new decision or proposal. For example, a misunderstanding occurred between the OFU staff and the mandate of the MoA. This was realised through interviewing the Secretary General of the MoA and the head of the MoA Policy Directorate, who stated that the Jordan Institution for Standards and Metrology (JISM) is the responsible body for deciding on the standards of all food products, including organic farming production standards, with the cooperation of other members from other ministries. Then, OFU reported that the MoA has these rights to set the standards. Another example is that NCARTT was not involved in the organic farming process; also, the OFU has not contacted the JISM. Importantly, producers were not on the agenda of the MoA for participation in the organic farming movement. For example, the MoA Secretary General mentioned that the ministry was interested in producing olive oil and herbal plants as organic products, but investigation showed that farmers were not consulted and the OFU is interested only in olives. The results comply with the views of the MoA (2005a), that these problems are considered to be major constraints to the development of the agricultural sector. It was also recognised in Chapter 5 Section 5.4 that the majority of farmers build their advisory links with the private sector instead of MoA. Therefore, adopting organic farming requires that these institutions should work together instead of replicating the same work. This should be very simple to do because these organisations are provided with good infrastructure and communication means. A focal point between these organisations is required to be established to coordinate their work.

The third problem which was reported by respondents as a barrier is refusal of loans and unavailable insurance. According to the ACC, loans are given mainly for conventional farming but not for environmentally friendly farming or natural farming. A point raised by all farmers is that the ACC used to support conventional farming, for example it used to support farmers in the digging of a well at a cost of £45,000, but does not accept applications for a water-harvesting project, even though the cost is only £5,000. The government also helped conventional farmers to buy synthetic inputs (Chapter 3 Section 3.7). This problem was confirmed by the ACC Mafraq Director who said this needs to be tackled at a high level of decision makers to change the regulation.

The fourth problem is that organic farming is perceived as a technique, not as a production system. This was reported by the MoA Policy Director who stated that organic farming cannot be adopted or addressed within the ministry as a policy issue because it is considered a technique, like any other agricultural technique, not as a production system.

Therefore, if organic farming is to grow in Jordan, the institutions mentioned above and any institution relevant to organic farming should work as one team to develop organic farming. It has been also suggested by stakeholders that all relevant institutions should cooperate and coordinate for the adoption of successful organic farming (Chapter 7). Moreover, there is a need to develop regulations to provide farmers with loans or insurance for organic farming, at least at the beginning of organic farming adoption, and to solve problems with grant applications. These institutional issues are addressed in Chapter 7.

6.2.8. National regulation and legislation

Organic farming is based on a set of regulations and legislation, and based upon a transparency that makes the production system comprehensive and reliable, and ensures the consumer confidence necessary for market development (Yussefi 2005). Therefore, lack of regulations has been reported as a significant barrier to the adoption of organic farming by several authors (Chapter 2). For example, it has been found by Niemeyer and Lombard (2003) that the lack of national legislation was rated as the most serious problem to the adoption of organic farming in South Africa. They say that not only this but also the suitability of the legislation is a problem, if it does not suit a country as is the case in South Africa (Chapter 2 Section 2.10).

In Jordan, lack of regulation and legislation is a serious barrier to organic farming. This research shows that there is no legal framework for organic farming. Jordan has Agricultural Law No. (44) for 2002 in which Article (1) states that this Law shall be called "the Law of Agriculture for the year 2002" and shall be put into practice after thirty days as from the date it is published in the Official Gazette. The Law has 73 Articles regulating all agricultural sectors: Sanitary and Phytosanitary Measures, Plant Production, Seeds, Fertilizers and Plant Growth Regulators, Pesticides, Control of Plant Pests and Plant Quarantine, Forests and Ranges, Animal Production, Animal Health and Veterinary Quarantine, Slaughter of Poultry and Livestock, Fishing, Bees, Protection of Wild Birds and Wild Animals and General Provisions (MoA 2006). However, reviewing the law showed that it does not include any article about how products are produced, production methods or marketing labels. It was also observed by the researcher that there was no distinction between products brought to the market in terms of the production method. The only difference that sellers consider is the quality of the products and which part of Jordan the products come from, i.e. south, north or from the Jordan valley.

The research shows that Jordan does not have its own organic farming regulations (certification and inspection). This was reported by all farmers, discussion groups and MoA officials, who say lack of such regulation is a significant barrier to the adoption of organic farming. This was also emphasised by the Jordan food standards officer/JISM and the Yarmook University Vice Chancellor, who stated that there is a need to have a system in Jordan for dealing with organic farming starting with the laws on international standards. All respondents participating in this research agreed that lack of national regulation and certification is a barrier for the adoption of organic farming. It is worth mentioning that lack of regulations is a common constraint in the Arab world, not only in Jordan (Al-Bitar 2004, Aref 2004, Taher 2004, Kahouly 2004).

Therefore, Jordan needs to develop its regulation to adopt organic farming. To do so, a proposed action plan in Chapter 7 shows how regulations can be adopted and how they can be developed. It is reported in Chapter 7 that there is also a need to develop such regulations not only to produce organically but also to import organic products.

6.2.9. Information, advisory and services

The research shows that lack of information and advice was a further significant barrier to the adoption of organic farming in Jordan. This result complies with various studies (Lampkin 1990, Padel and Lampkin 1994, IFAD 2001, Schneeberger, Darnhofer and Eder 2002, Niemeyer and Lombard 2003, Hasbani 2004). Since organic farming is not practised in Jordan, the involvement of advisory and extension services, the national press and official agricultural institutions is still very small and still oriented to conventional farming. In this research, the vast majority of farmers (98%) and discussion groups (100%) reported that there is a lack of information and extension services regarding organic farming. These farmers say they have developed their farming experience in the area of conventional farming (Chapter 5), which means that adoption of organic farming requires that farmers should learn new organic farming techniques. Farmers and discussion group participants both agreed that farmers and extension agents need time to develop their skills to be able to farm organically. They reported that not only the lack of information is a barrier but that uninformed extension agents are also a significant barrier. It was also found that all extension documents and advisory leaflet advices produced by the MoA were concerned with conventional farming. Moreover, it was also emphasised by the Yarmook University Vice Chancellor that in Jordan there is neither research nor work on organic farming being undertaken in Jordan's universities. Most of the work which has been achieved is individual research concentrating on certain issues related to the soil or pest control, but nobody has done research on organic farming as a system.

6.2.10. Approach used by the OFU to adopt organic farming

The results show that one of the main barriers to the adoption of organic farming in Jordan is the approach used by the Organic Farming Unit (OFU), which was established by the MoA in 2002 to set up a plan for organic farming in Jordan (Chapter 3 Section 3.10.5). This is because the establishment of organic farming was not built on a participatory approach in which farmers were involved or consulted about the idea or the perception of organic farming. Neither the MoA Secretary General nor the OFU discussed the idea of organic farming with any group of farmers or the private sector, as was addressed in the OFU aims explained in Chapter 3 (Section 3.10.5). Moreover, there was no coordination between the OFU and farmers nor between the OFU and the MoA's relevant departments. The OFU agreed on this point and promised to involve more farmers in the movement of organic farming in Jordan. Also, most of the proposed aims of the OFU (Chapter 3 Section 3.10.5) to establish organic farming in Jordan had not been achieved after two years of its establishment. Table 6.7 shows the aims and its achievements.

Table 6.7: The OFU aims and achievements

Aim	Achievement
Collect different technical information regarding organic farming	Very little information collected about organic farming (manure use). Results showed there was no information about certification, inspection or any other information about setting up organic farming system.
Organic farming library	After two years of the establishment of the OFU there was no library
Transfer and deliver technical information to the target groups	The unit has not established the target groups
Cooperation between this unit and the private sector	There was no private organisation dealing with the OFU
Establish national organic farming regulations and standards	Have not been established yet. Moreover, it was found the unit was not authorised to do so
Establish some demonstration sites at the ministry stations	The OFU started working in a new site

An important issue which occurred during this research is the demise of the Organic Farming Unit (OFU). This was confirmed by Najdawi (2007)-one of the OFU staff-who reported that the budget allocated for the OFU from the MoA was finished, and the staff of the OFU and its external role have been transferred to the department of plant production at the MoA.

6.3. Conversion to organic farming

The development of organic farming worldwide has showed that the conditions and the interest in conversion to organic farming have changed. The pioneers of organic farming were converting to organic farming for different reasons: environmental, religious, biodiversity, consumer health and animal welfare. However, farmers of today convert or consider converting to organic farming not only for these reasons, but also because they are attracted by the availability of higher prices, subsidy payments and the existence of a more secure market for their products (Freyer, Rantzau, Vogtmann 1994, Rigby, Young, and Burton 2001, Baraibar 2006). This is because conversion to organic farming requires at least two years (Palz, Braun, and Dabbert 1994, Freyer, Rantzau, and Vogtmann 1994, Rigby, Young, and Burton 2001) in which the decision is preferable from an economic point of view and for the financial viability of the farm (Lampkin 1990, Freyer, Rantzau, and Vogtmann 1994, Rigby, Young, and Burton 2001). Furthermore, several studies have showed that the decision to convert on the part of the farm is not easy and has significant barriers including financial information, financial support, technical experience and advice (Lampkin 1990, Lampkin and Padel 1994, Padel and Lampkin 1994, Palz, Braun, and Dabbert 1994, Rigby, Young, and Burton 2001, Schneeberger, Darnhofer, and Eder 2002). It has also been reported by Lampkin (1990), Schneeberger, Darnhofer, and Eder (2002) and Freyer, Rantzau, and Vogtmann (1994) that the decision to convert has a high element of risk and uncertainty as far as the financial viability of the farm is concerned, and this is compounded and exacerbated by the current lack of detailed information and advice. Organic farming also requires a high level of commitment (Lampkin 1990, Freyer, Rantzau, and Vogtmann 1994) and careful planning is necessary to avoid financial problems during conversion (Freyer, Rantzau, and Vogtmann 1994). It can also be said that the organic pioneers did not have to pay for the extra costs of the conversion process, which include certification and inspection costs, as farmers of today do.

After investigating the anticipated barriers to the adoption of organic farming, it was important to find the opinion of farmers if the government proposed the adoption of organic farming. To achieve this, farmers were asked 'If officials from the MoA came to their farms and advised them to adopt organic farming, would they accept that advice? and why/why not?' Results (Table 6.8) showed that about 55% of them would not accept the idea of organic farming. These farmers say that their decision is built on the anticipated barriers mentioned above. They believe that these barriers will not enable them to produce the same quality and quantity that they produce now with profit.

Table 6.8: Farmers' responses concerning adoption of organic farming (n=46)

Response	Frequency	Percent	Reason
Do not accept	25	55	Technical barriers, risk, losses, and not profitable
Accept	8	17	If the majority of farmers accept
	13	28	If the production is protected and any losses compensated by the ministry or available subsidy sources
Total	46	100	

However, results show that ca 45% of farmers would accept the adoption idea under certain conditions. These farmers are divided into two groups: 17% would accept the idea of organic farming, "if the majority of farmers in Jordan accept the idea of organic farming". This group of farmers say that applying this condition means that all of the products have the same quality and quantity and then good prices could be achieved. This condition is unrealistic, which means that these farmers are unlikely to adopt organic faming. The second group, 28% of the farmers, put a condition, "if the production is protected and any loss compensated by the MoA". This condition can be achieved, since several governments support farmers in adopting organic farming. This result shows that farmers have some acceptance of adopting organic farming, but they need some incentives.

6.4. Potential and opportunities

When this research started, the idea was to critically evaluate the potential and opportunities for organic farming in Jordan. As the research developed the focus broadened to include the sustainability of the agricultural sector. Therefore, the research shows that Jordan should not only focus on the potential and opportunities for the adoption of organic farming, but also that organic farming has the potential to sustainably maintain its agricultural sector and natural resources. It was found in Chapter 5 that the current farming system in Jordan is not sustainable, and that this system has created severe environmental problems to soil, groundwater and livestock (Chapter 5 Section 5.8). Accordingly, the research argues that whatever barriers could face organic farming in Jordan, organic farming is the best option to maintain and sustain Jordan's agricultural sector. This chapter has shown that adoption of organic farming in Jordan has several barriers, but that it has also potential opportunities for its adoption, which will now be discussed.

6.4.1. Potential farmers in the adoption of new methods

The most important potential factor in producing organic products is farmers. It was explained in Chapter 3 Section 3.11 that in the study area farmers like to copy what other people have, whatever the cost or the results. As a result, if organic farming was applied and successfully adopted by a group of farmers then many farmers would do the same. The research shows that farmers in the study area are willing to apply any natural technique that could increase their production or could increase their profit. For example, farmers already use honeybees for flower pollination of vegetables and fruit trees (Chapter 3 Section 3.11).

6.4.2. Climate and the geographical position

Jordan has climatic conditions suitable to producing a variety of products such as olive oil, vegetables, fruits, herbs and cereals in different seasons which could be exported to the European market. Climatic conditions are characterised by high temperature and dry climate (Chapter 3 Section). These characteristics are considered as potential beneficial factors because they help in decomposing the organic matter in a short time, which helps to provide plants with nutrients, while in cold areas this process takes several months. Also, the low moisture levels in arid lands help to reduce the pest infestation and to control several pests and diseases (Kenny 2004). Moreover, Jordan's geographical position is suitable and competitive for international markets. Being in such a position of closeness to organic markets is considered as a potential beneficial factor for the spread of organic farming (Taher 2004). Other positive factors include low cost of labour and the good infrastructure (road infrastructure, transportation, airports) that Jordan has.

6.4.3. Factors favourable to organic production

To find the potential and opportunities for organic farming in Jordan, both farmers and the PAS discussion groups were asked to list the favourable factors that the study area possesses. The results (Table 6.9) show that 93% of the farmers and 100% of the PAS discussion groups stated that the Badia in general has a large area and available virgin lands, which are difficult to find elsewhere in Jordan, which give the area an advantage for organic farming. Both stated that there are some lands that have never been cultivated, unlike in other parts of Jordan. This would help the convesion to organic farming and would make the conversion period short, which is considered as an advantage for farmers in Jordan. Having such an advantage has been reported by Taher (2004) as a potential factor for the spread of organic farming. It was also found that *ca.* 87% of the farmers and 100% of the PAS discussion groups stated that the area has the best water quality in Jordan. The water is groundwater and not polluted with sewage or other materials.

Table 6.9: Factors favourable to organic production in the study area. Responses of farmers (n=46) and the discussion groups (n=5)

Response	Farmers %	Discussion groups %
Wide area and available virgin lands	93	100
Availability of water with good quality	87	100
It is easy to isolate farms in the Badia because the area is wide	-	80
Long production season	87	100
Good weather and air is not polluted	74	80
Soil is not polluted	83	80
Livestock present	7	40
Labour (workers) available	-	40
The biggest tomato factory in the country	43	40
Farmers accept new profitable ideas	78	60

Results showed that 80% of the PAS discussion groups stated that it was easy to isolate farms in the Badia because the area is large. This procedure reduces pest infection rates and makes it easier to control pests. It can be noted that none of the farmers mentioned this point, which can be explained because their knowledge about pest control is less than PAS. Moreover, 74% of the farmers and 80% of the PAS discussion groups say that the weather in the study area is good and that the air is not polluted, which gives another advantage for organic farming.

Most respondents (87%) of the farmers and all the discussion groups considered that the area has a long production season in comparison with other parts of Jordan. They said that crops can grow at least nine months per year while in other places, like the Jordan Valley, it is about five months. Eighty-three percent of the farmers and 80% of the PAS discussion groups said that the soil is not polluted because it has a short cultivation history, and that much of the area has never been cultivated, which is another potential advantage. Seventy-eight percent of the farmers and all the discussion groups stated that the farmers in the area are a positive factor because they accept new profitable ideas. For example, if there is a new crop variety that could make better production and profits, then farmers would buy it. Forty-three percent of the farmers and 40% of the PAS discussion groups reported that having the biggest tomato factory in the country in the area is a positive factor; it might be used multi-purposely for both organic and conventional products.

Livestock and labour were considered not to be significant factors. None of the farmers reported labour as a potential barrier because they bring workers from the Jordan valley.

6.4.4. Liberalised economy

An unliberalised economy is considered as a challenge for countries wishing to establish organic farming operations (Walaga 2003, Taher 2004). Jordan has a liberalised economy which is considered as a potential factor for the expansion of organic farming. This is an advantageous as factor for Jordan in establishing organic farming production and export operations (Walaga 2003, Taher 2004).

6.4.5. Jordan's trade relations with the EU

It was discussed in Chapter 3 (Section 3.10.4) that Jordan could benefit from the global organic food market through its international agreements. Such agreements give Jordan a potential advantage in establishing organic farming (Hasbani 2004). The best agreement is the one that Jordan has established with the EU Community on reciprocal liberalisation measures to remove its processed agricultural products from customs duties. This agreement was applicable from 1st January 2006, and by 1st January 2010 customs duties on imports into the Community of all agricultural products originating in Jordan will be eliminated, except for cut flowers and olive oil (Table 6.10).

