MODELLING THE RELATIVE COMPARATIVE ADVANTAGE OF ORGANIC WHEAT PRODUCTION IN THE WESTERN CAPE

BONGISWA MAHLANZA

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Supervisor: Professor Nick Vink

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DECLARATION

I the undersigned, declare that the work contained in this thesis is my own original work and that I have not previously in its entirety or in part submitted it at an university for a degree.

Signature **Date**

ABSTRACT

After sixty years of state control, the agricultural sector in South Africa has been transformed to the so-called free dispensation, with the driving forces being market access and rules of the WTO. On the one hand, this increased the exposure of the sector, particularly at international level where interest for South African produce developed. On the other hand, transformation induced a considerable degree of price squeeze and risk in the production of certain commodities including wheat.

Notwithstanding, local wheat producers like any other farmers are generally price takers, and in some cases do not have a comparative advantage in what they produce. This is worsened by policy distortions in product markets, although to a lesser extent than before. These distortions are responsible for farmers to make decisions that are neither economically efficient nor optimal in a social sense.

Therefore, the uncertain future of the wheat industry, particularly in the Western Cape, including the changing business environment, urges producers to adapt quickly if they wish to stay in business. Hence, the challenge for a farmer and agricultural support organisations is to find solutions to these problems. One of the factors that can be looked into in finding solutions is to look at the demand side of the equation by taking product differentiation and market identification into account. In other words, products that carries a specific character, and a niche market where these products attain higher prices are the main objectives of this exercise.

In looking at these options, it is necessary to first study the end consumer of these products. Looking at the local market first, there is a relatively small but growing market for high priced niche products, but for the most part, local consumers are looking for low cost commodity-type products. In many cases, South Africa is marginally competitive in these products and so must look at alternative markets. On the export market, on the other hand, consumers are generally more sophisticated and specific in the kind of food they demand, where they are looking for quality and tracebility, and are willing to pay a premium which can be exploited.

Therefore, the aim of this study is to determine whether wheat would have a comparative advantage if produced under organic management, as a system that have products with these attributes. The study first evaluates the comparative advantage of the existing industry, the so-called conventional wheat, specifically looking at the policy environment around this commodity, as these are likely to affect the potential of organic wheat. The Policy Analysis

Matrix technique is used to calculate various indicators of comparative advantage and to identify the effects of policy measures with regard to wheat. The analysis used the available data for ten selected farming areas. On the other hand, organic wheat farming is not practised in the Western Cape at present. As a result, expert assessment was used to provide information based on the reference method.

As the study is the comparison of two systems, the results therefore indicates that some areas of the Western Cape do not have a comparative advantage in wheat production under conventional practices, which would not be the case if produced under organic management. The reasoning underlying this is complex, but mainly traced from high levels of input use that carries a distorting effect, partly because of tariffs on imported inputs, unlike organic production which is less subject to this effect. The net effect of the whole policy environment has a negative impact on producers including those of potential organic wheat, as some policies are likely to affect this potential industry. Consequently, it is recommended that farmers must evaluate their options by looking at systems that utilise less distorted inputs, and hence higher profits like organic farming.

UITTREKSEL

Na sestig jaar van staats-beheer is die landbou sektor van Suid-Afrika omvorm na 'n sogenaamde vrye bedeling met marktoegang en die reëls van die WHO as drywers. Hierdie omvorming het enersyds die blootstelling van die landbou sektor verhoog, veral in die buiteland waar belangstelling in Suid-Afrikaanse produkte toegeneem het. Aan die ander kant het die transformasie die realiteite van die prys-koste knyptang en produksierisiko, ook in die geval van koring, na vore gebring.

Plaaslike koringprodusente, soos alle ander boere, is in die algemeen prysnemers en in sommige gevalle het hulle weinig mededingende voordele in wat hulle produseer. Dít word vererger deur beleidsversteurings in produkmarkte al is die versteurings minder as in die verlede. Die versteurings gee egter steeds daartoe aanleiding dat boere soms besluite neem wat nie ekonomies of sosiaal optimaal is nie.

Dit volg dus dat die onsekere toekoms van die koringbedryf, veral in die Wes-Kaap, asook die vinnig veranderende besigheids-omgewing produsente noop om vinnig by die veranderende omstandighede aan te pas indien hulle in besigheid wil bly. Die uitdaging is dus vir boere en hul ondersteunings meganismes om oplossings vir voorgenoemde probleme te vind. Een moontlike oplossing kan gevind word deur die potensiaal van produk differensiasie en mark identifikasie aan die vraagkant van die vergelyking te ondersoek. Met ander woorde, die identifikasie van nis-produkte met 'n spesifieke karakter wat hoër pryse behaal.

Ten einde sodanige produkte te identifiseer is dit nodig om die verbruiker daarvan te analiseer. In die plaaslike mark is daar 'n relatiewe klein maar vinnig groeiende mark vir hoë-waarde nis-produkte. Dit moet egter toegegee word dat die grootste gedeelte van plaaslike verbruikers meer geïnteresseerd is in goedkoop kommoditeits-tipe produkte. In die meeste gevalle is Suid-Afrika marginaal kompeterend in hierdie produkte en moet alternatiewe markte dus ondersoek word. Hierteenoor is verbruikers in sekere gedeeltes van die uitvoermark meer gesofistikeerd en spesifiek in die aard van die produkte wat verlang word. Die fokus is veral op kwaliteit en naspoorbaarheid en sodanige verbruikers is gewoonlik bereid om 'n premie te betaal vir produkte wat hierdie behoeftes bevredig.

Die doel van hierdie studie is dus om te bepaal of organies geproduseerde koring 'n mededingende voordeel sou hê indien dit aan die eienskappe van kwaliteit en naspoorbaarheid sou voldoen. In hierdie studie word die relatiewe mededingendheid van die bestaande stelsel,

sogenaamde konvensionele koring produksie, geëvalueer met spesifieke verwysing na die beleidsomgewing waarbinne produksie plaasvind. Hierdie beleidsomgewing sal natuurlik ook 'n invloed uitoefen op die organiese produksie van koring. 'n Beleids Analise Matriks word gebruik om verskillende indikatore van mededingende voordeel te bereken en om sodoende die invloed van die beleidsmaatreëls op die koringbedryf te analiseer. Vir konvensionele produksie is bestaande data uit tien verskillende boerderygebiede gebruik. Alhoewel geen voorbeelde gevind kon word van bestaande gesertifiseerde organiese koringproduksie in die Wes-Kaap nie, is die ekspert-groep tegniek met behulp van die verwysings metode gebruik om die nodige data te genereer.

Aangesien die studie 'n vergelyking tussen twee stelsels is, is gevind dat waar die konvensionele produksie van koring geen mededingende voordele in sekere gebiede van die Wes-Kaap geniet nie, dit wel mededingende voordele tydens organiese verbouing in hierdie gebiede geniet. Alhoewel die onderliggende redes hiervoor kompleks is, kan dit herlei word na die hoë vlakke van beleids-versteurde insette wat tydens die konvensionele produksie van koring gebruik word. Hierteenoor steun organiese produksie meer op plaasgeproduseerde insette wat die distorsies dus verminder. Die netto effek is egter dat die beleids-omgewing 'n negatiewe impak op produsente, ingeslote potensiële organiese produsente, inhou. Gevolglik word dit aanbeveel dat produsente hul opsies moet oorweeg deur veral te fokus op stelsels, soos organiese verbouïng, wat minder beleids-versteurde insette gebruik en waar die winsmoontlikhede dus hoër is.

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LIST OF ABBREVIATIONS

EEC .... **European Economic Community**

AIAB .... **Associazione Italiana per I'agricoltura Biologica**

CAP .... **European Union's Common Agricultural policy**

CCOF .... **California Certified Organic Farmers**

Demeter .... **Bio-dynamic Agricultural Association**

EC .... **European Commission / European Communities**

ECOA .... **Egyptian Centre of Organic Agriculture**

EU .... **European Union**

FAO .... **Food and Agriculture Organisation of the United States**

GMO .... **Genetically Modified Organisms**

IFOAM .... **International Federation of Organic Agriculture Movements**

KRAV .... **Swedish Organic Agriculture Association or Kontroll-foreningen for altenativ Odling**

NASAA .... **National Association for Sustainable Agriculture Australia**

OGBA .... **Organic Growers and Buyers Association**

OTCO .... **Oregon Tilth Certified Organic**

UKROFS .... **UK Register of Organic Food Standards**

USA .... **United States of America**

WHO .... **World Health Organisation**

WTO .... **World Trade Organisation**

CHAPTER ONE

INTRODUCTION

1.1 Background

Sparked partly by an uproar over genetically modified crops, the organic sector is showing positive growth rates around the world. An analyst at Natural Food Merchandiser (Wilbur, 1999: 1) reports that investors valued Monsanto Biotech's agricultural business unit in the USA at 'less than zero dollars'. Wilbur suspects that this low value of the agricultural unit reflects fears that the market for genetically modified seeds may wither after four years of explosive growth. These fears are reinforced by the tremendous world-wide growth that has been experienced in organic farming. Although as yet a small industry, organic agriculture is becoming of growing importance in the agricultural sectors of a number of countries, irrespective of their stages of development.

According to the Committee on Agriculture of the Food and Agricultural Organisation of the United Nations (FAO, 1999a: 1), developing countries such as Egypt, Mexico, Uganda and Kenya, have small domestic organic markets. This is also the case in South Africa where the market is growing at a relatively slow rate. In contrast, organic agriculture has come to represent a significant portion of the food system in developed countries. Countries such as the USA, France, Japan and Singapore are experiencing growth rates that exceed 20 percent annually, while the industry already represents about ten percent of the food system in Australia and 7.8 percent in Switzerland. This phenomenon indicates that the organic sector is heading towards a boom.

There are various reasons for the increase in the growth of the organic sector. Knorr (1983: 281) describes the negative effects that industrialisation had on the agricultural sector in the 1940s. As the emphasis in agriculture shifted from small farms to larger farms that use modern machines and production practices, farm workers as well as farmers were displaced, farm size increased and farms were capitalised. This resulted in ever-enlarging farm debt, while both land prices and production costs increased significantly. At the same time production practices such as the intensive use of synthetic chemicals like fertilisers and pesticides seriously affected the farm resource base. These products are associated with a myriad of environmental problems such as soil erosion, pollution, and destruction of water resources caused by erosion and runoff. Runoff also tends to lead to contamination of food and soil. This situation was also exacerbated by governments and research units alike, through subsidies, farmer support services and other government programs.

Human beings have also been affected by industrialisation. Knorr (1983: 281) writes of "food faddists" as individuals who consume diets thought by most to be irrational. These consumers associate their health problems with the food they consume, or are dissatisfied with certain food attributes. However, he did find that the growth of health consciousness is a more significant factor in the development of organic farming than his terminology indicates. Edwards *et al.* (1990: 655) for example, view health consciousness and environmental concern as a single concept, arguing that circumstances that tend to be damaging to the environment also tend to be damaging to human health. These authors identify three major agricultural health risks that have led to increasing health consciousness: pesticides, antibiotics and nitrates.

Edwards *et al.* (1990: 655) also mention that certain antibiotics in animal feed may cause bacteria in animals to become resistant to antibiotics, a resistance that might be transferred to bacteria in humans, thus making antibiotics ineffective in treating human bacterial infections. Through conversion processes, he adds, nitrates lead to methemoglobin, which is perceived to be a threat to infants. Dunlop and Beus (1992: 418) confirm this view, associating infertility, immune system incompetence and cancer with pesticides. Viewing public concerns over the environment and health as "consumer concern" because they relate to consumer behaviour, they strongly argue against the use of pesticides.

It is clear that the negative effects of industrialisation have raised environmental concerns among farmers as well as the society at large. It is the decision of farmers to restore the resource base through organic farming (resource stewardship), together with the increase in health conscious consumers, that seems to have set the trend towards organic farming.

1.2 Aims and Methodology of the Study

The foremost aim of this study is to investigate whether wheat would have a comparative advantage if produced under organic management practices in the Western Cape Province of South Africa. The subsidiary aim is to examine various distortions, if any, of the existing policy environment surrounding the wheat industry as these will have an effect on the likelihood of organic wheat production.

The above aims will be achieved by using qualitative and quantitative primary data, obtained by conducting interviews with:

- individual organic farmers,
- specialists in agricultural economics,
- experts in wheat production and in the field of organic farming,
- organisations involved with organic farming, and
- agricultural related institutions.

The secondary data from the literature and Combud enterprise budgets will also be used.

The data will be used to accomplish the following detailed objectives in the first section:

- investigation of the position of the existing wheat industry in the Western Cape with a view to describing policies that affect this industry, as these are likely to affect the potential organic wheat industry,
- review of the theory of organic farming with an intention to describe the practice in detail,
- examination of the position of organic farming in countries that have experience in this farming system, focussing mainly on major organic wheat producers, and
- determination of the position of the general organic sector in the Western Cape, with a view to investigate the potential of organic wheat farming in this province.

The second section will focus on setting out and explaining the reasons for the particular analytical technique selected for this study.

The third section, data processing, will focus more on economic analysis, where specific objectives will include:

- determination of economic values in selected typical conventional[1] wheat budgets and simulated organic wheat budgets, and
- calculation of policy analysis matrices from the budgets.

The main aim of the matrices is the:

- estimation of the domestic resource cost ratios (DRCs) and social cost-benefit ratios in order to determine the comparative advantage in the use of resources,
- calculation of nominal protection coefficients (NPCs), effective profitability coefficient (EPCs), profitability coefficients (PCs) to determine the extent of distortions effected from various government policies, and
- computation of social and private profits to measure the extent of divergences.

Finally, the objectives in the last section will include:

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[1] 'Conventional' refers to a farming system that uses synthetic inputs and will be used interchangeable with the term "orthodox" in the text

- interpretation of results from various policy analysis matrices,
- evaluation of a sensitivity analysis in order to allow flexibility of the parameters used in the policy analysis matrix,
- conclusions, and recommendations for further study.

1.3 Problem Identification

1.3.1 Rationale for government intervention

The period after the Great Depression until the 1980s brought increasing prosperity to several sectors of the economy in South Africa, particularly the agricultural sector. Specialists like Vink *et al* (1996: 73) associate this prosperity with statutory intervention measures that are argued to be harmful both in terms of efficiency and equity. The key objective of these measures was to ensure optimal resource use. To achieve this, factors of production had to be used optimally with respect to economic, political and social development, and stability. Furthermore, these factors also had to contribute to the promotion of an economically sound farming system.

The approach used to accomplish the above objectives involved protection of farmers from foreign competition. This was done by granting subsidies to producers and controlling prices, which were largely above market prices. In favour of agricultural protectionism, McCalla and Josling (1985: 47-50) contend that some government policy measures, although inefficient, are implemented for the social welfare of the nation. Van Zyl (1990: 135) also argues that not all policies are inefficient, as there are policies that can make the agricultural production process profitable.

Studies by Lindert and Pugel (1996: 159), Bale and Lutz (1981: 8), Romer (1994:5) as well as others have also focused on the negative consequences of the direct and related government policy measures to agriculture. In this light, they argue that the measures themselves create and worsen the distortions in the market place. When such discrepancies exist, divergence occurs between market (private) prices of commodities and their economic (social) prices. In other words, prices of goods and services will not reflect their scarcity values (Van Zyl, 1990: 135). As a result, the interests of the private farmer and that of the state diverges. Josling (1993: 805) adds that protectionist policies undermine not only the agricultural market, but also national and international resource use. As a result, doubts arise as to the optimal use of the advantages of the nation, such that resources that could be efficiently used elsewhere would be wasted.

Apart from direct agricultural policies, Kirsten *et al* (1998: 538) mention that the comparative advantage position of agricultural commodities is also influenced by government related policies affecting agricultural inputs and resources. These include capital, land, water and labour. Distortive policies affecting agricultural inputs include value-added tax, import tariffs on imported inputs, and the like. In South Africa, one major example of an industry affected by these policies is the wheat industry.

1.3.2 The scope of change

During the mid-1980s within the agricultural policy framework, the agricultural sector was faced with many changes, which resulted from deregulation and market liberalisation that involved removal of direct and indirect support measures. The basis for this was the Uruguay Round negotiations of the GATT in 1986 (Ohene-Anyang, 1997: 10). These negotiations had long-term consequences for the agricultural sector, particularly wheat farmers as they exposed the industry to the world market with increased competition and less government intervention. Global markets that are relatively more free should motivate farmers to make optimal use of available resources, that is, to exploit products in which they have a comparative advantage. However, despite the fact that direct and indirect measures of subsidisation and protectionism have been removed, agriculture is still widely considered to be protected and uncompetitive, as Kirsten *et al* (1998: 538) contend.

Organic agriculture is also a new phenomenon in South Africa. However, because there is no legislation pertaining to organic agriculture, it is also likely to be affected by the existing policies, which will in turn affect its comparative advantage. In the future, organic agriculture will be regulated under the existing Agricultural Products Standard Act of 1990 (Act 119 of 1990). Draft regulations have been published by the National Department of Agriculture (NDA, 2000) (a). The regulation of organic farming is also disputed, as proponents against protectionism view this as an element of protection from foreign competition, which is also believed to have an effect on the comparative advantage of the industry (National Research Council, 1989: 235). Proponents of organic agriculture view legislation as an attempt to encourage farmers and to protect the consumer against deception in the market place, as it provides and protects certain labels that indicate a process claim.

1.3.3 Statement of the problem

The goal of trade liberalisation and deregulation is to create increased opportunities and global competitiveness in the trade of agricultural products. However, they have both induced a considerable degree of price squeeze and risk into the South African wheat industry at large. This should be contrasted to the past approach regarding the international market where the certainty of demand for domestic production (implied by the single channel fixed price system) limited some of the risk exposure of producers and processors. Under the existing market structure, producers and consumers bear the risk of volatile production, quality and prices (Edwards and Leibbrandt, 1998: 244).

As far as production is concerned, price and volume volatility widens the range of income fluctuations and increases the risk of production. On the marketing side, volatility of production places pressure on the smooth functioning of transport, storage and handling process in the marketing chain. This increases marketing costs, worsens price fluctuations and leads to lower than optimal investments in marketing facilities. Finally on the processing side, because wheat constitutes a vital and significant component of the final product of the milling and baking sectors, any changes in the price, supply and quality of wheat directly affects production costs and output prices. The burden of an increase in output prices is directly carried by the consumers.

1.4 Motivation

With respect to the problems identified in the previous section, a number of institutions including the Western Cape Department of Agriculture are looking at different strategies that can be considered as alternatives for wheat farmers. In identifying the strategies, the demand side of the equation has also been taken into account. Areas investigated include production system effectiveness, product differentiation, and market identification. Therefore organic farming in the Western Cape is believed to be one of the points of departure. This is because of the potential for long-term sustainability as well as higher prices for organic produce when compared with conventional produce (Lampkin and Measures, 2001: 62).

As organic farming is a new and a developing sector in the Western Cape, it qualifies as a niche market, which is differentiated by its unique products in the market place. Accordingly, the improved soil quality associated with organic practices is believed to have positive effects on the quantity and quality of products produced. Furthermore, several authors that include Lampkin and Padel (1994: 74) contend that organic farming is profitable. They ascribe its profitability to the present high price premium and market opportunities available for organic produce.

However, high premiums and market opportunities for organic produce are seen as short-term benefits, and this contributes to uncertainty as to the potential of the organic wheat industry in the Western Cape. Despite the inherent advantages, local farmers are price takers and need to lower their costs to survive. In this light, the only option available for them is to stop farming or invest in unit cost-reducing, output-increasing technologies, other inputs, and better management. This normally requires borrowed capital. Uncertain as to how many farmers can expand output, an innovative farmer may or may not become competitive and profitable enough to repay the borrowed capital.

Correspondingly, uncertainty is a constraint in the decision-making process and farmers make decisions that are irreversible, disregarding aggregate output and market prices (Bonnen and Schweickhardt, 1998: 593). From this perspective, determining the comparative advantage of the likely organic wheat industry can reduce this uncertainty and provide more insight into the possible future position of the industry.

1.5 Research Question

In a study that examines the comparative advantage of the potential organic wheat farming, it is important to determine all the distortionary effects of each of the policies that might affect the establishment or the efficient functioning of the industry. The results will therefore facilitate decisions not only on the extent to which the government and the industry should invest in organic farming, but also to understand the magnitude of policy effects in agriculture. These results will be a response to the main question the study is aiming to address, that is, should government and farmers invest in organic wheat farming, and if yes, to what extent?

1.6 Underlying Hypothesis and Value of the Study

Although government policy measures in agriculture are supposedly implemented for the welfare of the nation they can create and lead to distortions. Accompanied by exposure to foreign competition as the WTO urges all countries to move towards freer trade, the hypothesis underlying this study is that regardless of these conditions, organic wheat farming in the Western Cape is likely to have a comparative advantage. In addition to this fact, with fewer distortions the industry will operate more along efficiency lines.

The results of this study will also provide a basis for farmers to decide whether to invest or reverse their investments in organic farming, and for government to decide whether and to what extent it should invest in the industry. As the study addresses some environmental issues, environmental authorities may also find some use for this information. Lastly, because this is a new area of research in South Africa, the study will provide new information to agricultural economists, agricultural associations (including organic farming associations), and statistics institutes.

1.7 The Study Area

In the Western Cape, wheat production dates back a few centuries. During the 18th century it expanded gradually to certain areas, as the 'trekboere' opened up the hinterland. Therefore areas such as the Swartland, Riebeeck-Kasteel, Piketberg, Botrivier, Riviersonderend, Bredasdorp, Caledon, Swellendam and the like became well known as the major wheat producing areas of the Western Cape (Wheat Board, 1977: 1). In today's demarcation, wheat is produced in all five administrative areas of the Branch: Agriculture of the Western Cape, the so-called Boland, Swartland, Little Karoo, South Coast and the Northwest.

As a result, the study is intended to cover all regions in order to capture any effects on the production process of wheat under existing practices, as this is the base for investigating the potential of wheat when produced under organic practices. Various areas have been researched in the economics of wheat production. These include a research by Street *et al* (1996), where he compared the yields and production costs of wheat in South Africa with those of other major wheat producing countries. Another research that focused on the summer rainfall areas of South Africa, which excludes the Western Cape, was a study by Ohene-Anyang (1997). This was followed by Vink *et al* (1998) who compared the competitiveness of the Western Cape wheat industry at an international level.

The economists at the Western Cape Provincial Department of Agriculture have also analysed the wheat industry from a supply chain perspective (Troskie and Goedecke, 1998; and Troskie and Smit, 1999). Furthermore, Troskie in 1998 analysed South Africa's position in the international market, as well as the effect of an ad valorem (cursive) tariff on export parity. Another paper by Troskie and Wallace (1999) analysed the influence of a weakening exchange rate. Moreover, Edwards and co-workers have published a number of interesting analyses of the Western Cape wheat industry that focus on the importance of quality characteristics (Edwards, 1996; Edwards and Leibbrandt 1997 and 1998). Van Eeden (2000) also studied cost reducing production practices for small grain production systems in the Southern Cape.

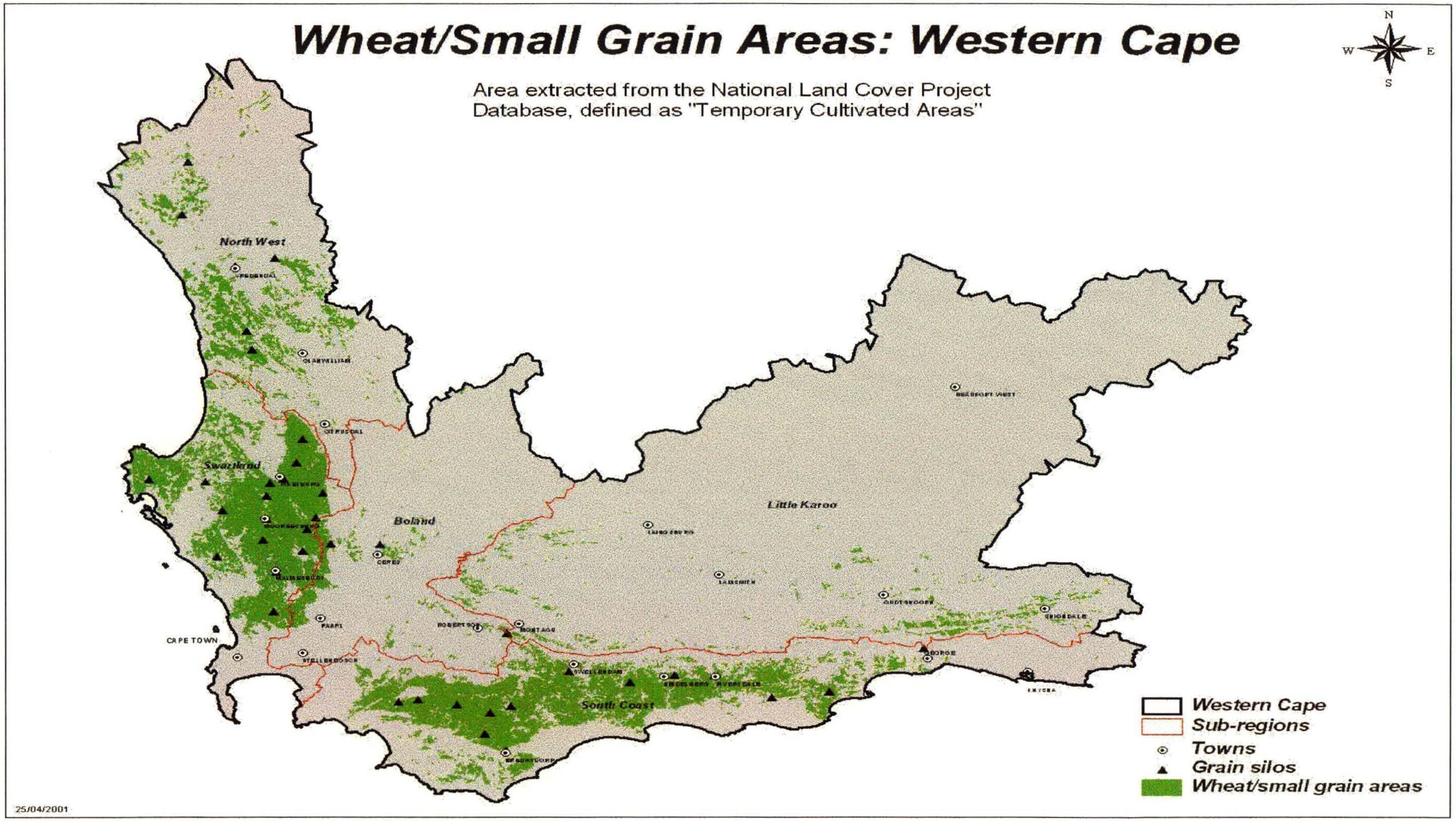
Finally, is a study by Van Rooyen (2000) that analysed the comparative advantage of wheat in the Western Cape focussed only on major wheat producing areas, omitting the Little Karoo and the North West regions. Furthermore, these studies scrutinise wheat under the existing practices and none of these has looked at whether wheat would have a comparative advantage if produced under organic management. However, for this study to retain credibility and validity, ten farming areas that are representative of the wheat producing regions in the Western Cape, have been chosen. Figure 1.1 below shows the wheat producing areas while the details of the areas chosen for the study are provided in the enterprise budgets (see Appendices A and C).

1.8 Outline of the Study

In Chapter Two a general description of the nature of organic farming will be provided. Chapter Three reviews the position of organic farming world-wide, with specific reference to wheat farming, showing which countries have developed significantly in this area. In Chapter Four, a description of the wheat industry is provided under the existing farming systems, including government policies that might have an impact on the comparative advantage of the industry. In this chapter, an attempt is also made to reveal whether there is the potential for organic wheat farming in the Western Cape.

Detailed information on the analytic tools that are used in this study is provided in Chapter Five. A financial and economic analysis follows in Chapter Six. Chapter Seven contains an interpretation of the results including a sensitivity analysis, while Chapter Eight summarises the main findings of this study and makes recommendations for further studies.

Figure 1.1 Wheat/Small grain areas: Western Cape



Source: Wallace, 2001

CHAPTER TWO

THEORY OF ORGANIC FARMING

2.1 Introduction

Growing public concern over the environment has led to a proliferation of terms, such as biological, organic[2], ecological, sustainable[3], and biodynamic. These terms have been used to describe an agricultural system that is perceived to be environmentally benign, economically sound and socially just. In most instances, an agricultural system that satisfies the above characteristics is viewed as being sustainable.

In line with the above clarification, Widdowson (1987: 1) views a sustainable agricultural system as holistic in nature. He describes a holistic agricultural system as concerned with giving the best utilisation of land resources, including labour and capital. The aim is to provide a full diet of highly nutritious food at competitive prices for the consumer on a national and international basis. At the same time, for an agricultural system to be holistic, there must be a realisation that there needs to be interdependence within the system. This interdependence refers to the interaction between environment, livestock, crops, and human beings. Amongst all approaches to sustainable agriculture, organic farming is viewed as satisfying all characterisations of a holistic farming system (Widdowson, 1987: 1).

However, as organic farming is not a widely practised phenomenon it is generally confused with all other approaches to sustainable farming, and as a result it is important to provide its definition. The practices and the rationale behind this farming system are also highlighted in this chapter, as these are perceived to offer more clarity.

[2] In many countries, the terms organic, ecological, and biological are used in a similar context, therefore will be used interchangeable in the text.

[3] In the text, the term sustainable is used in a wider sense to encompass not just conservation of nonrenewable resources (soil, energy, minerals) but also issues of environmental and social sustainability, however, the term is not used to describe organic farming or agriculture.