Table 6.10: Jordan agricultural products to be liberalised for importation into the EU (MoA 2005c)

Item/Yearly tariff quota volume (tonnes net weight)	from 2010 on
Cut flowers, fresh	
Potatoes	Liberalised
Garlic	Liberalised
Cucumbers and gherkins, fresh	Liberalised
Citrus, fresh or dried	Liberalised
Strawberries, fresh	Liberalised
Olive oil	

According to this agreement, Jordan should have no significant barriers to enter the EU market, which gives Jordan the potential to establish its organic farming. Moreover, according to the Director of the Trade Agreements at the MoA, Jordan can benefit from this agreement to include organic farming products. Jordan should therefore develop its regulation and standards to be compatible with the EU organic farming requirements, and work on its regulations to establish its farming system.

The research shows that Jordan could export organic farming products to the EU member states but that strict regulations must be met. Jordan could potentially access the EU market via import permit EU Reg. 2092/91 Article 11 (6) (Harris *et al.* 2003) which covers the vast majority of imports into the EU (Kilcher, Huber, and Schmid 2004) (Chapter 2 Section 2.8.4). To do this, Jordan needs to do two important things: apply for import permits from an EU 'competent authority' before they can import products into the EU; and secondly to sign an inspection contract with a European certification body and to provide documentation with their applications proving that both organic production standards and certification are EU equivalent (Harris *et al.* 2003, Kilcher, Huber, and Schmid 2004). These issues are explained in Chapter 7.

6.5. Summary

Organic farming is not an easy option for either farmers or producers due to several anticipated barriers reported by the research respondents. These barriers are divided into six groups: perception, technical, economic, cultural, marketing and institutional. However, there are a number of factors favourable to the adoption of organic farming and a percentage of farmers would accept the adoption of organic farming if they were provided with incentives. International and regional experience shows that these barriers can be overcome through developing a national action plan for the adoption of organic farming. This was concluded from the Sekem experience, which showed that organic farming can be achieved even in a very harsh area with limited resources. Therefore, despite these barriers, it is believed that organic farming could have a place in Jordan as it has in Egypt. Therefore, if Jordan aims to develop its organic farming sector, it is important that Jordanian institutions work together to develop an action plan. To achieve this plan, the researcher, for the second phase of this research, developed an action plan for adoption to facilitate and overcome these barriers which is discussed in detail in Chapter 7. The plan has been developed in cooperation with all stakeholders who have an interest in organic farming.

CHAPTER SEVEN: THE JORDANIAN ORGANIC FARMING ACTION PLAN

CHAPTER SEVEN
The Jordanian Organic Farming Action Plan

7.1. Introduction

This chapter focuses on critiquing an action plan to promote the adoption of organic farming in Jordan. The development of the plan is based on different factors: the empirical results (including the survey and the PAS discussion groups,) and the outcomes of the national workshop (farmers, government officials, academics, and national and international organisations) and a theoretical adoption model, the Innovation Diffusion Theory (the perceived attributes of innovations). The chapter starts with the recommendation and suggestions made during the workshop, followed by farmers' characteristics and the five perceived attributes of organic farming in Jordan. Following this the chapter describes the development of the action plan and its components. The plan sets out a series of practical steps which the Jordanian Government and stakeholders need to take to promote the adoption of organic farming. The plan is divided into four levels: *government, field, academic,* and *regional and international,* and explains the role of each level and its relationship with other levels. Finally, the chapter shows how this plan could be implemented, and shows that the plan's success with delivery of its objectives does not rely only on the MoA or any other single body, but on everyone involved in the provision of the organic farming sector in Jordan.

7.2. Recommendations and suggestion on the action plan development

The participants at the national workshop organised during the course of this research believed that the adoption of organic farming in Jordan would not be easy and carries with it several constraints. They confirmed that the barriers presented by the researcher at the workshop have the potential to retard the adoption of organic farming in Jordan. Therefore, they raised some difficulties and thereafter suggested several recommendation and ideas that can be used to develop an action plan to promote the adoption and diffusion of organic farming in Jordan. Their suggestions and ideas included: extension services (information on organic farming), marketing, financial support for conversion, regulation and legislation, research, academics' involvement, and increase of awareness. These suggestions and recommendations for organic farming to be diffused in Jordan are discussed in the following section within the action plan and are summarised in Appendix (J).

7.3. Jordanian farmers as innovators or organic farmers

According to diffusion theory, innovators are characterised as venturesome and eager to try new ideas which lead them away from local peers and into more cosmopolitan relationships, are young, have better education than later adopters, have common communication channels despite considerable distance they have, and are able to cope with a high degree of uncertainty about an innovation they adopt. Similarly, a high proportion of organic farmers have less farming experience, high levels of formal education, are young people, and come from urban backgrounds (Padel 2001). Looking at these characteristics, it shows that Jordanian farmers interviewed in this research share some of the characteristics, for example, they are risk takers since they dig wells up 500 m depth despite the possibility that the well would collapse. They grow crops under difficult environmental conditions with uncertain returns. Organic farmers are usually young and have less experience of farming. In this research, the average age of farmers was 51 years, which suggests that they are less innovative and would follow their routine behaviour (current farming). Nevertheless, farmers in the study area do adopt new farming systems if they believe these system would be suitable for them, for example converting from a sheep farming system to a crop farming system, as explained earlier on. However, ninety-three percent (93%) of them have only secondary school education, which is at variance with the attributes of an innovator which stipulates that an innovator has higher education; but some of them were highly educated. The majority of them (76%) have a farming background, but 24% come from urban backgrounds, as common with organic farmers. Therefore, it would be difficult at this stage to categorise Jordanian farmers as innovators or as organic farmers, but it could be said that their characteristics show that they have high potential to adopt new farming systems depending on the new system's suitability. Therefore, in the next section attention will be paid to organic farming as a new system and how it is perceived by farmers. Based on this, an action plan will be suggested to promote its adoption.

7.4. The perceived attributes of organic farming in Jordan

According to diffusion theory the five perceived attributes of an innovation are strongly related to its adoption rate. In this research the empirical results obtained from stage one and the outcomes of the workshop (Appendix J) were used to evaluate the perceived attribute of organic farming in Jordan and to predict its rate of adoption and how its adoption can be diffused. Based on the analysis an action plan is suggested to promote the adoption and diffusion of organic farming in Jordan. The plan is considered as a primary step towards the adoption of organic farming at a national scale. The five perceived attributes of organic farming can be explained as follows:

7.4.1. Complexity

For an innovation to be adopted it should be simple, understandable in its meaning and easy to practise. In this research, the results obtained from survey, questionnaire, interviews, discussion groups and the national workshop on the potential and barriers of organic farming in Jordan show that farmers have perceived the adoption of organic farming as a complex issue surrounded by uncertainty and not easy to practise. The 46 farmers interviewed in this research perceived that the adoption of organic farming is not easy and would necessitate profound changes in their farms' organisation. Both farmers and the PAS have perceived organic farming in Jordan as a new system which is relatively difficult to understand and adopt. They reported different barriers to the adoption of organic farming (technical, economic, marketing) as discussed in Chapter 6. One of the complex issues raised by the majority of the respondents of stage one and the workshop participants was that the perception of organic farming is unclear.

In this research, complexity has been identified as a significant barrier to the adoption of organic farming in Jordan, and this has been experienced during the course of this study. For example, the 46 farmers interviewed and all five discussion groups reported several technical barriers which would retard the adoption rate of organic farming (Chapter 6 Section 6.2.2). They said that practising organic farming will increase the pest infestation (insect, disease and weeds). Powdery mildew, for example, has been identified by 98% of the farmers as an important and difficult disease to control even in conventional farming, and the same is true for other pests, diseases and soil fertility. This was attributed to the fact that farmers would need to learn how to control pests and diseases, improve and build up soil fertility and choose varieties adapted to the local conditions. Another example is the mixed farms (vegetables and fruit) that some of the farmers have. Such farmers need to know some skills suitable for vegetable production as well as fruit production. This may not be easy for some farmers, since vegetable production requires different management from fruit production.

Expectantly, innovations that have low risk are adopted easily. But in this research, 70% of the farmers and 60% of the discussion groups say it is risky to adopt organic farming due to poor soil fertility and pest infestation. There is also a risk in that the 46 farmers and five discussion groups expected to have yield reductions in both quality and quantity, due to increase in pest infestation, abandoning of fertilisers and pesticides, and also due to unbalanced or insufficient nutrient supply (NPK) (Chapter 6 Section 6.2.2). Another related issue is that the farmers have conventional farming experience. Adoption of organic farming necessitates that they learn new experience and skills, which would be a complex issue. The complexity of organic farming, as perceived by the research respondents, is negatively related to its rate of adoption. Therefore, the perceived complexity of organic farming by farmers would be an important negative factor which would retard the adoption rate of organic farming in Jordan.

7.4.2. Trialability

Trialability refers to how much an innovation is easy to test before adoption. It is essential that for organic farming to be adopted by farmers in Jordan it should be tried on their farms, either on a small or large scale. During the course of this research it was found that farmers in Jordan prefer to try a new idea on a small scale or to see its success at a friend's farm before they adopt it, while the private sector companies do make agreements with farmers to try new crop varieties, or pesticides or fertilisers in part of their farms as a micro-experiment. Such companies pay for all costs, give incentives in the form of agricultural inputs, and the net returns (profits) are for the farmers. In this approach other farmers visit the site of the micro-experiment to see the results, and according to the success, decide whether or not to adopt the new idea (Chapter 5 Section 5.4). This approach can be applied to the adoption of organic farming, whereby farmers need to try it and see its success before they adopt it. But adoption of organic farming is not like adopting a new pesticide or a new crop variety. Organic farming is a complex system and farmers in Jordan need to learn to adopt and integrate more that one factor (crop rotation design, soil fertility strategy, pest management programmes). A related issue is that companies such as these mentioned above are not available in Jordan to support farmers to try organic farming or to pay for the cost. Also, there is a risk for farmers in trying organic farming even on a small scale as they perceive organic farming to be a source of infection, and farmers believe that it is better to spray crops even when there are no pests. For example, results in Chapter 6 showed that 70% of the farmers and 60% of the discussion groups said it is risky to try organic farming in the Badia. They believe that prevention is better than cure, which means they spray their crops as prevention, even if there is no pest. According to them, some farmers in the Badia tried not to spray their crops until a pest comes, but their crops were lost. Another risk to farmers even on a small scale, is the lack of markets for organic farming products. It is therefore envisaged that having less trialability of organic farming by farmers would reduce its acceptability and adoption; and it is predicted that its adoption rate is negatively affected.

7.4.3. Relative advantage

This research shows that farmers aim to make profit from their agricultural production and are ready to adopt any new technology that would have economic advantage. They are motivated to adopt alternatives or new ideas when their current farming practice is not fully satisfactory. An example from this research is that when farmers were not satisfied with the soil productivity, 78% of them used humic acid to improve the soil fertility, although humic acid was not used in the area until four years ago (Chapter 5 Section 5.7). Hence, when they are satisfied with their current farming practice they might not look for alternatives. Growing tomatoes is a good example. It was found that tomatoes occupy the highest percentage (i.e. 33%) of the total cultivated crop area and the largest cultivated area among farm types (Figures 5.3 and 5.4). The reason for this, as farmers say, is that: 'the tomato never makes a loss because of its high production and the long harvesting period it has, which means there is always a chance to get a good price in comparison to other crops which have one harvesting time'. This means that their decision in adopting new ideas depends on the distinct advantages of the ideas which are often expressed in economic profitability.

Therefore, for organic farming to be accepted, it should have relative advantage in terms of economic profitability and environmental benefits, which would have a positive relationship with its rate of adoption. This can be seen from the economic and marketing barriers reported in Chapter 6, which show that farmers perceive that organic farming can provide environmental benefits, but they envisage it would not secure more economic benefits than the current farming system they use due to several reasons: marketing, economic, policy support-financial support (Chapter 6 Sections 6.2.4-6.2.7). All these would retard or affect the adoption rate of organic farming in Jordan.

Farmers also perceived an increase in the costs to produce organic produce, combined with consumers' preference: for example 80% of the farmers reported that consumers are concerned about price more than quality. Also, 98% of farmers were concerned about lack of market and premium prices to cover the extra costs of production. The workshop participants emphasised that the lack of incentive from government and non-government organisations was a further concern for farmers, combined with the competition from conventional products. The participants reported this will not allow farmers to make expected profit by selling organic products in a conventional market.

Therefore, it is predicted that the adoption rate of organic farming would be slow because farmers have great difficulties in perceiving its relative advantage.

7.4.4. Compatibility

For organic farming to be adopted by farmers in Jordan it should be compatible with their existing experience and with their socio-cultural values. Results from this research show that farmers do not have cultural, social or religious barriers to adopting organic farming, but organic farming is incompatible with the existing experience of farmers. Farmers have gained good experience in conventional farming, which includes dealing with different crop varieties, pesticides and fertilisers. For example, fifty percent of them believe that applying organic farming is incompatible with their current experience of conventional farming and will force them to learn new experiences which will take time, and they do not know its possible results. Uncertainty of result was also emphasised by the five discussion groups and by the workshop participants. Nearly all of them agreed that the lack of knowledge of farmers about organic farming is a significant barrier to adopting organic farming. Another related issue is that the current extension services in Jordan are devoted to conventional farming. Therefore, the incompatibility of organic farming with existing experience of farmers retards the adoption rate of organic farming in Jordan.

7.4.5. Observability

Organic farming can be diffused easily between farmers when they observe its results and benefits on the ground, which is considered to be positively related to its adoption. In Jordan farmers have a strong social bond, through which information is easily communicated, but organic farming has not been established as a system yet in Jordan and farmers have not observed its results as a new innovation. However, the private sector, as discussed in trialability above, uses the observability approach to introduce new inputs through demonstration experiments. The decision of farmers to adopt the new input depends on the success of the results. Therefore, it is predicted if farmers observe good results from the application of organic farming, then the rate of adoption will be positively affected; otherwise it would be retarded.

Overall, it can be concluded that at present, organic farming is perceived negatively to its rate of adoption. Therefore, the research suggests the following action plan to help the government of Jordan to promote and ease the adoption of organic farming in Jordan.

7.5. The development of the Jordanian organic farming action plan

The final objective of this research was to develop a practical action plan that can be used in Jordan to promote and increase the diffusion of organic farming. The plan was developed based on the empirical results achieved in stage one and the outcomes of the national workshop combined with five perceived attributes as explained in Figure 7.1.

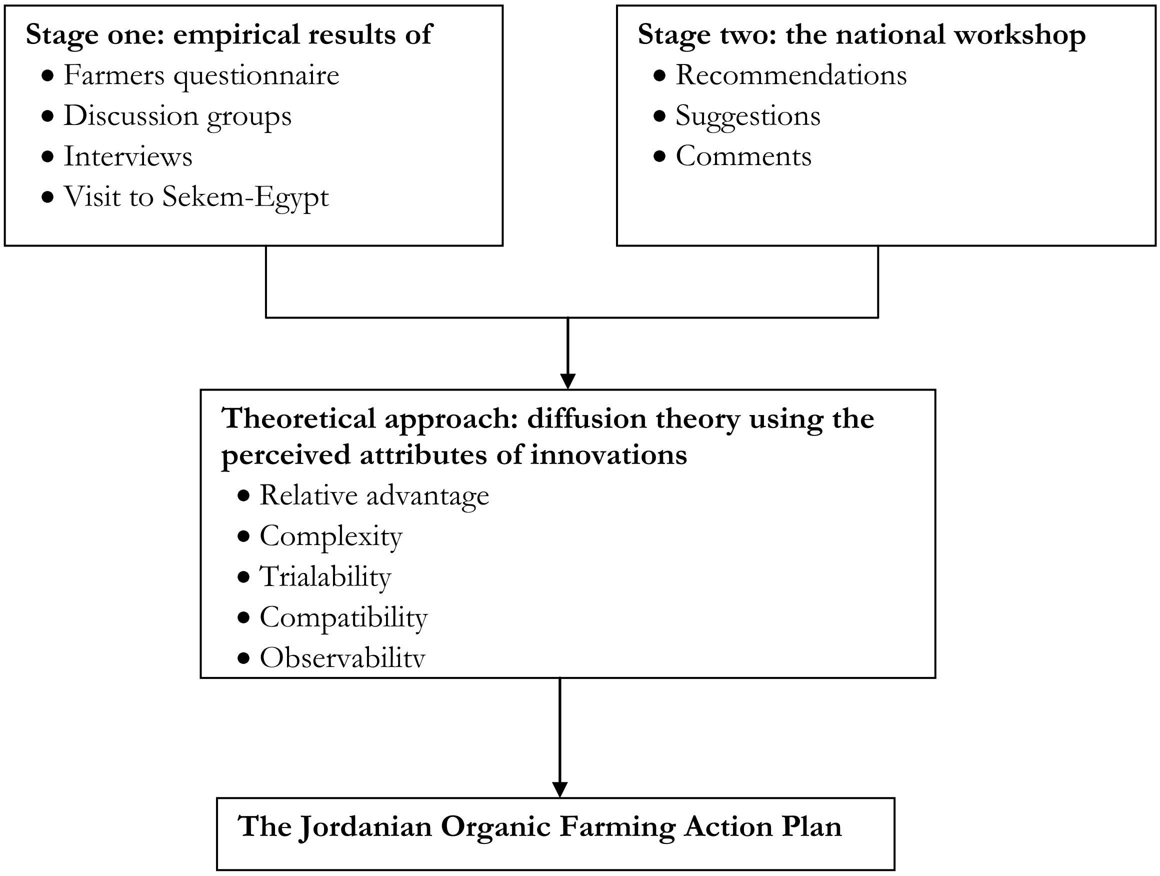

Figure 7.1: The method used to develop the Jordanian organic farming action plan

7.6. The Jordanian organic farming action plan

The plan sets out a series of practical steps that the government and stakeholders can take to promote the adoption of organic farming in Jordan. In this plan, farmers, academics, government officials and the private sector who attended the workshop have committed themselves to working with the plan to ensure that Jordanian farmers can take advantage of the opportunities offered.