2.2 What is Organic Farming?

In the past there was no single definition of organic farming as it was defined by a multitude of private certification organisations in several countries. It can be said that it was still at a niche-market stage. Today multinational traders demand greater consistency, which has led to increased uniformity of this definition as the organic industry is growing rapidly. The Food and Agriculture Organisation of the United Nations (FAO,1999b: 5) defines organic farming in its basic standards as a term referring to a particular farming system that prohibits the use of synthetic[4] inputs. According to this organisation this definition does not mention the gist of organic farming. However, IFOAM (1999), a non-governmental organisation that is networking and promoting organic agriculture defines organic farming based on its principles and processes, as a system aiming to:

- produce food of high nutritional quality in sufficient quantity
- interact in a constructive and life enhancing way with all natural systems and cycles.
- encourage and enhance biological cycles within the farming system, involving micro organisms, soil flora and fauna, plants and animals.
- maintain and increase long term fertility of soils.
- promote the health, use and proper care of water, water resources and all life therein.
- help in the conservation of water and soil.
- use renewable resources in locally organised agricultural systems.
- work within a closed system with regard to organic matter and nutrient elements.
- work with materials and substances which can be reused or recycled either on-farm or elsewhere.
- give all livestock conditions of life which allow them to perform the basic aspects of their innate behaviour.
- minimise all forms of pollution that may result from agricultural practices.
- maintain the generic diversity of the agricultural system and its surroundings including the protection of plant and wildlife inhabitants.
- consider the wider social and ecological impact of the farming system.

[4] No single definition exists for this term as it is defined differently in different countries. The British, Columbia and Canada define a synthetic compound as a process which chemically changes a material extracted from naturally occurring plant, animal or mineral sources, excepting microbiological, mechanical and heat processes. The USA defines synthetic as a substance that is formulated or manufactured by a chemical process or by a process that chemically changes a substance extracted from naturally occurring plant, animal or mineral sources, except that such term shall not apply to substances created by naturally occurring biological processes (FAO, 1999b).

- produce non-food products from renewable resources, which are fully biodegradable.
- encourage organic agricultural associations to function along democratic lines.

Although the above definition describes organic farming, the major factor that distinguishes this farming system from other approaches to sustainable agriculture is the existence of both legislated standards and certification procedures. Their establishment defines a clear dividing line between this farming system and other approaches to sustainability, primarily for market purposes to protect both producer and consumer interests (Lampkin and Padel, 1994: 5). To this definition Klonsky and Tourte (1998: 1119) add that the term organic on its own is usually used as a label to differentiate amongst agricultural commodities in the market place.

However, the certification procedures and legislated standards that will be stressed later are not the only tools to distinguish organic farming from other approaches, but also practices that are used in this farming system.

2.3 General Practices of Organic Farming

According to Lampkin (1990: 28) organic farming has "suffered more than its fair share" of misconceptions and misunderstandings, and even today it still attracts some criticism from its rivals for being too ideological. These misconceptions and misunderstandings effected from the previously mentioned concepts such as biodynamic, biological, sustainable and ecological, as they are associated with a return to primitive or non-industrialised agriculture with complete abolition of agricultural chemicals. Lampkin (1990) further adds that this resulted from the fact that organic farming draws on some traditional techniques that were abandoned by intensive farming systems, not because they were ineffective, but as a result of various policies that were directed to achieve certain objectives. In explaining this, Poincelot (1986: 14) points out that at its best it is not a return to primitive agriculture as the methods used move with increased technology, but technology that is thought to be energy efficient and less or non-polluting. These will be highlighted in the paragraphs below.

2.3.1 Crop management

2.3.1.1 Crop rotation and intercropping

According to Grubinger (1992: 760) successful organic production is not possible over the long term unless intensive crop rotation is practised. Heady (1948: 646) defined crop rotation as successive planting of different crops in the same field. Accordingly, Blake (1989: 30) points out that in this process pests cycles are broken, as those specific to certain crops can remain in the soil from one year to the next, but the several-year gap between planting a particular crop ensures that pests have disappeared when that crop is planted in the same field again. This practice often serves multiple purposes, and thus it has been touted as a good management practice in organic farming as it also rectifies weed control, particularly those that attract insects and diseases to plants.

Apart from pest control, Power (1987: 7) asserts that the term crop rotation refers to the rotational effect, which includes an increase in yields of some crops, especially when combined with intercropping as opposed to monocropping under similar conditions. Goldstein and Young (1987: 53) add that this increase in crop yields is usually greater than expected, especially when legumes are used in rotations as they have the capability to fix nitrogen from the atmosphere into the soil because of their symbiotic traits. Thus rotations reduce bought-in inputs, improve soil fertility and structure, and increase crop diversity. Improvement in soil structure as a result of crop rotation and the use of cover crops can prevent soil erosion (Jackson, 1990: 53).

However, although crop rotation is regarded as a good practice in organic farming it also has its drawbacks, particularly those involving diversifying from cash grains to crops such as leguminous hays with less market value. These can cause economic trade-offs and may also require purchasing of new equipment (National Research Council, 1989: 141). The Council further suggests that as with all sound management practices rotations need to be tailored to local soil, water, economic and agronomic conditions.

2.3.1.2 Weed control

In all aspects of pest management, weed control poses the greatest challenge to organic farming as weeds can result in yield reduction in that some have allelopathical, parasitic, and infectious effects that are hazardous to crops. According to the National Research Council (1989: 187) multiple strategies in controlling weeds are employed, including mechanical cultivation, water management and cultural practices such as hand weeding, animal grazing, and timing of planting. Dudley *et al.* (1992: 23) observe that cultural practices such as crop rotations with intercropping have the capability of reducing weeding as a result of the density of crops. This also ensures the even distribution of labour as harvesting work comes in manageable portions throughout the year rather than all at the same time as is the case for monocropping. Mulches, flame weeding, and stale seedbeds amongst other cultural practices are also used to manage weeds. Several combinations of cover crops and tillage practices are also effective in controlling weeds especially when certain crops like soybeans and corn are planted.

However, out of all the weed control strategies, mechanical cultivation and especially hand weeding, still remains the most commonly used in organic farming but are found to be costly (Grubinger, 1992: 760).

2.3.1.3 Biological control

Biological practices also play a very important role in organic farming, where naturally occurring and purchased pest predators and parasites are used to keep the pest numbers to a level where the damage they do is economically acceptable. Fisher (1997: 62) mentions that a naturally occurring bacterium, *Bacillus thuringiensis*, is the one that is used expansively in organic farming, especially in vegetable production. Some organic growers follow a formal integrated pest management (IPM) programme using traps that are permissible with lures such as pheromones. In line with this, Grubinger (1992: 760) adds that biological practices such as the use of beneficial insects that are commercially produced could soon become an important factor in organic farming, as this will also accommodate large-scale organic production.

Although these practices are perceived to be less costly they are also found to be less effective in the short-term when compared with their conventional counterparts (Grubinger, 1992: 760).

2.3.1.4 Herbicides

Herbs and plant extracts are also used in organic farming, often including flowering perennials used mainly for their medical and aromatic-flavouring properties (Gill, 1999: 31). These herbs are used for both plant and animal production in organic farming. According to Pickering (1993: 47) certain herbs such as thyme, rosemary, parsley, yarrow, chives, scented geraniums, and roses have their part to play in organic plant production as they are used as deterrents against different insects that are hazardous in plants. Some of these plants are later gathered for sale, particularly those with aromatic-flavouring properties, as they are also used for domestic purposes. He further mentions that other herbs like tobacco nicotine residues are mixed with sugar to make a sticky liquid that is effective in controlling pests that include red spider mite.

As with all farming practices these herbs are also criticised for their slow reaction when compared with synthetically manufactured remedies (Food and Beverage Reporter, 1999: 24).

2.3.2 Soil management

Lloyd (1989: 23) remarks that soil husbandry is one of the most important principles of organic farming as its proponents believe that the physical, chemical, and biological structure of soil is achieved through created and lasting compost that is collected from selected material. This compost is made from organic residues that include various manures, domestic yard waste, and other food processing wastes that are produced locally or imported onto the farm.

According to Poincelot (1986: 760) the compost used for organic matter maintenance plays a very important part in organic farming, as it is also the primary source of plant nutrients, particularly nitrogen. These nutrients are also enhanced by the use of legumes in rotations. In view of this, the National Research Council (1989: 152) adds that nutrients like phosphorus can also be replenished through compost application though rock phosphate can be used instead. Potassium is also one of the most important nutrients required by plants, and obtained through planting various crops such as alfalfa and clovers.

However, looking at nutrient maintenance, there are arguments that organic farmers are also using synthetic inputs to supplement residues. The National Research Council (1989: 144) holds that these farmers use these inputs only when residues cannot meet the nutrient requirements of their crops. The Council contends that there may be certain conditions whereby soils are chronically low in a nutrient, especially at the early stages of conversion and early in the season when soils are cool and mineralisation rates are low. In addition, synthetic inputs like copper and sulphur are also used in organic farming to supplement the residues, although there are restrictions and they require permission for their use.

In conjunction, Klonsky and Tourte (1998: 1120) point out that these soil management practices are criticised, as the organic matter requires a period of time to decompose and mineralise before nutrients are made available for plant utilisation. The practices are also criticised for suppressing some soil-borne pathogens, particularly compost. In addition, there is uncertainty as to the efficiency of some organic practices in supplying nutrients, specifically manure as it is subject to runoff and volatilisation. These authors further mention that practices that can increase the efficient use of nutrients may be economically costly.

The practices of organic farming as discussed in the previous paragraphs refer mainly to crop production. However, there are also organic practices covering animal husbandry, though organic livestock production is rarely found in South Africa, specifically in the Western Cape. These will be highlighted in the paragraphs below.

2.3.3 Animal management

Animals, especially livestock, play a very important role in organic farming, particularly in nutrient cycling and their ability to make crop rotations economically feasible through their consumption of forage crops. As mentioned in section 2.2, one of the main principles of organic farming is to promote animal health through appropriate natural management. In line with this Fisher (1997: 62) states that the following practices are used in organic livestock production:

- animals are fed a diet to which they are physiologically adapted.
- young stock are usually raised by their own mothers for extended periods.
- internal parasites are primarily controlled through clean grazing systems.
- housing with adequate space and bedding to allow comfort and minimise stress is required.
- mutilations such as tail docking of piglets and debeaking of poultry are not allowed.

Gill (1999: 31) explains that herb and plant extracts are also used for medication in livestock management, as are growth promoters. In addition, he also points out that to be in line with organic livestock principles, the European Union is aggressively banning the historically-used antibiotic growth promoters because of the risk of possible drug resistance to human pathogenic bacteria.

Although organic livestock production is practised, the Food and Beverage Reporter (1999: 22) contends that it is a costly exercise as it requires longer production times, as hormones and other artificial growth promoters are not permitted. For example, organic chickens are usually slaughtered at six to nine weeks instead of the usual six to seven weeks in orthodox practices. The Reporter further holds that additional space also increases the costs of organic livestock, as production requires natural extensive grazing as compared to feedlot based production. Organic feed is also usually twice the cost of conventional feed which exacerbates the costs, although these are thought to be offset by animal manure that is used as fertiliser to produce the feed.

2.4 Anticipated Organic Wheat Guidelines for the Western Cape

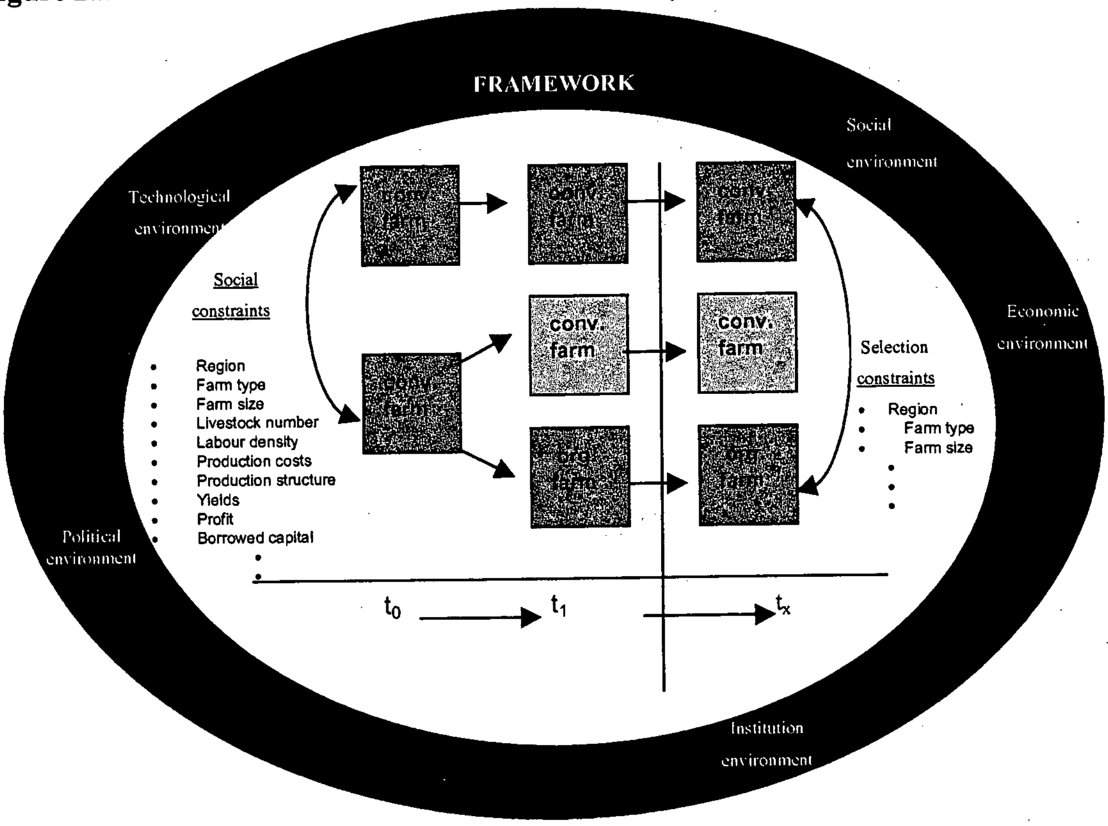
Although general organic practices are discussed in the previous section, there are some guidelines that wheat producers need to consider pertaining to organic wheat farming in the Western Cape. These guidelines are based on certain assumptions that must be made when modelling an organic farming system using various techniques that include the reference system.

2.4.1 Designing and defining the reference system

An organic farming system is complex as it is composed of interrelated components, which means that a multidisciplinary approach is needed to study it (Upton, 1987). However, to reduce complexities and to increase understanding, simplification is of importance. Thus this study concentrates on only wheat as a subsystem. The study is based on the following assumptions: (i) it is the farmer's choice to follow a certain production system or pattern (mixed farming, crop rotation, and intercropping) (ii) interaction effects have little impact on yields or levels of input use (Monke and Pearson, 1989: 162).

The reference system as used by Offermann and Nieberg (2000), Klepper Lockeretz (1977), and Murphy (1992) is used in this study to compare organic with conventional farms. However, the study uses the approach where the income of a conventional farm in the year of observation is used as an indicator of the hypothetical income of the organic farm (Offermann and Nieberg, 2000). In this case, comparison is between conventional and organic farms that have a similar potential, that is, a similar endowment of production factors. This approach allows for exogenous variables to the system to be excluded, so that the effect of the endogenous variables can be determined, as well as for alternative scenarios to be investigated (Fowler *et al.*, 1998). The approach is illustrated in Figure 2.1 where selected conventional and organic farms are compared at a point in time t_x.

Figure 2.1 Selection of a conventional reference system for the analysis of organic farms



Source: Nieberg and Offermann (1998)

It is therefore under these circumstances that the following subsection is focussed on organic wheat management particularly for the Western Cape.

2.4.2 Soil management

In wheat production, carbon is one of the main determinants of quality. Therefore, soil management, particularly of low yielding systems like organic farming should include regular return of carbon-containing organic matter to the soil. This is crucial in the Western Cape, which is characterised by low quality wheat when compared with other provinces, especially the Orange Free State and other countries (Edwards and Leibbrandt, 1998: 242). Therefore, this is the reason underlying the importance of crop residues, particularly wheat straw, green manures, and compost in organic wheat farming. Accordingly, tillage practices, including cultivation, should aim to maintain the biologically active surface layer in the top 15 to 75 mm. Various biological formulations like beneficial fungal feeding mites, bacterial-feeding nematodes, flagellates, amoebae and celiates are also needed to enhance soil biological processes (Ingham, 2001).

Deep rooted annual and perennial pastures or crops like lupins combined with rotational grazing are also recommended in a rotation design for the improvement of poor soil structure. This is because good soil structure without compaction allows extensive deep root growth to exploit soil reserves for moisture and nutrients, hence the use of light machinery in organic farming (Moffett, 2001).

2.4.3 Crop nutrition

One of the important considerations in soil management is to balance the nutrients. In organic wheat production, nutrients like nitrogen and phosphorus are obtained from an appropriate proportion of green manure crops such as medics and lupins. However, for a low yielding system like organic farming, these nutrients often have to be supplemented (see the Table 2.1). In the Swartland area which has a poor soil structure, further top dressing is recommended due to nitrogen losses resulting from leaching. For wheat production in general, nitrogen is of importance as it is an important determinant of grain quality, and hence price.

The maintenance level for other nutrients including phosphorus is estimated at about five kilograms per grain yield (ton). To supplement this, phosphate sources like seaweed and rock phosphate can be used. In acidic soil areas where pH is low and phosphate fixation capacity is high, natural rock phosphate is recommended. With regard to nutrients like potassium, it is assumed to be readily available in the soil for crop requirements. However, in cases of a demonstrated need, especially on sandy soils, inputs like rock potash, potassium sulphate or potassium chlorine can be used with the permission of the certification agency.

The first application of these nutrients using organic fertilisers is recommended before and during planting which mainly take place in May depending on the cultivar (Expert Group, 2001)[5].

[5] Derek Crafford, Dirk Hannekom, Mike Ferreira, Gavin Cooper, Kobus Laubscher, Philip Oosthuizen, Brian Pickering, Dries Engelbrecht, Evan Browning, Mark Hardy, Sandra Lamprecht, Pieter Raath, and Benny Wessels (2001)

Table 2.1 Anticipated fertilisation guidelines for dryland organic wheat in the winter rainfall region (per ton)

	Nitrogen	Phosphorus	Potassium
Need to maintain	40 kg	5 kg	7 kg
Get from soil	30 kg	0 kg	7 kg
Nett	10 kg	5 kg	0 kg
Apply	30-40 kg	8-10 kg	0 kg

Source: Expert Group, 2001

In areas that include the Middle Swartland, Darling-Hopefield, and Strandveld, deficiencies of certain microelements such as copper have been identified. To eliminate this problem copper sulphate at approximately two kg per ha or copper-oxichloride at one kg per ha can be applied as an emergency measure not later than the piping stage (Volschenk and Eksteen, 1977). Conversely, areas such as Sandveld, Heidelberg, and George are susceptible to zinc deficiencies while the North Swartland and Strandveld are identified as having deficiencies of manganese (Division of Soil Science at Elsenburg, 1988). However, fertilisers used in organic farming also contain trace elements to combat these imbalances. To achieve the desired results, two applications are recommended, the first in July and the second in September.

2.4.4 Crop rotation

Good crop rotation planning is the single most important management practice determining yield and profitability. Crop rotation is also viewed as an investment in risk aversion. A well-planned rotation is critical if growers are to remain economically, environmentally and agronomically viable. However, there is no universal rotation system that will suit all cereal producers, as this will depend upon various determinants including the attitude and aspirations of the producer, targeted enterprise, cash flow situation, commodity prices, natural conditions like soil type, soil fertility, and rainfall distribution. Accordingly, weed species and distribution, livestock considerations, and available machinery and equipment are also among the contributing factors (ARC Small-Grain Institute, 2000: 2).

For organic wheat production, however, it is recommended that sustainable rotations typically include a well-managed balanced legume-based pasture phase to rebuild soil chemical, biological and physical condition to make it suitable for successful cropping. In addition, rotations can be designed to break pest and disease cycles and reduce weed burden (McCoy, 2000). One example of a rotation design recommended for strong soils includes one year of pasture, then → wheat → chickpeas → wheat. On lighter soils the rotation can be varied to accommodate one year of pasture, then → wheat → pasture → lupins→wheat→ pasture → canola. Rotational designs include grass pastures to control weeds like quack (Expert Group, 2001).

However, for the best rotation design a market for the alternative crop has to be considered, as the aim is also to improve the farmer's cashflow. In the above likely rotation systems, chickpeas are the only crops that are not grown by Western Cape wheat producers. However, the crop is of importance in India, the Middle East, the Mediterranean area, Mexico, and China. Chickpeas are mainly marketed for human consumption while the second grade is used as stock feed. There is also a small growth in demand for chickpeas in the textile industry as the leaves yield an indigo-like dye. In India, the leaves are also used medically as an aphrodisiac as well as to cure throat bronchitis, cholera, diarrhoea, snakebite and the like. Chickpea production in the world has increased slightly over the years but is unlikely to match the demand, suggesting a market opportunity for farmers. At present the grain also fetches reasonable prices, ranging between \$500 to \$600 per ton of chickpeas (Agriculture, Western Australia, 1999).

2.4.5 Weed management

Weed control is one of the main challenges facing the producers of organic products. However, with timely management integrated weed control gives the best results without the use of herbicides. Additional preventative measures including high density planting, soil cultivation, rotation design, and flaming have been recommended for organic wheat production.

Timely soil cultivation after a good first germination or the first autumn rains of the wheat year is recommended, followed by an effective second weed kill at seeding. Although limited by soil type, tine implements composed of a no till planter, fixed shanks, flat blades, and prickle chain can achieve desired results. This implement can be effective in controlling weeds before and during planting. It is mainly suitable for the sandy soil areas like that of the Northwest region, Darling and Hopefield areas of the Swartland region. To conserve moisture content, the use of crop residues and injected micro-organisms is of importance due to poor soil structures in the wheat producing areas, and tillage practices followed in organic production. As a result tillage practices are recommended to a depth of 15 to 75mm of the topsoil. Cultivation, particularly after planting, will be more effective with a lower plant density of 120 plants per m^2 on a wider row spacing although this is not strongly supported because organic farming is a low yielding system (Expert Group, 2001).

Options that include flaming are widely used on extensive systems especially during wet weather conditions. This method is also recommended for the steep slopes of the Ruens including the strong soil structures of the Swartland and the Little Karoo. The effectiveness of this method has been observed, especially on narrow row spacing. However, the method is believed to be costly, particularly because of the cost of the propane gas that is used. However, mixed propane (LPG) can be used as an alternative to lower the costs (Expert Group, 2001).

Typical organic wheat management also requires close pasture management prior to cropping in order to reduce the weed seed burden, possibly involving high impact grazing pressure. To achieve desirable results, grazing by approximately eighty-seven sheep per hectare, for example, is suggested for at least two weeks before planting.

Apart from livestock, a good rotation design is one that includes leguminous plants as it is the most effective in controlling weeds. However in a rotation of wheat after medics, rhizotonia problems have been identified, therefore an allowance of a month for post emergence weed control is recommended. Therefore, good timing of medics plantings after the first germination can keep the weed problem under control (Expert Group, 2001).

Through biological processes, balancing the ratio of micro-organisms is also effective to combat weeds due to tillage practices. To achieve desired results, organic inputs like E.M (Effective Micro-organisms), although not yet registered, can be used (Moffett, 2001).

2.4.6 Pests and disease control

In the Western Cape diseases such as yellow rust, eye spot, and stem and root rot are the major problem in wheat production. For most cereal and grain legume crops, rotation design is fundamental for the control of soil borne diseases and pests. The black sandmite, ball worm and aphid are also the major pests associated with wheat production. In particular, aphids are at their maximum levels during September.

However, preventive measures including balanced crop nutrition, variety selection, habitat management to encourage predators, and organic manuring to stimulate antagonists to soil borne diseases are effective. Pure organic seeds have been observed to have resistance to diseases in variety selection. Also oak trees have been found to be the best habitat for predators like ladybirds. The endemic predators like parasitic wasps and parasitoids can also keep pest populations under complete control although they rarely justify the cost (Zúñiga, 2000: 257; and Expert group, 2001). However, where direct intervention is required, organic production standards permit a number of inputs including sulphur. These products should be used as a last resort as they still have the capacity to disrupt the ecosystem interactions on which the stability of the organic farming system depends.

2.4.7 Varieties and seeding

Cultivar choice is an important production decision and if correctly planned, could greatly contribute to reducing risk and optimising yield. Factors determining the cultivar choice are fundamental to the farmer's decision, including yield potential, grading and quality, straw strength and length, and growth period. Crop competitiveness, resistance to diseases as well as other varietal characteristics such as earliness of ripening are also attributes that need to be considered in variety choice (Richards, 1989: 577).

In the Western Cape, the most popular cultivars are SST 57 and 88 although the latter is losing popularity as a winter wheat, as it requires a long growing season. Others characterised by a strong straw and a short growing season include SST 65 and 94. SST 94 and SST 57 are the best for disease resistance (ARC-Small Grain Institute, 2000: 11, and Expert Group, 2001). At present, organic farmers are allowed to use conventional seeds due to the shortage of organic seeds, however, in five years time farmers will be obliged to use organic seeds only (Browning, 2001).

Furthermore, it has been identified that older traditional varieties of wheat would be more suitable for organic producers, although modern varieties have been found to perform satisfactorily (Newton, 1995:63). In this context, tall crops were traditionally used to smother weeds (Richards, 1990: 160). To spread the risk, it is recommended that different cereal varieties grown in the field can have positive benefits (Lampkin and Measures, 2001:60).

Seeding rate is also one of the determinants of grain yield in organic wheat farming. This rate has to compensate for low germinateability, poor emergence and damping-off of seedlings, hence a high density of 250 plants per m^2 (154 kg of seeds) for a narrow row spacing (154 mm) is recommended. However, high densities can contribute to water stress problem especially if wheat is planted after canola. For effective cultivation purposes, a density of 120 plants (70-80 kg of seeds) is recommended on a wider row spacing of not less than 300 mm, particularly using SST 57.

2.4.8 Post harvest practices

Prior to harvesting, one of the determinants of wheat grain quality is the moisture content where levels are recommended to be lower for better quality. After harvesting, which is mainly between October and December, storage is the main determinant of quality. This is because protein content is believed to increase with storage. With regard to temperatures, wheat grain is generally stored at about 10^0C in a pest free environment, which can be controlled by a variety of organic inputs such as diatomaceous earth.

However, for milling purposes the requirements are determined by market specifications, where the main concern is quality. Several studies including that by Starling and Richards (1990: 205) have been conducted to determine the quality of organic wheat. These authors proposed a positive relationship between quality and the cultivar chosen. Furthermore, with correct practices, the authors observed an improvement in quality. Generally, baking companies specify moisture levels of less than 13. 5 percent and not greater than 14.5 percent in processed grain. These levels can be maintained starting from harvesting where the grain dried by almost eight percent. However, for milling purposes, the grain is recommended to be approximately 12 percent dry. Farmers meet these requirements mainly through the use of blowers.

In South Africa, the quality of wheat is determined by the grading system which is promulgated under the Agricultural Products Standard Act of 1990 (Act 119 of 1990) such that only one bread class will exists with three subclasses such as BP, BL, BS. The classes are determined according to the protein content (>11%) of the grain. The hectolitre mass as a density parameter gives a direct indication of the flour extraction capability of the grain sample and is also a critical parameter as it largely influences profitability. Furthermore, a high falling percentage of wheat, which is an indication of the α-amylase enzyme activity in the grain, is also amongst the determinants of quality.

Table 2.2 Classes and grades of bread wheat

Subclass		BP	BS	BL
Protein (12% mb)		> 12	> 10	> 9
Falling Number (min)		250 S	250 S	250 S
Grade				
Kg/hl (min)	79	BPS	BSS	BLS
	76	BP1	BS1	BL1
	74	BP2	BS2	BL2
	70	UT [Utility grade-Falling number (min) 150 S]		
	70	Class other		

Source: ARC-Small Grain Institute, 2000

At present, the only organic flour that is produced domestically, particularly in the Orange Free Sate is stoneground flour, which is believed to meet the above specifications. However, the quality will be even better through adoption of improved varieties and the use of agronomic methods for quality improvement (Starling and Richards, 1990: 209).

2.5 Why Organic Farming?

During the past twenty years, farmers have shown a steadily increasing interest in organic farming. In line with this, Cacek and Langner (1986: 25) remark that farmers who adopted organic farming methods early in this period were motivated by various reasons, augmenting those mentioned in the previous chapter. The definition and practices of organic farming, comprising the aims and principles of this farming system, also highlighted some of the reasons. These are perceived to include both public and private benefits with the latter referring to low production costs, high price premiums and benefits that are obtained through diversification. These are measured through the market as observed by Savage *et al.* (1974: 20). The public benefits include reduction in environmental pollution (negative externalities), maintenance of rural communities and employment, and food security. These will be discussed in the paragraphs below.

2.5.1 Reduction in negative externalities

Economists define pollution as a negative externality, which is a human-made, unbargained-for, negative element of the environment. Also, pollution is termed an externality because it imposes costs on people who are external to the transaction between the producer and the consumer of the polluting product. These conditions hold usually in the case of commonly owned goods like water, air, and land which are also inputs in the production and consumption process. Economists called this the "free access problem" which is also termed as the "tragedy of the commons" by Hardin (1962: 1243). This is a problem that explains the reason for commonly held open access goods being overexploited, arising from the fact that they have public goods features.

According to Ronald (1960: 19), and Tweeten and Zulauf (1997: 263), when goods are publicly owned a tendency to free ride arises, as consumption by an individual does not diminish consumption available to another, such that the marginal cost is zero. This condition also leads to difficulties in internalising externalities, as there are high transaction costs involved. Savage *et al.* (1974:23) state that when these conditions exist the market fails to register all costs and benefits, thus this has been partially responsible for the deterioration of the environment. They further contend that if other means were used to reduce the environmental deterioration, today this problem would be minimal.

The MAF (1997: 1) consider organic farming as one of the means to reduce environmental deterioration, as it avoids or restricts the use of synthetic inputs and instead relies more on recycling of nutrients that are observed to be less susceptible to leaching, even when applied heavily in its farming operations. MAF reviewed a number of ground water studies and found that synthetic fertilisers can lead to pollution of ground and surface water with nitrogen and phosphorus, especially under conditions of high rainfall. The organisation further contends that, although incorrect organic practices could indeed bear some potential risks for polluting ground and surface water, the detriment to the environment tends to be generally lower compared to orthodox practices.

According to Poincelot (1986: 27) organic farming is also thought to contribute to the reduction in air contamination, a common externality. This is made possible by the use of light machinery in organic practices. Light machinery emits less fuel gases into the air, and can be utilised in organic farming because of good soil structures found in this farming system. In addition Poincelot (1986: 27) mentions that the use of excessive synthetic pesticides that are prohibited in organic farming are also observed to be harmful to the environment as they emit harmful gases, which are also detrimental to the ecosystem.

Stolze *et al.* (2000: 35) remark that soil as an element of the environment is one of the most important natural resources because it is the central basis for all agricultural activities. Conservation is thus important, as it maintains the productive capacity of this resource. In addition they argue that "non-sustainable farming systems as a result of their practices are exacting costs in order to achieve their high rates of crop productivity". These costs include soil erosion, which is also a negative externality. Therefore, organic farmers in their practices are thought to be effective in reducing these costs.

2.5.2 Maintenance of rural communities and employment

Maintenance of rural communities and employment is seen as one of the major public benefits of organic farming, and for the farmers who are thought to be concerned about the wellbeing of society this can be viewed as one of the reasons for their interest in this farming system. According to MAF (1997: 28) technological change in farming practices as a result of industrialisation, especially over the last four decades, resulted in an increase in social costs. These costs have increased as industrialisation has led to the displacement of farm labour, a situation that was exacerbated by a rise in off-farm income and employment opportunities. MAF argues that for a farming system to offer balanced sustainability it must have the ability to maintain and enhance the social and cultural wellbeing of the society.

Cacek and Langner (1986: 28) and Lockertz *et al.* (1978: 132) state that organic farming can help maintain rural communities as it is observed to offer some returns. These returns are associated with less inputs being purchased by farmers, although this remains controversial. The returns can also be exacerbated by the fact that farmers borrow less money and thus are less affected by interest that is charged by commercial banks compared to farmers who depend more on external inputs. As a result, Havinga (1995: 10) adds that farmers with little capital can also have their place in organic farming. Wynen (1992: 9) compares the input use of organic products with those of conventional farms, which is indicated in Table 2.3 below.

Table 2.3 Comparable input use in South Eastern Europe ($ per hectare operated)

Input	Organic	Conventional	Difference
Fertilisers	3	19	-16
Pesticides	0	14	-14
Interest	5	16	-11
Fuel	12	21	-10
Machinery & Equipment	31	74	-42
Labour	35	41	-6

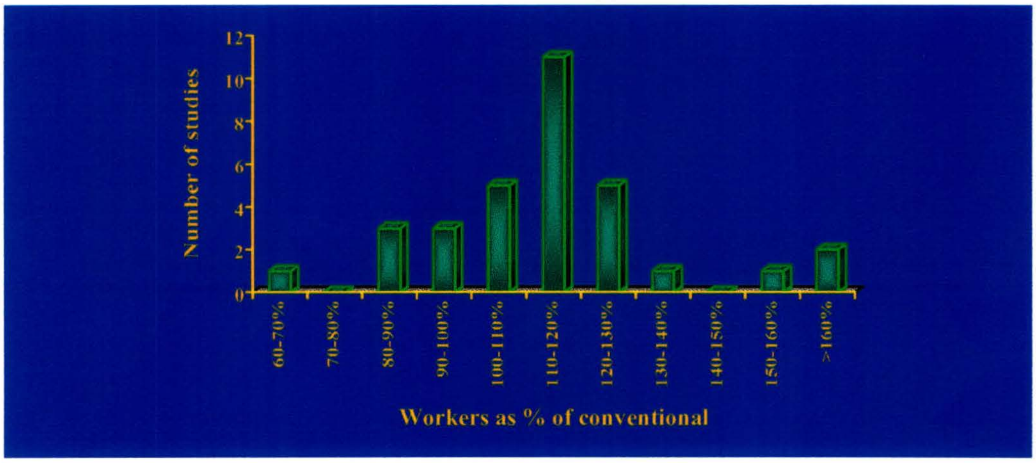
Source: Wynen, 1992

The table indicates that input use in organic farming is lower when compared with conventional farming, with the exception of labour where the difference between the two farming systems is found to be smaller. However, a number of studies that include Offermann and Nieberg (2000: 15) found labour costs in organic farming to be generally higher when compared with conventional agriculture, depending on production activities and farm type. In this regard, they reported higher values for labour per hectare on organic arable and mixed farms, while organic dairy farms are found to use the same amount of labour or less than comparable conventional farms.

Apart from production costs, the Association for Conservation and Energy (1998: 3) pointed out that the world policy agendas today emphasise the importance of the relationship between environmental protection, economic and social goals such as job creation and protection of human health. In this respect, Offermann and Nieberg (2000: 18) remark that as employment creation characterises policy objectives in several countries, organic farming is seen to have the potential to achieve this objective. These authors reveal that in Europe, a larger impact on employment was expected as labour use was estimated to increase by 20 percent per hectare on average as a result of organic farming. They further hold that with 1.3 percent of agricultural land farmed organically in Europe, about 18 000 more people were employed in 1996 than would have been in a situation without organic farming.

However, employment creation in organic farming is a controversial issue, as it is associated with inefficient labour allocation and increased labour costs (see Figure 2.2). Arguably, Widdowson (1987: 1) contends that in a well-balanced agricultural system efficient allocation of resources is the main focus, such that in the case of labour an even spread of work over the whole year is ensured. He further holds that a well-balanced agricultural system must be considered on a holistic basis, such that the replacement of a farm worker by a machine must not be based on a simple cost-effective basis. The cost-effective basis includes the question of whether depreciation on a machine amounts to less than an employee's total cost? Under these circumstances, Widdowson suggests that additional costs of unemployment must be taken into account.

Figure 2.2 Comparable labour intensity



Source: Offermann and Nieberg, 2000

2.5.3 Food Security

With regard to sustainability, particularly food sustainability, organic agriculture plays a very important role and hence its importance in food security. A sustainable food security system implies producing and consuming food in a manner that conserves the regenerative capacity of the natural resource base and maintains biodiversity for present and future generations. FAO (1998: 2) defines food security as 'a situation in which all households have both physical and economic access to adequate food for all members of the society, and where all households are not at risk of losing that access'.

There are three dimensions implicit in the above definition, namely: availability, stability, and access. Adequate food availability means that on average sufficient food supplies should be available to meet consumption needs. Stability refers to minimising the probability that in difficult years or seasons food consumption might fall below consumption requirements. According to Van Zyl (1992: 181) access draws attention to the fact that, even with abundant supplies, many people still go hungry because they do not have resources to produce or purchase the food they need.

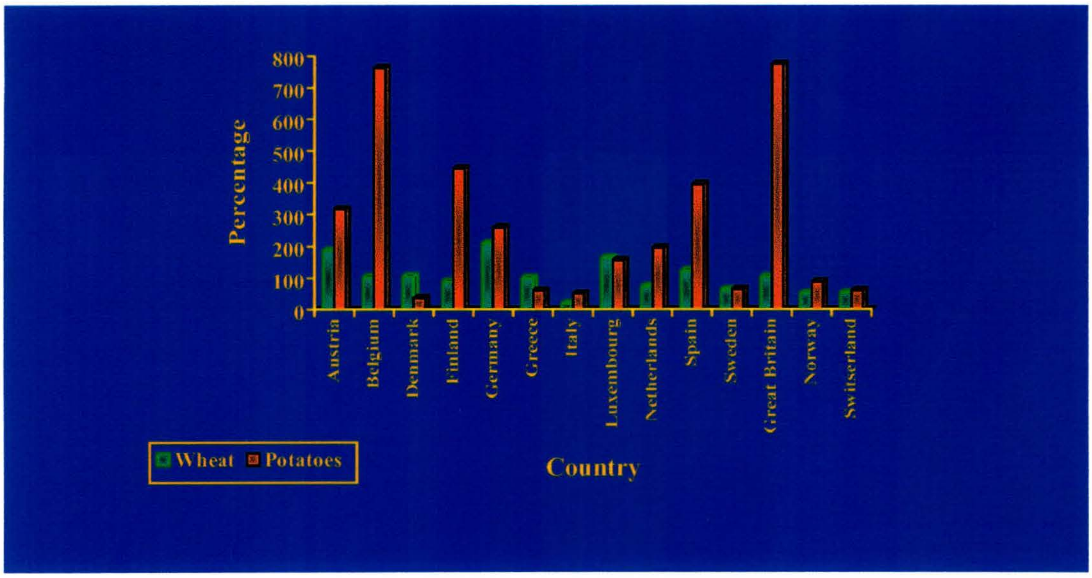
The FAO further remarks that if food needs are met through exploitation of non-renewable natural resources or degradation of the environment, there is no guarantee of food security in the long-term. This organisation further indicates that dependence on off-farm agricultural inputs such as synthetic fertilisers, pesticides and seeds increase farmers' dependence on credit facilities, which lead to a decrease in local food security and self-reliance. This is the reason that organic agriculture is viewed by some as a better farming option as it relies less on purchased inputs as indicated in Table 2.3.

However, non-proponents of organic farming do not view organic farming as a system that can offer adequate food availability. Arguably, Newton (1995: 1) points out that organic producers are seen as a group of idealists providing food for a minority. Hodges (1978: 5) also mentions that the rivals contend that biological agriculture has a relatively low productivity as compared to conventional farming in that it would never be productive enough to supply the steadily increasing world food requirements. Various studies by Lampkin and Padel (1994); Offermann and Nieberg (2000); and Hodges (1978) reveal that these beliefs do not hold in the long-run as organic yields can be as high as the orthodox ones due to a balanced system. The latter confirms this by revealing that in 1975 an official French government report was produced on biological agriculture where cereal yields were found to be equal or only marginally below yields on orthodox farms. On dairy and vegetable farms, yields were found to be similar to those of orthodox neighbours.

2.5.4 Price Premium

As was mentioned previously, organic farming has numerous private benefits, higher price premiums for organic products compared to conventional products being one of these (see Figure 2.3)

Figure 2.3 Typical producer price premia for organically produced wheat and potatoes in different countries (1994-1997)



Source: Offermann and Nieberg, 2000

Offermann and Nieberg (2000: 42), and Lampkin and Padel (1994: 76) view this price premium as one of the reasons that some farmers have an interest in organic farming. They add that the premium is due to the fact that the product is organic and consumers therefore are prepared to pay a higher price. Offermann and Nieberg (2000) pointed out that the availability of the price premium is highly dependent on the product, and varies from country to country and also from crop to crop.

Figure 2.3 shows price premia for wheat that range between 50 and 200 percent above conventional prices in a number of countries. Lampkin and Padel (1994: 101) attribute these premia to demand and the level of conventional prices. Apart from percentages, Table 2.4 shows real producer price premia in monetary terms.

Table 2.4 Scottish farm gate prices for organic grain

Cereals (September 2000)	£/ton	R/ton
Milling wheat	200	1400
Feed wheat	190	1330
Malting Barley	170	1190
Feed barley	180	1260
Milling oats	195	1365

Source: Http://www.sac.ac.uk, 2000

Note: the exchange rate (R700 = £1) used in conversion is as was in September 2000

The premium received for organic products is also controversial. Moffett (1999: 22) contends that even in actual terms organic prices are higher than conventional prices and on average, these price premiums range between 15 to 50 percent. In addition, he agrees with Offermann and Nieberg (2000) and holds that the type of product influences its price, that is, the more perishable the product the higher the price. Thus vegetable and fruit products command a higher price as compared to cereals such as maize and wheat that are experiencing lower prices today after enjoying 30 years of high price premiums (see Figure 2.3).

Newton (1995: 105) also adds that another controversial issue about some organic products is that the price premium falls as the price of conventional products increases, an example being the organic meat industry. Furthermore, there is a strong argument that the price premium for organic produce will decrease with an increase in supply. In view of this, organic proponents maintain that even if the premiums decrease they will still range between 10-15 percent such that the producer would still be able to survive.

2.5.5 Diversification

Private economic benefits through diversification are also found to be among the reasons farmers have an interest in this farming system. Cacek and Langner (1986: 27) observe organic farmers grow a greater diversity of crops. Thus the entire farm production is less vulnerable to seasonal weather events or pests. Hence, if there is total crop failure, organic farmers suffer fewer economic losses because they have invested less in purchased inputs. Apart from private benefits, the greater diversity of crops on organic farms has also been found to have economic benefits. These include protection from adverse price changes for single commodities.

Diversification also provides a better seasonal distribution of inputs and machinery utilisation throughout the year. The National Research Council (1989: 141) has also proved this view.

However, on top of the benefits accrued through diversification, Cacek and Langner (1986: 27 point out that organic farms require more intensive management than conventional farms, and different machinery is also required to suit a diversity of crops, which thus increases costs.

To reduce these controversies, a world-wide review of organic farming follows in Chapter Three to highlight the significance of this farming system.

CHAPTER THREE

WORLDWIDE REVIEW OF ORGANIC AGRICULTURE

3.1 Introduction

The beginnings of modern organic agriculture dates back to the early years of the 19th century, and is generally attributed to the philosophies and writings of Rudolf Steiner from Austria and Hans Muller, the German-Swiss. Lady Eve Balfour in Britain, JI Rodale in the United States and Masanobu Fukuoka in Japan were also among the personalities who inspired the movement towards organic agriculture during this period. Tate (1994: 11) summarises the organic movement over the last 70 years into four phases. He describes the years 1924 to 1970 as a period of struggle and financial difficulties in establishing organic farming. In the years 1970 to 1980, key organic symbol schemes were established. During the 1980s, organic agriculture gained acceptance and national and international standards were introduced in various countries. Late in this period, legislation to define organic farming in legal terms was also introduced by the European Community and United States.

In today's economies, modern organic agriculture is gaining popularity as a result of the above mentioned personalities, specifically in their countries of origin, such that Europe, the United States and Japan are experiencing a rapid growth in the organic market. A few countries in the emerging economies of Asia and Africa are also experiencing this growth, although at a slower rate (Olesen, 1999: 1).

According to Jones and Doolan (1998: 1) there are good reasons for the growth of the organic market in these countries. These include increase in consumer demand, certification, regulation, and support of organic agriculture, which in turn contributed to increased production by area and by product. This chapter starts by investigating the institutional structure of organic farming where an overview of certification and regulation is provided. The second section investigates the world wide wheat market. In this section, the aim is to reveal production and trade trends at an international level, although the majority of countries do not differentiate between organic and non-organic products. The section also makes an attempt to reveal the level of support to agriculture, at an international level. This is also provided on a per country basis. Depending on data availability, a special effort to focus on wheat related support will be made.

The last section investigates the development of the organic market where the focus will be on major organic wheat producers. A special effort is made to expand on domestic market trends in these countries, as these are also believed to reveal the position of the organic industry. An attempt to focus on wheat and wheat products is also made, although in many countries the product is not isolated from other grains or cereals.

3.2 Institutional Overview of Organic Farming

3.2.1 Certification

Certification is the central feature in organic farming as it is the only way used to maintain separation between this farming system and other systems. Thus certification is explained as a 'procedure by which the third party gives written assurance that a product, process or service conforms to specified requirements'. This conformity is done through inspection and accreditation, with the former referring to 'evaluation by observation and judgement accompanied by measurement, testing or gauging'. The latter refers to 'a procedure by which an authoritative body gives a formal recognition that a body or person is competent to carry out specific tasks' (Rundgren,1998: 14). In addition, he points out that certification is a market instrument that enables producers to access a special market, often with a premium price.

Organic certification operates such that farmers, wholesalers and processors join schemes that entitle them to use certain symbols which inform consumers that the products are certified if they meet certain standards. These symbol schemes were introduced by major organic consuming and producing countries, many of which have compiled an official set of standards for organic certification at national level. The first scheme that was introduced in the 1970s was Demeter which still has branches in several countries in Europe, North America and Africa. The other schemes are Nature et Progréss of France initiated in 1972, Soil Association of Britain, opened in 1973, and Bioland of Germany that followed in 1978 (Tate, 1994: 15). According to the IFOAM (1999) in the 1980s and 1990s, numerous certification bodies were introduced, as organic agriculture was gaining popularity during this period. These include AIAB from Italy, Argencert (Argentina), Bioagracoop (Italy), Bio-Gro (New Zealand), Bolicert (Bolivia), CCOF (USA), and Farm Verified Organic (USA). The other bodies are Instituto Biodinamico in Brazil, KRAV (Sweden), NASAA (Australia), Naturland Verband (Germany), OTCO (USA), OGBA (USA), UKROFS (United Kingdom), and ECOA (Egypt).

Several authors including Barry (1998: 1130) associate problems in organic certification with the formation of these individual schemes, as they resulted in the lack of uniformity of organic standards. Schmidt and Lovisolo (1998: 25) notice that it is this problem that called for the need for international trade harmonisation in 1977. During this period, IFOAM was the only organisation that was recognised internationally, as it was the first to develop and approve organic standards for certification. As a result of trade between countries, detailed standards for exports and imports were developed by some countries (FAO, 1999b). On a world-wide level, FAO points out that the main body whose role is to set restrictions and general criteria to facilitate trade and to protect consumers against deception and fraud is CODEX Alimentarius. In other words the food code of the WHO and FAO with the help of IFOAM interacting at different levels.

Vandeman and Hayden (1997: 29) express the view that certification in organic agriculture tends to offer a number of benefits. These include transparency, which is observed to facilitate contacts between producers and consumers. Others include improvement in the image of organic agriculture in societies, and increasing the credibility and visibility of the organic movement. Certification is also observed to make production more efficient and profitable, as it facilitates production planning through documentation.

However, certification in organic agriculture also has some drawbacks, as it is observed to involve costs that can be beyond economic levels. The costs have been estimated to be higher than the premium obtained by farmers from the market depending on the farm size, a situation that is thought to deprive the small farmers of the benefits (Rundgren, 1998: 29). He further holds that this problem will be a challenge to certification programmes, such that provision of a good service and a reliable verification system at reduced costs will be available in future.

3.2.2 Regulation

Regulation of certification is also a key element in organic farming, as it is necessary to maintain the high ethical standard of the organic movement. This is important in order to retain consumer confidence and to encourage and support organic farmers across frontiers (Geier, 1997: 10). Schimidt (1999) states that the European Community (EC) in January 1991 was the first to lay down regulations (2092/91/EEC) on organic food products. The regulations have been amended and replaced by REG 2092/99/EEC in 1999 to include organic animal husbandry and exclude

GMO's in organic agriculture. The introduction of the EC legislation has had a major impact on the number of approved certification bodies. In addition to this, Rundgren (1998: 35) points out that the legislation also allows imports from non-EU members to be marketed within the EU carrying a label referring to the organic origin. This is possible provided it is accepted that the products are produced and certified according to procedures equivalent to those of the Union.

Rundgren (1998) further mentions that legislation in organic farming systems also exists in a number of countries that include the USA, Argentina, Australia and Switzerland. In many cases, regulation in these countries has been triggered by the desire to become recognised by the European Union for imports in the EU. He continues by adding that on a world-wide level there is no regulation of organic agriculture. The WTO which is an active body on this level, does not regulate organic agriculture but only becomes involved in the case of a trade dispute between member countries, where they will refer to CODEX Alimentarius and IFOAM.

However, this aspect has been criticised, as it could drag organic agriculture and its certification schemes into trade wars that could also lead to other international trade deals being made. It has been also criticised as taking away responsibility for credibility from the sector (Schmidt and Lovisolo, 1998).

Apart from the institutional structure, the following section will expand more on the position of the wheat industry at international level.

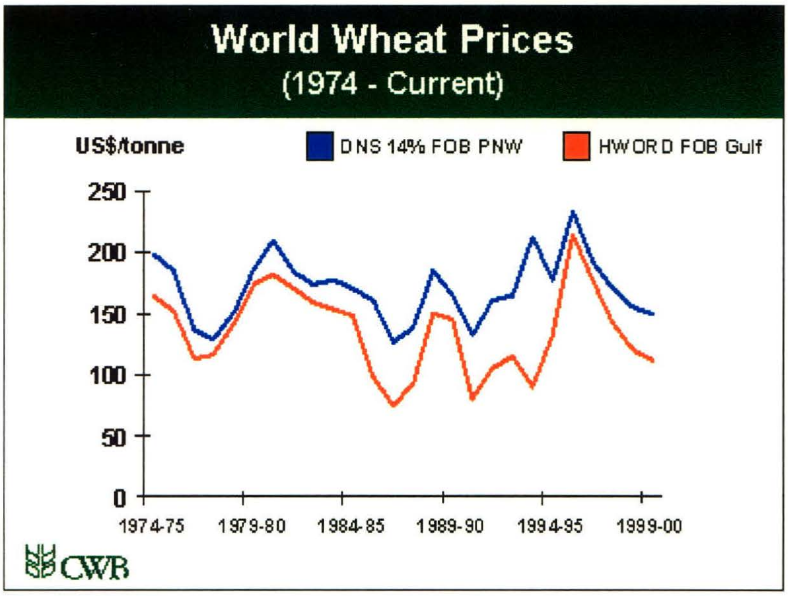
3.3 The World Market for Wheat

The past few years have been difficult for wheat producers around the globe. During this period farmers have been suffering from low grain prices, while also faced with high input costs. This situation was worsened by high transport costs, as transport subsidies in some countries are no longer given to farmers as a result of the Uruguay Round of the WTO negotiations in 1996. The effect on world wheat prices, particularly for Dark Northern Spring (DNS)[6] and Hard Winter Ordinary (HWORD)[6] is indicated in Figure 3.1. These factors in turn affected production and area devoted to wheat production in many countries.

[6] DNS and HWORD refer to wheat types according to the quality.

One more negative factor affecting wheat producers world-wide is the high level of support given to farmers in countries like the United States and the European Union, such that other countries across the globe have to compete under these unfair circumstances. It is however, unlikely that there will be a significant recovery in wheat prices within the next two years, as prices will remain pressured by large exporter stocks, particularly in the EU and US. This has also affected organic wheat production, because as indicated in previous paragraphs, some countries do not make a distinction between organic and non-organic products (Canadian Wheat Board, 2000).

Figure 3.1 World wheat prices, 1974-Current



Source: Canadian Wheat Board, 2000

3.3.1 World production of wheat

World production of wheat is estimated to reach approximately 600 million tons annually. Indicated in Table 3.1 are the wheat usage figures, which are increasing with production, as does wheat stock with the exception of 1998/99 period. During this period usage figures outstripped production, which is an indication of shortages of world wheat supply as a result of climatic changes. Hence, it can be concluded that further arable land has been withdrawn from wheat production in most developing areas [Canadian Wheat Board (CWB), 2000].

However, for the relevance of the study, section 3.4 will focus to countries like United States, Europe, Canada, Australia and Argentina, as among the top wheat producing countries (CWB, 2000).

Table 3.1 World wheat estimates for 1998/99 (million tons)

Period	Production	Used	Stock
1995/96	541	553	106
1996/97	582	578	110
1997/98	609	588	132
1998/99	583	594	121

Source: Cornelius, 1999

3.3.2 World wheat trade

These major wheat producing countries are also found to be among the major wheat exporters. These countries, particularly the United States and Europe, also reluctantly maintain a significant proportion of the world wheat reserves and normally account for over 90 percent of the world trade in wheat, as a result of subsidies (Fowler, 1992). Table 3.2 indicates total world wheat exports. The table reveals that wheat exports in 1999 show signs of decreasing. This is also associated with low world wheat prices. The Canadian Wheat Board projected the total world trade to rise to 102 2 million tons by the year 2003. This growth is based on hopes for the Seattle Round of the WTO negotiations as factors contributing to low commodity prices were among the issues that were supposed to be addressed in these negotiations. Accompanying this is the fact that various governments, including Canada, are pressing for effective support programmes that will help to ensure the survival of wheat farmers. This verifies that there is still a future for the world wheat market (Arason, 1997: 7).

Table 3.2 World wheat trade (million tons)

Period	Total Exports
1994/95	91.5
1995/96	90.0
1996/97	95.0
1997/98	95.0
1998/99	94.0

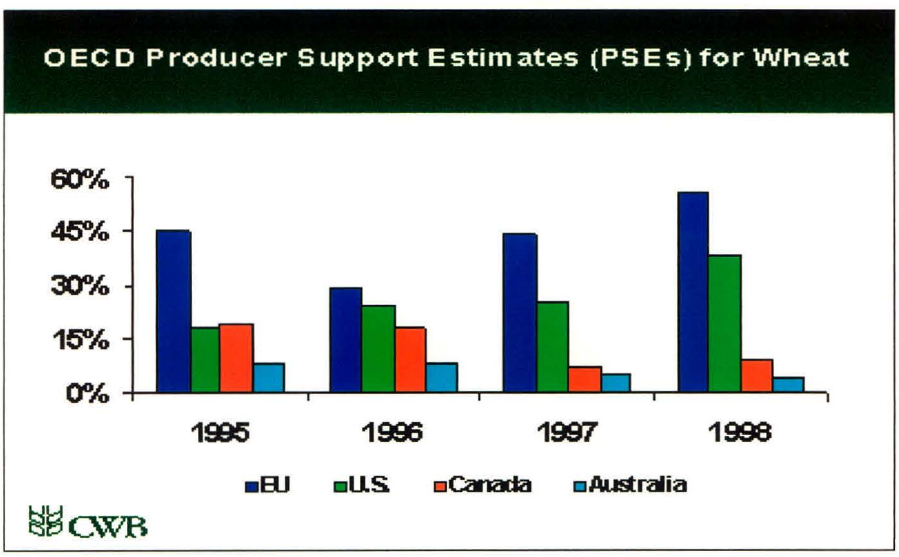
Source: USDA, 1999

3.3.3 World wheat support

Agriculture is one of the most subsidised sectors globally, although recently this kind of support has been reduced under the WTO agreements. However, although support is being decreased, many countries, including Europe and USA (especially the former), are still subsidising their agricultural sector. Specific details on this issue will be provided in this section.

The Organisation for Economic Co-operation and Development (OECD) calculates Producer Support Estimates, previously known as Producer Subsidy Equivalents, which are an indicator of the annual monetary transfers from consumers and taxpayers to agricultural producers (see Figure 3.2).

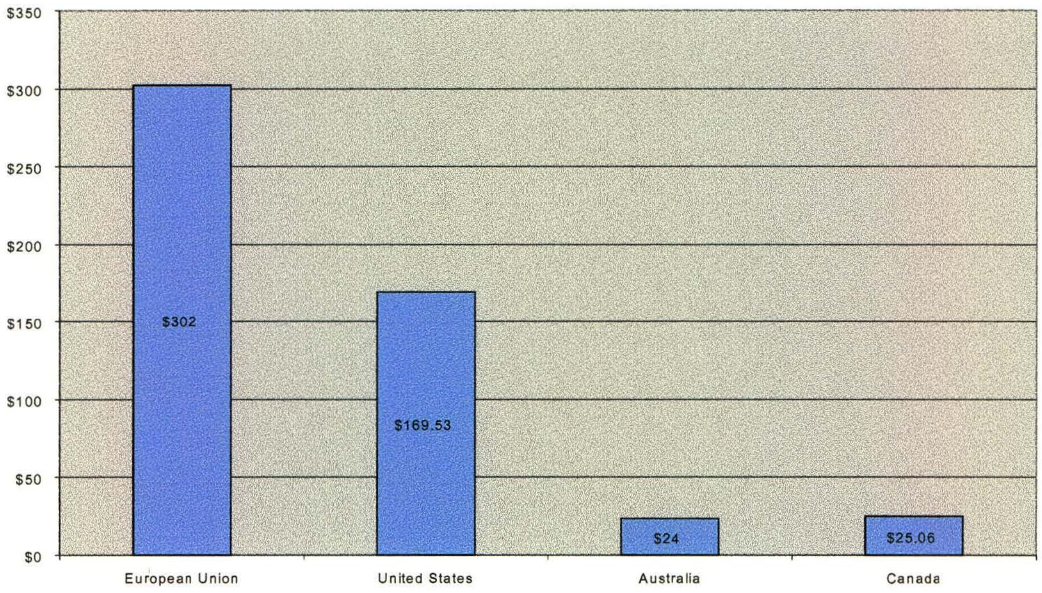
Figure 3.2 OECD Producer Support Estimates (PSEs) for wheat



Source: USDA, 1999

As the data clearly indicate, PSEs for wheat were much higher in the EU and US than in Canada and Australia. The organisation mentions that the PSEs have been increasing for the former two countries due to a combination of declining gross farm income and rising subsidies. In the case of the EU, export subsidies have increased in the last two years in response to falling prices, while the increase in subsidy spending in the US has been in the form of domestic support (Arason, 2000: 4). This is also confirmed in Figure 3.3, although the PSEs are in monetary terms.

Figure 3.3 Wheat support in 1999 (US dollars per ton)



Source: OECD, 1999

However, these are the conditions that negatively affect small countries like South Africa as they have to compete with immense EU countries and the and US, the EU having a greater effect because it is South Africa's major trading partner.

Apart from the general wheat industry, the following section will investigate the organic market. An effort is made to focus on wheat where data are available. In this section, consumer patterns as traced from various countries, particularly those selected for the study are provided, as these are believed to have an influence on the development of this market.

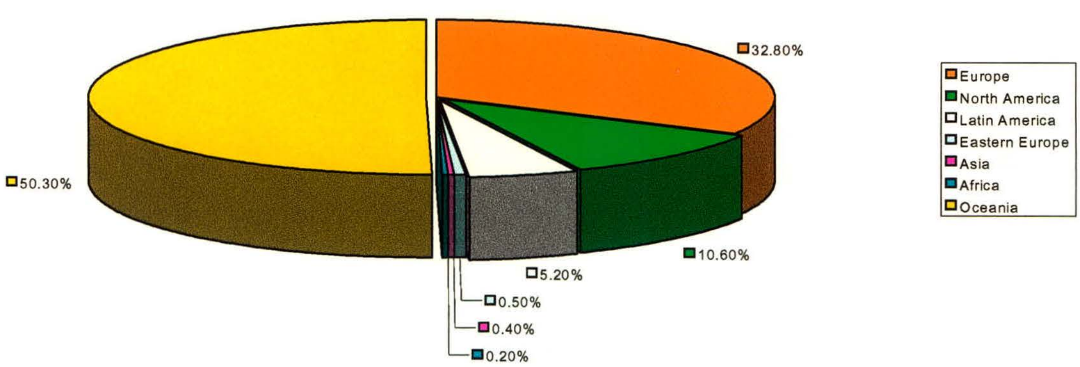
3.4 Development of the Organic Market

The organic market in most countries is still relatively small and characterised by niche markets, although in some countries the term niche can be misleading. This is because of the growth in consumer interest for organic food and because producers are increasingly targeting both domestic and export markets. However, according to the (FAO, 1998b), it is clear that there is increased market potential in various countries such as Europe, the United States, and Japan.