The title of the proposed action plan is ‘the Jordanian Organic Farming Action Plan’. The action plan aims to ensure a sustainable development of organic farming in Jordan, increase its diffusion among farmers and consumers, benefit from the relative economic and environmental advantage of organic farming, and reduce the external agricultural costs, which in return will benefit the Jordanian economy. To achieve this, the plan addresses the main steps required to motivate the diffusion of organic farming in Jordan. The plan is divided into four main levels and under each level there are sublevels as shown in Table 7.1.

Table 7.1: The Jordanian Organic Farming Action Plan

Government level	Field level	Academic level	International and Regional level
Reform of the Jordanian Agricultural Policy (JAP)	The Jordanian Organic Farming Cooperative Society	Conduct research to solve technical and economic problems facing organic farming	Continuing collaboration with agencies working in Jordan (USDA, DFID, ECD, GTZ and others)
Financial support programmes for conversion	Organic farming demonstration site	Teach organic farming modules for both undergraduates and postgraduates	IFOAM
Establish organic farming cooperative society	An organic farming website	Establishing a Professorship in organic farming	The Codex Alimentarius
Developing the organic products market	Suitable marketing approach	Increasing awareness about organic farming	Sekem-Egypt
Awareness and public education	Awareness and public education	Develop suitable extension tools for farmers about organic farming	
Reliable extension on organic farming			
Research and development (R and D)			

7.6.1. The government level

As discussed above it is predicted that the adoption of organic farming in Jordan would be difficult since organic farming is envisaged by farmers and other stakeholders as a complex issue, has less relative advantage, and it should be trialled before it can be adopted. In addition, the research shows that despite of the interest of the MoA in organic farming, there is a lack of official government support for organic farming, which was identified as a potential constraint to organic farming adoption. Therefore, the 42 participants who attended the workshop agreed that the government of Jordan (mainly MoA and JISM, and any government organisation interested in organic farming) should intervene by having a role to promote and ease the adoption of organic farming.

The government' role is to encourage farmers to convert to an organic farming system as seen during the course of this research in many parts in the world, where organic farming has gained a high level of governments support. Based on the suggestions of the workshop participants, the role of the Government of Jordan should also be to support organic farming by encouraging better coordination of public-sector agencies to support organic farming, helping farmers in finding markets, establishing commercial contracts, and establishing organic farming regulations. In addition to these suggestions, it should also be recognised by the government that supporting organic farming in Jordan can be justified since organic farming has several benefits such as environmental sustainability and social and economic benefits as explained in Chapter 2 Section 2.6, which are considered to give a relative advantage for the adoption of organic farming. Accordingly, the action plan suggests that the government's potential work should include the following parameters:

Reform of the Jordanian Agricultural Policy (JAP)

For organic farming to be adopted in Jordan, the priority is to reform the JAP to provide official government support for organic farming. This suggestion is built on the review from Chapter 3 Section 3.9 which shows there has been no such support for organic faming, the barriers discussed in Chapter 6 and also on suggestions made by the majority of participants at the national workshop. For example, one academic who attended the workshop said that 'for organic farming to be adopted officially in Jordan, the MoA should review its agricultural policy to give more attention to organic farming as a farming system, which means the policy should consider technical, finatial and legal support'. The suggestion is built also on the perceived attributes above which show that organic farming is a complex issue (perception, practice, regulation) and an intervention by the government is important to ease its adoption. This requires the government to reform its policy to integrate organic farming within the Jordanian Agricultural Policy. Policy reform is important not only to support farmers but also because the principles of organic farming explained in Chapter 2 (Section 2.11) comply with the Jordan Agricultural Policy [JAP] (Chapter 3 Section 3.9), and the principles can also bring environmental, social and economic benefits. Such policy support for organic farming is required since individual efforts in the organic farming movement are not enough to develop the organic farming sector in a country on a national scale. This has been found through the researcher's visit to Egypt, which showed that although organic farming was started in 1977 by Sekem as an individual effort, it was still growing very slowly and Egypt as yet has no national regulations.

In the workshop, the majority of the participants emphasised that reform of the policy should consider three important issues: the action plan should be integrated within the National Strategy for Agricultural Development (NSAD) as part of the Agricultural Development Sector, a legal framework (definition, standards, and certification and inspection systems) to regulate and protect organic farming in Jordan, and financial support schemes to cover extra costs during conversion, and to support training, extension, marketing and infrastructure to ensure the sustainability of organic farming.

According to the participants, reform of the JAP should consider the fact that farmers need enough time to be able to convert to an organic faming system. This is because organic farming is a complex issue, needs to be tried and observed, and farmers need to acquire different skills to adopt it. This requires time for organic farming and its practices to spread through the farming community. The participants emphasised that the government should aim at encouraging farmers to convert to organic farming within a certain period of time, in which all or part of their cultivated land is to be converted. During this period farmers need to make their experience compatible with organic farming, and therefore they need time to know how to re-establish the natural order and prepare their soil to be ready for organic farming, and need to be familiar with the organic farming regulations. In this regards, the research suggests that steps suggested by El-Araby (2004) that farmers in arid lands need to follow to convert to organic farming (Table 7.2), are important to help farmers in Jordan to convert to organic farming systems. Other important procedures and steps to be considered are explained in Chapter 6 Section 6.2.3.

Table 7.2: Steps farmers need to take to convert to organic farming (El-Araby 2004)

Restore soil fertility by minimising soil disturbance and maximising soil organic matter
Provide suitable natural habitats for predators and preserve existing types
Re-introduce plant diversity into the cropping system, as diversity is nature's most effective way of maintaining the pest/predator balance and of ensuring continued soil fertility,
Gradually reduce the amounts of agro-chemicals used as fertiliser, herbicides, insecticides and fungicides
Substitute organic matter and manure in place of mineral fertiliser
Use rotations, under-planting and mechanical cultivation in place of herbicides

Therefore, the action plan suggests a period of ten years from the action plan’s inception date; during which 1-5% of the cultivated area in Jordan is to be managed organically, starting in one geographical area (the study area) but able to be extended to other areas that have potential for organic farming.

Financial support programmes for conversion

> Government financial support for organic farming is justified by the environmental public good which organic farming delivers, which extends to society as a whole and not just to the minority of consumers who choose to purchase organic food
>
> (DEFRA 2002: 2)

The empirical results and the perceived attributes show that organic farming is perceived by farmers not only as a complex issue but also as having low relative economic advantage and financial barriers which challenge their confidence in converting to organic faming. For example, 98% of farmers reported that one of the main economic barriers is the lack of an organic market or premium price for organic products, 76% already have big investments, and 52% reported other financial commitments (Chapter 6 Section 6.2.6). All the farmers and the head of the farmers' union who attended the workshop emphasised that farmers' financial commitments and lack of markets and premium prices are important barriers for farmers to adopt organic farming. Therefore, all the workshop participants including the MoA Minister suggested that financial support programmes should be considered to encourage farmers to adopt organic farming. The aim of the financial support programmes would be to increase the degree of relative advantage of organic farming, which could be direct or indirect support in order to encourage farmers towards adoption. Such schemes should have a positive impact on organic farming expansion and adoption by farmers and would help to increase the area converted to organic farming and the adoption rate of organic farming.

Consequently, the government should set up financial support programmes that are well planned in terms of budget, time-period, based on average farm crop areas, number of farmers targeted to adopt organic farming and when the conversion money would be available. Furthermore, the participants emphasised that the government should not confuse farmers (as seen in the case of livestock keepers' subsidies in 2001 where it was not clear who should be subsidised and how much per head) and the rules should be made clear as to who will be subsidised and on what basis, and the support programmes should meet farmers' expectations.

In Jordan there have as yet been no government financial plans or public funds to support organic farming. In the meantime, the literature review for this research showed that the government used to subsidise conventional farming including chemicals (Chapter 3 Section 3.7). A visit made to the ACC showed that 80% of the farmers who had loans had not yet paid them back (Chapter 6 Section 6.2.6). Therefore, if the government wishes farmers to adopt organic farming then it should apply a financial support programme. To do so, the plan suggests that support for farmers could be from publicly funded programmes as follows:

- Direct support programme, 'A Common Organic Farming Credit Policy (COFCP)', in which farmers are supported to convert to organic farming. The COFCP should have political support for environmental reasons and should aim to support farmers who have loans from the ACC. The plan suggests that the financial support programme should be applied according to the conversion area. In this regard it is suggested that any farmer who has a loan from the ACC and wishes to convert part of his/her farm to organic farming, then the loan will be re-scheduled without any additional interest. However, it is not easy at this stage of the research to provide financial details as it will be the role of the government to determine the level of support programmes and to provide such details.
- Indirect support programmes by offering aids and tax reductions, as in Tunisia (Chapter 2 Section 2.11 and Appendix A), where there are several justifications for the government to support organic farming such as its environmental relative advantage. The environmental relative advantage of organic farming is of importance for Jordan, as was discussed in Chapter 3 (Section 3.10.2) and Chapter 5 (Section 5.8). Accordingly, the plan justifies the argument that such environmental benefits should motivate the government to provide farmers also with conversion aid and maintenance payments through agri-environmental (organic farming) schemes aimed to encourage expansion of the area of land under organic management to reach 1–5% within ten years from the inception date of the action plan. This in turn would possibly speed up the diffusion of organic farming in Jordan.

Establish organic farming cooperative society

The head of the farmers' union who attended the workshop emphasised that 'at the current situation in Jordan, farmers as individuals are not able to adopt organic farming. Therefore, it would be better if we could establish a cooperative society by which a group of farmers can start the movement of organic farming in Jordan, and the society should be supported by the government'. This suggestion was also supported by other workshop participants, but they recommended that the membership of the society should be open to other stakeholders (private sector, academics, farmers from different geographical areas, MoA people).

Accordingly, the action plan suggests that the government should support farmers in establishing the cooperative society to start the organic farming movement in Jordan. Important issues raised by the participants included that the society should be supported financially by government, and be responsible for the organic movement in Jordan as a link between farmers and the government. Moreover, based on the perceived attributes of organic farming, the plan recommends that the society should aim to increase the observability of organic farming by showing the results of the adoption of organic farming to other farmers, and to increase the inter-personal contact between farmers. The society should also aim to reduce and ease the complexity of organic farming through minimising the administrative load which includes certification, inspection and legislative requirements (see Field Level below).

Establishing cooperative societies in Jordan has demonstrated that new ideas successfully implemented by cooperative society members are subsequently adopted by surrounding communities after the cooperative demonstrates success over a trial and error period (Al-Tabini, Gorman, and Libbin 2006). But two important points that should be considered to encourage farmers to be members in this society are reasonable membership fees and services for farmers such as marketing. Palz, Braun, and Dabbert (1994) found that farm managers in Germany do not join such societies due to lack of marketing advantages and the level of membership fees. The importance of such a body encouraged Tunisia to establish a body called '*Consortium*' to help farmers adopt organic farming and to export their organic products such as olive oil (Al-Turkey 2004).

Developing the organic products market

The research shows, as discussed above, that the economic relative advantage of organic farming in Jordan is perceived to be low due to the lack of organic markets, lack of premium prices and financial commitments. Also, all the participants at the workshop reported that at the current time there is no market for organic products in Jordan. For example, Hamarneh (2005) a representative of the OFU said:

> The first thing faces us in the OFU when we talk to farmers about the adoption of organic farming in Jordan is the marketing issue. Farmers say to us, we need a market before we can adopt organic faming, so we can ensure that our products are sold and our costs are covered with a marginal profit

Based on the research results presented during the workshop and Hamarneh's statement above, the workshop's participants suggested that for organic farming to be promoted, there is a need for the government to help farmers to overcome such barriers to convert to organic farming. They emphasised that the government should help farmers to develop and find potential organic markets locally and internationally, and to benefit from the agreements made with other countries such as the one with the EU. The government also should work with key multiple and independent retailers and experts to help promote and develop Jordan's organic market products. Arabieat (2005) a representative from JEDCO who attended the workshop, said that: 'the government should also inform farmers about the potential regional and international organic food markets as we do at JEDCO when we encourage our farmers to produce a crop that has a high demand but do not grew usually'. Habaebieh (2005) the JISM representative also suggested that the complexity of the organic food market requires the government to establish an organic market information system not only to develop market channels, but also to train farmers on regulation, standards and infrastructure for inspection and certification to meet international trade requirements to generate consumers' confidence.

From the knowledge gained during this research, the government can also help in increasing the economic relative advantage of organic farming through encouraging the purchase of organic food, locally produced where possible, by schools, the military, hospitals, universities, and tourist and other public organisations, starting with pilot projects. The plan also suggests that the government should allocate funds for research on marketing to identify potential local and external markets, and to collect reliable marketing data to develop organic projects to meet the market needs (Hasbani 2004).

Awareness and public education

For organic farming to be adopted in Jordan its meaning should be understandable and clear to farmers and consumers, otherwise its adoption rate would be low. The results from this research showed that organic farming and its principles were not clear for the majority of stakeholders and consumers, which is considered as a significant challenge to organic farming development in Jordan. Also, organic farming is perceived as a complex issue and its trailability is limited as discussed above. Therefore, the workshop participants emphasised it requires the concept of organic farming to be made clear and understandable, which can be achieved through increasing awareness and education, in which the government has an important role.

Workshop participants suggested that increasing the awareness of consumers and farmers of the *principles* of organic farming and its *relative economic* and *environmental benefits* would help to promote the adoption of organic farming. They said this requires making information on organic farming available via the media including TV, radio, newspapers and leaflets. According to the participants' suggestions, it is predicted that an increase in awareness and education about organic farming in Jordan can help in stimulating consumer purchases by raising consumer awareness of the differences between organic and conventional products. They considered that awareness and education are significant factors in developing organic farming in Jordan, and suggested that the government should develop a continuous public education campaign. This campaign should focus on the concept of organic farming, its relative economic and environmental advantage (potential markets, the principles of organic farming, health issues, environmental impact and the safety of organic produce), its regulation and standards, and should also aim to broaden information about organic farming through public organisations such as hospitals, universities, schools, the military and nutritionists. It should use media (TV and radio) for promotional programmes, promotional information and factual information for consumers, as well as mobile phones, demonstration sites and websites. It was also suggested by one participant that information leaflets can be passed to bakeries because most Jordanians buy their bread daily from the bakery.

Reliable extension on organic farming

The analysis of the five perceived attributes discussed above and the empirical results show that organic farming is a complex issue, has limited trialability and is incompatible with the existing experience of farmers. According to the diffusion theory, these issues would retard its adoption rate. Therefore, for organic farming to be adopted there is a need to have reliable extension combined with communication channels that suit the farmers' needs. However, the research showed that in Jordan there has been no previous experience of organic farming, limited access to information about organic farming, and that Jordan's extension is focused on conventional farming rather than agri-environmental farming. The NCARTT people who attended the workshop reported there is also limited financial aid and inadequate training and experience for extension agents. This has been confirmed by all the workshop's participants including the MoA representatives. Farmers also reported that reliable extension sources are important to show farmers how to practise organic farming. For example, a farmer attending the workshop said, 'if the MoA wants us to adopt organic farming, then the MoA extension agents should show us how to control pests and diseases and how to manage the soil fertility without using fertilisers'. Moreover, the empirical results showed that 70% of farmers in the study area reported that it is risky to apply organic farming as they expect an increase in pest infestation and reduction in the yields.