In Europe, countries experiencing growth in organic production include Italy, Austria, Sweden and Switzerland, with the former being far the largest producer by area. Among the European Union countries, it has been found that the major organic wheat producers are in Germany, France and the United Kingdom. Thus the main focus of this section is on these countries.

Apart from the developed countries, Third World countries, particularly the African countries like Egypt are also experiencing this growth. Figure 3.4 shows the share of each region of total organic area, with Oceania having the biggest share, although behind the major organic producers in terms of market growth. However, for this specific study, not all organic producing countries will be reviewed in this chapter, but only major organic wheat producing countries. These will include the USA, Argentina, Canada and some European Union countries, as mentioned in the previous section. The reason being that these countries will be the major competitors for the potential Western Cape organic wheat industry, as they are for the present industry.

Figure 3.4 Share of each continent from total organic area



Source: IFOAM, 2000

3.4.1 Consumer patterns

Consumers have played a vital role in the development of the organic market in several countries, although there is a lack of data to reveal demand by product. However, Table 3.3 reveals retail sales, as they are the major tool to forecast consumer demand. According to Barry (1998: 1131) in the late 1980s and early 1990s, various market research reports pointed to strong and rapid growth in consumer demand for organic produce, especially in countries like Japan where this increase is estimated to be 20 percent for the year 1999.

Arguably, Barry's most crucial point is that much of the knowledge in some aspects of consumer demand is based on self-reporting through questionnaires and surveys. Ott *et al.* (1991:7) and Michelsen *et al.* (1999: 54) attribute this growth to various reasons augmenting those mentioned in Chapter One. These reasons vary between countries and consumers to include altruism and consumer preferences. Altruism, which is basically the reason that is found in the First World countries, includes individual's health or food safety, quality, taste, and religion. Social factors like education and income status also play a vital role in influencing consumer behaviour towards organic products, especially in Third Word countries (Gendall and Bailey, 1998: 4).

However, Woese *et al.* (1997: 282) states that consumer demand for organic produce is one of the controversial issues. In his empirical research, he observed inconvenience of retail outlets to be one of the obstacles. Consumers believe that organic produce is not offered in a wide range when compared with conventional products. Lack of awareness, high price, poor appearance and scepticism about the credibility of organic claims are also found to be amongst the barriers. However, these are not considered to be significant as they have been observed to be mentioned by only the minority of respondents in most surveys.

Table 3.3 World markets for organic food and beverages, 1997-2000

Market	Retail sales (million US$),	% of total food sales	Forecast (million US$), 2000
Germany	1 800	1.2	2 500
France	720	0.5	1 250
U.K	450	0.4	900
Switzerland	350	2.0	700
Netherlands	350	1.0	600
Denmark	300	2.5	600
Sweden	110	0.6	400
Sub-Total (7)	**4 080**	-	**6 950**
Italy	750	0.6	1 100
Austria	225	0.6	400
Other Europe	200	2.0	500
USA	4 200	-	8 000
Japan	1 000	1.3	2 500
Total	**10 500**	-	**20 000**

Source: ITC, 2000

Note: - signifies not available

3.4.2 The organic market in Europe

Internationally, Europe is the leading producer and the largest market for organic products. In 1985, organic production in this region accounted for just over 100 000 hectares, which is less than one-tenth of one per cent of the total agricultural area. By the year-end 1999, the area had increased to 3 5 million hectares, that is, nearly 3 percent of the total agricultural area. The statistical results of several authors such as Foster and Lampkin (1999); Willer (1998); and Lampkin and Midmore (2000) reveal that the most extensive organically farmed areas are in Italy, Germany and Austria.

3.4.2.1 Germany

According to the International Trade Centre (ITC, 1999: 177) Germany is one of the largest producers and biggest markets for organic food products in the world. In this country, an area that is estimated at 45 000 hectares in 1999 was occupied by approximately 10 400 organic farms. From this area, a total of about 42 297 metric tons of organic grain is harvested, and this is estimated to account for 0.8 percent of the total grain production in this country. Wheat makes up about 25 percent of organic grain production (Kurz, 1999: 5). Germany has become self-sufficient in this sector, such that surpluses are no longer exceptional, which can have a negative effect on price levels (this is illustrated in Figure 3.7)

The ITC (1999) further mentions that, although Germany has reached self-sufficiency, it is still one of the world's largest importers of organic products, with total annual imports of about DM 307 million in 1998, which is estimated to account for 38 percent of the value of raw materials. Although not indicated in the table below, the largest category of imports is fruit and vegetable products, which were valued at DM 135 million in 1998. Imports of nuts and nut butter follow at DM 32 million during this period. Table 3.4 indicates imports of raw materials and sales, particularly those related to wheat and wheat products. As a major producer of grains and cereals, Table 3.4 reveals a low import proportion, particularly for these products.

According to Jones and Doolan (1998: 16) the organic retail food market in Germany was estimated to be approximately DM 3 6 million, although this value is calculated in US dollars in Table 3.3. In terms of market share, bread and bakery products were estimated to be in position three when compared with fruit and vegetables, and dairy products.

Table 3.4 Germany: Sales of organic wheat and wheat products (DM million)

Product Group	**Sales at retail level**		**Imports of raw materials**	
	Value (DM)	*%*	*Value (DM)*	*%*
A	**B**	**C**	**C**	**D**
Bread and bakery	515	14	3	5
Whole Grain Seeds				
Whole grain	110	3	3	10
Seeds	37	1	9	100
Pasta, cereals				
Pasta	74	2	9	80
Cereals	110	3	8	30

Source: ITC, 2000

Note: A- main categories Naturkostshops, C- percentage of total sales of organic products, D- estimated level of imports

3.4.2.2 France

Although France is a major producer of organic products and a significant importer of a wide range of food and beverages, organic farming has failed to keep pace with developments in consumption on the domestic market (ITC, 1999: 154). France currently ranks sixth within the EU, behind Austria, Sweden, Denmark, Finland and Germany in terms of organic production. According to the SÖL survey (2000) organic production at present is estimated to account for 1.10 percent of total production, which corresponds to 3 16000 million hectares. This area is estimated to be occupied by about 8 149 farms. Crop production in France is of interest to this study as wheat production falls under this category. In the crop production sector, about 70 percent of the farmers are involved in grain production, and 30 percent in other products [Piasson (1999: 1), see Table 3.5). As the table confirms, area devoted to organic grain production is the second largest following that of grazing and fodder.

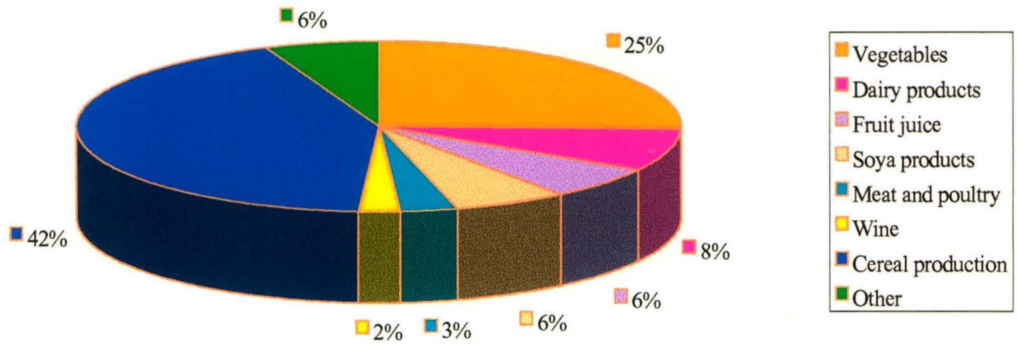
Table 3.5 Organic crop production in France

Period	**1997**	**1998**	**% Change 98/97**
Number of organic farms	4 780	6 130	+28
Area per product group (crop origin)			
Grains	22 900	24 600	+9
Oilseeds	5 900	5 400	-7
Vegetables	4 000	4 200	+5
Protein seeds	1 200	1 700	+42
Fruits	3 300	3 700	+14
Vineyard	4 700	4 800	+2
Grazing and Fodder	71 800	87 600	+22
Total	122 300	142 300	+16

Source: USDA, 1999

Although organic cereals have continued to lead in the organic processing sector, their share has fallen in recent years relative to other categories. The largest share in terms of total output is taken by bread and bakery products. Another category that is strongly increasing is that of dairy products, followed by eggs and poultry at a slower rate. In this sector, the market for cereals, and bread and bakery products was estimated to value $167 million in 1996. The forecast for 2002 is estimated to reach $333 million, which corresponds to 200 percent growth, as compared to the previous period, 1996 (Piasson, 1999: 8). Figure 3.5 provides an indication of sector trends.

Figure 3.5 Share of the organic food market in France, 1998 (Sector trends)



Source: USDA, 2000

In general, French organic growers sell to processors, retailers or directly to consumers. They also reach consumers through farm shops, deliveries, and supermarkets. Some products like organic fruit and vegetables are sold through wholesalers, although this practice is not the norm in this country. In monetary terms, the retail sales are estimated to stand at $720 million in 1999, which amounts to 0.5 per cent of total food sales. The expected growth in this sector is estimated to be approximately 20 to 25 percent, although cereals in particular are expected to increase by 33 percent. Projections for the year 2000 were estimated to reach $1 250 million (IFOAM, 2000: 24).

With regard to trade, domestic production of organic foods has not kept pace with consumer demand. As a result, there has been a sharp rise in imports. In 1997, imports were recorded to range between 13 000 tons and 20 000 tons, with the exception of organic wheat, as the country is self-sufficient in producing this product. These imports, which were estimated to be valued at $50 million, were sourced mainly from the EU countries, Latin America and some African countries. Apart from imports, exports are estimated to represent about 17 percent of all French organic products. The major organic French exports consist of grain and cereal products (ITC, 1999: 157). It is difficult to assess the size of export and import trade because EU foreign trade does not differentiate between organic and conventional food produce.

3.4.2.3 United Kingdom (UK)

In the United Kingdom, the total wholesale market for organic cereals in 1998/99 was about £12 million of which approximately 50 percent was used for human consumption. Despite the area of

UK land with full organic status rising by more than 30 percent in 1999, the organic arable area rose only by 19 percent. From this, less than 40 percent of the UK's requirement for organic grain was supplied by home-grown crops. UK wheat continues to be low in protein thus allowing substantial imports of higher quality produce from abroad. The increase in organic milk, poultry, and pig production has lead to an undersupplied market for feed wheat, barley, and triticale. At the same time the need for protein in animal rations has led to a shortage in supply of pulse crops, with peas and beans being in high demand from UK farmers (Lampkin and Measures, 2001: 15).

Generally, demand for all crops is very strong, with some grains fetching higher price premia (see Table 3.6). The increasing demand for grains is from livestock feed companies, bakers, brewers, and the processing industry for products destined for human consumption. For milling wheat in particular, the issue of quality and protein content remains very important.

Table 3.6 Organic grain prices in the UK for 2000 harvesting (ton)

Product	**Price (ton)**
Milling wheat	£190-195
Feed wheat	£10-15
Triticale	£170
Oats	£185
Barley	£185
Feed beans	£185
Feed peas	£185

Source: Lampkin and Measures, 2001

In Europe, apart form an increasing consumer demand, many factors contributed to the growth of the organic industry. A factor driving this industry is the government support given through green and blue boxes. Therefore the following subsection will provide a detailed level of support for the European organic agriculture.

3.4.3 Level of support for the European organic sector

The previous section, particularly Figures 3.2 and 3.3, reveals the level of support for European wheat production when compared to other countries. As this is the main feature of the European agricultural sector, organic farming also benefits from this support. Several authors that include Lampkin *et al.* (1999), Offermann and Nieberg (2000), and Zanoli and Gambelli (1999), confirm organic farming support. Lampkin *et al.* (1999) pointed out that in Europe, organic agriculture is supported in all member states of the European Union. Organic regulations, as the main feature of organic agriculture, forms the basis of support. Under the EU organic regulation, organic support is made possible through different frameworks. These include the main-stream and accompanying measures such as agri-environment (EEC Reg. 2078/92) and extensification programmes (EC, 1988b) under the CAP reform of 1992. The support in these countries is applicable in various forms such as direct and indirect payments at both regional and national level.

Lampkin *et al* (1999) further notes that mainstream measures in these countries include policies that support producers of certain arable crops (arable area payment scheme) and premiums for certain products. The arable area payment scheme is the main support for arable crops. Eligible crops include wheat, barley, oats, rye, maize *etc* whether grown for grain or fodder. Arable area payments are based on average regional yields excluding the best years and the worst years (see Table 3.7). The implementation of Agenda 2000 in the EU brought some changes in the organic sector including payments rate which increased by eight percent in year 2000 and seven percent in 2001 to compensate producers for further cuts in price support. The basic payments rate for cereals is expected to increase from the year 2003 onwards in the light of a final reduction in the intervention on prices of cereals (Lampkin and Measures, 2001: 51).

Table 3.7 Arable area payment rates for cereals (2001)

Region	Average yield (t/ha)	£/ha
England	5.89	233
Scotland -non LFA	5.67	225
Scotland -LFA	5.21	206
Wales -non LFA	5.17	205
Wales -LFA	5.05	200
North Ireland -non LFA	5.22	207
North Ireland	5.03	199

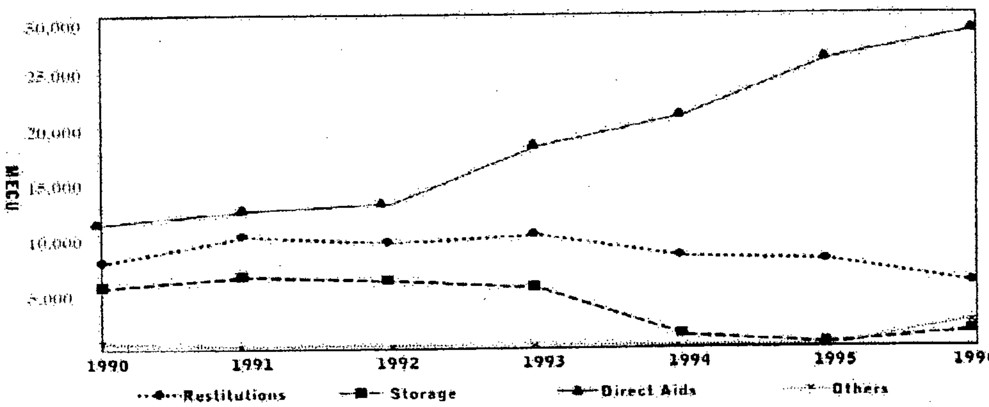
Source: Lampkin and Measures, 2001

Note: LFA refers to Less Favoured Areas

According to Lampkin *et al.* (1999) accompanying measures, like the agri-environment programme in Europe, aim at contributing to the achievement of policy objectives regarding agriculture and the environment and in providing an appropriate income for farmers. Some member countries that aim at reducing production of commodities that are in surplus used the extensification programme to support conversion to organic farming. Matthews and O'Flaherthy (1997) outline the budgetary expenditure variations as a result of the CAP reform in Europe and divide the total budget into four main categories:

1.Direct payments: referring mainly to compensatory payments.
2. Refunds: concern payments for export refunds
3. Intervention expenditure: concerns costs for public and private expenditure
4. Other payments: concerns expenditure on research, advisory and training services, market information and taxation concessions (see Figure 3.6)

Figure 3.6 Composition of budget expenditure by cost category

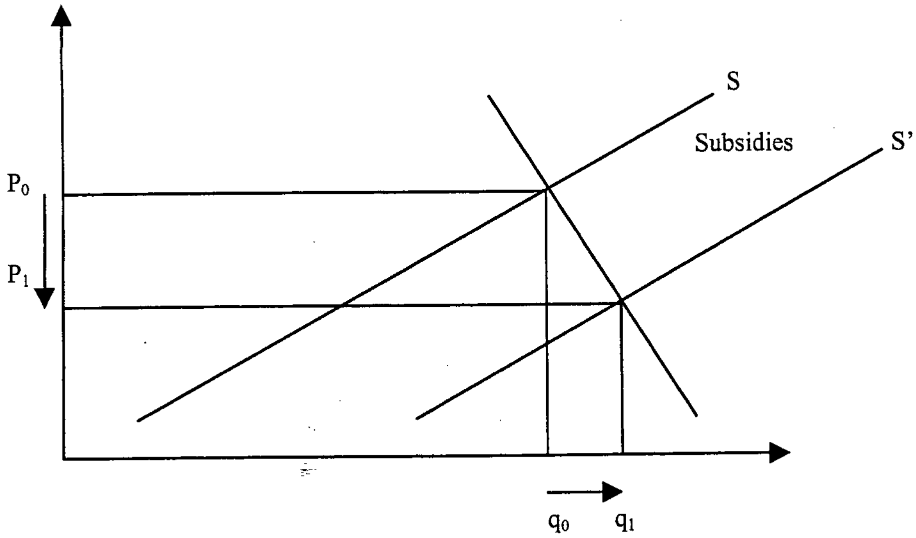


Source: Matthews and O'Flaherthy (1997)

In their explanation, Figure 3.6 shows an increase in direct payments in the last few years with respect to other categories, and this also reveals an increase in expenditure after 1996 as a result of increased support for organic agriculture.

However, as support for organic farming, is thought to *ceteris paribus* increase profitability of organic farming, any resulting conversion will increase the supply. This in turn carries the risk of eroding the price premia for organic products (Offermann and Nieberg, 2000: 89). Market observers like Hamm (1997) criticise such one-sided support and express the view that in the case of an inelastic demand, supporting conversion and hence the entry of new enterprises will harm existing producers. Furthermore, this will lead to induced price decreases that can in fact nearly cancel out any supportive effect the subsidies might have. This is illustrated in Figure 3.7.

Figure 3.7 Impact of supply subsidies when demand is inelastic



Source: Hamm, 1997

The diagram shows a downward shift of the supply curve (S to S'), as a result of payments. The more inelastic the demand curve, the lower the new equilibrium price p_1, and the smaller the supply increase (q_0-q_1) will be. These conditions resulted from the fact that some organic products are classified as niche, in that their uniqueness may be lost due to an increase in supply as shown by a movement of the supply curve from S to S' (Hamm, 1997).

Alternatively, it has been argued that the increased supply base that results is a necessary precondition for efficient processing and marketing, and may create demand through product innovation. In Ireland, this phenomenon is believed to have been keeping prices for organic products strong, and in Finland the increased supply base is seen as the cause of market development and even rising price premia.

3.4.4 The organic market in North America

Apart from traditional European countries, where immense growth of the organic sector has been highlighted, there are other countries that are also moving in the same direction including the United States of America. There has also been a noticeable expansion of the organic sector in countries such as Canada.

3.4.4.1 United States

According to the ITC (1999: 128) the United States is the world's second largest producer of organic products. The current figures as specified by the SÖL survey in January 2000 are estimated at 900 000 hectares of organic farmland, which is under the management of 6 600 farms. Although Table 3.8 does not reveal recent statistics, it gives an indication that from the total organic farmland, the largest proportion is mainly for crop production, which makes up about 12 percent of all certified organic land. The US organic farms are mainly concentrated on the West Coast, in the Northeast, in Texas, and in the Midwest.

Table 3.8 United States: Proportion of farmland devoted to organic, 1994

TYPE OF LAND	TOTAL FARMLAND	ORGANIC LAND	
	Hectares	*Hectares*	*% of Total farmland*
Total	382 940 260	456 435	0.11
Cropland	176 152 519	270 819	0.15
Produce	3 464 020	36 724	1.06
Other crops	172 688 499	234 096	0.13
Pasture and rangeland	166 579 013	180 873	0.11
Other land	10 339 387	174	0.001

Source: Dunn, 1995

According to a recent survey by the Organic Farming Research Foundation in 1999, 57 percent of organic producers grow vegetable, flower, and ornamental crops; 52 percent produce field crops, 40 percent produce fruit, nut, and tree crops; and 27 percent produce livestock or livestock products. An annual market growth of 10 to 20 percent was realised in the organic grain sector composed of wheat, corn, millet, barley, buckwheat, soybeans, and several varieties of rice. As a major wheat producing country in general, the United States also devoted a significant area of land to organic wheat production. Table 3.9 below is a representation of land devoted to organic wheat production per state.

Table 3.9 Certified organic land devoted to wheat (1997)

State	No of Acres	State	No of Acres
California	727	Nevada	150
Colorado	10 159	New Mexico	1 786
Delaware	12	New York	646
Idaho	4 625	North Dakota	24 203
Illinois	764	Ohio	1 825
Indiana	258	Oklahoma	1 255
Iowa	1 817	Oregon	90
Kansas	8 313	Pennsylvania	345
Maine	130	South Dakota	4 502
Michigan	801	Texas	4 650
Minnesota	4 432	Utah	13 435
Missouri	285	Virginia	84
Montana	31 729	Washington	1 583
Nebraska	6 636	Wisconsin	446
Total = 125 687			

Source: USDA, 1997

A study by Welsh (1999: 6) found that there is a relationship between land-use and the premiums obtained for organic wheat. He observed that prices paid for organic grain crops are consistently higher than their conventional grown counterparts which is a reason for the increase in land allocated to organic wheat production. Therefore Table 3.10 provides an indication of prices paid for organic grains in the US.

Table 3.10 Comparison of organic and conventional cereal prices ($/bu)

Crop commodity and year	Organic ($/bu)	Conventional ($/bu)
Spring wheat, 1995	6.09	4.33
Spring wheat, 1996	7.63	5.07
Spring wheat, 1997	6.49	4.00
Oats, 1995	1.97	1.64
Oats, 1996	3.17	2.06
Oats, 1997	2.96	1.64

Source: Dobbs, 1998

At a retail level, consumers in the US purchase organic products through different outlets. These include supermarkets, small health food shops or co-operatives, farmers markets and restaurants. About 65 percent of consumers purchase through direct sales, but shelf space for organic products is also increasing in the supermarkets. This indicates that in future, supermarkets will be the fastest growing segment of the retail organic grocery industry in the United States (Klonsky and Tourte, 1998: 1121). The authors further mention that new chains in the US are expanding across the nation and large-scale mergers are occurring in the country's 'natural' industry. At the same time, farmers' markets and internet sales are growing, and public and private partnerships are being created to develop wholesale markets for small farmers.

The produce purchased through the above outlets is estimated at approximately US$4 200 million and includes 1.3 percent of total food sales for the period 1997/1999. Projections for retail sales are estimated at US$8 000 million by the year 2000 depending on the source (Jones and Doolan, 1998: 10).

With regard to trade, it is difficult to delineate organic imports and exports from conventional ones, as US foreign trade statistics do not differentiate between these two categories. Therefore the statistics that will be shown in Table 3.11 on wheat exports represents both organic and conventional wheat exports. The 1998/99/2000 period shows low levels of exports when compared with other years. This is because of a severe decline in world wheat prices. The US wheat industry is expecting an increase in the level of exports for the period 2000/01. This can be associated with various factors, one of which is the higher level of support, as in sub-section 3.3.3.

Table 3.11 US wheat total exports (1000 metric tons)

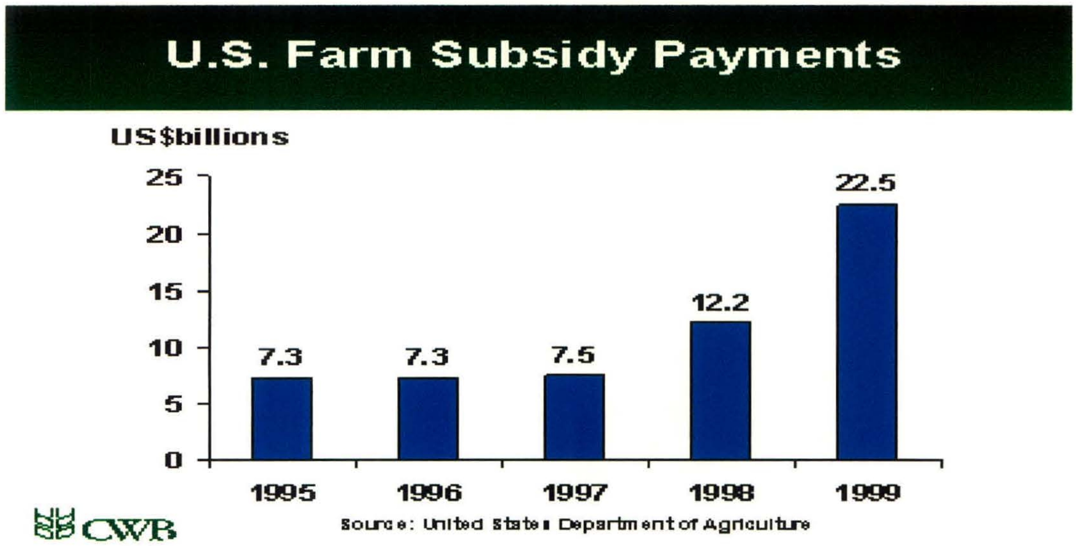
Period	Exports
1996/97	26 180
1997/98	27 662
1998/99	25 679
1999/2000	25 516
2000/001 (projections)	29.940

Source: USDA, 2000

3.4.4.2 US organic support

Although statistics are often not differentiated according to organic or conventional in terms of support, this section will make an attempt to relate support to the organic sector. The US agricultural sector is still considered to be heavily supported, although a member of the WTO (see Figures 3.2 and 3.3 for world comparison). High levels of support to US agriculture are also exacerbated by increased use of blue box measures, which are considered to have distortionary effects in the context of this study. In this regard, the US Department of Agriculture (USDA, 1999) estimated that approximately US$22 5 billion was spent on direct subsidy payments to farmers during the calendar year 1999. This represents a dramatic increase of 200 percent from 1996, although still less than the EU. Wheat producers received more support that amounted to US$2.00 per bushel of wheat in the form of direct subsidy payments. Figure 3.8 below is an indication of US farm subsidy payments from the year 1995 to 1999.

Figure 3.8 US farm subsidy payments, 1995 to 1999



Source: USDA, 1999

Within a similar framework, a number of programmes especially pertaining to organic agriculture, have appeared. A prime example is Iowa, which supports organic farming through EQUIP, a programme that provides targeted financial incentives to farmers. This programme is particularly designed to promote the adoption of conservation management, a category into which organic agriculture falls. Iowa also imposes fees and taxes on pesticides and synthetic fertilisers, and funds activities to reduce the use of hazardous agricultural chemicals. Other states, such as California, have also followed the latter approach.

Furthermore, the USDA's Agricultural Research Service has established trials specifically for organic research. In addition, the USDA has for more than ten years funded research through its Sustainable Agriculture Research and Education (SARE) Programme, which often provides useful information to current and potential organic farmers. Another federally funded programme, Appropriate Technology Transfer for Rural Areas (ATTRA), provides information on resource-conserving agricultural practises, including information relevant for organic farming.

A number of land grant universities have developed research efforts to test alternatives to chemically intensive agriculture, engaged sustainable farming groups, and designed undergraduate and graduate curricula in sustainable agriculture (Welsh, 1999: 26). However, benefits are more for small organic farmers as the US Department of Agriculture also has a clause in its organic regulations which exempts small farmers from certification, such that they can sell their organic produce without engaging in certification costs.

3.4.4.3 Canada

Canada is also a substantial producer of a wide range of organic products in North America. In 1997, the country was estimated to undertake organic production in an area that is approximately 163 843 hectares. During this period, the number of farms under organic management was estimated at 1 830 (SÖL survey, 2000). From this area, organic food production is concentrated mainly in the grain sector, followed by oilseeds and horticultural sectors. Organic grain production is estimated to be less than 0.5 percent of the total. There are also no official estimates available, as the statistics for Canada also do not differentiate between organic or non-organic.

However, Cahoon (2000:1) pointed out that organic wheat sales make up less than one percent of wheat sold by the Canadian Wheat Board. Although this is a small amount, organic wheat producers mention a significant growth in the sector, such that sales for the 1998/99 crop year were estimated at 16 000 tons, and were expected to be 22 000 tons for the crop year 1999/2000. From 22 000 tons of organic wheat, only about 4 000 tons were sold through individual farm sales whereas the bulk is sold through large grain companies. The producers further comment that some of the board's traditional export markets have shown interest in large-lot sales of more than 5 000 tons, an amount farmers think would be difficult to fill.

Cahoon (2000: 2) further mentions that Canada is also a net exporter of bulk organic grains, especially wheat. This is expected to strengthen further once the Canadian national standards come into effect although it is also difficult to find figures on exports and imports. With regard to organic wheat exports, the Canadian Wheat Board and the organic industry are working together to develop a system for organic grain segregation under its current regulated system of grain marketing.

Canadian organic producers also receive a significant premium in the export market, which is expected to be much higher as soon as organic grain segregation is in place.

Table 3.12 Canadian FOB organic wheat prices (US dollars per ton)

Crop	Price
Soft white winter	$330
Hard red spring	$330
Hard red winter	$320
Durum	$320

Source: Cloud Mountain, 2000

As far as agricultural support is concerned, Canada has a very low level of support compared to USA and EU, as the PSEs reveal in Figure 3.2. This condition places Canadian wheat farmers at a competitive disadvantage when it comes to trade. This has, however, resulted in the Canadian Government taking a strong stance in the WTO trade negotiations against the unfair advantage to the EU and US agriculture.

3.4.5 Organic market in Australia

The Oceanian region is also amongst the regions that are experiencing a rapid growth in organic farming both in area and market, as Figure 3.4 confirms. In this region, of relevance to the study is Australia. Growth in the Australian market has been initiated by a strong demand for organic produce overseas rather than the growth in demand for organic produce in the domestic market. Under these circumstances the industry is targeting the export market, although some products are produced mainly for the domestic market.

According to the SÖL survey (2000) Australia has about 1 657 certified organic farms occupying a land area estimated at 5 293 732 hectares. Jones and Doolan (1998: 2) pointed out that the greatest number (approximately 75 percent) of organic producers are in the horticultural industry. Only between ten and twelve percent of organic producers are in the grain and livestock industries respectively. Wynen (1992: 3) notices that, although only a small percentage are involved in organic grain production in Australia, this industry, particularly wheat, has been considered as an important portion of the expanding sectors, followed by rice and pulses. In the horticultural industry, production is mainly concentrated in oranges, apples, bananas, pears, potatoes, carrots, grapes, avocados, broccoli and wine. The country also produces a significant output of organic products from animal origin including livestock, meat and dairy products.

However, as one of the significant organic producers, the Australian organic sector is still small. During the period 1990/1995, the value of organic agricultural production was estimated to grow from $A28 million to $A80 5 million. In 1996 the industry also experienced an increase and was estimated at $A90 million, excluding exports. Currently, at retail level, the market for seeds, grains and cereals is estimated to value $A10 44 million of the total organic market, with supermarkets taking the largest share. A report from the USDA reveals that the overall market at present is thought to be in the order of $A200 million to $A250 million (Crothers, 2000: 1).

As Australian organic production is increasingly targeting the export market, the value of exports is estimated to amount to approximately $A30 million with imports at $A5 2 million in 1996. The main export markets are predominantly Japan, Norway, New Zealand, Netherlands, Singapore, Switzerland, United Kingdom, the United States and Germany. As with other countries, there is no distinction in trade statistics in Australia (MAF, 1997).

With regard to support to organic agriculture, Australia also regulates organic agriculture, which is also considered to grant an unfair advantage to the organic industry. In general, the government support to organic agriculture is at low levels when compared with other countries. In this view, Figure 3.3 and 3.4 indicate very low levels of government support for wheat production in Australia, especially for the calendar year 1998.

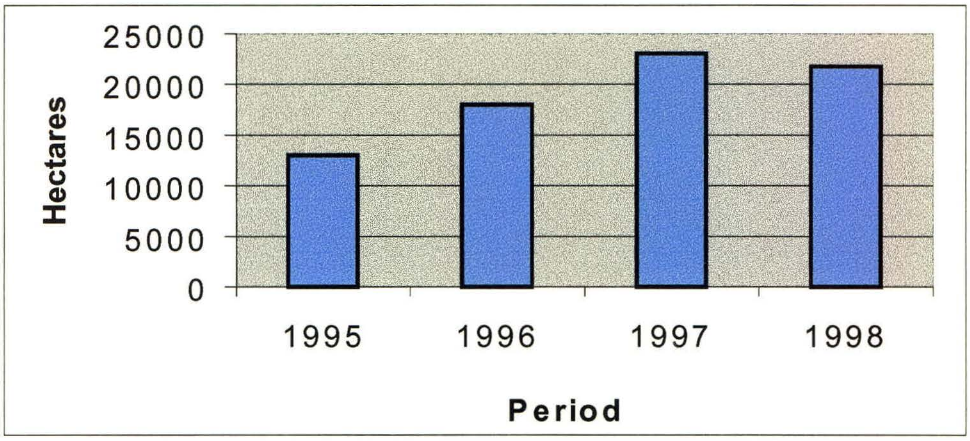
3.4.6 Organic market in Argentina

In Latin America, Argentina is the major producer of organic products with production estimated at $20 million. Production has continued to grow steadily in recent years at an annual rate of 25 percent. Organic agriculture took off in Argentina in the late 1980s and early 1990s and soon became a tremendous success. This is attributed to the development of the country's organic national legislation, which obtained equivalency with EC Regulation 2092/91 (ITC 2000: 113).

In 1999, the total area dedicated to organic production was estimated at 380 000 hectares, which is occupied by 1 000 farms. During the 1998 period, the area under organic management was estimated at 291 605 hectares. Of this area, 23 680 hectares is dedicated to products of vegetable origin and 207 600 hectares to products of animal origin (Harger, 2000: 6). Figure 3.9 provides an indication of the area utilised by products of vegetable origin during the previous years.

Groves (1998: 1) mentions that in 1997, almost 12 600 tons of organic produce were sold commercially. This figure denotes an important increase in activity with respect to 1996 whom 7 400 tons of certified products were registered. About 425 metric tons was organic wheat, particularly bread and 891 tons for organic corn.

Figure 3.9 Area devoted to organic production of vegetable origin in Argentina



Source: Secretariat, 1998

Although organic production is increasing in Argentina, it mainly targets the export market, as demand in the domestic market is quite small. Government data for 1998 reveal total exports to the EU of 13 937 928 kg. Of this, 7 152.527 kg is accounted for by grains and oilseeds. Other export destinations for Argentina's organic products are the United States, Japan and Uruguay. In 1998, the United States received a total of 1871 881 kg of organic exports from Argentina, with a total of 450 000 kg reaching Japan, Uruguay and the rest of Europe during this period.

Organic producers receive premiums depending on the region and product exported, as explained in Chapter Two. Table 3.13 gives a brief sample of price differences between organic and conventional products, specifically for grains in Argentina.

Table 3.13 Price premia for grains in Argentina ($ per ton)

Product	Organic($ per ton)	conventional($ per ton)	% Difference
Wheat	128.52	123.18	4.3
Corn	176.20	144.83	21.7
Sunflower	146.97	118.83	23.7
Soya	221.85	183.59	21.0

Source: Secretariat, 1998

With regard to support for organic agriculture in Argentina, there is no special treatment granted to organic farmers other than regulation of this farming system.

This chapter mainly reveals the significance of the organic industry at an international level in selected countries, although in areas where there are data limitations, general statistics is provided. The chapter confirms that EU is the major producer of organic foods, followed by the United States. This is attributed to various reasons that include regulation, support and increase in consumer demand. South Africa has been left aside in this chapter, as it requires a detailed description. In the following chapter an attempt to review the organic situation in South Africa is made, although the focus will be mainly on the Western Cape province as the area of the study.

CHAPTER FOUR

DESCRIPTION OF THE WESTERN CAPE WHEAT INDUSTRY AND GOVERNMENT POLICY EFFECTS

4.1 Introduction

There has been a long history of state intervention in agricultural production in South Africa, which reached a peak around the 1980s. During this period, significant policy changes have occurred in the country. These resulted in changes in the pricing and marketing policies of certain agricultural commodities (Jooste and Van Zyl, 1998). The policy changes also caused increases in production of certain crops and decreases for other crops. As stated in the preceding chapters, the changes have also affected the profitability and efficiency of production of various agricultural commodities in the country in diverse ways. One of the commodities adversely affected by these conditions is wheat.

It has therefore became clear to many governments that discipline needed to be restored. Therefore it was within this context that the Uruguay Round of negotiations of GATT was initiated in 1986, leading to the signing of the Marrakech Agreement in 1994 and the establishment of the WTO.

In this chapter a brief overview of the present wheat industry under a deregulated and liberalised environment will be provided. The organic sector, including the potential organic wheat industry will be examined. The discussion will also focus on various policies that affected and may still affect the supply, pricing, and marketing functions of the industry. This can serve as a basis for the evaluation of the performance of the industry. Among the elements of discussion will be the effect of issues from the General Agreement on Trade and Tariffs (GATT) on agricultural production.

4.2 The WTO and the Agreement on Agriculture

As indicated in the previous paragraphs, the most profound event shaping international agricultural markets has been the formation of the WTO and with it the signing of the Agreement on Agriculture in Marrakech. The WTO came into existence on the first of January 1994 as a result of the Uruguay Round negotiations. The fundamental principles upon which the international trading rules were based remain and are reaffirmed within the WTO framework (Van der Merwe and Otto, 1997: 437). In addition, the coverage and effectiveness of the General Agreement on Tariffs and Trade have been strengthened, including an improved dispute settlement mechanism.

The main agricultural package of the Uruguay Round negotiations has fundamentally changed the way domestic support for agricultural producers was treated under the GATT of 1947. As a result, agricultural policies that are based on heavy government interference, especially in the industrialised countries, are viewed as a serious problem. These unsatisfactory measures include protection of imports by tariffs or non-tariff barriers such as import licensing, quotas, and subsidies. Figure 3.2 in the previous chapter revealed this protection, particularly in the form of subsidies. Huge budget costs, surpluses, environmental degradation and unsatisfactory levels and distributions of farm incomes have also strengthened the opposition to these measures (Guyomard *et al.,* 1993).

The main object of the Agreement is to discipline and reduce domestic support, while leaving great scope for governments to design domestic agricultural policies in the face of, and in response to country-specific circumstances and individual agricultural sectors (Berning, *et al.,* 2000: 29). Under this agreement, however, domestic support measures that have, at most, minimal or no trade-distorting effect were excluded from reduction commitments. Such acceptable state intervention measures include the so-called 'green boxes'. These are mainly used by the developing countries like South Africa, as the developed countries make more use of the blue boxes, which were the main focus of negotiations in Seattle 1999. Other support measures that South Africa is not deprived of include *de minimus* provisions, defined as support that does not exceed five percent of the value of production of the product concerned. In the case of developing countries, the *de minimus* level is ten percent (National Department of Agriculture, 1997: 6).

South Africa as a co-signatory, has fulfilled more than its commitments in terms of this agreement. Quantitative import controls have been replaced with tariffs that are fixed at levels, at least for most products, far below the allowed maximum bound rates. Minimum market access quotas are allowing a certain percentage of domestic consumption to be imported at preferential tariff rates. Export and other subsidies have been virtually eliminated (Van der Merwe and Otto, 1997: 437). Comparative advantages should be the guiding factor in this regard. Producers involved in an industry that can show no comparative advantage, either regionally or globally, have to devise strategies which enable them to regain a comparative advantage. These include the identification of niche markets, or looking for production alternatives in order to ensure their long-term survival. Together with deregulation of the domestic marketing environment, these developments have exposed producers increasingly to global market forces.

Although the agreement to some extent is comprehensive and goes well beyond tariffs and border measures, it still represents only a partial liberalisation agreement. The quantitative cuts in support for agriculture are relatively small and spread over a number of years. This means that a large degree of distortion in the world of agricultural commodity markets will still remain even after the complete implementation of the reduction commitments (FAO 1995: 5, and Ohene-Anyang, 1997: 11). Inequities still remain, for example South Africa is still treated like a developed country under certain circumstances.

4.2.1 Domestic support level in South Africa

Domestic support in South Africa dates back to the early 1970s where government intervention was still heavy in the agricultural sector. This continued to the early 1980s with the aims of achieving the goals of the White Paper of 1984. Agricultural policy in this period was characterised by huge government subsidies to farmers, usually in the form of drought aid and other disaster payments. The government also paid industry subsidies to *inter alia,* the wheat, maize, and dairy industries. The subsidy to the wheat industry was paid to keep consumer prices of wheat and wheat products as low as possible. Helm and Van Zyl (1994: 216) calculated the total support received by South African Agriculture during the period 1988/9 to 1993/4 period using the producer subsidy equivalent (PSE) measure. Although the total PSE of South Africa was at lower levels (12 percent) when compared with other competitors during 1988/9, agricultural support was still found to be heavy in this period. This is because of producer prices of sugar, rye, eggs, chicory, beef, sheep, and dairy products that were higher than the representative world prices. In 1990/1 the total PSE again increased (14-17 percent) as a result of substantially higher domestic producer prices for certain products together with a decline in world prices.

Changes in producer prices of agricultural products relative to the world prices were once again the main reason for the higher market price support. There was also a large change in the percentage PSE (31 percent) in 1992/3 as a result of a huge once-off increase in direct income support to farmers, which came in the form of drought relief package. Total PSE for agricultural commodities were also calculated by Gouse *et al.* (2000) for the period 1996 to 1998 (see Table 4.1).

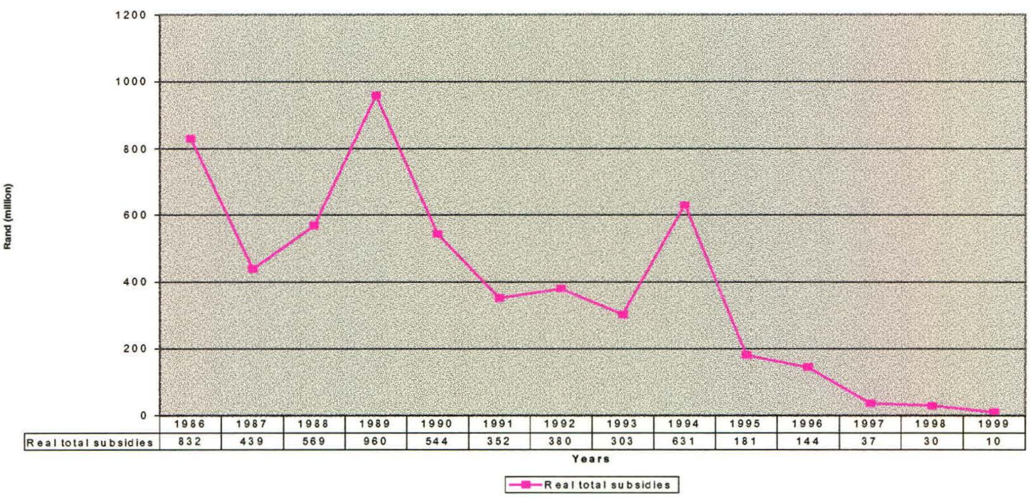
Table 4.1 PSE for South African agriculture from 1996-1998

Period	Total PSE (rand)	% PSE	Wheat PSE (rand)	% PSE for wheat
1996	656 90 045	2.3	21 154 408	1.48
1997	2 893 693 633	8.9	360 700 914	16.09
1998	867 751 907	2.7	482 788 355	19.45

Source: Gouse et al., 2000

Although Table 4.1 indicates increased PSE's for wheat, from 1994, there was a sharp decline in agricultural support because of a shift of interests from agriculture to other priorities. This was also coupled with the signing of the Marrakech Agreement. The history of changes in agricultural subsidies over some years is illustrated in Figure 4.1.

Figure 4.1 Historical changes in agricultural support



Source: Abstract of Agricultural Statistics, 2000

As agreed upon in the Agreement on Agriculture, all domestic support measures in favour of agricultural producers are in the process of change, as countries have to comply with the rules of the WTO. In this regard, South Africa as a co-signatory, made an attempt to function according to the WTO commitments, such that all information concerning the level of domestic support has been disclosed. The main emphasis of this study will be on wheat, as it is the commodity under scrutiny.

A report submitted to the National Department of Agriculture for the period 1995 to 1998 revealed a total market price support of 818. 84 million rands for wheat. In 1996, wheat was found to have an AMS (Aggregate Measurement of Support expressed in monetary terms) of about R816.86m. This AMS incorporates market price support, and product specific and non-product specific budgetary outlays. For the calendar year 1998 in terms of AMS calculations, zero domestic support has been reported on wheat and wheat products [National Department of Agriculture 1999a, 1999b, and 1997].

Although the AMS has been used to calculate domestic support, it is criticised for being too broad based and flexible (Berning *et al.,* 2000: 30). The IATRC (1997: 15), assert that as a result of blue box measures being exempted from reduction commitments and therefore not included in current AMS measurements, in effect, support levels for cereals, oilseeds and beef are now lower, even though in economic terms they have not decreased. This has been noticed mainly in the European Union. Furthermore, it has also been observed that the AMS increased dispensation amongst products. This has been observed in the case of wheat and flour, where the import duty on wheat increased from R0 per ton to R181 per ton and the duty on flour increased to R272 per ton in 1999.

4.3 Overview of the Existing Wheat Industry in South Africa

In South Africa, wheat is one of the most important grains grown (Otto, 1990: 5). The crop is produced mainly for human consumption, although small amounts not suitable for milling purposes are marketed as stock feed (Sartorius Von Bach and Van Zyl, 1994: 147). South Africa has traditionally been a deficit producer and thus an importer of wheat. However, during the 1970s production gradually overtook local consumption in certain years with the result that South Africa began exporting wheat in small quantities [(Kirsten *et al.*, 1998: 538) (see Table 4.2)]. In Table 4.2, decreasing exports together with an increase in imports indicate the problem faced by wheat farmers. This can also be exacerbated by unfair competition by other countries like Europe and United States that have wheat industries that are still heavily subsidised.

Table 4.2 South African statistics of total wheat exports and imports

Period	**Exports (ton)**	**Imports (ton)**
1997/98	79000	469000
1998/99	75000	484000
1999/2000	55000	592000
2000/01	N/A	N/A

Source: 1) SAGIS, 2000

2) Abstract of Agricultural Statistics, 2000

Note: N/A signifies not available

4.3.1 The importance of the wheat industry

In South Africa, the Western Cape has traditionally been seen as the 'breadbasket' of South Africa, as the province produced approximately 31.6 percent of the country's wheat crop in the period 1986 to 1996. The wheat sector in the Western Cape provides an interesting example given its considerable contribution towards field crop production and land use. It contributes more than 45 percent of total farm production, in certain regions of the province (Troskie *et al.,* 1995: 6).

Wheat production has relatively large income and output multiplier effects on the regional economy. Wheat production also showed positive employment effects, particularly with regard to grain processing activities, although these are lower when compared with other branches of agriculture (Vink *et al.,* 1998: 256). It is also vital as a staple food and as a primary input in the baking and milling industry.

4.3.2. Domestic production

Cropping patterns changed after the market was deregulated. As it is pointed out below, the total area planted to wheat has decreased, particularly in the season 1996/97. However, several authors, including Vink and Kirsten (1999) indicate an increase in total area planted and yield, with total production showing constant figures when taking a longer term view (see Table 4.3). This is attributed to the maize industry's experience of deregulation, which provided some guidelines for the kind of market adaptations which must eventually take place in the wheat industry.

Anecdotal evidence indicates that some of the Western Cape wheat farmers at least have already implemented a number of the changes that have been identified. These include vertical integration, which involves some form of processing, such that farmers can take advantages of value-adding. In the case of wheat, farmers can invest in milling or mixing of animal feed, expected to revert to a mixed grain or livestock production, and move away from monoculture as the main production mode.

However, it must be noted that the implementation of the Marrakech Agreement on Agriculture also played its role. Although the Agreement was expected to increase international wheat prices, however, South African wheat prices, paticulary in the Western Cape, are still at lower levels when compared with their Orange Free State counterparts and world prices, which also influence the area planted. These prices are expected to increase in the future as the current period on which the study was conducted is still considered to be part of the period of adjustment to the market forces (Goldin *et al.,* 1993: 25).

After a small decline in area planted with wheat during the 1996/97 period, the years after this period showed an increase, except the 1999/00 period. This can be attributed to many factors that include the depreciation of the currency, which can have a positive impact on wheat prices. The National Department of Agriculture (2000b) reported an increase in producer prices of approximately 18 percent. Conversely, anticipated weather conditions for the next season (2001/2002) can influence these results negatively (SAGIS, 2000).

Table 4.3 Production relationship of wheat between South Africa and the Western Cape

Period	South Africa			Western Cape		
	Area (ha)	Production (t)	Yield	Area (ha)	Production	Yield (t/ha)
1991/92	1435688	2085074	1.45	325000	457454	1.41
1992/93	740716	1270373	1.72	344495	582193	1.69
1993/94	1050893	1913408	1.82	386630	698384	1.81
1994/95	1050893	1775452	1.65	377472	696125	1.84
1995/96	1351663	1898787	1.40	371178	775291	2.09
1996/97	1241587	2570173	2.07	381469	769210	2.02
1997/98	1382300	2283500	1.65	400000	550000	1.38
1998/99	748000	1531000	2.05	300000	535000	1.78
1999/00	718000	1725000	2.40	310000	591500	1.91
2000/01	860000	2327120	2.71	360000	810000	2.25
2001/02	919750	2113180	2.30	374000	748000	2.0

Source: SAGIS, 2001

4.3.3 Domestic consumption

The consumption of wheat has been increasing steadily over the last five years. Table 4.4 reveals increasing wheat consumption at both national and provincial levels, with the latter referring to the Western Cape. SAGIS (2000) reported a total consumption of 2 429 000 tons for South Africa during the 1999/00 period. From this, an estimated 2 39 0000 tons was processed for domestic human consumption, 13 000 tons for animal feed and 26 000 tons for seed. On the other hand, from the total domestic commercial demand (2 429 000) for wheat during this period, 55 000 tons were exported. In the Western Cape alone, wheat consumption during 1999/00 has been estimated at 350000 tons (National Chamber of

Milling, 2001). Opening stocks for the 2000/01 season were approximately 548 000 tons. This is higher than the required three month pipeline stock of 392 000 tons, but significantly lower than the previous year's opening stock of 771 000 tons. Physical shortages have been experienced in the local market since June 2000 (National Department of Agriculture, 2000b).

Table 4.4 Consumption relationship of wheat between South Africa and the Western Cape (000 t)

Period	South Africa	Western Cape
	Consumption (tons) 000	Consumption (tons) 000
1991/92	2143	332
1992/93	2132	345
1993/94	2259	368
1994/95	2353	358
1995/96	2419	362
1996/97	2268	N/A
1997/98	2183	N/A
1998/99	2421	N/A
1999/00	2429	350

Source:1) Abstract of Agricultural Statistics (2001)

2) National Chamber of Milling (2001)

Note: N/A signifies not available

4.3.4 Domestic marketing and pricing

The policy and practice of agricultural marketing in South Africa has changed rapidly over the past three years with the new Marketing of Agricultural Products Act, No 47 of 1996 spelling out and setting rules that differ greatly from earlier legislation. Specifically for the wheat industry, the Wheat Board that operated a single-channel fixed price system in which it was the sole buyer and seller of wheat, was abolished and has thus led to several changes.

These include the loss of the statutory levy by the Winter Grain Producers (WPO) who have now merged with other arable based producer organisations to form the Grain Producers Organisation (GPO). Some silo owners have converted from being co-operatives to companies, so that many farmers are now silo customers rather than members. The Chamber of Baking's role has been reduced, as it is no longer allocating sales quotas between its members. The South African Grain Information Service (SAGIS) and the South African

Grain Laboratories were established to fill certain gaps that were left due to the closure of the Wheat Board. Furthermore, the Board on Tariffs and Trade (BTT) has come to play a particularly important role. This is because of the effect of tariffs on domestic prices, as import permits were replaced by import tariffs (Bayley, 2000: 72).

After October 1997, the price of wheat was determined through demand and supply forces (Edwards and Leibbrandt, 1998: 233). This has also led to an increase in on-farm storage and direct marketing of wheat, with an increasing number of quality specifications by buyers. Competition has increased in the market place as a result of the growth in the number of small millers and bakers (Bayley, 2000: 72).

It has been pointed out that many South African tariff rates, whilst quite high, are still well below their WTO bound rates. Bayley (2000) holds that in practice, South Africa's agricultural tariff levels are not currently constrained by its WTO commitments. Indeed, since the initial process of tarrification was completed, a number of applications have been made for the import tariffs on certain commodities, including wheat, to be raised. However, the degree to which the Rand depreciated against the US Dollar between 1995 and 1999, led to a fall in the real value of protection offered by the tariff on wheat, which in turn affected domestic wheat prices negatively (Edwards and Leibbrandt, 1998: 239). The effect on domestic prices is shown in Table 4.5, which is a representation of producer prices.

The real depreciation of the Rand in 1998 combined with concerns that the wheat industry would be vulnerable to EU export subsidies prompted a review of the tariff regime for wheat and flour. The system for calculating the tariff was revised in mid-1999 so that for every $1 per ton that the world price fell below $157 per ton, the import tariff increased by $1per ton. The 1999 effect on the wheat industry is associated with the fact that the new tariff regime probably came too late for the farmers to adjust their planting decisions. At the time of data collection, the tariff as calculated according to the tariff formula of the BTT at R269.00. With regard to reference prices, the world reference price for wheat as on the 4th of May 1999 was $112.67 per ton, with the South African initial reference price being $157.00 in dollar terms (SAGIS, 2000).

With respect to exports, phytosanitary requirements and quality standards must be adhered to and a Perishable Products Export Control Board (PPECB) certificate must be obtained (Van Rooyen, 2000: 9).

Table 4.5 Basic producer prices of wheat (BS1)

Production Period	Price (Rands)
1994	770.50
1995	846.78
1996	966.02
1997	817.75
1998	808.19
1999	953.78
2000	N/A

Source: Abstract of Agricultural Statistics, 2000

Note: N/A signifies not available

4.4 The Western Cape Organic Industry

Over the last few years South Africa has gained importance as a producer and exporter of organic products, although in some areas, including the Western Cape province, development has generally been at a slow rate. As this is a new phenomenon in South Africa, co-ordination is still lacking, which in turn results in difficulties in obtaining statistical information. The non-existence of legislation for organic production and labelling is also believed to exacerbate this problem, as there is no differentiation between organic and conventional produce. This situation is expected to improve as soon as national legislation is in place.

A SÖL survey (2000) indicated that there were about thirty-five certified organic farms in South Africa, although there have been increased conversions recently so the figure could be understated. Active certifiers in the country are mainly foreign bodies that include the British Soil Association, Ecocert, SGS, BioGro and SKAL, although a local certification body, AFRISCO, has been established recently. Organic farmers belong to either the Biodynamic Agricultural Association of South Africa (BDAASA), the Organic Association of South Africa (OASA) or are unaffiliated (ITC, 2000: 75).

In the Western Cape, organic farming has came to the attention of the Chief Directorate of Agriculture. This was within the context of finding alternatives for both commercial and small-scale farmers, as the former were adversely affected by the global market changes, while the latter are still trying to adapt to the global market. As a result, the Western Cape Department of Agriculture was active in investigating the prospects of implementing Provincial Legislation pertaining to organic farming in 1998. The general reaction to this was positive and the first draft, which also received a positive response, was published. This initiative was noticed by the National Department of Agriculture, the response being that the Legislation should be National. The National Department of Agriculture therefore took over with organic legislation (Mendes, 2000: 37). As a result, the first and second drafts of the National Organic Regulation were subsequently published by the National Department of Agriculture in May 2000 and October 2001 respectively.

4.4.1 Production

The Western Cape Province in South Africa is amongst those that have a growing potential for organic agriculture, producing a variety of products including herbs, vegetables, fruit, table grapes, wine grapes, and rooibos tea. In this Province, a group of organic producers came together recently to form the Cape Organic Producers Association (COPA), which was launched on 22 November 2000. As a result, farmers are now believed to act in cohesion with a stronger voice than before. In the province, the number of certified organic farmers in early 2001 is estimated at sixty-five. Redelinghuys (2000), the chairman of COPA, estimated a total of twenty farmers that are still in the process of conversion. This number is expected to increase as the certification bodies have had a large number of enquiries from farmers (Jackson, 2001).

At present, there is no known certified organic wheat production in the Western Cape. However, in the Sandveld area of the Northwest region, there is one organic wheat farmer, who only grows organic wheat occasionally due to climatic conditions. This is expected to improve in the future, as there are a few other farmers who are considering conversion as well as a few farmers who are in the process of conversion. This is because of the opportunities for farmers both domestically and internationally. Farmers are also considering conversion to organic wheat as an alternative because of the low margins achieved by conventional wheat at present. It is forecasted that the level of support in the major wheat producing countries is expected to decrease in the coming years, in which case the Western Cape producers could stand a chance in the international arena.

Organic production in this province ranges from small holdings to large commercial enterprises or a mix of conventional and organic enterprises, ranging in area from a half a hectare to 3 300 hectares. For all kinds of reasons, many people call themselves organic growers, although their farming practices do not coincide with internationally acceptable norms. There have been no steps taken against this, as there is no legislation to protect genuine producers, as well as the fact that strong cohesion is lacking amongst the growers.

4.4.2 Marketing

In the Western Cape, the organic market is still at a niche stage, but with available opportunities producers are increasingly targeting both the domestic and export markets, as local retailers are also looking at this market. Organic produce in the Province can be found in a number of stores, mainly Pick 'n Pay and Woolworths stores, with the latter selling a variety of organic fresh and processed produce. In future, Woolworths is expected to specialise in organic produce, and has stated its intentions to remove genetically engineered food from its shelflines due to a lack of transparency regarding this product for the consumer (Russell, 1999). Pick 'n Pay stores also report an increased demand for organic merchandise in certain stores, especially for fresh vegetables. As a result, these retailers are looking at having 20 percent of their fresh shelf space available for organic products in the next few years (see Table 4.6). These are the factors that should have a demand-pull effect on organic production.

One of the retail stores estimated the contribution of organic sales to retail sales at about 0.8 percent. Although the main focus of the study is on organic wheat, due to data unavailability, Table 4.6 reveals sales estimates of organic and conventional produce of vegetable origin. As shown in the table, the contribution of organic vegetable produce to retail sales is low when compared with conventional vegetable produce. However, this is an unequal comparison at present, as the retailers contend that they receive organic produce in small quantities compared to conventional produce. In general, the contribution of organic produce to retail sales, although not comparable to conventional produce, is believed to make a significant difference.

Table 4.6 Relationship between organic and conventional six weeks average sales (Rands)

Product	Organic sales	Conventional sales	Organic as % of conventional
Spinach	165	266	38
Cucumber	660	4168	84
Lettuce	720	6314	89
Parsley	96	280	66
Rosa	677	3273	79
Baby corn	663	919	28
Spring onion	222	360	38

Source: One chain retail store, 2001

As far as pricing is concerned, Jenks (2000) indicates that pricing of organic produce needs to remain competitive, as the product is differentiated by certain attributes that a consumer can rarely distinguish from the normal produce sold in the market place. On certain items a small price difference applies, as the premium varies according to the commodity. Table 4.7 reveals the price premia obtained for organic products.

Table 4.7 Price premium relationship between organic and conventional products (Rands)

Product	Mass	Organic price	Conventional price	Organic Price Premium %
spinach	300g	4.79	3.79	21
baby marrow's	350g	6.99	6.49	7.0
lettuce	300g	4.79	3.99	17
tomatoes	1kg	8.99	6.99	22
organic coffee	100g	46.99	43.99	6.4
organic jam	340g	24.99	19.99	20
tea	250g	19.99	10.49	46
self raising flour	*1.5 kg*	*12.99*	*4.59*	*65*
organic flour	*1.5 kg*	*13.99*	*8.99*	*36*
pasta	*500g*	*19.99*	*8.99*	*55*

Source: Own observations, 2001

Although not from the Western Cape, stone ground flour from organic wheat is produced domestically and is available in some retail stores. The organic wheat sold to produce this flour fetches a domestic price ranging between R1500 and R2000 per ton depending on the distribution channel. This is approximately forty percent higher that the conventional wheat price. The reason that the product is organic and that the market is still small. The distribution channel also plays a significant role, as organic wheat is mainly sold through direct marketing, thus reducing the complexities of price determination. As a result a farm gate price of R1500 per ton is used in the analysis (see Appendix A).