Therefore, the action plan suggests that for organic farming to be adopted, reliable extension services and accurate sources of information on organic farming suitable for the Jordanian environment conditions are important factors. For example, the availability of information and organic methods to control pests and diseases discussed in Chapter 5 are important to help farmers to overcome such technical barriers. While it is important to utilise available extension resources (books, magazines, websites), it is also necessary to develop techniques appropriate to Jordanian conditions. For example, not all organic farming production methods developed in Europe are suitable for the arid land of Jordan because they are developed in areas characterised by different soils and climatic conditions. The researcher's visit to Sekem shows that Jordan can benefit from Sekem's experience owing to similar environmental conditions. Based on the suggestions made by the participants and empirical results, the plan suggests that the government should take the following extension steps:

- Take advantage of the available information, and in the meantime develop information suitable for the Jordanian environmental conditions,
- Provide extension for all farmers having small or large holdings,
- Provide farmers with adequate information on how to control pests and diseases under organic farming systems (for example, powdery mildew and spiders as these are important for farmers),
- Provide farmers with information on integration of crops and livestock in organic farming systems,
- Provide farmers with information on soil fertility management in arid lands, how to make compost and to manage water,
- Provide farmers with information about organic farming regulation and standards
- Provide extension agents with adequate training in organic farming,
- Involve private extension agents in the organic movement,
- Provide public funds to support extension agents specialising in organic farming,
- Involve farmers in the extension process as they have good experience and they know how to transfer information to other farmers.
- And, it is advised to apply the learning method of farmers explained in Chapter 5 (Section 5.4): Demonstration experiments at farmers' farms, a method which is used by the private sector to introduce new ideas such as using new pesticides, crops and fertilisers. In this method, different organic farming practices can be demonstrated (observability and trialability) to farmers.
- Develop simple extension tools to help farmers learn about organic farming (the demonstration site below).

- Provide training for MoA extension field staff and people responsible for organic production.

Research and development (R and D)

The complexity of organic farming and its incompatibility with the existing experience of farmers, make the adoption of organic farming difficult. Different participants (academics, NCARTT people, MoA officials) suggested that the government should create R and D programmes to promote the adoption of organic farming in Jordan. R and D are required in organic farming since they can result in solutions to technical, marketing and economic barriers discussed in Chapter 6 Table 6.1. According to the suggestions made by the participants, the R and D programmes should integrate both socioeconomic and agri-ecological research, in which researchers combine research on technical aspects (pests and disease management, soil fertility management, livestock production, ecological issues, environmental impact assessment, and animal welfare), and socioeconomic issues (potential market and products, marketing standards, consumer behaviour, consumer trends and needs). An academic said that the R and D programmes should also be designed in coordination with the cooperative society members, academics from a range of research areas, and farmers. In addition, the government should allocate and establish funds for research into organic farming as part of agricultural research programmes through the public sector, private sector and NGO sources. Accordingly, the plan identifies those areas where research is most needed (see academic level below).

7.6.2. Field level

In addition to the government level there is a need to work at field level to promote and administer the adoption of organic farming in Jordan. To achieve this, the workshop participants suggested that the field level should be administered through a society to be called the Jordanian Organic Farming Cooperative Society supported by the government (see above) to ensure the sustainability of the organic farming movement in Jordan. They concluded that there is a need for such a society as a national association which should function effectively in promoting organic farming in Jordan and should serve as a catalyst for effective collaboration between organic farming stakeholders, government, and other relevant bodies. Based on the discussion with the workshop's participants, the plan suggests that the field level through the society should have the following responsibilities.

Organic farming demonstration site

The perceived attributes of organic farming above show that adoption of organic farming would not be easy for farmers because they perceive that organic farming is a complex system, is not compatible with their experience and needs to be tried and observed. Also, all the workshop participants recommended that there is a need to show farmers how to practise organic farming using appropriate communication channels. All participants agreed that starting with a pilot demonstration site would be the step towards organic farming. An important issue raised by the head of the JBRDC local community development division was that 'the site should be owned by the cooperative society but funds from the MoA and MoP should be available and could be located in the study area by renting a farm or making a contract with a farmer interested in organic farming'. He said that, 'from our experience in working with the local communities in establishing projects, it would be better if the project is owned by a cooperative society which gives more responsibility and commitment for the society members to ensure the sustainability of the project'. This suggestion was agreed by all the workshop participants.

The site is intended to be the first step in implementing organic farming in Jordan, introducing its concept and its regulation, testing its profitability, showing farmers organic farming practices, and building on farmers' experience. The site should be designed to integrate crops and livestock considering the issues discussed in Chapter 6 Section 6.2.3. Moreover, participants suggested the establishment of a network of organic farms as a communication channel by linking the site with a number of farms in the study area to be called *local benchmarking farms*. This would increase the trialability and observibility of organic farming practices and inform farmers about organic farming. In this method, farmers could learn and share knowledge from the demonstration site, and farmers who cannot go to the site can learn from the *benchmarking farms*. The site and the *benchmarking farms* will work as reliable extension sources in organic farming through open days, workshops, and by producing leaflets and newsletters.

The importance of a demonstration site for farmers in Jordan is illustrated by the experience of a DFID Livestock Project set up in 1998 to establish two livestock demonstration sites aimed at training farmers on feeding, vaccinating, lambing and fattening. Many people including public extension agents were against these sites and emphasised that the sites would not work. However, the sites changed the farmers' behaviour and encouraged them to adopt new techniques developed by the DFID team because farmers believe what they see on the ground, or what they can touch, more than what they are told. It was the first time for farmers to vaccinate their sheep during pregnancy or to use early weaning. It is vital to learn from the DFID extension plan, in which farmers themselves participated in setting up the sites and attended open days and training workshops. A successful strategy that DFID used was setting up the sites where farmers live and having access to the sites 24 hours a day, 7 days a week. The sites were managed by two flock masters and supervised by the DFID team (JBRDC 2002).

This action plan emphasises that in addition to the establishment of the site the private sector should be involved in organic farming at the early stages and should be involved in the development of the demonstration site. However, it is believed that applying organic farming in the study area means that private agricultural supply companies will lose part of their sales. Therefore, it is recommended that the companies should be brought into scheme by providing extension services, paid for by the government from the extension budget, and should be encouraged to introduce new organic farming inputs into their sales outlets such as compost and natural pesticides. Table 7.3 shows some suggested topics that farmers could learn from the demonstration site.

Table 7.3: Organic farming procedures and practices for conversion

Technical	Administration
Soil fertility management	Certification and inspection
Compost production, crop rotation	Recording and filling forms
Water management	Labelling and packaging
Pest and disease control	Marketing
Crops-livestock integration	

An organic farming website

The research found that various organisations (Soil Association, IFOAM, HDRA, FAO and USDA) developed websites to introduce the concept of organic farming to a large number of people. Therefore, at an early stage of this research it was decided to develop a website in Arabic to introduce the concept of organic farming, the regulations, markets, opportunities, and barriers, not only to Jordanians but also to other people who speak Arabic (universities, schools, hospitals, farmers and interested groups) and who have access to the internet. The website has been designed and has the URL www.organic.org.jo (Figure 7.2). The website information was provided by the researcher to a private company who designed it. In Jordan, most educational institutions, government organisations and private sector businesses have access to the internet. Therefore, the organic farming website aims to raise awareness and to introduce the concept of organic farming to these organisations. The website gives a general idea about organic farming, training workshops, a list of farmers who are interested in organic farming and links to organic farming sites, and also aims to provide extension agents with new information on organic farming and to present the results of this research. It can also be used by academics as a teaching tool for students. It is important to report that part of the site cost was a donation from a farmer (US $ 500). However, the researcher has found it difficult to update the site because it is under National Centre Domain. As a result, the researcher intends to bring the site under the JBRDC management and for it to be owned in the future by the cooperative society, which will enable the society to have access to the site to update and improve it, and it can be used for other purposes such as marketing. An important issue about this website was that all participants agreed that the website that has been designed is good but would be better if it could be more informative. This will be done after finishing this research and when further information is available.

Figure 7.2: The organic farming website

Suitable marketing approach

The perceived attributes of organic farming discussed above show that organic farming in Jordan has low relative advantage due to economic and marketing concerns. Moreover, the workshop participants emphasised that if there is no market, there will be no organic farming in Jordan. The emphasis is also concluded from the current status of vegetable markets in which the regular marketing channels are not helpful for marketing organic products (Table 7.4), and from the experience of the failed Aman/IPM project discussed in Chapter 3 (Section 3.8) and Chapter 6

(Section 6.2.5). The Aman/IPM marketing experience was not successful because products were sold in one market where the main customers were retail traders, who did not like to try new products that had not been bought by consumers before.

Table 7.4: Marketing channels: issues for marketing organic products

Market channel	Constraints
Central market	Organic produce is new to the market. The central market needs large amounts, has high costs, a lack of consumers, short period of selling, and it is a risk for retailers to try new products. Transport costs. Learn from Aman company experience
Export market	Needs large amounts which are not available, needs different crop varieties. Lack of regulations, and exporters are not ready to risk
Farm gate	Lack of regulation to control the distributors, who aim to sell on the same day and to make high profit, not ready to take risk

Therefore, for organic farming to be adopted in Jordan there should be a suitable marketing approach in which farmers can distribute their products with less difficulties. For this approach, it is recommended that the most important point regarding organic marketing is to avoid the Aman company experience (high running costs, expensive products and inaccessibility to consumers), and avoid the central market. Workshop participants suggested that the cooperative society, with help from the government, should plan for marketing in parallel with production, and it is advised not to delay marketing to the last stage. Consequently, the plan suggests using a true partnership marketing policy in which organic farmers should be involved in marketing, and policy should aim to raise awareness about organic farming, its concept and food value (mentioned above).

The workshop participants also suggested that the marketing policy should aim for most of the organic products to be sold by establishing an organic marketing company owned by the society, which requires support from the government for this company. And it was also suggested by Habaebieh (2005) at this stage to start with the Codex Guidelines for developing organic markets because they give guidance to governments in developing national regulations for organic food. An important issue raised by the majority of the participants, to be considered by the company, is to establish a simple marketing formula built on a marketing network approach using personal communication to display products and information in shops, and to contact supermarkets, universities, schools and hospitals. It was also suggested that the society use the box scheme system to market its organic products. The box scheme is an important organic trade system as the starting point of organic producer associations world in which producers organise a planned home delivery of boxes containing assorted organic vegetables, fruit and eggs brought in by other farmers (Lernoud 2006). This scheme has been implemented in many developed (UK, USA) and developing countries (Uruguay, Brazil, Egypt, Lebanon and Argentina) (Lernoud 2006).

Accordingly, the plan suggests using this marketing system as the starting point for Jordan's organic produce rather than producing large amounts and subsequently aiming for the expansion of the market. It was suggested also that the boxes should have a simple design since some designs in Jordan make consumers think that the product is expensive and this discourages consumers from buying organic food. Other examples prove that this approach is the realistic marketing approach in order to market special local agricultural products in Jordan. Examples include local products such as oil, wheat, white cheese and honey, in which a social marketing network approach has been established between producers and consumers. In this approach, producers sell products at their farm gates, deliver to consumers' houses, and use personal communications with shops and supermarkets. After many years of trust, consumers now contact the producers of these products to reserve certain amounts even before the production stage. Moreover, the plan suggests changing consumers' behaviour through an awareness campaign (Awareness and public education above) where health is more important than the price, and using several marketing promotion and advertising means, as shown in Table 7.5.

Table 7.5: Promotion and advertising means to support organic marketing

Paid display advertising	Radio and TV- Mobile phones
Posters in shops	Business cards
Agrichemicals shops	Schools, universities, mosques
Bakeries	Mobile phones and TV

An important issue recommended in the workshop was to have a labelling system to help consumers to recognise organic products and to protect both consumers and producers from 'pseudo-organic' products. Therefore it was suggested that in the marketing policy Jordan should have one logo for organic farming products supported by government efforts and advertised in various places where it can be recognised by consumers: supermarkets and shops, media, MoA directorates, schools and private agricultural stores.

7.6.3. Academic and educational level

Organic farming education has become an interest for several academic institutions in many developed and developing countries. However, the research shows that in Jordan organic farming was not on the academic agenda of Jordan's Universities where all research is on conventional farming and some on IPM. On the other hand, the research shows that organic farming is complex and has several barriers which make its adoption difficult. Therefore, many workshop participants suggested that academics should be involved in the organic movement in Jordan since they can play an important role through research and by increasing awareness about organic farming. They also suggested that this should include academics from Jordan's agricultural, social and business faculties as they have experience in some aspects related to organic farming. It was also recommended in the workshop that Jordanian Universities should conduct research and teach organic farming modules for both undergraduates and postgraduates, and benefit from other countries that have developed such an approach.

Three academics attended the workshop and agreed with the suggestions made by the participants, and decided to write to their universities requesting the inclusion of organic farming modules in their curriculum. Another important issue recommended by the majority of the participants was that academics should apply integrated, both social and biological, approaches and should coordinate their research with producers and farmers.

As for research, academics should aim to conduct research to solve technical and economic problems facing organic farming. The plan suggests establishing a focal point of researchers, including academics (technical and social), farmers, consumers, private sector and government and policy makers. It can also focus on the links between research, decision makers, and the development of policy from research outcomes. The plan suggests having an academic team representing all of those academics and establishing a Professorship in organic farming to encourage academics to conduct research in organic farming, and developing Masters degrees in organic farming as in the UK, Germany, and the Netherlands, Latin America, the USA (Lampkin and Padel 1994, Haumann 2005**,** Lernoud 2005) and Tunisia (Belkhaireiah 2004). Education should also be included in primary and secondary schools in Jordan to address the concept of organic farming at the early stages of education.

Therefore, the plan suggests that academics should conduct research in several areas as discussed in the government level (R and D) using funds allocated from the government and use the demonstration site and the benchmark farms to conduct the research. This would increase observability and decrease complexity of organic farming by showing farmers how organic farming can be practised. The plan suggests the following list (Table 7.6) which is derived from the empirical results of this research, the workshop suggestions and recommendations, and from the literature review.

Table 7.6: Multi-disciplinary research themes on future priorities in organic farming research for Jordan (Lampkin 1994b, IFOAM EU 2004, FAO 2006)

Research theme	Research area
Soil fertility management: creating a healthy soil Poor soil fertility has been identified as a significant barrier to the adoption of organic farming	Rebuilding soil fertility and structure Research on best crop rotation designs using legumes, suitability and adaptability of organic fertilisers and their application in arid lands Compost production under the Jordanian conditions and development of low input and minimum tillage systems Research on water use efficiency in arid lands
Plant protection: alternative control method Important pests and diseases have been identified in this research. This requires to conduct a comprehensive research on these pests and diseases under organic faming condition to find the best ways of control	Research on fungal diseases, particularly the powdery mildew, then prevention including the use of resistant crop varieties Research on control of orobanchae, an important parasitic weed in tomatoes fields Spiders, mites, aphids, thrips, and nematodes are important pests in organic farming systems and require the development of control methods, including mechanical control, traps, live barriers, prevention means, plant resistance, biological control, soil solarisation, and plant breeding without genetic engineering
Socioeconomic The research shows there are several socioeconomic barriers which require research to analyse all factors affecting organic farming production including risk and uncertainty of organic farming and to provide statistical information on organic farming	Research on financial and physical performance of organic farming in Jordan and changes in physical output and land use Consumer behaviour, demand and perception, potential markets (local and external) and actors in dealing with organic food Changes in consumption, patterns, prices, employment and income and social costs Impact of WTO and GATT settlement on organic farming in Jordan
Livestock Research on organic livestock production in Jordan is required owing to lack of information about performance of organic livestock systems under Jordanian environmental conditions	Research on crop-livestock integration Livestock production (housing design, feeding, disease and pest control, alternative veterinary medicine, and integrating breeding, and selection) Improving husbandry systems which respects animal welfare
Extension Research to find appropriate extension services and information involving farmers and the PAS	Reliable extension resources, extension tools and delivery systems such as using demonstration sites
Environment Environmental impact assessment	Investigate organic and low input farming effect on biodiversity, nutrient losses and recycling, Climate change, salinity, soil erosion, soil contamination and groundwater pollution
Health and Food Security Healthy food	Research on health organic products

7.6.4. International and regional level

In Jordan there is a lack of experience and information about organic farming and Jordan is still in the promotion stage of organic farming. Also, organic farming is perceived as a complex issue and it is predicted that its adoption rate would be slow. For this reason all the workshop participants recommended that Jordan should cooperate with international and regional bodies that have experience in organic farming and can help Jordan to develop its organic farming sector. Therefore, the plan highlights the importance of Jordan cooperating at international and regional levels to promote and ease the adoption of organic farming. This will help Jordan to develop its organic farming standards and regulations and to provide technical information required for conversion to organic farming. The plan suggests that Jordan should benefit from international agencies' experience, including NGOs and regional organisations such as Sekem. The suggestion came also because international and regional organisations have certain advantages, as presented in Table 7.7.

Table 7.7: Advantages of collaboration with international and regional organisations

Advantage	Author
Support developing governments in creating environments for organic farming Build capacity among farmers Providing infrastructure and finance farmer organisations in carrying out some organic farming tasks Provide supporting mechanisms for the regional integration of organic-agriculture efforts such as the sharing of research results Provide farmer training and establishment of uniform regional standards	IFAD (2001)
Provide support for organic farming approaches as they recognise the potential of organic farming as a central plank in developing sustainable livelihoods for the rural poor	Parrott and Kalibwani (2005)

There are several examples showing that these agencies support organic farming and provide financial aid to develop organic farming, especially in countries where national regulations and standards have not developed yet. For example, in Latin America international agencies from Germany, the Netherlands and Switzerland provided funds for extension and building associations (Yussefi 2005).

In Jordan there are already several international agencies (USDA, DFID, ECD, GTZ and others) supporting the agricultural sector, but the plan suggests starting collaboration on a Government level at this stage with agencies that are relevant to organic farming. This includes continuing collaboration with agencies working in Jordan, but establishing collaboration with three organisations, namely IFOAM, Codex Alimentarious and Sekem. The collaboration should focus on developing Jordan's organic farming legislation and regulations, which include organic farming definition, standards, certification and inspection systems. An important issue to be mentioned here is that the participants emphasised this cooperation, but most were not aware about the organisations that can help Jordan in this matter. Habaibieh (2005) a JISM representative was the only participant who suggested cooperating with Codex Alimentarious and she explained to participants why this would be helpful (below). The participants asked the researcher what other organisations can be nominated that the researcher found during the course of this research. In addition to the Codex Alimentarious, IFOAM and Sekem were suggested for the reasons explained below.

IFOAM

Jordan does not have a body as a member of IFOAM, the international umbrella of organic farming, therefore the plan suggests that one or more Jordanian organisations should become members. This is because IFOAM can provide help for countries wishing to adopt organic farming (Chapter 2 Section 2.8.1), and has assisted several countries, including in the developed world, to develop their organic farming action plans (Taher 2004). In Europe, the IFOAM European Union group assisted the action plans under the European Union's research programmes (Willer 2005).

The plan emphasises that Jordan can also benefit from the IFOAM Basic Standards (IBS) (Chapter 2 Section 2.8.1) in the development and adoption of organic practices, as they provide a framework for certification bodies and standard-setting. The plan also recommends that Jordan should work in close cooperation and consultation with IFOAM to design Jordan's certification and inspection system, to ensure the credibility of Jordanian organically-certified products and build consumer trust. IFOAM can also help to find the best training and inspection agencies that suit Jordan. Another benefit is the opportunity to attend IFOAM conferences and events which will help to provide more information and exchange experience. According to IFOAM, Jordan's producers or any other producers are expected to work within, and be certified by, certification bodies using standards that meet or exceed the requirements of the IBS (Kilcher, Huber, and Schmid 2005). Although IFOAM accreditation would be a good option for Jordan, it is argued by Rundgren (2006) that IFOAM accreditation has three main problems:

- The requirements as such are high, and many certifiers will not comply
- Because of the desire to get IFOAM accreditation accepted by governments, there is a tendency to incorporate all governmental requirements into the programme
- Finally, at the moment there is no guarantee that IFOAM accreditation will give recognition in export markets, even though it is clear that it is helpful

(Rundgren 2006)

However, the plan considers these challenges as the best way to establish a sustainable accredited farming system. Accordingly, it is expected that Jordan's producers would face some difficulties but will end with good results that enable them to enter the premium markets.

Codex Alimentarius

The Codex Alimentarius (CA) and its guidelines could help to develop Jordan's organic farming. The guidelines of the CAC presented in Chapter 2 (Section 2.8.2) are helpful to governments wishing to adopt organic farming, develop national organic food regulations and build consumer trust, especially for developing countries and countries in transition (Kahouly 2004, Kilcher, Huber, and Schmid 2006). Another important point is that the guidelines are in line with IFOAM and the EU Reg. 2092/91 and 1804/99 (Kahouly 2004, Kilcher, Huber, Schmid 2005). Accordingly, there are two important ways for Jordan to benefit from the CA guidelines: the CA requirements are in line with IFOAM IBS and the EU Reg. 2092/91 and 1804/99 (Kilcher, Huber, Schmid 2005); secondly Jordan is a member of the CA and already applying its guidelines for importing or exporting products (Habaebieh 2005). Also according to Habaebieh (2005) it would be an important step for Jordan to apply the CA organic farming guidelines as Jordan has no regulations on organic farming. However, this does not mean that Jordan should depend only on the CA; rather Jordan should work with all organisations that could help to develop its organic farming standards. Jordan must make sure that its regulations meet the EU Regulation 2092/91, as well as the private standards applied by producer organisations, especially based on the IBS. In the current situation Jordan is advised to develop its standards to be able to export organic produce to the EU via import permits (Art. 11, paragraph 6) (more details Chapter 2 Section 2.8.4).

Sekem-Egypt: regional assistance

According to the plan it is important that Jordan should learn and benefit from regional experiences under similar conditions. The research found that a regional organic farming experience can be obtained from Sekem. The researcher visit to Egypt showed that Sekem's experience will provide many lessons for Jordan, such as overcoming technical barriers to the adoption of organic farming, identification of domestic and regional markets, and certification procedures. The justification for choosing Sekem as a regional assistance agency is because it started in 1977 in a desert area similar to the environmental conditions of Jordan. Thus, Jordan can benefit from Sekem through establishing a collaboration agreement between Jordan and Sekem. The plan suggests that this agreement should be between the organic farming society and Sekem. The role of the government has been discussed above, and should be facilitation, financial assistance and monitoring of the process. It is important to give farmers the responsibility to be part of the agreement and the society members should combine efforts to develop organic farming initiatives in Jordan, as the Sekem founders did. The plan emphasises that including Sekem in Jordanian organic farming can also provide various assistance, as follows:

Technical and administrative help

The interviews in 2004 with the Director of Sekem-Egypt and his colleagues showed that they were happy to work with people from Jordan to help in developing Jordan's organic farming. However, the Director recommends studying the Sekem plan first, and then transferring what is appropriate and necessary for Jordan. Therefore, the action plan strongly recommends that Sekem can help Jordan in technical aspects of production (compost production, crop rotation design, soil fertility analysis and management, seed production and animal care), administration (certification, inspection, packaging, labelling and transporting) and marketing (to help Jordan to develop its organic market and to open new markets that Sekem is already linked to). It is also important to work with Sekem to develop new linkages between producer groups, packers, exporters and importers.

Entry into EU and other markets

The visit to Sekem showed that some of its products are for export, and mainly to EU markets. However, regulations and procedures are very complicated in terms of entry into these markets especially for new producers. Products must be certified by authorised bodies to enter the EU markets, which is regarded as a significant barrier for producers from developing countries (Barrett *et al.* 2001). Therefore, it is recommended by Barrett *et al.* (2001) that producer groups in developing countries work in partnership with a trustworthy exporter and that this will provide the best opportunity for entry into EU markets. This can be achieved through Sekem as it is considered a trustworthy exporter to EU markets. Jordan can also benefit from the domestic marketing experience that Sekem has developed (Geier 2005).

Facilitate the certification and inspection process

Sekem-Egypt has developed a substantial export and domestic market for a range of products including herb teas, fruit and vegetables and organic cotton in which most of its certified products are exported (Abd-El Moity 2004). One of the advantages of working with Sekem is that in Egypt two important regulations are adopted by control bodies, namely the EU Reg. 2092/91 and the American National Organic Program (NOP). Also the two national certification bodies, Egyptian Centre for Organic Agriculture (ECOA) and the Centre of Organic Agriculture in Egypt (COAE) are members of IFOAM and accredited by a European accreditation body. Moreover, there are three foreign certification bodies represented in Egypt, IMC, QCI, BCS, and two companies working at a distance, the Soil Association and Bioagricoop (Taher 2004). These factors make Sekem a helpful body to facilitate certification and inspection processes and reduce the costs in Jordan. It is therefore recommended by the plan that the organic farming society of Jordan should work in partnership with Sekem. If the society is certified through Sekem then the products can meet with a much greater expectation of success than if the society works alone. The director of Sekem reported:

> We are ready at Sekem-Egypt to work with farmers from Jordan. We are ready to make contracts with them as we do in Egypt. In this contract, we provide technical and administrative advice. We can have Sekem-Egypt in Jordan as Sekem-Jordan
>
> (Sekem's Director 2004)

7.7. The plan implementation

The plan implementation is to be undertaken under the guidance of the Ministry of Agriculture, a stakeholders' partnership, and will be supported by other relevant government organisations. Coordination with other organic agencies in Jordan is necessary, and account will need to be taken of developments in plan reform and plan evaluation.

Progression to the international level requires the establishment of an advisory (ad-hoc) committee on organic farming, which was also recommended by participants. The plan suggests that the members of this committee should be producers, MoA officials, consumer interest groups, and also that it should include people from IFOAM, CAC and Sekem. To achieve this, the MoA should provide financial aid for this committee to cover travelling expenses and other costs. The committee should aim to develop Jordan's organic farming standards to meet the proposed certification and inspection system.

An important issue is that the possibility of rejection of adoption of organic farming is part of this plan, since not all farmers will have potential and some of them may reject the plan or work against it. In this case the government should explain to farmers this plan is not compulsory, but the government should explain the advantages and disadvantages of this plan. Finally, this plan is an outcome of joint efforts between many people who worked together over three years aiming to achieve a sustainable organic farming system in Jordan. The plan, in addition to being an outcome of this research, will be submitted by the end of 2007 to the Minister of Agriculture for acceptance as the final draft.

7.8. Summary

This chapter proposed a sustainable organic farming adoption plan for Jordan called the Jordanian organic farming action plan. The development of this plan was based on empirical results from stage one, outcomes of the workshop and underpinned by the five perceived attributes of innovation of the diffusion theory. The chapter showed that the proposed plan is divided into four levels, government, field, academic and regional and international, and explained the role of each level and its relationship with other levels. Finally, the chapter shows that the success of this plan does not depend only on the Ministry of Agriculture but also on stakeholders' involvement as a partnership, and on other relevant government and international organisations. Moreover, coordination with other organic agencies both in Jordan and elsewhere is necessary to ensure the sustainability of this plan.

CHAPTER EIGHT: DISCUSSION AND CONCLUSIONS

CHAPTER EIGHT

Discussion, Conclusions and Recommendations

8.1. Introduction

This chapter aims to summarise and evaluate the research's overall aim and its objectives and to discuss the research findings. The chapter also reviews the action plan in the context of the literature, the findings and suggestion from participants in this study, and the theoretical approach adopted. Recommendations and policy implication for the implementation of the plan are also assessed. The chapter discuses the methodology used, limitations experienced during the course of this research, and also suggests some recommendations for further studies regarding organic farming. The chapter is structured into six parts: introduction, summary and discussion, conclusions and recommendations, the research methodology, research limitations, and suggestions for future work.

8.2. Summary and discussion

The overall aim of this research was to evaluate the opportunities and potential for organic farming in Jordan's arid lands in order to develop an action plan for the adoption of organic farming. This was to be based on local farmer participation, using farmers' local knowledge and their own initiative, as well as institutional participation combined with a theoretical approach. This aim has been achieved and a generic plan was developed for the adoption of organic farming for Jordan (Chapter 7). To achieve this aim, seven supporting objectives were identified in Chapter 1 Section 1.3, and have been achieved as follows:

The first objective was met by examining and assessing the development and trends of organic farming including the international and national means, practices and information requirements for the establishment of certified organic farming systems. A comprehensive discussion of organic farming background, history, development, concept, principles, environmental impact, barriers, regulations and potential was presented in Chapter 2. It is concluded from this chapter that organic farming is an old farming system and the ideas behind it have been around since the 1920s and it is now practised in about 120 countries of the world, including those that have arid areas. Moreover, organic farming has increased rapidly in terms of land area and number of farms, covering a cultivated area of ca. 31 million ha representing more than 633891 farms. Also its food and drinks market has had a notable growth and is increasing rapidly in both developed and developing countries. The suggestion is that this growth is due to the increase in consumers' awareness, the change in consumer preferences towards more healthy and environmentally friendly products from sustainable production systems, relative demand and prices, and consumers' desire to buy high quality and ethical products, in both developed and developing countries.

Importantly, organic farming has a positive impact on the environment, which makes organic farming a sustainable farming system that safeguards the environment and feeds humans at the same time. This is because organic farming aims to stop degradation and to re-establish natural balance, and preserves the environment through the minimisation of chemical use and maximisation of natural inputs, enhances the ecosystem's health including soil biological activity and soil fertility, minimises pollution of the environment, and involves a wider consideration of agricultural system social impacts. Organic farming differs from other farming systems, not only because of its environmental impact and production methods, but also because it is defined and practised according to specific regulations. Organic farming also is based on a number of principles which meet health regulations, work in harmony with the environment, build biological diversity and foster healthy soil and growing conditions. But its adoption is not easy; therefore farmers and producers have to overcome several barriers [financial, technical or legal] before they can adopt organic farming.

The second objective was to investigate key issues relating to the Jordanian agricultural sector, and the situation of organic farming and its implementation in the framework of the Jordanian agricultural policy (Chapter 3). It was found that there has been no official government policy designed to support organic farming, although the current Jordanian Agricultural Policy (JAP) aims to establish a sustainable farming system which has several objectives that comply with the principles of organic farming as explained in Chapter 3. Achieving this objective has led to the fact that farming in Jordan is not organic or low external input, but rather is conventional and directed to high external inputs. However, the contribution of this sector to the GDP is small (3.8%) and continues to decline, but it still has a relatively important impact on the national economy by providing a livelihood for about 20% of the population. Another vital issue is that the sustainability of this sector is at risk; therefore, Chapter 3 (Section 3.9) proposed organic farming as a sustainable and ecological farming system to maintain the Jordanian agricultural sector.

Moreover, proposing organic farming for Jordan complies with the aims of the current Jordanian Agricultural Policy (JAP) to establish sustainable farming systems, and with other studies such as Hasbani (2004) and Sharma (2005) who recommended that adoption of organic farming would have relative advantage for arid lands. It is concluded that there are also other reasons to make adoption of organic farming in Jordan necessary such as: the government's new regulations to control the amount of water allocated for agricultural purposes, environmental concerns, health concerns, global organic market trends, the interest of the MoA in organic farming which led the MoA in 2002 to establish an organic farming unit (OFU) and the objectives of the Jordanian National Strategy for Agricultural Development (NSAD) which complies with the principles of organic farming. Also, organic farming, with its principles and global market, can benefit farmers in Jordan and in the meantime can help to conserve natural resources, which is the main goal of the Jordanian Government. It is worth mentioning that achieving this objective was not easy due to lack, and contradiction of, information about the agricultural sector, especially statistical information, which complies with Al-Adamat (2002). It was found that there were few reports about the agricultural sector and a few studies covering general topics, but not specific research studies.

The third objective of this research was to investigate the current farming practices used by farmers, including pest control and soil fertility management methods, and the knowledge of farmers regarding non-chemical and organic farming practices. This objective was achieved through using a number of research methods explained in Chapter 4, which included fieldwork to conduct interviews with several key informants as shown in Table 4.1. This stage involved collection of a data set which gave a clear idea about farming in Jordan (the study area). The findings presented in Chapter 5 show that the farming system has created permanent and temporary jobs and any impact on this sector will have a significant impact on these jobs, and therefore, the introduction of organic farming should carefully take into account the impact of organic farming on these jobs. This is because introducing new systems or decisions in Jordan without considering their impact could lead to undesirable results as experienced when the Government of Jordan in 1996 removed feed subsidies, which resulted in many poor families selling part of their flocks to feed their remaining animals, and resulting in less livestock jobs (Al-Sharafat 2001). Results showed also that at present there is neither a certified nor non-certified organic farming system, but conventional farming depending on the use of external chemical inputs (pesticides and fertilisers). The findings comply with a study by al-Hussein (2000) and Al-Adamat (2002) who showed that farmers in the arid lands in Jordan depend on using chemicals for farming. In the meantime, the current farming system has a number of constraints such as potential pests and diseases, unavailable alternative methods to control pests or to improve soil fertility, insufficient amounts of organic fertilisers and decline in soil fertility and increase in pest infestation, as well as marketing.

Constraints include also that the livestock numbers are not enough to produce the required amount of manure for farming in the study area. Moreover, there was a lack of extension and advisory services provided by MoA and farmers preferred to use private and farmer extension resources, and this result complies with Al-Adamat (2002) and Abu-A'moud (2003). This can be explained by the fact that the private extension sector has better infrastructure, transport and communication means to reach farmers, while the public extension does not. The lack of extension services and involvement of the MoA had led the private sector to be the main player for providing farmers with information and advice, associated with selling its agrichemical products. This has led farmers to be oriented to use synthetic inputs and practise conventional farming. However, the research revealed that various non-chemical and organic farming methods were used by farmers (refer to Table 5.9) for both pest control and enhanced soil fertility, but results showed that there was a lack of knowledge among farmers about the use of these methods. A related issue is that the current farming system has led not only to social problems such as losing farms' ownership but also to environmental impacts on soil, water and livestock. The findings in Chapter 5 conclude that there is a need to convert to a sustainable farming system, and these findings support a recommendation by Al-Adamat (2002) that the government of Jordan should encourage farmers to adopt sustainable systems. However, before thinking of conversion to such a system as 'organic farming' it was important to talk to farmers and other stakeholders to find barriers to, and potential for, organic farming and this was achieved through the fourth objective of this research.