With regard to supply, local stores currently source certified organic produce from local producers. As a result of inconsistency in supply, retailers have also considered outsourcing, as organic farmers that are currently available have produce available for only short periods of time, which does not offer continuity of supply.

Labelling is the main tool used to differentiate organic produce in the market place, and the certification mark is the guarantee to the consumer that the product is organic. Therefore if the label does not include certification by an internationally recognised certification organisation, there is no guarantee that the produce is organic. If the product is from a producer that is under the process of conversion, it is labelled so, although some stores have been observed to use their own labels for organic produce.

4.4.3 Trade

In the Western Cape, organic products are produced mainly for the export market, although a small amount is sold on the local market. Among the products that are exported are table grapes, organic wine, vegetables, herbs and spices. The main export destination is the European Union, particularly Denmark, France, Sweden and the United Kingdom. The primary wholesaler of organic produce is Unifoods in Durban (ITC, 2000: 75).

South Africa is also an importer of some organic products, particularly from countries such as Zimbabwe. It also imports a limited amount of frozen and processed foods from New Zealand and Europe (ITC, 2000).

4.4.4 Limitations and challenges

Although some have already been highlighted, the challenges that are facing organic farmers are often institutionally related. One of these is the non-existence of organic legislation, yet negotiations are in place, as indicated previously. Certification programme is also considered as one of the major barriers to organic farming, because costs of certification, particularly licensing costs can reduce profits, such that organic farming is not an easy option for new entrants and small farmers at existing prices. Although a local certification body, AFRISCO that has been established recently, can offer some benefits, it is not believed to act differently from the existing internationally based bodies. This is because certification is a business and the interests of the certifiers will not always coincide with the interests of the operators. Also, the certifying organisation has to be internationally accredited, which is also costly.

Small farmers are experiencing many problems, including the lack of production capital, as it is difficult for these farmers to borrow from financial institutions due to lack of security required. This can be exacerbated by high risks associated with organic production. The distance to the market, poor management skills, and thus poor record keeping particularly during the establishment years are also the major contributing factors. However, these costs are believed to diminish, particularly from record keeping as it improves with time (Lampkin and Measures, 2001: 22).

There are also various ways to reduce costs of certification, as some organisations make use of group certification schemes to encourage small producers, processors and retailers to work together in order to reduce these costs. In this light, certification organisations mainly use the whole farm turnover as the restriction. This is to avoid exploitation by larger producers, processors and retailers, and also to encourage development of local food marketing initiatives. Share farming schemes for share cropping are also available in certain organisations at reduced costs (Lampkin and Measures, 2001: 27). In general, the costs of certification differ with organisations as the methods of charging vary. In this context, some organisations base the charges on time (per hour) while the others on holdings or area certified (Browning, 2001). Even so, there is a need for local legislation, and hence a local certification body because organic agriculture is based on local resources and conditions.

Furthermore, unavailability of extension services is also a major constraint, as the existing extension officers do not have any knowledge of organic farming. Most of the organic knowledge lies with farmers themselves as well as a few select private consultants. Educational and training facilities, coupled with research are also among the constraints to organic farming in the province, although these are believed to diminish with development.

Apart from institutional constraints, there is also a lack of certain organic inputs, particularly organic wheat seeds. This is a major challenge to organic wheat farmers in the future as the certification organisations allow the use of conventional seeds at present, but this will change. This allowance will expire in 2003, which implies that only organic seeds will be allowed after this period. With regard to conventional wheat seeds that are used in organic wheat farming, requirements are that farmers should clean the seeds to remove substances like lindane before they are inoculated with micro-organisms for planting purposes (Moffet, 2001).

4.4.5 Potential of organic wheat production

Organic farming faces constraints that inhibit an increase in organic production. However, with the national legislation in place, there is no doubt that the Western Cape has good possibilities for organic wheat production. Physical factors such as restricted soil depth, poor drainage, and low nutrient status in the Western Cape, as identified by Lipton *et al.*, (1996: 146), are believed not to constrain organic wheat production. In fact, organic wheat practices are believed to eliminate these problems, as good soil structure is one of the principles of the system.

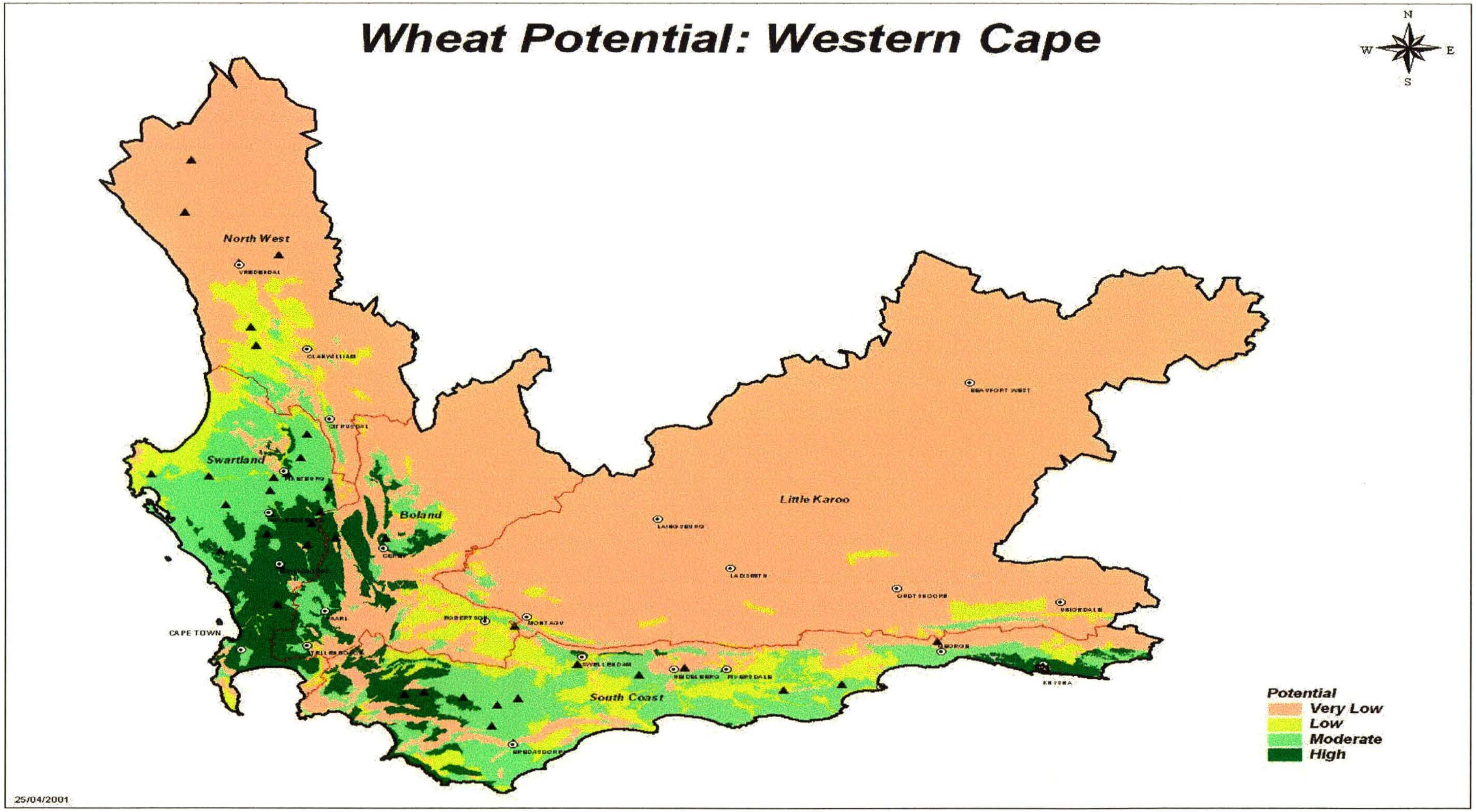
Wheat as a winter grain is produced mainly on dryland with the exception of the Northwest region where it is also grown under irrigation, although production in the latter is no longer prevalent. As a result Figure 4.2 shows the potential wheat areas of the Western Cape.

As production mainly takes place under dryland conditions, irrigation requirements are less when compared with other winter crops. This implies that wheat does not place a heavy burden on water resources in the Western Cape, as water is considered to be a scarce resource. These factors, accompanied with the occurrence of winter rainfall (as the Western Cape is a Mediterranean area) are the conditions that contribute to the potential for organic wheat production in this Province.

South Africa at large is grouped under the list of countries with a good export infrastructure, in that it is already a significant exporter of conventional products. Organic wheat produce therefore can benefit from these facilities. Furthermore, there seems to be a great interest in organic agriculture amongst farmers, extension agents, NGO's and other associations. Several activities are already being undertaken, including the training of students and research that is being conducted in this field.

It has been identified that organic farming has the potential and opportunities for further development, but it is of importance to determine whether the industry would operate along the lines of comparative advantage, as cited in the introductory chapter. Therefore to find out if organic wheat in the Western Cape would conform to this principle it is of importance to evaluate the position of the existing wheat industry in this province. This is because factors that can affect its comparative advantage are likely to affect the comparative advantage of the expedient organic wheat industry.

Figure 4.2 Wheat potential: Western Cape



Source: Wallace, 2001

In summary, Section 4.3 provided a brief overview of the wheat industry, where the main focus was on policies that affect the industry. Section 4.4 on the other hand has assessed the position of the organic sector in the Western Cape in general, as wheat is not produced organically at present. The preceding subsections dealt with production, marketing, potentials, limitations and challenges of the organic sector, as these need to be investigated when evaluating the comparative advantage of an industry. It has been found that the organic sector in the Western Cape is still small and underdeveloped, but has the potential for further development.

As a result, the following chapter will describe various methods that are used to evaluate comparative advantage of an industry, although the focus will be on the policy analysis matrix, which is selected for the study.

CHAPTER FIVE

ANALYTICAL TECHNIQUES TO MEASURE COMPARATIVE ADVANTAGE

5.1 Introduction

Developed more than a century ago by David Ricardo, John Stuart Mill and other followers of Adam Smith, the theory of comparative advantage, or, as it is sometimes called the theory of "comparative cost" is viewed as a closely reasoned doctrine. This is because it is able to identify gross fallacies in the political propaganda for policies related to protectionism (Samuelson, 1967: 646).

In theory, the principle of comparative advantage holds that each country will specialise in the production and export of those goods that it can produce at relatively low cost (in which it is relatively more efficient than other countries). Conversely, each country will import those goods which it produces at relatively high cost (in which it is relatively less efficient than other countries) (Samuelson and Nordhaus, 1989: 901).

Agriculture in many countries is characterised by policy distortions and some of these have been highlighted in the introductory chapter. This is the condition that urges researchers to determine whether or not the production of any commodities within an agricultural system in any part of the country is financially or economically profitable. The measurement of these requires proper analysis of the production process. Such analysis will entail a critical assessment of input requirements of the production process as well as the output that will be generated. Through calculation of the existing private and social revenues, costs, and profits, it is possible to determine whether the scarce resources of a country are used efficiently. It is then also possible to determine whether government agricultural policies are leading to inefficient resource allocation.

The primary aim of this chapter is therefore to investigate various methods that are used to determine the economic efficiency in the production of agricultural commodities based on comparative advantage principles. An attempt to investigate the methods that are used to measure the distorting effects, if any, of government policies towards agricultural production will be made. The chapter will finally describe the method that is selected for the study, which is the Policy Analysis Matrix.

5.2 The Alternative Techniques

As computing power has grown in recent years, increasing attention has been given to economic models as one of the most powerful aids to analyse various policies. While various methods have been developed during these years, analysis of their strengths and weaknesses has been lacking (Kendrick, 1990: 2). Therefore this chapter will review various models that evaluate comparative advantages.

The analysis methods are classified into two broad models, that is, sectoral and economy-wide models. The economy-wide models can be usefully divided into two groups, general equilibrium models and growth models. Alternatively, sectoral models may be for a single country, a region or the whole world. Within this framework several economic methods to analyse commodity systems have been developed. In investigating the comparative advantage at sector level, particularly for wheat, the stochastic coefficient regression method, conventional gravity model and partial equilibrium methodologies were examined. Therefore the forthcoming paragraphs will provide a brief description of these approaches.

5.2.1 General equilibrium models

The general equilibrium models focus more on the prices of goods and factors and are therefore useful for analysing the effects of tariff changes on prices throughout the economy. The example being the effect of a tariff change on wages and returns to other factors. This means the models can be helpful in analysing the income distribution effects of changes in trade policies.

Most general equilibrium models such as SAM-style models and Johansen-style models are characterised by an assumption of perfect competition. However, today, there is a group of models that have been created with GAMS and or MATLAB software. These models permit substantial price flexibility without the necessity of the above assumption (Kendrick and Lane, 1961: 453).

The main advantage of the general equilibrium models is the provision for specification of price and income elasticity in imports and exports, thus permitting some analysis of comparative advantage in an economy-wide model setting.

However, as the general equilibrium models capture a larger picture, they are not useful in analysing comparative advantage of a particular industry, as they are limited by the quality of the data available (Evans, 1972: 2). Furthermore, the models are usually static and do not include spatial information and economies of size. As a result, general equilibrium models are found to be lacking in analysing comparative advantage, as several economists observed this to be dynamic (Kendrick, 1990: 86).

5.2.2 Gravity model

Bergstrand (1985: 478), and Koo and Karemera (1991: 441) describe a gravity model as a reduced form equation from general equilibrium of demand and supply systems. This model has been used to evaluate the impact of trade policies on commodity systems, particularly wheat, this system being viewed as a classic example of trade intervention. The gravity model is comprised of three variables:

- economic factors affecting trade flows in the original country
- economic factors affecting trade flows in the destination countries, and
- natural or artificial factors enhancing or restricting trade flows.

However, the gravity model also has its limitations, as the error component of this model is perceived to have the undesirable property of being asymptotically efficient, although estimates may be biased. The model has also been criticised for not including dummy variables for individual country pairs and/ or time effects. It is therefore detected as an inaccurate measure of trade policy effects in commodity systems (Hausman, 1978: 1265).

5.2.3 Stochastic coefficient regression approach

Swamy and Tinsley developed the Stochastic Coefficient Regression Method (SCM) in the 1980s. The method has been used in China to determine the influence of 1978 policy reforms on future production, consumption and imports of wheat. As a result, the model qualifies to be classified under sectoral models, as it focuses on a single country as well as a particular industry. The SCM model succeeds the standard fixed coefficient-estimating methods such as ordinary least squares (OLS). Like the general equilibrium models, the OLS has difficulty in defining the stages of policy impacts, that is, the exact timing of when the individual policies are announced, when they are in full effect, and how they are fine tuned. Another limitation of the model is based on fixity of agricultural assets and inelastic demand and supply, which contrast with abrupt shocks that occur when dummy variables are used. Thirdly, the method assumes constancy in the marginal contribution of casual factors, which is restrictive when evaluating the impacts of evolving policies in a country.

However, even though the SCM is preferred to standard fixed coefficient-estimating methods, it also suffers from shortcomings because it involves functional specifications that are observed as a source of uncertainty. The model is also criticised as it focuses on a single country at a time and thus fails to consider the larger economy-wide impacts (Halbredt and Gempsaw, 1990: 268).

5.2.4 Partial equilibrium methodologies

Policy analysts have been searching for consistently correct and understandable summary measures to evaluate the comparative advantage of alternative activities, but they lack the data and other resources needed to construct a specified model to do so. Masters and Winter-Nelson (1995: 243) mention that there is now extensive theoretical and empirical literature on numerical indicators that can be used to compare the contribution of alternative activities to aggregate growth. In addition, Scandizzo and Bruce (1980: 1) pointed out that the indicators are also useful measures of economic incentives and efficiency in the field of policy analysis.

The analysts developed two types of summary measures. One strand of analysis focuses on private and social costs of public sector investment. In this area popular measures include the net present value (NPV) and the economic internal rate of return (EIRR). The second strand of analysis focuses on the static effects of price distorting policies. Popular measures in this area include effective protection coefficient (EPC), and the domestic resource cost ratio (DRC) (Nelson and Pangabean 1991: 703). Along these lines is also the social cost-benefit ratio (SCB) as used by Masters and Winter-Nelson (1995: 243). Other popular measures of policy impacts include the nominal protection coefficient (NPC), producer subsidy equivalent (PSE) and the policy analysis matrix (PAM). The PAM, as a successor of all the above measures will incorporate some of these indicators in its construction.

The measures are classified under partial equilibrium analysis, which is a technique of microeconomic analysis pioneered principally by Marshall and Cournot to analyse a market or part of an economy. When an analysis is conducted, only the relationship between two variables is considered with the assumption that if an external factor can influence that relationship, it remains unchanged. Some of the measures will be discussed in the paragraphs below.

5.2.4.1 Net Present Value (NPV)

The NPV is one of the popular methods in cost-benefit analysis. Dasgupta and Pearce (1978: 159) state that in project analysis the necessary condition is that a project or policy be deemed socially worth while if its benefits exceed the costs. In the computation of the NPV method, the difference between the benefits and costs in a specified year is discounted to the present by using the social discount rate. It is the discounted sum of all these net benefits over the economic project life that is defined as the net present value. Its definition can satisfy the formula below:

$$NPV = \sum_{t=0}^{n} (B_t - C_t) / (1+r)_t ,$$

where:

B_t are project benefits in period t

C_t are project costs in period t

r is the appropriate financial or economic discount rate

n is the number of years for which the project will operate.

The criterion for the acceptance of the project or policy is that the net present value must be positive, in other words, funds will be voted for a project only if the analysis produces a positive NPV (Central Economic Advisory Service, 1989: 24).

An observable problem of the NPV measure is that the selection criterion cannot be applied unless there is a satisfactory estimate of the opportunity cost of capital.

5.2.4.2 Internal Rate of Return (IRR)

Gittinger (1982: 329) states that the IRR is a measure usually used by the World Bank for all its economic and financial analyses of projects, as do most international financing agencies. In economic analysis it is known as the economic rate of return. The IRR is defined as the discount rate that, if used to discount a project's costs and benefits, will just make the project's net present value equal to zero. Thus the internal rate of return is the discount rate, r, which is indicated by the following equation:

$$IRR = \sum_{t=0}^{n} (B_t - C_t) / (1+r)_{t} = 0$$

Note: explanation of variables is similar to those in Sub-section 5.2.4.1.

The formal selection criterion for the internal rate of return measure of the projects' worth is to accept all independent projects having an IRR equal to or greater than the opportunity cost of capital (social discount rate).

Although the IRR is considered as the most useful measure, it must be used cautiously because there are situations where the mathematical solution of the above equation is not unique (Central Economic Advisory Service, 1989: 24).

5.2.4.3 Social Cost-Benefit Ratio (SCB)

Policy makers often need to use some indicators to rank alternative activities, or to identify a single most desirable activity. Masters and Winter-Nelson (1995: 243) regard the simple SCB ratio as a generally superior measure as it produces activity rankings that are consistent with maximum social profitability. The SCB method has been used along with the DRC method in Kenya to compare activities that make intensive use of tradable inputs (conventional wheat) with those that make intensive use of domestic factors like traditional farming systems. It is in this country where it was concluded to be superior when compared with the DRC in social profitability ranking as it avoids misranking of activities (Masters and Winter-Nelson, 1995: 243).

The SCB formula has been derived from a general production function and makes up the following equation:

$$SCB = \frac{P_d\, Q_d + P_t Q_t}{P_0 Q_0},$$

where:

P_d = shadow price of domestic factors in the local currency;

P_0 and P_t = shadow prices of output and tradable inputs in foreign currency; and

Q_0 is a function of two composite inputs: domestic factors Q_d and tradable goods Q_t, (Bruno, 1972: 20 and Krueger, 1972: 54).

The interpretation of the above equation is that profitable activities have an SCB between zero and one, and unprofitable activities have an SCB that is greater than one. However, the danger with any summary measure like SCB is that it may summarise too much such that important results of the analysis go unnoticed.

5.2.4.4 Producer Subsidy Equivalent (PSE)

The Producer Subsidy Equivalent (PSE), sometimes known as the Producer Support Estimate is also one of the comprehensive measures of policy impacts on agricultural incomes. This method was developed by economists of the US Department of Agriculture and the Organisation for Economic Cooperation and Development (OECD) in the early 1980s. The

PSE methodology indicates the value of the monetary transfer to agriculture resulting from agricultural policies in a given year (Gouse *et al.,* 2000: 1). In rough schematic summary, Lindert and Pugel (1996: 283) describe the PSE as:

$$PSE = \frac{(P_{prod} - P_{world}) + (\text{Government subsidies} - \text{Input price markups})}{P_{world}},$$

where

P_{prod} = producer price;

P_{world} = world price.

According to Helm and Van Zyl (1994: 215) and Gouse *et al.* (2000: 1) the calculation of this approach includes five categories of agricultural policy measures:

- Market Price Support - are the measures that transfer money to the producers by affecting producer and consumer prices simultaneously;
- Direct Income Support - measures that transfer money directly from taxpayers to producers without raising prices to consumers;
- Indirect Income Support - measures that transfer money to producers without lowering input costs
- General Services - measures that reduce costs to the agricultural sector as a whole and are not received directly by producers
- Other Support - involves measures that are funded by the state and certain tax concessions

However, like all other measures the main limitation of the PSE method is that it misses the effects of government on farm familys' cost of living (Lindert and Pugel, 1996: 284).

As the preceding paragraphs reveal the strengths and weaknesses of alternative methods discussed, a positive concept is to choose the approach that suits the objective of the study. Likewise, the approach must have the least disadvantages, but still produce accurate results (Van Rooyen, 2000: 23). In this paper, the Policy Analysis Matrix is selected, as it is believed to satisfy these conditions.

5.3 The Policy Analysis Matrix

5.3.1 Background

The PAM was originally developed in the late 1970s and early 1980s by faculty members and graduate students of the Food Research Institute of Stanford University and other institutions (Van Zyl, 1990: 138). The method is explained in detail in Monke and Pearson (1989).

The PAM approach, like all methodologies, is enabled by many antecedents to achieve its results. It has apparent links to social benefit-cost analysis. As it is a way to carry out both efficiency and policy analysis, the approach also has antecedents in the literature on international trade policy. A methodological breakthrough underpinning the eventual development of the PAM was the invention of the domestic resource cost approach. The PAM therefore grew out of a history of policy analysis using the DRC approach (Van Zyl, 1990: 138).

5.3.2 Significance of PAM

According to Kydd *et al.* (1997: 224) a reason why the PAM has attracted much attention from agricultural policy specialists is its appropriateness to circumstances in which the framework of economic policy is affecting agriculture. Monke and Pearson (1989: 5) mention examples to include policy changes that affect real exchange rates, real interest rates, input and output subsidies. Others include taxes, quantitative controls on particular inputs and outputs and marketing institutions.

Krabbe (1999: 20) remarks that the model is specifically a useful way to identify sources of policy transfers. It also focuses attention on the identification of efficient resource patterns to measure their cumulative effects on commodity systems. Moreover, it can also be used to construct scenarios comparing the economics of alternative pricing policies, technologies, or investments in commodity systems.

Since its development the PAM has been used in various situations in different countries. These range from project evaluation to policy evaluation as confirmed by previous indicators. In the early 1990s, it was used by Nelson and Panggabean to measure the costs of Indonesian Sugar policy. Adesina and Coulibaly in 1998 also used this approach to measure the country's competitiveness within the maize industry in Cameroon. Concurrently, it has been used by Harrison and Piedra (1998) to measure the competitiveness of the United States sugar industry. Yao (1997) also used the same approach for assessing costs and benefits of the Thai agricultural diversification policy in 1994-96.

At country level (South Africa), the PAM approach has been used by Ohene-Anyang (1997) to measure comparative advantage and policy incentives for commercial maize and wheat production. Joubert and Schalkwyk (1999) also used the method to determine the effect of policy on the South African valencia industry. Furthermore, the model has been used by Krabbe (1999) to measure the comparative advantage of the South African sugar industry. Although not focussing on South African agriculture, Nakhumwa *et al.* (1999) also used the technique to measure policy incentives and the comparative economic advantage in Malawian agriculture.

At provincial level, Gronum and Du Plessis (2000) used the policy analysis matrix to determine the comparative advantage of dryland soybean production in the Northwest. Ngqanweni *et al.* (2000) also used the PAM to determine the efficiency of small holders in the Eastern Cape. Lastly, it has been used by Van Rooyen (2000) to measure the comparative advantage of the Western Cape wheat industry. Although the focus in the latter study is on wheat, however, none of the above have used the policy analysis matrix in comparing comparative advantages of different farming systems in South Africa.

5.3.3 Structure of a PAM

The policy analysis matrix is a method that is constructed through a double-entry bookkeeping system, as it is comprised of two accounting identities. The first identity defines profits as the difference between revenues and costs measured in private (market) and social (shadow) prices. The second identity shows the net impact of distorting policies, efficient policies and market failures (divergences) all measured in social prices. In other words it is simply the difference between the first and the second row of the matrix (see Table 5.1). The matrix also consists of three main columns, the first for revenues, the second for costs and the third for profits. The costs are divided into two to represent a column for tradable inputs and a column for domestic factors or non-tradable inputs (Monke and Pearson, 1989: 18, see Table 5.1).

Table 5.1 General structure of a Policy Analysis Matrix model

	Revenues	Costs		Profits
		Tradable inputs	Domestic factors	
Private prices	A= $(\sum P_x Q_x)$	B= $(\sum P_i Q_i)$	C= $(\sum P_j Q_j)$	D
Social prices	E= $(\sum P^*_x Q_x)$	F= $(\sum P^*_i Q_i)$	G= $(\sum P^*_j Q_j)$	H
Divergences	I	J	K	L

Source: Based on Monke and Pearson (1989)

Table notes:

- *Matrix A, B and C are the sum of products of market prices (P) and quantities (Q) representing all the activity's outputs (x), tradable inputs (i) and non-tradable or domestic factors (j).*
- *Entries E, F and G use the same quantities but valued at shadow prices (P^*).*
- *Private profits, D = A - B - C,* *actual net benefit*
- *Social profits, H= E - F - G,* *net benefits in terms of opportunity costs*
- *Output transfer, I= A - E,* *generated by domestic / border price difference*
- *Input transfers, J= B - F,* *generated by domestic / border price difference*
- *Factor transfers, K= C - G,* *generated by actual price / shadow price difference*
- *Net transfers, L= D - H / equal to I - J - K,* *net effects of policies*

Variables

P_x = *market price of produce x*

Q_x = *quantity of produce x*

P^*_x = *world price of produce x*

P_i = *market price of produce i*

Q_i = *quantity of tradable inputs*

P_j = *market price of domestic factors*

Q_j = *quantity of domestic factors*

P^*_j = *social price of domestic factors*

The policy analysis matrix measures two kinds of profits, that is, private profits, and social profits. The details of these will be discussed below.

5.3.4 Private profitability

Monke and Pearson (1989: 19) define private profitability of an agricultural system as the net returns that are calculated using market prices. In the context of the model, the term private refers to observed revenues and costs received or paid by farmers in a system. The private or the actual price[7] thus incorporates the underlying economic costs and valuations plus the effects of all policies and market failures. It also reveals that prices paid and received by

[7] The terms market, observed, actual and private prices will be used interchangeably in the text

farmers do not reflect the economic (social) cost of resources used and products generated because of various market distortions. This condition is exacerbated by the existence of different restrictions on prices and trade that are commonly imposed by government agencies for various purposes. As a result, choices made by individual farmers do not correspond to the social optima and could lead to an inefficient allocation of the country's resources (Ohene-Anyang, 1997: 47).

Private profitability therefore reveals the competitiveness of an agricultural system, given current technologies, output values, input costs, and policy transfers. Furthermore, it is a criterion used by farmers to assess and compare alternative plans open to them for exploiting available resources at their disposal.

Positive private profits (D > 0), indicate that farmers are earning super-normal profits. The existence of these circumstances should lead to a future expansion of the system, unless the farming area is a constraint or the activities can be more privately profitable. Alternatively, negative profits (D < 0) are an indication of a subnormal rate of return and thus farmers can be expected to exit this system (Monke and Pearson, 1989: 20).

5.3.5 Social profitability

Social profitability as indicated in the second row of the accounting matrix is defined as the net returns of an enterprise calculated using social prices[8]. These valuations measure the comparative advantage or efficiency in the agricultural commodity system. Social profits are an efficiency measure because outputs, E, and inputs, F + G, are valued in prices that reflect scarcity values or social opportunity costs. World prices, particularly long-run values are used to estimate appropriate values of inputs and outputs that are traded internationally.

A positive social profit indicates that the system uses scarce resources efficiently and contributes to the national income. Conversely, when social profits are negative, a system cannot survive without assistance from the government. Such systems waste scarce resources by producing at social costs that exceed the costs of importing. The alternative to negative social profits is to provide private incentives for systems that generate social profits, subject to noneffiency objectives (Monke and Pearson, 1989: 27, Krabbe, 1999: 23).

[8] The terms social, economic, world, and shadow prices will be used interchangeably

5.3.6 Policy effects

Actual market or private valuations diverge from their underlying social valuations for one of two reasons. One type of influence is caused by the existence of market failures. The second and more widespread source of divergences is the existence of distorting government policies. However, government policies are not always distorting, as efficient policies exist to offset market failures. Alternatively, distorting policies are not necessarily inappropriate, as they can be justified if their efficiency losses are more than offset by gains from the furthering of nonefficiency objectives (Van Zyl, 1990: 135). The PAM therefore provides indicators that conveniently measure the effects of various policies in agricultural production. A brief description of these indicators will be provided in the sub-sections below.

5.3.6.1 Output transfers

"Monke and Pearson (1989: 227) define the output transfer, I, as the difference between the actual market price of a commodity produced by an agricultural system, A, and the efficiency valuation of the commodity, E". Output transfers from the accounting matrix are calculated as follows:

$$I = A - E = \sum (P_x Q_x) - \sum (P^*_x Q_x)$$

A positive output transfer of a commodity is an indication of an increase in private prices of a commodity over the world prices, as a result of various policies. The positive output transfer is therefore an incentive to private farmers since it causes the production system to realise higher private profit than it would have without the aid of the policies. Alternatively, a negative output transfer implies lower private output prices to the corresponding world prices, hence a disincentive to private farmers (Ohene-Anyang, 1997: 49).

5.3.6.2 Tradable input transfers

By definition, tradable input transfers, J, are the difference between the total costs of the tradable inputs valued in private prices, B, and the total costs of the same inputs measured in social prices, F. In the PAM it is calculated as:

$$J = B - F = \sum (P_i Q_i) - \sum (P^*_i Q_i)$$

A positive input transfer is an indication of a disincentive to farmers, causing the production system to realise lower private profits than it could have without the aid of the distorting policy. However, negative input transfers indicate incentives to private farmers such that the production process can be socially unprofitably but privately profitably (Monke and Pearson, 1989: 229).

5.3.6.3 Domestic factor transfers

Domestic factor transfers, K, are defined as the difference between the costs of all domestic factors of production valued in actual market prices, C, and the social costs of these factors, G. A distinction is made between the inefficiency-causing effects of distorting policies affecting either output or factor markets and of market failures in factor markets (Monke and Pearson, 1989: 232). In a PAM, domestic factor transfers are given by the following equation:

$$K = C - G = \Sigma (P_j Q_j) - \Sigma (P^*_j Q_j)$$

Positive domestic factor transfers reduce incentives to private farmers, and hence are disincentives. Conversely, negative domestic factor transfers are incentives to private farmers since they increase private profits.

5.3.6.4 Net transfers

Net transfers, L, are output transfers (I) minus tradable input transfers (J) minus domestic factor transfers (K). In other words, net transfers (L), is the net difference between private profits (D) and social profits (H). The value of L shows the extent of inefficiency in an agricultural system. If the market failures are a large source of the net transfer, this measure indicates how much long-term government effort will be required eventually to permit the economy to operate efficiently. If (L) is traced to distorting policies, the government can increase efficiency by reducing the degree of distortions (Monke Pearson, 1989: 233).

5.3.7 Indicators of comparative advantage from a PAM

Within the PAM model one is able to calculate frequently used coefficients, which measure the impact of policy on prices and efficiency of resource use. The main advantage of these coefficients is the ratio form, which is more useful for comparison of commodity systems which are dissimilar in the relative proportion of input use (Kydd *et al,* 1997: 327). Some of these indicators were developed independently of the PAM model but will be dealt with as an integrated part of this model in this study.

5.3.7.1 Domestic Resource Cost (DRC)

In a world of trade restrictions and distorted exchange rates leading to distorted prices and unrealistic investment decisions by governments, considerable effort had been spent on devising analytical frameworks. These could also be useful for the measurement of the opportunity cost of producing or saving foreign exchange as well as the economic cost of various restrictive systems. Among the frameworks developed was the domestic resource cost analysis (DRC) (Kirsten *et al,* 1998: 540)

The domestic resource cost which is often called the Bruno ratio, has a relatively long history of practical use, particularly by Bruno in Israel and Krueger in Turkey during the 1950s. It has attracted the attention of government planners where it was used as a means of project evaluation and policy analysis under conditions where official exchange rates and prices of tradables were distorted (Bruno, 1972: 17). The DRC has also been used in academic research by McIntire and Delgado, Nelson and Panggabean, Nishimizu, Page, and Weiss. Its primary use has been in applied work such as the World Bank sector studies and policy analysis sponsored by other international agencies, including the FAO by Appleyard and in International Maize and Wheat Improvement Center by Morris. It has also been used by Gonzales *et al* of the International Food Policy Research Institute and Alpine and Pickett of the Organisation for Economic Cooperation and Development (Masters and Winter-Nelson, 1995: 245).

In simple definition the DRC measures the ratio of the cost of domestic resources used by the commodity system to the value created by the commodity system, both measured at social prices (Kydd *et al,* 1996: 328). Quite apart from its use as an *ex ante* measure of comparative advantage, the DRC method can also be used as a systematic *ex post* measure of effective protection of various goods (Balassa and Schydlowski, 1972: 65). To calculate the DRC method, Gittinger (1982: 400) mentions four items that are a necessity:

- the foreign exchange value of the product to be produced
- the foreign exchange cost incurred to produce the product
- the domestic currency cost of producing the output
- the opportunity cost of capital

In the DRC calculation, its variant, namely the resource cost ratio (RCR) is used and indicated by the following formula:

$$RCR_x = \Sigma(P^*_j Q_j) / (P^*_x Q_x - \Sigma(P^*_i Q_i)$$

The explanation of the above variables is similar to those explained in Table 5.1. A value of domestic resources used in production that is less than the value of foreign exchange earned or saved indicates comparative advantage. Alternatively, when the value of domestic resources used in the production exceeds the value of foreign exchange earned or saved there is no comparative advantage. Furthermore, extreme use of foreign exchange in the production of the commodity than what the commodity is worth also indicates no comparative advantage (Ohene-Anyang, 1997: 41).

However, like any other partial equilibrium technique, the DRC also has limitations. One of these stems from the fact that indicators like DRC are constructed from average-cost budgets based on observed input-output coefficients and imputed shadow prices, the latter being calculated separately. As a result, indicators tend to ignore substitution and cross price effects (Masters and Winter-Nelson, 1995: 244). The construction of the DRC formula is biased as it tends to overstate the relative profitability of activities that make intensive use of tradable inputs and misrank the alternative activities. As a result, the use of DRC alone in analysis is undesirable.

5.3.7.2 Nominal Protection Coefficient (NPC)

The Nominal Protection Coefficient is classified into two categories, NPCO for outputs and NPCI for inputs. According to Bale and Lutz (1981: 9) the method specifically measures the disparity between domestic and international prices. In other words it indicates the impact of policies that causes divergence between these prices. In the form of an equation it is defined as:

$$NPC = \Sigma(P_x Q_x) / \Sigma(P^*_x Q_x)$$

An NPC that is greater than one shows that policies increase market prices above world prices, thus providing a positive incentive to the producer. Likewise, an NPC less than one indicates negative incentives to the producer. Thus the production incentives do not reflect the full economic values and the country will have some unexploited comparative advantage in expanding production (Ohene-Anyang, 1997: 43).

However, the main limitation of the NPC is that it cannot take account of government policies that affect farmers' incomes without affecting domestic agricultural prices. Another limitation is that it does not take account of how the government is affecting the prices of farmer's purchases. As a result, it fails to reflect the fact that government protection of the industry raised the prices of farm inputs and the consumer goods farm families buy (Lindert and Pugel, 1996: 283).

5.3.7.3 Effective Protection Coefficient (EPC)

The EPC represents an attempt to measure the whole structure of incentives or disincentives that exist with respect to a given production process. The method has been developed to take account of the limitations of the NPC in that instead of only being concerned about distortions in the output market, the EPC also incorporates distortions in the prices of inputs (Appleyard, 1987: 14, Balassa and Schydlowski, 1972: 63).

The EPC is defined as the ratio of the value added in local prices (V) to the value added in world prices (V^*), where V and V^* are defined as revenue minus the sum of all tradable input costs measured in local and world prices respectively (Johnson, 1969: 119).

$$EPC = V / V^* = (P_x Q_x - P_i Q_i) / (P^*_x Q_x - P^*_i Q_i)$$

An EPC that is greater than one indicates that private profits are higher than they would have been without commodity policies. Conversely, an EPC that is less than one indicates that private profits are lower than they would have been without the commodity policies.

However, the method has two serious omissions. These include government subsidies or taxes that do not affect price and government policy effects on farm families' cost of living (Lindert and Pugel, 1996: 283). For this reason, calculation of PC (Protection Coefficient) to reflect the incentive effect of all policies and therefore serve as a proxy for net policy transfer is of importance. The PC is defined as the ratio of private and social profit, that is PC = D/H from the matrix (Table 5.1).

5.3.7.4 Private Cost Ratio (PCR)

The private cost ratio is defined as the ratio of domestic factors to value added in private prices i.e. PCR = C / (A-B) (see Table 5.1). The value added is the difference between the value of output and the costs of tradable inputs. It shows how much the system can afford to pay the domestic factors and still remain competitive. The farmers can earn excess profits when their private factors costs, C, are less than their value added in private prices (A - B) (Monke and Pearson, 1989: 26).

5.3.7.5 Subsidy Ratio to Producers (SRP)

Subsidy Ratio to Producers is an indicator of incentives, the net policy transfer as a proportion of total social revenues or SRP = L/E (D – H)/E in Table 5.1. The SRP shows the proportion of revenues in world prices that would be required if a single subsidy or tax were substituted for the entire set of commodity and macroeconomic policies.

5.3.8 Strengths and weaknesses of a PAM

The PAM has been selected as the best amongst all other partial methodologies as it allows varying levels of disaggregation. It also makes the analysis of policy-induced transfers straight forward. Furthermore, the method makes it possible to identify the net effects of a set of complex and contradictory policies and to sort out the individual effects of those policies in a commodity system (Nelson and Panggabean, 1991: 31).

However, as a partial equilibrium analytical tool, the PAM typically uses fixed input-output coefficients, and hence it is not possible to use it directly to indicate consumer or producer responses to policy changes that reduce distortions. Since the PAM is not a behavioural model, it cannot be used to calculate the new quantities of outputs and inputs that would follow from other alternative prices (those resulting from policy changes). Furthermore, the PAM measures only the relative incentives without measuring the magnitude of that change (Nelson and Panggabean, 1993: 703, Ohene-Anyang, 1997: 52).

In this chapter, various methods to measure comparative advantage have been described along with their strengths and weaknesses. Among these approaches, the one selected for the study is believed to yield good results. The majority of these techniques in their use require the determination of efficient values (shadow prices), and therefore the following chapter will expand more on various methods that are used to obtain these values.

CHAPTER SIX

AN ECONOMIC EVALUATION FOR THE PAM MODEL

6.1 Introduction

There are many facets to the agricultural sectors of countries, particularly those of developing countries like South Africa. One of the most important of these is that resources are limited, therefore they must be used efficiently. These scarce resources are traded at specific prices referred to as market prices. Provided specific conditions are met these prices should give an indication of relative scarcity. According to this view, the price mechanism is the best criterion upon which the allocation of resources for specific uses can be based. Under perfect competitive market conditions, the assumption is that prices of goods and services are determined by the forces of demand and supply, where the opportunity cost of an item would be its price. Similarly the price would also be equal to the marginal value product of the item (Gittinger, 1982: 254).

Across countries, multilateral and bilateral trade agreements and geographical and political constraints shape trade patterns and limit the scope for substitution and competition (Scandizzo and Bruce, 1980: 7). Hence, these unsatisfactory conditions result in market prices not reflecting their economic scarcity values, and therefore the use of shadow prices becomes necessary (Bruce, 1976: 1). The PAM model is also composed of two sets of identities, one defining profitabilities and the other the difference between private and social values (Monke and Pearson, 1989: 18). Private and social values as well as the ratios that are involved in a PAM also require the calculation of shadow prices, particularly of inputs and outputs because these prices represent their opportunity cost to the economy. This means that they make it possible to identify the contribution each commodity system makes to the economy.

This chapter will therefore describe various methodologies that are used to determine efficiency values. It will also concentrate on evaluating which inputs and outputs within the production system are affected by distorting policies. To avoid confusion, it is necessary to clarify terminology such as shadow prices and market prices as these are used throughout this chapter.

6.2 Market Prices

Market prices are mostly used in financial analysis and are the perceived prices at which products and services are traded, irrespective of interference in the market [Central Economic Advisory Service (CEAS), 1989: 11]. Any project is characterised by inputs and outputs, and it is these inputs and outputs that need to be valued. Their values are obtained from the market through various sources that include farmers, importers and exporters, extension officers, government market specialists and statisticians, and publicly or privately held statistics about national and international markets (Gittinger, 1982: 69).

Gittinger also suggests that a good rule in determining a market price for agricultural commodities that are produced by the project is to seek the price at the point of first sale. Under competitive conditions, the price determined at this point is probably a relatively good estimate of a commodity in both economic and financial terms. This price is normally known as the 'farm-gate' price. In well-organised markets for projects producing commodities, the farm gate price may not be too difficult to determine. This is true for most food grains like wheat when traded domestically in substantial quantities. This would not be the case for the Western Cape organic wheat as it would be in small quantities, if available at all. This condition also applies to conventional wheat as some quantity is traded internationally.

Gittinger (1982) further indicates that the farm-gate price may be a poor indicator of the true opportunity cost that is required in economic analysis when distortions exist in the market place. When these conditions prevail, a farm-gate price has to be corrected for economic analysis.

6.3 Economic or Shadow Pricing

Brent (1996: 80) defines an economic or shadow price as the increase in social welfare resulting from any marginal change in the availability of commodities or factors of production. Little and Mirrlees (1974: 23) use the term accounting prices to denote shadow prices because of unreal connotations associated with these prices and because of their role in government accounts to value inputs and outputs. Acknowledging the method of Dinwiddy and Teal (1996: 88) this study will use the terms shadow and economic prices interchangeably, as they are thought to portray real values and scarcities more accurately than the prevailing market prices of some products and services. In other words, shadow prices are adjusted prices of production inputs and outputs where market prices are not effective in reflecting the scarcity of resources as a result of structural imbalances.

The calculation of shadow prices for products and services is often difficult and further complicated because their calculation may need added considerations, particularly pertaining to regional differences.

6.3.1 Regional considerations

Regional differences when calculating shadow prices of commodities, are indeed of importance. When market prices are used to value resources they should reflect the value for different regions as reflected in the enterprise budgets that are used in this study. In cases where market prices are not acceptable, shadow prices also should reflect the value of resources for the regions where they are purchased, for example, the shadow price of land (CEAS, 1989: 13). When shadow pricing, farm locations and potential reference or border points of resources should be considered as some production inputs and outputs exit and enter within the boundaries of these points. In line with this, it may also be necessary to know the geographical sources of domestic inputs and the geographical locations of target markets.

As South Africa is a country with more than one major port, this should be taken into consideration when these ports are used as reference points. In this regard, it is therefore necessary to make reference to a particular port and location when border prices are used. Thus terms like C.I.F price at Durban or F.O.B price at Cape Town Harbour are more appropriate.

6.3.2 Principles in the calculation of shadow prices

In many countries people pay a premium on traded goods over what they pay for non-traded goods as a result of national trade policies (e.g. tariffs on imported goods). The description of these goods will be provided in Section 6.4. This premium is not adequately reflected when prices of traded goods are converted to the domestic currency equivalent at the official exchange rate (Gittinger, 1982: 247).

Benjamin (1981: 155) noticed two main approaches that are used by economists in determining shadow prices of commodities. These approaches are specifically used to correct any premium placed on foreign exchange when non-tradable and tradable goods are valued. The first approach proposed by UNIDO (1972) is explained in Guidelines for Project Evaluation, while the second approach has been developed by Little and Mirrlees (1974) and later elaborated by Squire and Van der Tak (1975).

6.3.2.1 *UNIDO Guidelines (Domestic price approach)*

The traditional method used in this approach to take account of the foreign exchange premium is to value traded and non-traded goods and services in terms of domestic price equivalents. Domestic prices are used as numeraire, which is the common unit of account used in valuing inputs and outputs of a commodity system. The traded inputs and outputs of a production system are firstly expressed in terms of their f.o.b. and c.i.f. border prices. They are then converted from foreign currency to domestic currency using a shadow exchange rate (SER)[9] rather than the official exchange rate (Bruce, 1976: 2).

The shadow exchange rate is used in economic analysis when there is a fear that the currency is protected and that the official exchange rate (OER) may be pegged. Prior to 1995, South Africa was characterised by the dual exchange rate system. This is a system differentiating between current and capital transactions made by non-residents and residents, as the financial and commercial rands were used respectively. The dual exchange rate system was abolished on the 13th of March 1995 (Liebenberg, 1995: 3, and Roux 1999: 35). Since then, South Africa has had only one exchange rate that is believed to be determined through market forces, as was the case with the previous commercial rand exchange rate. Even though other means may be used by the South African Reserve Bank to protect the rand, for example, higher interest rates, it may still be argued that most of the restrictions on the exchange rate have been removed. Therefore the OER which was R7.44 per US dollar on the 26th of January 2001 can be assumed to be a good conversion factor to convert foreign currencies into the South African rand and vice versa.

6.3.2.2 *Little and Mirrlees (Border price approach)*

The alternative approach developed by Little and Mirrlees (1974) also values goods at their border prices. These authors used border prices in the process of evaluating the rationality of the existing pattern of specialisation of a country in light of its trading opportunities. The prices can also be adjusted to producing points and compared to producer (farmgate) prices to evaluate the consistency of private and public incentives in production (Scandizzo and Bruce, 1990: 4). The border prices will also be used in a similar context in this study.

However, these border prices are then converted into local currency at the official exchange rate rather than at the shadow exchange rate. The traded production inputs and outputs are

[9] SER gives the value of the domestic currency relative to other currencies when there is no intervention in the foreign exchange market, for example through pegging of the exchange rates or to limit capital flows. The SER is therefore the nominal exchange rate adjusted for the effect of intervention (CEAS, 1989).

effectively kept in their border prices. However, if there is a foreign exchange premium in the country, the prices of non-traded goods will have risen to match the tariff inclusive prices of the tradables. The price of non-tradables will therefore overstate the good's true value to consumers relative to the border prices of traded goods. The border price approach therefore revalues these non-traded goods in border price equivalents using commodity specific conversion factors, which will be discussed in the following subsection (Perkins, 1994: 181).

6.3.2.3 Conversion factors

The border price approach by Little and Mirrlees and later by Squire and Van der Tak is sometimes called the conversion factor approach. In its simplest form based on straightforward efficiency prices, a single or a standard conversion factor is derived by taking the ratio of the value of all exports and imports at border prices to their value at domestic prices (Gittinger, 1982: 248). In South Africa, exports at year-end 2000 were estimated to value R189 422 497 as compared to R173 169 927 in domestic currency terms (Department of Trade and Industry, 2001). Following Gittinger's derivation, their ratio is calculated to be 7.43, which is approximately equal to the OER. In this form, the standard conversion factor bears a close relation to the shadow exchange rate. The standard conversion factor is normally useful in the valuation of minor non-traded goods that do not warrant detailed analytical work.

However, prime movers of this approach rather recommend derivation of specific conversion factors for particular groups of products that will allow for any difference between market prices and opportunity costs. For example, if the project uses electricity, individual conversion factors that are specific to specific goods and services are needed. Specific conversion factors are preferred to standard conversion factors, as they are believed to reflect the actual resource flow accurately (Ward *et al.,* 1991: 26, and Bruce, 1976: 10).

6.3.2.4 The Purchasing Power Parity (PPP) approaches

Several studies that include Krabbe (1999: 39) made use of the purchasing power parity approaches in determining the shadow exchange rate, specifically the Big Mac index and the approach used by the Bureau of Economic Research of the University of Stellenbosch (BER). The focus of Krabbe's study was mainly on the BER approach. These approaches are based on the theory of purchasing power parity, which states that products that are substitutes for each other in international trade should have similar prices in all countries when measured in the same currency. According to Lindert and Pugel (1996: 365) this should hold for at least a long run period in order for market equilibrium to be restored after major shocks.

With regard to the BER approach, it bases its calculations of the PPP exchange rate between the US$ and the Rand on the following formula:

$$R/\$PPP_t = \{R/\$_{1970} / [(USPPI_{1970}) / (RSAPPI_t / RSAPPI_{1970})]\}$$

Where: $R/\$PPP_t$ = R/$ purchasing power parity in period t

$R/\$_{1970}$ = actual R/$ exchange rate in base period, i.e. 1970

$USPPI_t$ = US producer price index in period t

$USPPI_{1970}$ = US producer price index in base period, i.e. 1970

$RSAPPI_t$ = RSA producer index in period t

$RSAPPI_{1970}$ = RSA producer index in base period, i.e.1970

This approach is found to be reliable when compared with the Big Mac index. However, it also has a disadvantage of running over a period when many structural changes took place. Conversely, the Big Mac index as used to compare actual rates with PPP to indicate whether a currency is under or over-valued has also been criticised, as the law of price equalisation might be difficult to hold. This is because price differences may be distorted by trade barriers, sales taxes, local competition, and changes in the cost of non- traded inputs such as rent and labour. Therefore the Big Mac index should be seen as an indicator of whether a currency is under or over-valued rather than as an absolute indicator of the extent to which a currency is over or under-valued.

Furthermore, the approaches based on the PPP theory predicts well at the level of one heavily traded commodity either at a point in time or for changes over time, as long as free trade conditions exists. In South Africa, particularly in the case of wheat, the law of one price is not a fair approximation of an exchange rate. This is because wheat in South Africa is not a heavily traded commodity, and it is also characterised by government intervention, as an import tariff of R196.00 per ton is charged on wheat. This tariff level has been in effect since 12 January 2001. Added to this is the fact that PPP approaches also predict moderately well at the level of all traded goods, which is difficult for this study as commodities such as land, labour and the like that are non-traded are also considered. As a result the PPP approaches are not suitable for this study.

Hence, this study will mainly make use of the border price approach. The main claim to the superiority of this approach is that it enables more precise estimates to be made of the economic value of the production commodity system by making use of individual conversion factors. Because the border price approach uses many individual conversion factors and because the data requirements for estimating each conversion factor are low, the chances and consequences of making a major error may be reasonably low (Bacha and Taylor, 1971: 210).

6.4 Tradable and Non-tradable Commodities

Agricultural projects operating in an open economy that involves trade with the external world are characterised by two types of commodities, that is, traded and non-tradable commodities. In almost all of these projects many inputs as well as output in a large number of some projects are tradable.

Perkins (1994: 145) defines tradable goods as items and services whose use or production causes a change in the country's net import and export position. Tradable goods produced or used in a project do not actually need to be imported or exported but must be capable of fulfilling this function. According to this view, Sugden and Williams (1978: 101) indicate that if a project uses a tradable input, it will have a negative impact on the country's balance of trade or its exchange rate, either directly or indirectly. This is because the extra demand for the input generated by the project will necessitate an increase in the imports of that input preventing some domestically produced units of that input from being exported. As indicated previously, tradable goods are either exportable or importable. Exportables are those whose domestic cost of production is below the free on board (F.O.B) export price that local producers can earn for this good on the international market. Inversely, importables are goods whose landed C.I.F (cost insurance freight) import cost is less than the domestic cost of producing these goods.

Non-tradable items are goods and services whose marginal domestic production costs are less than their c.i.f. import cost but greater than their f.o.b. export revenue (Gittinger, 1982: 251). It is therefore not profitable to import or export such goods or services. A detailed discussion on these two types of commodities is provided in the forthcoming subsections. In cases of deviations in economic calculation of tradables and non-tradables between organic and conventional wheat systems, an attempt is made to explain those differences.

6.4.1 Economic evaluation of tradable commodities

When shadow prices for tradable commodities are determined, the first thing to do is to subtract direct taxes and subsidies from the financial values in order to obtain the corresponding economic values in border prices. Therefore the enterprise budgets that are used in this study include a column that indicates the economic values of tradable commodities. Tradable goods, as pointed out in the previous paragraphs are either exportables or importables, therefore terms like F.O.B and C.I.F will often be used in this subsection.

6.4.1.1 Economic evaluation of wheat

In most years South Africa consumes more wheat than it produces, with the result that prices generally relate to import parity (see Table 4.1). As a result the import parity prices of wheat receive attention in this study. For comparison purposes, the export parity prices are calculated and discussed in Appendices B1 and D1. The export parity price applies where producer's transport costs from the farm to the harbour are deducted from the international price of wheat. Conversely, the import parity price applies where transport costs to the consumption point of wheat are added to the international price. As a result export parity prices are mainly lower than import parity prices (Standard Bank, 1998: 11).

The import parity prices calculated in Tables 6.1 and 6.2 represent No.2 Hard Red Winter wheat, due to data availability and relative imported quantity levels. Added to this, Durban is used as the reference point, because it is assumed that there are no differences between the shipping costs from the selected major wheat producing countries either to Durban or Cape Town harbours (Troskie, 2001).

Table 6.1 Determination of an economic import parity price for conventional wheat

FOB Gulf Value ($/t)	Freight rate (20-30000t) ($/t) (+)	Insurance ($/t) (+)	Cost, insurance and freight ($/t) (+)	Exchange rate (R/$)	C.I.F (R/t)	Financing (R/t) (+)	Discharging costs (R/t) (+)	Transport costs (harbour to mill) (R/t) (+)	Transport costs (to Gauteng) (R/t) (-)	Storage costs (WC) (-)	Storage costs (GP) (-)	Import parity value (WC) (R/t
145.00	20.00	0.6	165.60	7.440	1 232.06	137.12	56.29	105.00	177.0	65.00	40.00	1248.47

Source: 1) SAGIS, 2001

2) Troskie, 2001

Table 6.2 Determination of an economic import parity price for organic wheat

FOB Gulf Value ($/t)	Freight rate (20-30000t) ($/t) (+)	Insurance ($/t) (+)	Cost, insurance and freight ($/t) (+)	Exchange rate (R/$)	C.I.F (R/t)	Financing (R/t) (+)	Discharging costs (R/t) (+)	Transport costs (harbour to mill) (R/t) (+)	Transport costs (WC to Gaut) (R/t) (-)	Storage costs (WC) (-)	Storage costs (GP) (-)	Import parity value (WC) (R/t
214.94	20.00	0.6	235.60	7.440	1 752.86	137.12	56.29	105.00	177.0	65.00	40.00	1768.84

Source: 1) Troskie, 2001

2) Homestead Organics, 2001

Note: Gaut. →signifies Gauteng, and WC→Western Cape

From the above it is therefore clear that transport costs are important and also affect the competitiveness of producers. Their impact is more significant in export parity prices (see Appendix B1 and D1). Producers' location in relation to the buyers of grain is therefore vitally important. Competitiveness also varies from region to region, for example, the Western Cape coastal situation affects grain producers such that producers realise lower prices for their produce when compared with inland producers like that of Free State which also supply wheat to Gauteng. This implies that coastal (Western Cape) producers realise wheat prices that are closer to the export parity than import parity. Transport costs from the farmgate to the silo are mainly incorporated into the enterprise budgets.

6.4.1.2 Economic valuation of directly traded goods

When looking at wheat production, a variety of purchased inputs that include chemicals and fertilisers, plant material, and fuel, mainly involve direct trading (Gittinger, 1982: 251). When determining the shadow prices of these goods, some possibilities have to be identified:

- where direct traded goods are imported without tariff protection, or purchased locally, the market price is used in the economic analysis.
- directly traded goods that are imported or purchased locally with tariff protection, requires subtraction of the percentage of tariff from the domestic price.
- where goods are purchased locally and are not normally traded across the borders in which case the local price or the local availability of the good is not altered, it can be accepted that the scarcity value of the product is reflected by its market price.

Therefore in this sub-section, each item is discussed according to its respective market environment and highlighted in cases where distortions exist. Methods of calculation are similar in both organic and conventional wheat budgets.

Chemicals and fertilisers: In South Africa, the market for agricultural chemicals and fertilisers is considered to be highly competitive as companies such as Kynoch Fertiliser, Agrochem, Beyer, Novartis and the like are operating at full capacity (Agri24.com, 2000). As a result, the market for these inputs is identified as having few market failures. Hence, in the case of fertilisers, market prices are used as their economic values. Conversely, for environmental reasons, the government levied a 10 percent tariff on a number of chemicals like pesticides, fungicides and weedicides that are used in conventional farming (Customs and Excise, 2001). As a result, the economic value of these goods must exclude the tariff component.

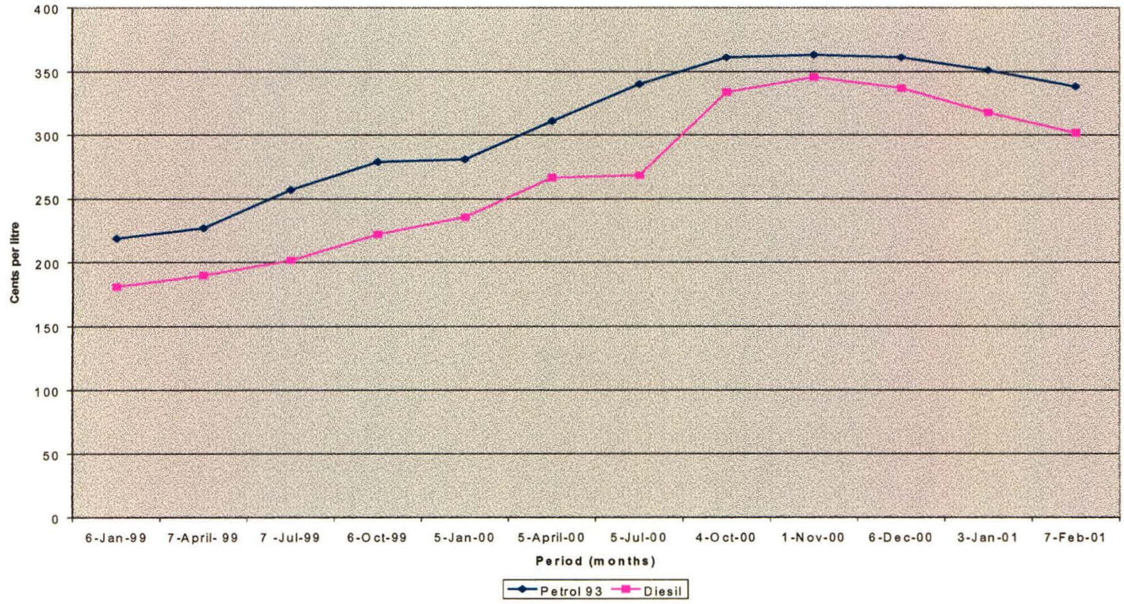
However, organic inputs are exempted from this tariff, as they are perceived to carry no (less) risk (Helga, 2001). Therefore, input suppliers for organic farming also imitate the behaviour of conventional input suppliers as their number is increasing at a tremendous rate. Nevertheless, the Western Cape has input suppliers that include Reliance Compost, Penac Organics, Agro-Organics, New Crop Laboratories and the like, and hence market prices are used to denote economic values.