The fourth objective was to analyse and assess the perception and attitudes of farmers and other stakeholders to organic farming and their interest to convert to organic farming systems. This objective was achieved through using questionnaires and interviewing of farmers, stakeholders, policy makers, key players and other interest groups as explained in Chapter 4 (Table 4.1). The findings of this objective, presented in Chapter 6, conclude that the perception of 'organic farming' is not clear to the majority of people in Jordan including farmers and some of the MoA officials. Therefore, respondents' perception was identified as a significant barrier to the adoption of organic farming. Identifying 'respondents' perception' in this research as a significant barrier to the adoption of organic farming complies with Padel and Lampkin (1994). Accordingly, if organic farming is to grow in Jordan, the first important step is that the concept of organic farming must be made clear, and clear information on what organic farming is, should be provided to Jordanians [farmers, extension agents, consumers, processors, retailers and any other interested groups]. To do so, the organic farming action plan developed in this research recommends that the Jordanian Government should establish a wide campaign at national level to increase the Jordanians' awareness and recognition of organic products, including recognition of its regulation. According to the plan, this campaign should focus on the concept of organic farming, the principles of organic farming, health issues, environmental impact and the safety of organic produce. The campaign should also aim to broaden information about organic farming through public organisations such as hospitals, universities, schools, the military, nutritionists, and also should use communication channels (media: TV, newspapers, and radio) for promotional programmes and factual information for consumers, as well as mobile phones, demonstration sites and websites.

The fifth objective was to identify and assess the potential barriers to organic farming in Jordan's arid lands. These barriers were investigated through using a number of methods (questionnaires, discussion groups, interviews) presented in Chapter 4 (Table 4.1). Chapter 6 has shown that there were ten technical barriers to organic farming reported as most important by respondents. These were items related to pest and disease infestations, yield reductions, decrease in plant growth size, soil fertility, limited alternative options available compared to conventional farming (resistant varieties, biological control and organic fertilisers), knowledge of farmers and the weather conditions (refer to Table 6.2). The research shows that six of these barriers (higher diseases and pest infestation, yield reductions (quantity and quality), decrease in plant growth, soil fertility is poor, risk of trying, and varieties are not suitable) comply with the literature review (*i.e.* Rigby, Young, and Burton 2000, Schneeberger, Darnhofer, and Eder 2002, Niemeyer and Lombard 2003), while the other four barriers (biological control is not available, long production periods, ignorance for the farmers' experience (knowledge), and weather fluctuations) were reported for the first time. Barriers also included economic, marketing, regulations and institutional barriers which comply with literature review (*i.e.* Rigby, Young, and Burton 2000, Schneeberger, Darnhofer, and Eder 2002, Habani 2004), but it was found that farmers have no labour, social or cultural barriers. In organic farming, availability of labour and increased workload is a common problem, particularly in industrial countries, but this is not a problem in Jordan because labour is available and is inexpensive, and this complies with Niemeyer and Lombard (2003) who showed labour is identified as a constraint in developed countries but may not be in developing countries as seen in South Africa. However, the research shows that farmers, in general, have an interest in converting to organic farming. If there is a serious plan by the government to resolve barriers reported in this research, many farmers would convert to organic farming.

The research emphasises two important points with respect to the perceived barriers that have been identified by respondents. The first is that these barriers should not be considered as prohibitive factors for Jordan not adopting organic farming. This is because experience in countries such as Tunisia, Morocco and Egypt, having similar conditions, showed that farmers have succeeded in overcoming such barriers. There is no doubt that the technical barriers can challenge farmers in Jordan at the beginning of the adoption of organic farming, but it is concluded from the visit to Sekem-Egypt and other observations, that farmers in Jordan can overcome these barriers.

The second point is that these barriers were perceived by conventional farmers who have not seriously experienced organic farming before and who do not have enough knowledge about the actual situation of organic farming with respect to production methods, crops performance, pest management, and market opportunities and constraints. This suggests that some of the barriers identified in this research may not arise, while other barriers which have not been reported (social, cultural, new technical problems) may arise when the Jordanian farmers actually go through the organic farming conversion/adoption process. It is the economic, marketing and institutional barriers that challenge farmers more in adoption of organic farming in Jordan. Therefore, the research recommends that implementing the organic farming action plan presented in Chapter 7 would ease the adoption of organic farming in Jordan, and it is expected that most barriers can be overcome.

The sixth objective was to evaluate the opportunities for organic crop farming in Jordan's arid lands. This was achieved through discussing the opportunities for organic farming with 46 farmers and 5 PAS groups. Findings showed that despite the significant barriers to organic farming mentioned above, organic farming has potential and opportunities in Jordan. Respondents reported a number of factors favourable to organic production in Jordan owing to its extensive area, uncultivated areas, labour availability, good water quality, potential farmers and international agreements (refer to Table 6.9). The findings comply with Kenny (2004) and Sharma (2005) who showed that arid lands have potential for organic farming production.

The final objective of the research was to develop and propose an action plan for the adoption of organic farming for Jordan utilising the diffusion of innovation theory. The plan development was based on the empirical results of stage one (questionnaire, interviews and the discussion groups) and stage two (the workshop outcomes), and utilising the diffusion of innovation theory-the five perceived attributes of innovations: relative advantage, complexity, trialability, compatibility and observability. The analysis of the five perceived attributes of innovations showed that organic farming is perceived as a complex issue, has low relative advantage, is not compatible with current experience of farmers, and it needs to be trialled and observed before adoption; and the overall conclusion is that the adoption rate of organic farming would be slow. This complies with the diffusion of innovation theory (Rogers 2003) which considers that for an innovation to be adopted, it should have distinct advantages which are often expressed in terms of economic profitability, social prestige; have higher compatibility which means higher adoption rate; is not complex; trialable-divisible; and observable, otherwise its adoption rate would be low. Therefore, the research developed 'the Jordanian Organic Farming Action Plan' to help the government of Jordan to promote and ease the adoption of organic farming in Jordan. The action plan has been developed on an integrated and participatory approach as is explained in Chapter 7. Suggestions and recommendations that the plan contains rely on information collected from different stakeholders [farmers, government officials, the private sector, NGOs and academics] who involved themselves closely in its development through their responses during the first stage of the research and through the national workshop. The plan sets out a series of practical policy measures which the Jordanian Government, or any other government, and the stakeholders will take to encourage a sustainable organic farming sector. It is important to bear in mind that developing the plan will not be enough to adopt organic farming, but its adoption by the MoA is the first step for sustainable adoption of organic farming in Jordan.

8.3. Conclusions and recommendations

Overall, this research concludes that organic farming has increased rapidly in terms of land area, number of farms and market size. The research concludes that there is a potential for organic farming in arid lands, as in humid lands. This is suggested through the visit to Sekem-Egypt, which showed that Sekem has succeeded in adopting organic farming in arid lands and Sekem can be considered as a typical model of organic farming in arid lands. Looking at Sekem's model (refer to Chapter 6 Section 6.2.3), it can be said that organic farming in arid lands is characterised by integrating crop-livestock, rearing a variety of livestock, growing forage and producing compost. Sekem's model shows that soil fertility is a very important issue in organic farming in arid lands, therefore Sekem has established its compost production unit and a laboratory to do chemical analysis for soil and compost to determine the crop's nutrient requirement. The other important issue is that pests and disease infestation are a challenge for farmers in arid lands, in particular those that favour dry weather such as powdery mildew and red spider mites. However, the research shows there is a need to do more research to describe the specific features of organic farming in arid lands (see below suggestions for future work).

The research also concludes despite the rapid growth of organic farming, its adoption is not easy and it has several barriers before it can be adopted. Therefore, countries wishing to establish organic farming systems including Jordan should consider several important factors. One of the factors is to conduct a comprehensive study to identify potential and opportunities for, and barriers to, organic farming, using all possible research methods to examine whether or not organic farming would be a suitable farming system for farmers. Such a study should involve all stakeholders and most importantly should identify those most likely to adopt organic farming (innovators), and identify stakeholders, organisations and institutions to be involved in the organic farming movement. Following this, it is important to develop a practical action plan for the adoption of organic farming. The action plan should aim to show farmers that organic faming can work in their fields (trialability, compatibility and observability), it is profitable and there is a market for their organic produce (relative advantage), and what steps they need to convert to organic farming systems (ease complexity), otherwise the adoption rate would be slow. The plan should be built on an integrated methodological approach sustaining the development of organic farming where different stakeholders representing a wide range of interest groups participate in its development using a related theoretical approach such as the diffusion of innovation theory (Chapter 4). In this action plan, it is not only the government who should play a role in the development of the organic farming sector, but also farmers, consumers and the private sector are involved, since they are considered to be the driving force behind organic farming development worldwide.

Another important issue is that the plan should consider that adoption of organic farming requires governments to reform their policies to integrate organic farming within the policies. Policy reform is important not only to support farmers but also because the principles of organic farming explained in Chapter 2 Section 2.5 comply with government policies, including the Jordan Agricultural Policy [JAP] (Chapter 3 Section 3.9), and the principles can also bring environmental, social and economic benefits. It should be also recognised that organic farming itself has the potential and relative advantage to maintain the agricultural sector, which means that policy makers should not only look for potential factors to adopt organic farming, but also should consider that organic farming can provide several benefits that protect and maintain the agricultural sector. Therefore, countries wishing to adopt organic farming are advised to have defined government policy support for establishing their organic farming systems. Such a policy has been adopted by both developed and developing countries, as discussed in Chapter 2 (Section 2.12). It is also important that the defined policies should consider organic farming as a production system, not merely as a technique, as has been the case in Jordan (Chapter 6 Section 6.2.1). Lack or insufficiency of defined policies supporting organic farming can be a significant barrier to establishing organic farming systems, as seen in Jordan. It is also important to learn from both regional and international experience, which have the potential to help countries starting their organic sector.

A defined government support policy for organic farming is required because individual efforts in the organic farming movement are not enough to develop the organic farming sector in a country on a national scale. This can be concluded through comparing two developing countries, Egypt and Tunisia. The researcher's visit to Egypt showed that although organic farming was started in 1977 by Sekem as an individual effort it was still growing very slowly. Egypt as yet has no national legislation simply because there has been no clearly defined government policy support. In contrast, it has been seen in this research that Tunisia became interested in promoting its organic farming sector in the late 1990s and the policy is now established. Tunisia has developed its own standards (EU compatible), certification and inspection systems. Moreover, policy support for organic farming should consider two important issues: a legal framework (definition, standards, and certification and inspection systems) and financial support schemes. The legal framework is to regulate and protect organic farming. The financial support schemes should not only be for subsidising farmers to cover extra costs during the conversion period but also to continue to support training, extension, marketing and infrastructure to ensure the sustainability of organic farming.

It is also concluded from this research that the adoption of organic farming requires changes in public institutions. This is because adoption of organic farming is like any other sustainable system in that it requires not only policy support but also institutional changes to ensure its sustainability. Institutional changes should aim to restructure the agriculture sector and change the role that it plays. For example in Jordan, extension departments should aim to provide more information on organic farming and develop new extension means to promote organic farming. The involvement of the private agricultural sector in organic farming is vital, which could be stimulated by encouraging this sector to provide marketing and other agricultural production inputs, which could act to stimulate private initiatives for organic farming.

An important factor in introducing organic farming to Jordan or any other country is ensuring that it is not considered as an alternative or in opposition to conventional farming or other low-input systems such as IPM or rainfed systems. It should be introduced on a gradual basis which is helpful for a sustainable conversion to organic farming, which could ease the complexity of organic farming and show farmers its trialability and observaility in their farms to increase it adoption rate. This approach helps producers to learn more about organic farming practices and to improve their knowledge and skills in this regard (compatibility). In turn, the generated organic farming knowledge could be forwarded to other parts and farmers of Jordan. It is also important that both the private and public sector should work together to sustain the growth of organic farming and to forge action plans and further measures to support organic farming as well as regulation-related issues.

Introducing organic farming should also aim to offer a fair and long-term support for public goods, foster the development of a stable market and facilitate the growth of the organic sector.

The research, by developing the plan, tried to put the first step for the Jordanian Government and other countries wishing to establish organic farming systems, but the ball is in the governments' court to implement this plan. The research emphasises that whatever potential and opportunities there are for organic farming in a country, governmental policies are crucial to the establishment of sustainable organic farming systems.

8.4. The research methodology

To achieve the overall aim and the objectives of this research, it was appropriate to integrate quantitative and qualitative approaches since they complement each other. Integrating the two approaches was a useful approach to allow data triangulation from interviews, observations, survey, discussion groups, and the outcomes of the workshop as shown in Figure 4.1. Using this approach was valuable and allowed the researcher to use a wide range of techniques, such as observations, questionnaire surveys, discussion groups, and structured and unstructured interviews. But the most important issue of the methodology was that the researcher was able to encourage different farmers and people to participate in this research which helped in achieving the desired results (refer to Table 4.1). A good example was the participation of farmers and other stakeholders including the Minister of Agriculture in a national workshop to come up with suggestions, priorities and recommendations on what can be done to develop an action plan to adopt organic farming in Jordan. In addition, the development of the action plan and the recommendations it contains, were based on the empirical results of stage one (questionnaire, interviews, the PAS discussion groups) and stage two (the workshop outcomes as presented in Chapter 7) and was underpinned by the diffusion of innovation theory-the five perceived attributes of innovations: relative advantage, complexity, trialability, compatability and observability. The research showed that the diffusion of innovation theory was useful to predict the adoption rate of organic farming and the analysis of the five perceived attributes of innovations has helped in the development of the action plan by describing the prediction rate of organic farming. However, the research shows that there is still a need to do more research on the diffusion theory to investigate its application in organic farming research, particularly in the adoption phase. It is also recommended that the participation of the target population in research on an agricultural 'innovation' is vital to achieve valid results that can help in adopting sustainable systems. Moreover, the research methodology helped not only to develop an action plan which gives guidance for countries wishing to adopt organic farming, but also helped to propose the following research method steps for better organic farming adoption for a country.

- Integrate qualitative and quantitative research approaches using literature review, questionnaires, interviews, discussion groups and observations.
- Identify potential and opportunities for organic farming in a country.
- Present the results in a national workshop and seek for suggestions, priorities and recommendations on what can be done to develop an action plan to adopt organic farming in a country.
- Do further analysis of the empirical results and the outcome of the workshop utilizing a suitable theoretical approach (for example in this research the theoretical approach was the diffusion of innovation theory).
- Deliver the plan to the authorised body (i.e. Ministry of Agriculture) for implementation.

8.5. Research limitations

This section presents the main limitations that have been experienced during this study. One of the main limitations faced by the researcher was collecting information and data about the organic farming sector in Jordan, which is still in the infant stage. Another limitation was how to conduct research more or less related to social sciences. This is because the first degree of the researcher was in agricultural sciences (Plant Protection) which was oriented to laboratory experimental research not to social sciences. Therefore, for this research it was required to conduct social as well as agricultural research and design a research methodology to meet the objectives of this research. It was learnt that the library itself was not enough but the most important issue was the diversity of the supervisory team which included scientists and social scientists that helped also to develop the research methodology. Another limitation was that there was no established or accepted methodology to conduct research on organic farming in Jordan, where organic farming is new and farming there is directed to conventional practices. This challenge can be overcome by using a comprehensive research approach that combines qualitative and quantitative approaches. This method is useful for organic farming researchers, which helps in the reduction of inappropriate certainty and helps in data validity (Figure 4.1). Lack of research on organic farming, particularly in developing countries, was a further limitation. It was found that most of the research on organic farming was conducted in developed countries, which is not always suitable for developing countries. Therefore, it was hard to find studies that can be used to inform similar research for Jordan that can achieve the objectives of this research.

Another important problem was the lack of information in Jordan about organic farming. This research is the only research that has been carried out on organic farming, while most of the agricultural research in Jordan is directed to conventional farming.

On the interpersonal side, the difficult economic situation of some farmers had an impact on the researcher. This is because the researcher noted different economic constraints facing those farmers, but providing quick solutions for these constraints was difficult. The help that the researcher was able to give was to report these constraints to the policy makers.

8.6. Suggestions for future work

The research has produced multi-disciplinary research themes on future priorities in organic farming research for Jordan, presented in Table 7.6 and covering various aspects. The research also suggests other areas of future research as follows:

- Water availability has been acknowledged in this research as an important limiting factor to agriculture and adopting organic farming would not solve this factor completely but would be one of the solutions. Therefore, the research recommends that there is a need to evaluate the water use efficiency in an organic farming system under Jordanian environmental conditions. There is also a need in the longer term to determine the crops that can be grown within an organic system in an arid area of Jordan that hold higher water use efficiency, relatively higher economic returns per unit area compared to conventional crops, and the potential to add value through processing and marketing.
- The specific features of an organic farming system in arid lands needs further investigation. There is still a lack of published detail and description of an organic farming system in arid lands. Therefore, it is recommended to use the Sekem organic farming model as a typical arid land organic faming system, to describe organic farming systems in arid lands with respect to pest and disease management, soil fertility management, crop-livestock integration systems, marketing opportunities and constraints.
- This research has provided the base for organic farming research in Jordan, but still there is a need to undertake a more formal economic analysis of the results using different agro-ecological areas of Jordan so that a statistically valid assessment can monitor economic feasibility of organic farming over the coming years. The study should also examine the economic impact of organic farming on both local and national economies, and the economics of conversion to organic farming.
- This research has shown that in Jordan there had been no research efforts towards comparing the performance of organic farming over conventional farming systems.

Therefore, it is important to carry out on-farm adaptive research (OFAR) in order to evaluate possible relative advantages of organic farming under the Jordanian farming conditions in terms of crop performance, pest and disease control, and soil fertility.

- This study has focused on barriers and potential for organic *crop* production in Jordan. It would be useful to carry out a study on *livestock* production and for this study to cover different aspects of feed, crops-livestock integration, disease, and organic livestock product marketing.
- The action plan has been submitted to the President of the Jordan Badia Research and Development Centre (BRDC) who will submit it to the Minister of Agriculture for implementation. It would be important to examine the implementation of this plan in Jordan, and it would also be valuable to study the applicability of the action plan as a blueprint for the adoption of organic farming in other arid lands planning to adopt organic farming.

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Appendices

Appendix A: Examples of state policy support for organic farming

Tunisia, organic farming has gained benefits like other agricultural investments benefits which included tax reductions, VAT exemption and direct financial benefits in the following cases:

- Subsidies, related to project study fees, equivalent to one percent of investment amount and up to 1500 Tunisian Dinars (TD[3]) for B category investment and 5000 TD for C category investment.
- Investment subsidies fixed at 30% of the value of equipment, implements and means specific to organic projects.
- Annual subsidies over a five-year period to cover the inspection and certification fees, equivalent to 70% of the cost, provided that the overall value of the subsidies does not exceed 5000 TD.

(Al-Bitar 2006: 181-182)

Austria, government efforts encouraged both conversion and maintenance of organic farming through developing a government programme called the Austrian Agri-environment Programme. The overall aim of this programme is the promotion of environmental awareness and creation of an extensive and natural habitat protecting agriculture. The Austrian government efforts led to a rapid growth of organic farming in which 9.8% of farms in 1999 were run under organic farming principles (Schneeberger, Darnhofer, and Eder 2002) and now more than 13 % of agricultural land is organic (Willer 2006).

Denmark, organic farming has been a concern for the public and politicians since the 1980s as converting to organic farming was perceived as a solution to problems resulting from conventional farming. As a result, the government produced legislation to support organic farming called Act on Organic Production (1987) which included two support systems to promote and support conversion to organic farming:

1. The financial support system included two schemes
   - A conversion grant scheme to provide grants for farmers to cover the costs during the conversion period due to yield reductions and extra labour needs because premium prices cannot cover these costs. The total spent by the end of 1992 was Danish Krone (DKK[4]) 39 million to convert. Accordingly, farmers had to comply with the official organic standards set in the Act on Organic Production, (1987).

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[3] 1 TND = 0.756430 USD
[4] DKK= 0.18254 USD

- A development support scheme to support the development of the research including the setting up of an extension and marketing infrastructure enhancing organic farming (DK 98 million at the end of 1992).

2. An official labelling system for organic products with public control of production and marketing through a legal framework to protect both consumers and producers.

(Dubgaard and Holst 1994)

Switzerland: support policies can direct the degree of financial aid on the percentage of area converted or production. A common example was used in Switzerland in which the five Swiss cantons pay conversion subsidies as a single premium one part per farm and another per hectare. Other conditions for the payments include:

- 50% of the money will be paid to the farmer after the first year if requested;
- The farm must be operated organically for 12 years, otherwise the subsidies must be repaid;
- State farms cannot receive a subsidy;
- Farmers with a very high income (because of other sources of income) receive less money.

(Schmid 1994: 395)

Appendix B: Farmers' Questionnaire

Farm's number:	**Questionnaire number:**
Date of interview:	**Time of interview: begin- end-**
Farmer's name:	**Sex/ Age:**
Family size:	**Qualification:**

A. Farm's information:

1. Farm's GPS Coordinates

N: **E:**

2. Farm's total area:

3. Crops grown 2003/2004

4. Livestock (type and number) 2003/2004

5. Jobs existing on the farm/wages paid

6. How many of your family members depend on:

On-farm income Off-farm income

B. Extension:

1. As a farmer what is the best way to get the information you need about your agricultural production?

C. Pest control and management:

1. What are the main pests that attack your crops? Control methods used?

2. What are the pesticide types do you use to control pests in your farm? Rank according to the percentage of the use (Use images).

3. What non-chemical strategies do you use to control pests in your farm? (Checklist # A)

D. Soil fertility management:

1. What area the main steps that you take to make your land ready for growing your crops? Soil analysis- soil moisture and evaporation- soil pH - soil amendments.

2. What is the inorganic fertilising programme do you use from the land preparation to harvesting stage? (Use the chart).

E. Organic fertilisers: as a farmer in this area, could you:

1. List what types do you use? (Type, amount per dunum, and the Price JD ton^{-1}).

2. Give three reasons why do you use organic fertilisers?

3. Give three constraints to using organic fertilisers?

4. What non-chemical strategies do you use to improve the soil fertility? Checklist # B.

F. Environmental impacts:

1. What environmental impact have you seen with practise of the conventional farming on your farm?

G. Organic farming:

1. Have you heard about organic farming (alzeraa'h alodweyah)? What is the best translation for it?

Organic farming barriers

2. What are the main technical barriers could face organic farming?

3. What are the main cultural barriers could face organic farming?

4. What are the main economic barriers face you to adopt organic farming?

5. Give three potential factors in your area to produce organic products?

H. Adoption of organic farming:

If officials from the ministry of agriculture came to your farm and advised you to adopt organic farming, would you accept that advice? Why?

Farmer's interview checklists

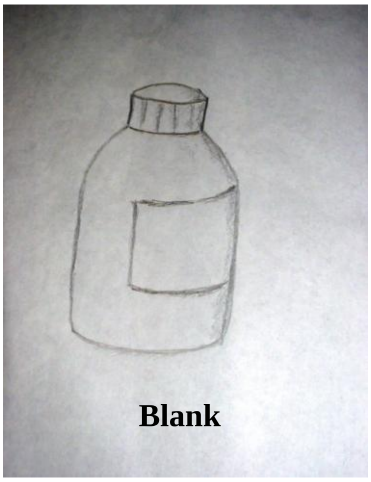
Checklist A: Non-chemical strategies used to control pests

Strategy	**Note**
Clean stock/ Sanitation/ Good hygiene	
Crop rotation	
Fallow periods	
Hand picking	
Live barriers	
Mulches (black plastic)	
Resistant varieties	
Site plantation (crops pattern)	
Spraying water	
Summer and winter oils	
Tillage and irrigation management	
Timely planting	
Sulphur	
Weeding	
White stone (lime stones)	

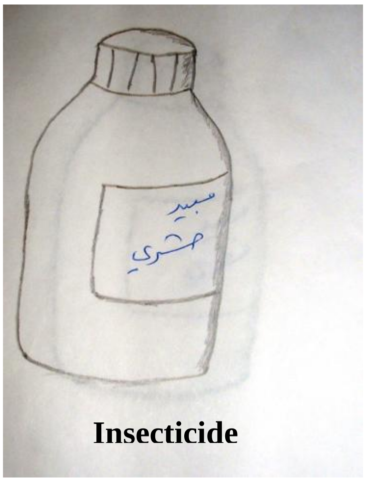
Checklist B: Non-chemical strategies used to improve soil fertility

Strategy	**Note**
Compost application	
Crop rotation	
Fallow period	
Manure	
Mineral rocks	
Mulching	
Timing of various activities: seeding, fertilisations	
Windbreaks	

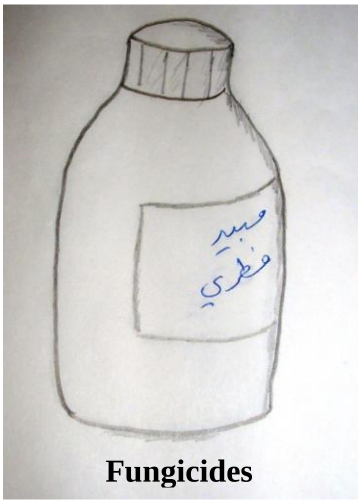
Visual aids used to rank amount of pesticides used by farmers



Blank

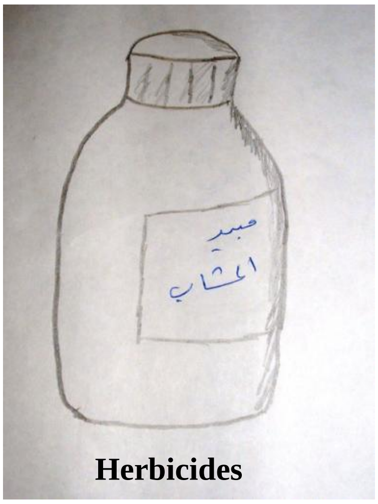


Insecticide



Fungicides

Acaricides



Herbicides

Nemacides

The fertilisation programme used

Land's preparation

The growth stage

The flowering stage

Fruit set stage

Before marketing

Farms observation checklist

Water source
Water reservoir
Water pumping system
Irrigation system
Fertilising systems
Land preparation
Planting
Pest control
Pesticides and fertilisers storing
Fruit collecting
Packaging and marketing
Farm’s layout

Appendix C: Private Agricultural Store Suppliers' Questionnaire (PAS)

Group's number: **Questionnaire number:**
Date of interview: **Time of interview: begin- end-**
Store owner's name: **Sex/ Age:**

Part A: information about the store

1. **Organic pesticides:**

Pesticide	**Pest**	**Crop(s)**	**Source**

2. **Organic fertilisers:**

Fertiliser	Crop	Source

3. **Store observations**

Part B: Organic farming:

1. Have you heard about organic farming (alzeraa'h alodweyah)? What is the best translation for it?

Organic farming barriers

2. What are the main technical barriers could face organic farming in your area?

3. What are the main cultural barriers could face organic farming in your area?

4. Give three potential factors in your area to produce organic products? Barriers

Appendix D: Key Players' interviews

Key player	Interview details
Professor Fayes Alkhasawnieh was Dean for two university agriculture faculties, MoA Minister, and the Yarmook University Vice Chancellor during the fieldwork	Two visits were made to Yarmook University to interview the Vice Chancellor, in July and August 2004. The interview covered the perception of the organic farming, the main institutional barriers, government role, academic work regarding organic farming and recommendations to establish organic farming system in Jordan.
The ex-Secretary General of the MoA	Engineer Mazen Alkhasawnieh he was the only farmer in the study area who used a more ecological system to manage his farm. The system used is presented in the data analysis. The interview aimed to discuss the possibility of adopting of organic farming in the study area, which included perception, potential, barriers, and the government policy.
Aman Company Manager (IPM products)	A visit was made to the company in June 2004 Amman Central Vegetables Market. A face to face interview was carried out with Aman manager. It was found that the name of the company was *Aman* Company for the IPM Products. The visit aimed to look at the history of the company, the idea behind the company, products sold at the company, current economic situation, barriers and future planning.

Appendix E: Decision makers-people interviewed from the MoA

People interviewed	Aim
Organic Farming Unit (OFU) staff	The main aims of the unit and its organisational structure, If the unit has involved farmers in the concept of organic farming, If so, has the unit investigated the idea and the perception of organic farming, If the unit has established a certified organic farming system, If the unit has an inspection system, If the unit has established organic farming standards for Jordan, Future planning, strategy and barriers
Secretary General of the MoA	What could the ministry provide farmers with to convert to organic farming What are the regulation and legislation have been made to establish organic farming system in Jordan, and authorised body in Jordan to put the national organic standards Definition of organic farming in Jordan Involvement of farmers in establishment of organic farming system in Jordan
Head, Agricultural Policy Unit - MoA	Perception and definition of the organic farming Whether the organic farming has been addressed within the agricultural policy or not Adaptation of organic farming by farmers Authorised body in Jordan to establish national organic standards

Appendix F: Information about researched farms
List of Farmers Interviewed

Farmer's number	Farmer's town	Farm's site	Age	Family size	Family type	Land total area ha	Farm type
1.	SABHA	SABHA	55	20	Extended	42	Mixed
2.	SABHA	SABHA	34	30	Extended	50	Mixed
3.	SABHA	SABHA	60	50	Extended	55	Mixed
4.	IRBID	SABHA	35	22	Extended	35	Vegetables
5.	SABEASEAR	SABEASEAR	56	25	Extended	40	Vegetables
6.	AMMAN	SABHA	55	12	Nuclear	120	Fruit
7.	IRBID	KOMARRAF	43	32	Extended	50	Mixed
8.	AMMAN	SABHA	32	25	Extended	45	Vegetables
9.	SABEASEAR	SABEASEAR	40	35	Extended	40	Vegetables
10.	SABHA	SABHA	55	27	Extended	20	Vegetables
11.	SABHA	SABHA	65	30	Nuclear	30	Fruit
12.	SABHA	SABHA	40	25	Nuclear	65	Vegetables
13.	SABHA	SABHA	56	27	Extended	20	Vegetables
14.	KOMARRAF	KOMARRAF	25	15	Nuclear	25	Fruit
15.	SABHA	SABHA	60	22	Nuclear	28	Vegetables
16.	SABEASEAR	SABEASEAR	45	40	Extended	27	Vegetables
17.	KOMARRAF	KOMARRAF	40	50	Extended	57	Fruit
18.	SABHA	SABHA	55	15	Nuclear	40	Vegetables
19.	KOMARRAF	KOMARRAF	55	12	Nuclear	20	Fruit
20.	SABHA	SABHA	70	60	Extended	400	Mixed
21.	SABHA	SABHA	60	25	Extended	40	Mixed
22.	SABHA	SABHA	51	20	Extended	30	Vegetables
23.	AMMAN	SABHA	35	30	Extended	21	Vegetables
24.	SABEASEAR	FAISALIAH	55	32	Extended	30	Vegetables
25.	FAISALIAH	FAISALIAH	60	35	Extended	20	Mixed
26.	SABHA	FAISALIAH	65	30	Extended	25	Vegetables
27.	SABHA	SABHA	50	38	Extended	30	Mixed
28.	SABHA	FAISALIAH	52	30	Extended	20	Vegetables
29.	SABHA	SABHA	53	34	Extended	60	Mixed
30.	AMMAN	SABHA	40	20	Extended	40	Mixed
31.	DAFYANEH	DAFYANEH	60	25	Extended	30	Vegetables
32.	AMMAN	ZOMLAH	65	10	Nuclear	35	Mixed
33.	DAFYANEH	DAFYANEH	50	21	Nuclear	20	Vegetables
34.	AMMAN	FAISALIAH	65	15	Nuclear	25	Fruit
35.	AMMAN	ZOMLAH	71	15	Nuclear	75	Fruit
36.	AMMAN	ZOMLAH	55	10	Nuclear	20	Fruit
37.	FAISALIAH	FAISALIAH	40	14	Extended	35	Fruit
38.	SABHA	DAFYANEH	43	24	Nuclear	20	Vegetables
39.	SABEASEAR	SABEASEAR	65	45	Extended	60	Mixed
40.	AMMAN	SABEASEAR	45	25	Nuclear	50	Vegetables
41.	SABHA	SABHA	48	10	Nuclear	25	Vegetables
42.	ZOMLAH	ZOMLAH	38	30	Extended	25	Vegetables
43.	SABHA	SABHA	45	23	Extended	18	Fruit
44.	SABHA	SABHA	36	21	Extended	100	Vegetables
45.	SABHA	DAFYANEH	45	35	Extended	60	Vegetables
46.	DAFYANEH	DAFYANEH	64	25	Extended	30	Vegetables

Farms that were working during the field work

Farmer's number	Number of farms	Farm's GPS Coordinates				Land total area ha	Farm type
		N		E			
1.	1	32	21.264	36	30.725	42	Mixed
2.	1	32	21.023	36	29.658	50	Mixed
3.	1	32	19.294	36	30.616	55	Mixed
4.	1	32	20.82	36	31.939	35	Vegetables
5.	1	32	20.698	36	28.213	40	Vegetables
6.	3	32	18.387	36	32.765		Fruit
		32	20.931	36	31.086		
		32	20.615	36	30.756	120	
7.	1	32	21.214	36	28.165	50	Mixed
8.	2	32	19.105	36	29.049		
		32	20.323	36	32.622	45	Vegetables
9.	1	32	20.047	36	28.173	40	Vegetables
10.	1	32	20.704	36	28.823	20	Vegetables
11.	1	32	17.792	36	30.402	30	Fruit
12.	2	32	17.304	36	30.689		
		32	18.418	36	30.385	65	Vegetables
13.	1	32	19.795	36	31.509	20	Vegetables
14.	1	32	21.768	36	27.056	25	Fruit
15.	1	32	18.942	36	29.649	28	Vegetables
16.	1	32	20.718	36	27.636	27	Vegetables
17.	2	32	21.979	36	26.813		
		32	21.322	36	26.694	57	Fruit
18.	2	32	17.844	36	31.29		
		32	17.142	36	33.769	40	Vegetables
19.	1	32	21.608	36	27.79	20	Fruit
20.	3	32	19.335	36	31.741		
		32	16.615	36	31.388		
		32	18.073	36	32.787	400	Mixed
21.	1	32	19.782	36	30.562	40	Mixed
22.	1	32	20.675	36	30.063	30	Vegetables
23.	1	32	19.438	36	29.459	21	Vegetables
24.	1	32	17.873	36	28.124	30	Vegetables
25.	1	32	18.024	36	28.295	20	Mixed
26.	1	32	17.449	36	29.227	25	Vegetables
27.	1	32	18.347	36	31.222	30	Mixed
28.	1	32	17.57	36	29.853	20	Vegetables
29.	1	32	20.988	36	32.111	60	Mixed
30.	1	32	20.394	36	32.109	40	Mixed
31.	1	32	18.668	36	33.35	30	Vegetables
32.	1	32	16.854	36	30.39	35	Mixed
33.	1	32	19.029	36	34.267	20	Vegetables
34.	1	32	16.8	36	29.79	25	Fruit
35.	2	32	15.88	36	32.644		
		32	15.824	36	32.113	75	Fruit
36.	1	32	15.354	36	29.662	20	Fruit
37.	1	32	16.339	36	31.898	35	Fruit
38.	1	32	19.772	36	33.234	20	Vegetables
39.	1	32	19.955	36	26.657		
		32	19.99	36	27.2	60	Mixed
40.	1	32	19.952	36	25.635	50	Vegetables

41.	1	32	18.869	36	31.985	25	Vegetables
42.	1	32	19.952	36	25.635	25	Vegetables
43.	1	32	20.254	36	30.21	18	Fruit
44.	2	32	20.082	36	31.09	100	Vegetables
		32	18.053	36	29.815		
45.	2	32	17.68	36	33.648	60	Vegetables
		32	18.096	36	33.433		
46.	1	32	20.855	36	32.977	30	Vegetables
47. *	1	32	19.852	36	30.469	50	Fruit
TOTAL	**58**						

*Refused to be interviewed

Farms that were not working during the field work

Farmer's number	Number of farms	Farm's GPS Coordinates				REASON
		N		E		
48.	1	32	18.774	36	30.778	System collapsed
49.	1	32	20.1	36	29.695	Financial
50.	1	32	20.59	36	31.357	Financial
51.	1	32	18.256	36	29.263	System collapsed
52.	1	32	29.456	36	21.657	System collapsed
53.	1	32	20.021	36	29.048	Financial
54.	1	32	20.477	36	29.623	Financial
55.	1	32	19.876	36	32.462	System collapsed
56.	1	32	20.602	36	33.492	Financial
57.	1	32	18.303	36	32.254	System collapsed
58.	1	32	19.611	36	34.607	Financial
59.	1	32	17.813	36	32.892	System collapsed
60.	1	32	16.619	36	30.833	System collapsed
61.	1	32	19.048	36	32.784	System collapsed
62.	1	32	21.314	36	28.765	Financial
63.	1	32	21.228	36	31.325	System collapsed
64.	1	32	18.352	36	30.465	System collapsed
TOTAL	**17**					

Farm's type and area

	Farm's type			
Data	**Fruit**	**Mixed**	**Vegetable**	**Total**
Number of owners	10	12	24	46
Number of farms	14	14	29	57
Percentage	24	26	50	100
Cultivated area ha	395.5	542.2	550.9	1488.6
Total land area ha	425.0	882.0	846.0	2153.0

Crops cultivated and their areas

Crop	Farmers N	Farmers %	Area ha Fruit	Mixed	Vegetable	Sum	Mean	%
Tomato	35	76.1	0	165.5	327.0	492.5	14.07	33.1
Stone fruit	14	30.4	269	66.0	0.0	335.0	23.93	22.5
Olive	24	52.2	116.0	207.5	7.0	330.5	13.77	22.2
Watermelon	30	65.2	0.0	59.5	104.0	163.5	5.45	11.0
Cauliflower	7	15.2	0.0	8.0	42.0	50.0	7.14	3.4
Melon	12	26.1	0.0	6.5	27.9	34.4	2.87	2.3
Cabbage	8	17.4	0.0	7.5	16.0	23.5	2.94	1.6
Eggplant	7	15.2	0.0	8.5	12.5	21.0	3.00	1.4
Grape	8	17.4	10.5	8.2	0.0	18.7	2.34	1.3
Beans	3	6.5	0.0	0.0	14.5	14.5	4.83	1.0
Cactus	2	4.3	0.0	5.0	0.0	5.0	2.50	0.3
Total			395.5	542.2	550.9	1488.6		100

Appendix G1: about the workshop

Participants in the Workshop

Number	PARTICIPANT	POSITION
1.	ABAID SHOBAIL	FARMER
2.	AHMAD ALWAN	FARMER
3.	ALI ABDO	FARMER
4.	ALI HUWAIL	FARMER
5.	AYED ALI	FARMER
6.	GHNIM ABU RABEEA	FARMER
7.	RESEQ BATAYNEH	FARMER
8.	SAMI JBARAT	FARMER
9.	TAREQ ALLOWZI	FARMER
10.	ZAIED ARAB	FARMER
11.	NHAIER ADOBAISE	FARMER
12.	ENG. MAZEN KHASAWNEH	FARMER
13.	KHALED KHABBAS	FARMER
14.	KHALEEL ABU SERHAN	FARMER
15.	MUGHAREBY	FARMER
16.	JAMAL MAGABLEH	PRESIDENT, FARMERS UNION
17.	DR. AZMY ABURAYAN	JU
18.	DR. KHALED AL-SHRAIDAH	SECRETARY GENERAL, HIGHER COUNCIL FOR SCIENCE AND TECHNOLOGY
19.	ENG. MOHAMMAD SHAHBAZ	PRESIDENT, BRDC
20.	ENG. MAZEN AL-MEHASEN	MOA MINISTER
21.	ALA ALREFAAI	MOA
22.	MAHMOOD MAHARMEH	MOA
23.	MOHAMMAD AL-FAWAEER	MOA
24.	DR. NEMER HADADEEN	MOA
25.	FALAH AWAMLEH	MOA
26.	RAED HAMARNEH	OFU
27.	ABDELLATEF ALAZAYEDEH	JORDAN RADIO
28.	BASSAM ALSHOUBAKI	NCARTT
29.	DR. MARWAN ABDELWALLI	NCARTT
30.	DR. MOEEN ALQARUTI	NCARTT
31.	EMAN ABUDHAIM	NCARTT
32.	ENG. AHMAD ALOMOUSH	PLANT PROTECTION OFFICER, NORTH BADIA AGRICULTURAL DIRECTORATE
33.	ENG. RYADH BAQAEEN	DIRECTOR, NORTH BADIA AGRICULTURAL DIRECTORATE
34.	HALAH ALKHAIAT	ALGHAD NEWSPAPER
35.	HANI ALNOORI	JOFS
36.	ISLAM MAGHAIREH	AEA
37.	KANAKO TSUBA	OFU/NICCOD/JICA
38.	MAHA ARABIEAT	JEDCO
39.	MOHAMMAD AYESH	JOFS
40.	MUNAH HABAEBIEH	JISM
41.	OMAR ABU EID	EU MISSION TO JORDAN
42.	RASHA ALUSTAH	JORDAN RIVER FOUNDATION

Appendix G2: Procedures used to conduct the workshop

Procedure	Aim	Achieved by
Contact the MoA Minster by phone to arrange for the workshop	Brief the MoA Minister about the workshop and ask him for a convenient time to conduct the workshop under the patronage of his Excellency	The BRDC President
Prepare a timetable for the workshop	Give an overview of topics to be covered	The researcher
Write an official invitation letter enclosing the timetable to the MoA Minster	Inform the MoA Minister about the workshop title and themes to be discussed in the workshop	The BRDC President and the researcher
Choose a convenient location and time for the workshop	To enable the stakeholders to attend the workshop	The researcher and BRDC public relationship staff unit
Contact three hotels	Give proposals to choose one of them to conduct the workshop, time, date, number, costs	BRDC public relationship staff unit and the researcher
Prepare invitation letters	Invite the stakeholders and brief them about the workshop	Signed by the BRDC President and sent by the researcher. The invitation letters were sent by fax to people who had fax machines and delivered by hand but only delivered by hand to those who had no fax machines
Follow up	Ensure that the stakeholders will participate in the workshop and to answer if they have any queries	The researcher
Contact the media	To cover the workshop	The MoA public relationship and the BRDC public relationship
A visit to the workshop place one day before the workshop date	Ensure that the place is suitable and all tools (laptop, data show and flipchart board to take notes) needed are there	The researcher and the BRDC public relationship
Conduct the workshop at Holiday Inn Hotel		
Techniques used in the workshop		
The workshop was conducted in a U-shape which gave participants the feeling that they were equal and their voices and opinions were heard	A PC and data show were used to present the empirical results and the diagrammatic overview using a power point, a flipchart was used to take notes and comments made by stakeholders, a badge for every stakeholder	Media: Jordan TV and newspapers were invited to cover the workshop activities and to raise awareness regarding organic farming movement in Jordan
The workshop closing: Lunch for stakeholders		
The workshop report was sent to the minister for approval Feedback on the report		

Appendix H: Annual agricultural calendar

Vegetable farms cultivation calendar

Activity	01	02	03	04	05	06	07	08	09	10	11	12
Decide where to grow	■											■
Buying seeds		■	■					■	■			
Sawing seeds in nurseries in Jordan valley		■	■									
Sawing seeds in nurseries in the Badia					■	■						
Buying plastic mulch and irrigation materials		■	■	■								
Use boulders to clean the land		■	■	■								
Ploughing the soil			■	■								
Buying manure from poultry farms		■	■									
Moving the manure to the farms			■	■								
Planning the farm				■								
Add the manure to the soil				■								
Set up the drip irrigation system				■	■							
Trial irrigation				■	■							
Put the plastic mulch				■	■							
Pre transplanting irrigation				■	■							
Transplanting				■	■	■						
Irrigation				■	■	■	■	■	■	■	■	
Pest control				■	■	■	■	■	■	■	■	
Fertilisation				■	■	■	■	■	■	■	■	
Harvesting							■	■	■	■	■	
Selling the product							■	■	■	■	■	
Re transplanting [CR]								■	■			
Removing plant residues								■	■		■	■
Removing the plastic and the drip irrigation system												■
Sawing wheat seeds	■											■
Ploughing the land to cover the wheat seed	■											■
Harvesting the wheat						■						

Fruit farms cultivation calendar

Activity	01	02	03	04	05	06	07	08	09	10	11	12
Decide where to grow												
Decide what trees to grow												
Buying the rootstocks and leave them at the nursery for one year												
Buying the drip irrigation system												
Use boulders to clean the land												
Ploughing the soil												
Plan the farm site including roads and dig holes for the trees												
Growing the trees in their holes												
Set up the drip irrigation system												
Add the manure												
Irrigation												
Fertilisation												
Pest control												
Scion drafting												
Pruning												
Harvesting 3 years after planting												

Appendix I:

Growing cactus or the Indian fig (*Opuntia* spp):

Two farmers had cactus or the Indian fig (*Opuntia* spp); one had 4 ha and the other one had just 1 ha in their conventional farms. The one who had 1 ha reported it was a new trial (2 years) to judge the results. The one who had 4 ha had a good experience for more than 5 years about cactus, which encouraged the researcher to visit this farmer more than three times to document this experience. The advantages of the farmer's experience were no extra cost for synthetic inputs, low cost of irrigation, healthy product; also, another advantage noticed during the field observations was that the vegetation and diversity were greater than other farms as is shown in Figure I. There were three disadvantages (a) there was no separate market for such a natural product, (b) consumers did not distinguish between this product and conventional products; the most important thing for them was the price and the shape of fruit, and (c) there was no encouragement from the government. It was noticed from the field observations that sheep manure was used for both crops. The sheep were fed on conventional feed. It was also noted that the cactus drip irrigation system was connected to the farm's main conventional irrigation system, which meant that some of the fertiliser residues might go to the cactus plants during the irrigation process.

Figure I: Cactus grown naturally in the study area

Appendix J: Suggestions, comments and recommendations made by participants in the national workshop to develop an action plan for the adoption of organic farming in Jordan

Regulation and legislation

All participants emphasised that one of the main barriers for the adoption of organic farming in Jordan is the lack of national regulation. Therefore, all of them emphasised that there is a need to develop national regulation and legislation to:

- Have certification and inspection systems including certification bodies
- Provide financial subsidy and support to establish pilot projects for organic farming by establishing demonstration sites to train interested farmers, and to help farmers to establish organic farming society
- Establish a higher committee headed by the Minister of Agriculture or the Secretary General for the establishment of Jordanian organic farming, including the private sector
- Implement the regulation by authorised organisations (JISM and MoA)

Definition

All participants agreed that the organic farming is not clear to the majority of people in Jordan. Therefore, there is a need to establish an appropriate definition of organic farming, its objectives and its basic principles, in Arabic, which people in Jordan can understand. This would strengthen the concept of organic farming and make it clearer. The definition should target both producers and consumers through awareness campaigns and educational programmes

Website

All participants agreed that the website that has been designed is good, but it would be better if it could be more informative

Society group of farmers \ Administration

Participants suggested that establishing a cooperative society for a group of farmers to start up the organic farming would be helpful to motivate the adoption of organic farming. Also, enhance networking through the development of a national organic farming committee (Ad hoc committee) or an organic umbrella organisation including the private sector to manage, plan and advise the policy makers on organic farming

Regional and international cooperation to

Jordan does not have good experience about organic farming. Therefore, participants suggested combining the efforts of all forces in organic farming, through regional and international cooperation and knowledge sharing in the development of organic farming, which will help to overcome barriers found in this research and to ease the adoption of organic farming in Jordan. This would help to learn from other experience to develop regulations and markets, and also farmers could visit countries like Egypt to learn experience to solve technical problems (pest and diseases, soil fertility, compost production etc)

Awareness

Due to lack of information about organic farming, participants suggested to increase consumers' and producers' awareness and recognition of organic farming, organic products. Awareness should be that the quality of organic products and the environmental benefits matter more than price. To do so, it is recommended to use all means to increase the awareness, including media, schools, universities and hospitals. It has to be linked to the health issue, with many people accepting this idea especially from a health point of view

Extension

Organic farming is a new concept in Jordan, a complex system, and is incompatible with the current experience of Jordan's farmers. Therefore, is a need for extension work to provide farmers with enough information about organic farming since extension work is devoted to conventional farming. Extension should aim to provide farmers with easy access to information about organic farming methods. It is important that extension is to be funded and not demoralised. It can be done through establishing demonstration sites involving the private sector, establish sites at farmers' farms, simple extension methodology (new leaflets and brochures) and continuous training workshops of organic farming practices.

Continued

Research There is a need for research which is a necessary step for organic farming development in Jordan to solve technical problems and to evaluate the socioeconomic impact of the adoption organic farming in Jordan. It is important to have national research institutions and research at field level with adequate collaboration between institutions having research agendas to meet the development of organic farming conditions in Jordan: technical, social, economic, marketing and environmental. To have good research, it is important that research must be funded from the public and private sector. Moreover, the results of the research should be delivered to farmers and other interest groups through the extension channels
Marketing and Economic Participants emphasised for organic farming to be adopted, it is important for the government to find potential products and markets and conduct feasibility studies for organic products. It is also important that research should cover marketing and economic issues. It is recommended to find obstacles and barriers to organic product marketing and suggest reliable strategies to overcome these barriers. Establishing a network of marketing in which the MoA and other organisations help in marketing
Inputs At present, organic farming production inputs are not available in Jordan. Therefore, regulation should inform producers what are the criteria of inputs and the best source for the inputs. In the meantime, cooperation between Jordanian organisations is required to produce inputs such as fertilisers, and to initiate projects to produce such inputs. Participants also emphasised that the MoA should advise farmers to deal with the lack of inputs and what strategies can be adopted
Academic It was suggested to add an academic level to the plan. The suggestion is to have organic farming programmes at both graduate and postgraduate level. This will help to increase awareness, and solve some technical, social and economic constraints through conducting research, and also to provide development capacity