Furthermore, organic farming replaces other goods and services in the market, for example, nitrogen fertiliser, as the farming system makes use of green manures or legume crops to fix nitrogen. In this situation, production costs are cast on a with-and-without basis. As a result the economic value of the incremental net benefit stream would reflect only savings from green manures compared with synthetic nitrogen fertiliser. This is because one of the costs of green manuring would be the benefit forgone from the previous production that is no longer realised and one of the benefits would be the costs avoided of the previous production methods. As a result production costs of green manures are entered into the financial and economic accounts of the organic wheat enterprise budgets.

Planting material: A variety of planting material is used in wheat production as indicated in the enterprise budgets. In South Africa, seeds are sold by a number of companies including Agrocon, Pinnar, Sensako and the like (Agri24.com, 2000). The market for this category is also perceived to be competitive, therefore market prices for planting material are also taken as economic prices.

Fuel: Fuel is described as energy in the enterprise budgets. Prices of fuels are among those characterised by distortions. During the last five years, prices of fuels, particularly petrol and diesel have increased tremendously and affected agricultural production negatively. However, the price of these fuels started decreasing towards year-end 2000 and their relationship is illustrated in Figure 6.1.

Figure 6.1 Relationship of price changes between petrol and diesel (Coast)



Source: Henderson, (2001)

In this study, emphasis is given to diesel as this is mainly used in the production of wheat. The price structure of diesel (expressed in cents per litre as from the 15th of February 2001) is as follows:

Wholesale Price	**= 312.9 c/l (Gauteng)**
Wholesale price	**= 301.75 c/l (Coast)**
<u>1) Taxes and levies:</u>	
Customs and Excise,	= 4.0 c/l
Fuel Levy	= 79.1 c/l
Total Taxes	**= 83.1 c/l**
2) Special levies for fuel pricing subsidies and government funding relating to fuels supply and pricing	= 8.0 c/l
Total Taxes and Levies	**= 91.1 c/l**

Therefore the social cost of diesel at the coast is the difference between the wholesale price and total taxes and levies i.e. 301.75 c/l – 91.1 c/l = 210.65 c/l. This verifies that the distortion in the price of diesel is close to 30 percent. The standard consumer price of diesel also contains a component of insurance, which is 10.3 percent. However, this is not included in the calculations because this not in the price that the farmer pays (Krabbe, 1999: 44).

6.4.1.3 Economic valuation of tradable but Non-traded commodities

Some non-traded commodities in agricultural production including machinery (locally assembled tractors, combine harvesters and the like) in fact involve a substantial import component and are thus indirectly traded. In this case, it is good practice to value the domestic component as a non-traded item and the imported component as a traded item. In financial analysis, indirectly traded items offer no conceptual problem as the actual market price is used. However, when using economic analysis, indirectly imported items must be decomposed into an imported component and a domestically produced component and each valued separately (Gittinger, 1982: 265). In cases where there is a lack of data, the non-tradable (domestic) portion of economic prices is assumed for certain items (Monke and Pearson, 1989: 147, see Table 6.3).

Table 6.3 Components of the economic value of some commodities

Item	*% traded*	*% non-traded*
Purchased inputs	90	10
Machinery/implements costs	80	20
Contract/hire and other	65	35
Insurance	5	95

Source: Own assumptions

The decomposition exercise can be applied to all inputs listed in both fixed and intermediate categories in the enterprise budgets. For example, the cost of fixed inputs reflects some marketing margin in addition to their basic costs. This margin incorporates the payments to factors and tradable inputs needed to operate an activity. In the case of hired labour, payments to this category implicitly include payments for transportation to the production site. On the other hand, transportation costs reflect payments to a range of domestic factors and tradeble inputs, and hence the percentage traded is assumed to be higher for contract or hired services (Monke and Pearson, 1989: 145).

Machinery: Table 6.3 indicates that the traded (imported) component of machinery is estimated to be 80 percent and the domestic component 20 percent. If the market price for machinery is estimated at R110.37 per hectare the calculation will be:

Imported component value (traded) = R110.37 *0.8 = 88.30

Domestic component value (non-traded) = 110.37*0.2 = 22.07

The value added in the domestic component will most likely arise from sources such as wages paid to domestic skilled labour and domestically manufactured items that use mainly domestic raw materials. South Africa has a large number of machinery and implement suppliers, which is an indication of high competition in the markets for these inputs. Accompanied by zero import tariff on this category of inputs machinery, the market price for these goods is accepted to reflect scarcity (Gittinger, 1982: 266).

The equipment and machinery do wear and tear after some time, hence depreciation is taken into account in the enterprise budgets. The financial price used to reflect the depreciation of the equipment and machinery is also considered to reflect the scarcity values of these items.

Insurance: One of the indirectly traded items that can sometimes lead to confusion is insurance. At first glance, insurance might look like a transfer payment and thus would not be included in economic analysis. In this study, however, insurance is looked upon as a kind of sharing of risk of real economic loss. Therefore, insurance should be included in the economic accounts. The relative insurance amount is usually based on the probability of a real loss as well as the value of the item insured, thus the market price can be accepted as good actuarial estimate of the economic value (Gittinger, 1982: 256).

Certification and soil analysis: These costs are also classified under tradable but non-tradable goods and services as they tend to be cheaper to produce domestically than to import. As producers pay for these services under existing market prices, their economic valuation is based on the willingness to pay criterion and the market price is accepted as a good indicator of the economic value of these services.

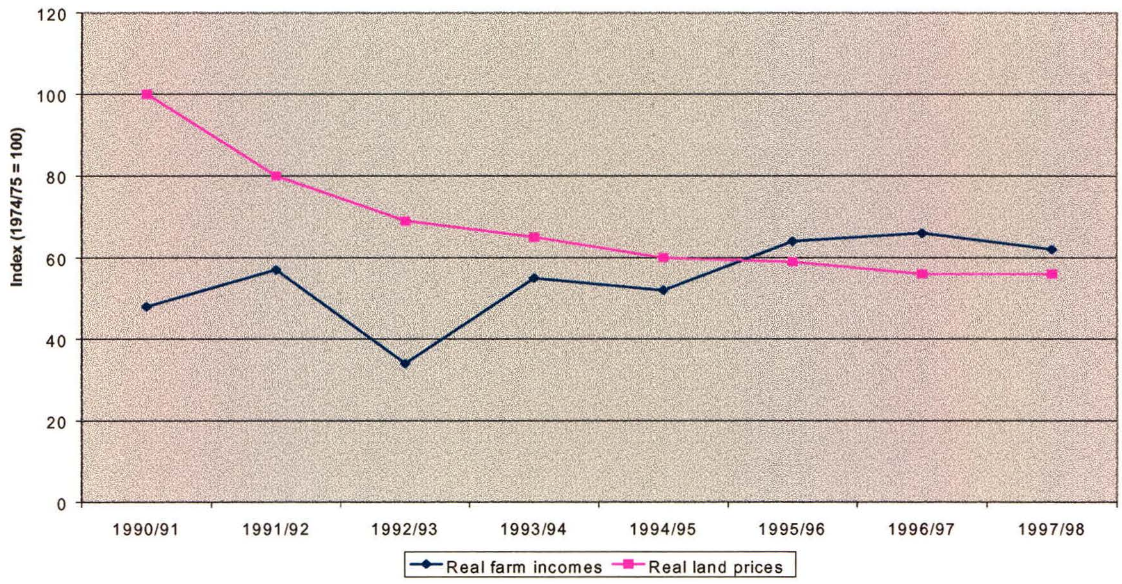
6.4.2 Economic valuation of primary factors

Product sources or means of production are often scarce factors that are needed in the production process and determine the supply of goods and services. The following discussion concentrates on the determination of their economic prices.

6.4.2.1 Land

Unlike other commodities, land is unique because it is the only truly fixed factor in agriculture. It is also a basic depository of value and productive potential for agriculture. Its value is difficult to assess since it is not only a production factor, but also an asset and related markets are often thin, unreliable and complicated. Figure 6.2 below illustrates how real farm incomes and land prices have declined in the last ten years. This is ascribed to the drought of the early 1990s, although in the mid-1990s the level of real agricultural incomes had recovered to approximately two thirds of their value in the mid-1970s. Unsurprisingly, the drop in real farm incomes has caused land prices to decline. As land prices and farm incomes have fallen, so as the real value of farm assets as measured by the National Department of Agriculture, although the situation stabilised in the 1990s.

Figure 6.2 Real farm incomes* and land prices in the winter rainfall regions



Source: Abstract of Agricultural Statistics (2000), and Bayley, 2000

**Note: After provision has been made for depreciation, salaries, wages, interest and rent paid.*

However, conclusions drawn from an analysis of this data have to be qualified as the use of the Deeds Office data in the construction of land price indices has been criticised. This is because it gives undue weight to transactions involving small pieces of land which have relatively high per hectare values, because their primary purpose is recreational rather than agricultural (Bayley, 2000: 76).

Furthermore, land markets in countries like South Africa are not very active as land in the hands of the poor people is scarce and they tend to hold on to it as the only secure means of subsistence. Alternatively, the market for land tends to reflect often tenurial institutions and distortions in the labour market. This results in rental rates not necessarily relating either to the price of land or to its marginal products, and under these circumstances, land acts as claimant on the profits from farming (Scandizzo and Bruce, 1980: 10).

In order to avoid the danger of a circular definition of the valuation of land, it is necessary to devise a definition that has some economic validity. There are various ways of determining the value of land, however, the one that received attention in this study is the value attached to the land in its next best alternative use (LMC International, 1999: 11). For example in the Swartland area, oats production is found to be the best alternative to dryland wheat production, therefore the social value of land for the wheat activity is represented by social profits (excluding land) from the oats activity.

With regard to the above description, the social profit is the difference between revenues and costs, calculated on a per hectare basis from the oats activity. It is therefore this difference per hectare, which is used as the value of land. For the South Coast, Little Karoo, and the Northwest regions, barley and lupins respectively, are found to be the best alternatives for wheat. Therefore, the determined values will be entered in all financial and economic accounts of the enterprise budgets.

When land values are included in domestic factor costs, the measure of factor market costs of divergences (K = C – G) requires careful interpretation. In as much as both the private and social land values are determined in alternative uses, K will include some effect of the policies and market imperfections that influence the profitability of the alternative crop (Monke and Pearson, 1989: 208).

6.4.2.2 Labour

Labour cannot travel freely and be sold between countries, therefore labour services are a form of a non-traded primary factor. In South Africa, labour differs in many respects, as there can simultaneously be a shortage of skilled labour and a surplus of semi-skilled and unskilled labour (CEAS, 1989: 19). At the same time factors can exist in the labour market that result in the labour wage not reflecting relative scarcity (Sapsford, 1981: 67). Some of these factors will be discussed below.

In the Western Cape, agriculture is the biggest employer and was estimated to support about 150 000 farm workers in the year 2000. The wheat industry accounts for 26 percent (Van Rooyen, 2001). Until 1992, agricultural labour in South Africa was protected under the common law, but in 1993 the Basic Conditions of Employment Act 3 of 1983 (BCEA) and Unemployment Insurance Act 30 of 1966 (UIA) were extended to agriculture. These Acts were followed by the Agricultural Labour Act of 1993 (ALA). The BCEA stipulates minimum conditions governing working hours, leave, overtime, and the like, while the UIA requires contributions to the Unemployment Insurance Fund. Labour dispute settlement is the responsibility of the Labour Relations Act 28 of 1956 (Newman *et al.,* 1997).

Arguments in favour of labour legislation suggest that economic growth is unlikely to be achieved on the basis of low wages paid to workers and under the existing working conditions. According to this view, low wages are believed to constitute a subsidy to unprofitable and inefficient enterprises (Statistics South Africa, 1997). Although legislation is believed to have positive effects, it is also believed to increase labour and transaction costs. Transaction costs increase because more time is spent on maintaining labour records and arbitration. If wages and transaction costs of skilled and unskilled permanent labour increase, farmers might opt to substitute labour for machinery, including contract machinery or contract labour (Goedecke and Ortmann, 1993: 74). The end result is unemployment. Labour laws, including the minimum wage that has been proposed in agriculture recently, are considered to have an effect on the price of labour. However, minimum wage is not taken into consideration in this study, as the year of data collection was 2000, although an increase in the price of labour is forecasted in the sensitivity analysis.

Skilled labour in developing countries is considered to be in short supply and would most likely be fully employed. Hence, the wages paid to skilled workers are generally assumed to represent the true marginal value product of these workers, and the wages are entered at their market values in the economic accounts. In most agricultural communities there is usually a season when virtually everyone who wants work can find it. This is normally during planting and harvest periods. Thus it can be reasonably assumed that during these peak seasons, the labour market is a relatively competitive one, such that labour is in relatively short supply at this time. Consequently, the daily wage is taken as a good indicator of the daily marginal value product of the labour engaged (Gittinger, 1982: 258).

The only difficulty in economic analysis is to determine the shadow wage rate for semi-skilled and unskilled labour during the off season. Gittinger also states that in many agricultural projects, labour is not engaged on a year-round basis. Rather the work is quite seasonal, such that it must be considered in which particular season hired labour would be engaged. If the cropping pattern calls for work to be done during the peak season, then one should consider the peak season market wage as probably a good estimate of the marginal value product. Therefore, choice of a lower wage rate as the basis for the shadow wage rate that is used in several previous studies (even though there might be considerable unemployment in the off-season) is unjustifiable.

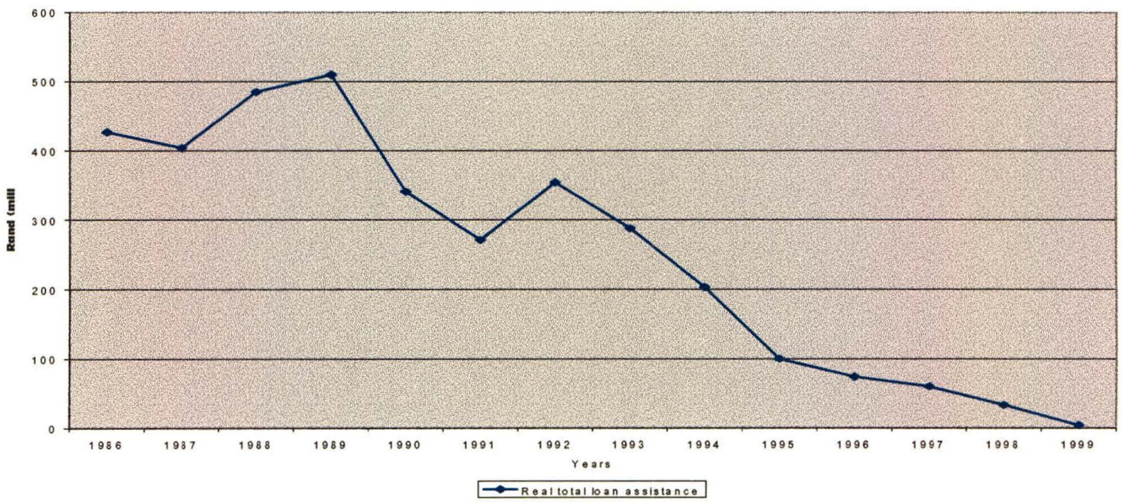
In the Western Cape, for example, wheat production calls for work to be done during the planting season in April, and harvesting in November. Although wheat production is highly mechanised, however, these periods are considered as the peak season as hired labour is engaged (see enterprise budgets in Appendices A and C). Therefore, it is assumed that the peak season market wage is probably a good estimate of the marginal value product, and the use of a shadow wage rate derived from a base that is less than the market wage is unjustified. As a result, labour will thus be reflected in the economic accounts by the market prices.

6.4.2.3 Capital

Starting in 1984 with the White Paper on Agricultural Policy, the main objective of formal policy was to ensure optimal resource use. One major instrument that was thought at this time to achieve this goal, apart from the Marketing Act, was the provision of the long-term credit to agriculture through the Land Bank. This assistance continued until the early 1990s where farmers were provided 'cheap' credit and those that were near insolvency or solvent were relieved from debt. This provision was through the Financial Scheme of the Department of Agricultural Development, managed by the Agricultural Credit Board.

However, the above system has changed as the reserve requirements of the banking sector made it impossible for the Land Bank to continue subsidising farmers' interest rates. Reserve Bank intervention led to a rise in the interest rates to very high levels because these prices had to equalise with international prices. These changes led to the increasing exposure of farmers to market-related interest and exchange rates (Vink *et al*., 1998: 74). As a result, budgetary allocations supporting white farmers declined about 50 percent between 1987 and 1993 and declined even further since 1994 (see Figure 6.3).

Figure 6.3 History of financial support



Source: Abstract of Agricultural Statistics, 2000

The prime interest rate in South Africa at which farmers obtained loans from co-operatives and commercial banks was found to be 14.5 percent and the interest on machinery and implements was 11.750 percent in the data collection period. Since bank interest rates in the country are no longer fixed, rather determined by market forces, it is assumed that there were no discrepancies between the prime rate and the economic cost of capital and the interest charged on machinery and implements in that period. Therefore, 14.5 percent, which was the prime rate, is taken as the economic cost of capital and is used in both financial and economic accounts. For machinery and implements, 11.750 percent, which is a rate of interest charged on these items, is also assumed to reflect the economic cost of interest.

6.4.3 General problems in the calculation of shadow prices

When determining shadow prices, some caution has to be taken, as some factors in the economy can have an indirect influence on their calculation. It is therefore important to take a stand on how externalities, inflation, taxation, subsidies and the value of the currency should be dealt with.

6.4.3.1 Externalities

Externalities can be explained as the effect of a project or action on the environment, ecology or general standard of living of a community that are not reflected by the prices of inputs or outputs. Externalities are often excluded in project assessment because they are not directly allocatable, for example, the opportunity cost of polluted air (CEAS, 1989: 15). Added to this is the fact that organic farming is believed to reduce these costs.

6.4.3.2 Inflation

Inflation is the sustained rise in the general price level that makes the determination of relative scarcity values more difficult. Inflation is not taken into account in the economic analysis and all evaluations are done in the base year prices with allowances for relative price shifts.

6.4.3.3 Indirect taxes and subsidies

Indirect taxes and subsidies are treated as transfer payments in the economic analysis. This is because taxes, which are part of the total project benefit, are transferred to the government, which acts on behalf of the society as a whole, and thus are not treated as costs. Conversely, a government subsidy to the project is a cost to society, since the subsidy is an expenditure of resources that the economy incurs to operate the project. As a result, these costs are not taken into account in the economic analysis (Gittinger, 1982: 19).

6.4.3.4 Direct transfer payments

Direct transfer payments are payments that represent the transfer of claims to the real resources from one person in the society to another rather than the use of resources, and hence are considered in the economic analysis. The most common direct transfer payments in agricultural projects are direct taxes, direct subsidies, and credit transactions that include loan receipts, repayment of principal, and interest payments (Gittinger, 1982: 251). In South Africa, a value added tax (VAT) of 14 percent is charged on a number of commodities including agricultural inputs. At the end of a two-month period VAT can be claimed back from the receiver of revenue on purchased inputs. Inputs purchased from the co-operatives by VAT registered producers do not have VAT included, for example, chemicals, fertilisers, and fuel, but some inputs purchased elsewhere carry the 14 percent VAT (vehicles). For the economic analysis, all these entries should be taken out before the financial accounts are adjusted to reflect economic values (Fourie and Owen, 1993: 287).

6.4.3.5 Currency

The price of any imported product or mineral is converted by means of the exchange rate to internal price levels. In this study, the Rand is fairly representative of the forces of supply and demand as determined by imports and exports and is therefore used as the shadow price of the currency.

However, in this chapter it has been indicated that some commodities do not reflect their true values because of both market failures and government intervention. As a result, shadow prices are calculated. The use of shadow prices is essential for the study because all the indicators of comparative advantage and policy incentives which are calculated from the PAM require the use of both financial and economic prices. These prices will also make it possible to identify the effect of incorrect agricultural policies that affect and may still affect production and marketing of agricultural products. The following chapter will therefore provide the results derived from the PAM analysis including their interpretation.

CHAPTER SEVEN

DESCRIPTION AND INTERPRETATION OF RESULTS FROM POLICY ANALYSIS MATRICES

7.1 Introduction

The principal purpose of this chapter is to describe the methods used for data collection and to interpret the results of the different policy analysis matrices, which are computed from the enterprise budgets. This allowed the calculation of various indicators of comparative advantage (see Section 5.3). However, in interpreting the results an attempt is made to incorporate other indicators of comparative advantage apart from those used in the PAM, to reduce prejudice. As the study has constructed PAMs for comparable agricultural systems, the results will facilitate decision-making and aid in the allocation of resources, especially investment. This provides a response to the research question posited in Chapter one.

7.2 Enterprise Budgets

In this study, Combud data representing typical wheat budgets were obtained from the Department of Agriculture at Elsenburg. The enterprise budgets for wheat under organic management are based on 'expert opinion' from specialists within the Province because wheat was not organically grown in the region during the time of data collection. For the budget estimates, particularly the financial accounts, market prices obtained from input suppliers, service providers, and producers are used. This excludes the price of nitrogen fertiliser in the organic wheat budgets, and land values in all enterprise budgets (see Sub-sections 6.4.1 and 6.4.2).

However, nitrogen fertiliser is replaced by green manures such as medics and lupins in organic wheat budgets. It is therefore the production costs of these crops that are entered into the financial and economic accounts. The reason for this is because in organic crop production, green manures are primarily considered as the main source of nitrogen as they contribute to nitrogen fixation, form the basis of fertility building, organic matter accumulation, and annual weed control. If utilised by livestock, some financial return can be obtained and accumulated nutrients may be more readily available to the subsequent crop, but benefits resulting from organic matter produced will be reduced. As a result, the livestock component is not considered in the farm accounts.

Although lupin is also a green manure crop, its production costs are beyond the economic costs of nitrogen fertiliser. The reason for this is that in the Western Cape, lupin is primarily produced as a cash crop. However, the value of lupin as an on-farm source of nitrogen is significantly different from a cash crop. As a result, production costs of medics are used as representative. This also applies in areas where there is lack of data, for example, the Northwest region where green manures are only produced under irrigation for hay.

The detailed budgets and summary of accounts for all selected farming areas are provided in Appendix A and C. The selection of the budgets is based on the most popular wheat systems that are applicable in each region, that is, monoculture and rotational systems using minimum or conventional tillage practices.

7.3 PAM Results for Conventional Wheat

In this section, only eight out fifteen selected matrices will be discussed. This is because of similarities in results within regions. To prevent biasedness, the matrices that are discussed in this section are only those that have similar rotational designs. Also, to reflect differences in practices, minimum and conventional tillage practices are contrasted. The matrices calculated from all enterprise budgets will be provided in Appendix A.

7.3.1 The Swartland area

The Swartland is predominantly a wheat and pastoral producing area with annual rainfall ranging between 300 mm and 450 mm, usually falling from April to September. Because wheat is a winter crop, it benefits from the Mediterranean climate of this region. As a result, wheat is mainly produced under dryland conditions in the Swartland. The region is also characterised by moderate to very low temperatures, with the latter restricted mainly to the Pikertberg-Porterville Mountains. In all farming areas of the Swartland region such as Koringberg, Middle Swartland, Koeberg-Malmesbury and Pikertberg-Porterville Mountains, wheat is produced in medium deep or shallow, red or yellow, and sandy or loamy soils (Slabbert, 2001). The relative suitability for crop production in these areas is 54, 48, 57, and 51 percent of resource units respectively, which is evidenced by actual wheat production (Moolman and Lambrechts, 1996: 117).

In the Swartland area, the most popular wheat systems are monoculture and rotation, as mentioned in Section 7.3, therefore the matrices that are interpreted in this chapter focus on the two systems. An attempt is also made to reveal the differences in wheat practice, that is, minimum tillage and conventional tillage practices. In this region, the results differ between systems and practices.

With regard to monocultural system using conventional tillage practices as shown in Table 7.1, a DRC value greater than one denotes a comparative disadvantage for wheat production in this region. Since the DRC coefficient shows the use of domestic resource costs incurred per value of foreign exchange earned or saved, this means that the cost of producing wheat domestically is greater than the cost of importing it (Appleyard, 1987: 27). In other words the region is wasting scarce resources by producing wheat at social costs that exceed the cost of importing under these practices. This is also verified by negative social profits in the table below.

Table 7.1 Policy analysis matrix for dryland wheat production in the Swartland, (wheat – wheat, conventional tillage) 1999/00 (Rands)

	Revenues	Costs		Net Profits
		Tradable inputs	Domestic factors	
Private prices	1 980.00	2 837.46	768.05	-1 625.51
Social prices	2 746.63	2 757.91	1 277.51	-1 288.79
Divergences	-766.63	79.55	-509.46	-336.72

DRC = -113.25 NPCO = 0.72 NPCI = 1.03 EPC = 76.01 PC = 1.26 SRP = -0.12

Note: The explanation of the above indicators is in Sub-section 5.3.7

However, Table 7.2 below reveals a comparative advantage of wheat when using minimum tillage practices, although also produced under monocultural system.

Table 7.2 Policy analysis matrix for dryland wheat production in the Swartland, (wheat – wheat, minimum tillage) 1999/00 (Rands)

	Revenues	Costs		Net Profits
		Tradable inputs	Domestic factors	
Private prices	2 340.00	1 380.99	734.61	224.40
Social prices	3 246.02	1 332.89	912.77	1 000.36
Divergences	-906.02	48.10	-178.16	-775.96

DRC = 0.48 NPCO = 0.72 NPCI = 1.04 EPC = 0.50 PC = 0.22 SRP = -0.24

Moreover, the DRC in Table 7.3 also denotes a comparative advantage of wheat under a rotational system, using minimum tillage practise. This divergence can be ascribed to lower production costs, particularly tradable inputs under minimum tillage as compared to conventional tillage practices.

Table 7.3 Policy analysis matrix for dryland wheat production in the Middle-Swartland, (medics-wheat, minimum tillage), 1999/00 (Rands)

	Revenues	Costs		Net Profits
		Tradable inputs	Domestic factors	
Private prices	2 250.00	1 408.34	730.75	1 10.91
Social prices	3 121.18	1 363.67	952.15	805.36
Divergences	-871.18	44.67	-221.40	-694.45

DRC = 0.54 NPCO = 0.72 NPCI = 1.03 EPC = 0.48 PC = 0.14 SRP = -0.22

With regard to indicators of incentives, an EPC that is below unity under minimum tillage practices is an indication of lower incentives to wheat farmers. In other words this means that the net effect of policies that alter prices in product markets is to reduce private profits. Conversely, conventional tillage practices that make intensive use of inputs that are distorted reveal an EPC that is much greater than one (see Table 7.1). This indicates that the net impact of government policies influencing product markets is to enable the wheat system to generate a value added in private prices greater than it would have been without the existing policies.

An extension of the EPC, which includes factor transfers, is the profitability coefficient (PC). Under minimum tillage practices the PCs are less than one, showing that private profits are lower than social profits as would be the case if there were no policy transfers and factor market failures, particularly land. On the other hand, for conventional tillage practices in Table 7.1, PCs that are greater than one reveal that policy transfers have enabled private profits to be higher than social profits, although profits have negative values.

As expected, minimum tillage practices in Tables 7.2 and 7.3 also reveal lower private profits when compared with social profits although at positive values, which is an indication of supernormal returns and therefore should lead to future expansion of the system. Alternatively, negative private profits would be an indication of subnormal profits, which means that producers would thus be expected to exit from the wheat activity unless something changes profits to at least normal level (D = 0).

7.3.2 The South Coast area

The South Coast region of the Western Cape, particularly the western part, is predominantly a wheat and pastoral producing area. The western zone of this region has a typical winter rainfall, but it changes to non-seasonal rainfall towards the east. The average annual rainfall increases from north to south and ranges from 300 mm in the Ruens farming area to as high as 900 mm near the mountains.

In the South Coat region, a rotational wheat system is the most popular, as a result, all matrices calculated for this area are representative of this system.

In Table 7.4, the South Coast region have the discouraging results with DRC values that verify comparative disadvantage for conventional wheat. The values are unexpected especially since the last crop in the rotation is lucerne for both minimum and conventional tillage practices. However, this divergence can be associated with intensive wheat management required after lucerne as it has a long production cycle.

Table 7.4 Policy analysis matrix for dryland wheat production in the Malgas /Heidelberg region (lucerne-wheat, conventional tillage) 1999/00 (Rands)

	Revenues	Costs		Net Profits
		Tradable inputs	Domestic factors	
Private prices	1 800.00	3 255.10	774.31	-2 229.41
Social prices	2 496.94	3 121.85	1 356.58	-1 981.49
Divergences	-696.94	133.25	-582.27	-247.92

DRC = -2.17 NPC O= 0.72 NPCI = 1.04 EPC = 2.33 PC = 1.13 SRP = -0.10

Table 7.5 also confirms this comparative disadvantage as it is characterised by a large tradable input divergence when compared with other matrices. This is also exacerbated by distorting policies like import tariffs on chemicals that increase the average domestic price of these inputs and hence act as a disincentive to farmers.

Table 7.5 Policy analysis matrix for dryland wheat production in the Witsand /Heidelberg region (medics-wheat, minimum tillage) 1999/00 (Rands)

	Revenues	Costs		Net Profits
		Tradable inputs	Domestic factors	
Private prices	2 250.00	2 356.97	663.91	-770.88
Social prices	3 121.18	2 278.92	1 036.54	-194.28
Divergences	-871.18	78.05	-372.63	-576.60

DRC = 1.23 NPCO = 0.72 NPCI = 1.03 EPC = - 0.13 PC = -3.97 SRP = -0.18

With regard to the incentive effects of policies on inputs and outputs, the EPC mainly reveals a combined effect. EPC as an indicator of the net incentive effect of all commodity policies that affect prices of tradable inputs and outputs, is less than one in Table 7.5 presenting disincentives to farmers, while in Table 7.4 this indicator shows transfers from farmers to the state.

7.3.3 The Little Karoo area

The Little Karoo is predominantly a semi-arid-pastoral area, with a small quantity of dry grain production, irrigated fruit and grape production in the west. The eastern part is characterised by summer rainfalls while the west falls in the predominant Mediterranean climate of the Western Cape. The annual rainfall in wheat producing areas of the west varies between 300 mm to 500 mm per annum.

The main popular wheat system in this region includes rotation with pastures. Among existing systems is the fallow-wheat system, particularly in the Touw/Ladismith farming area, although this is losing popularity in the province at large (see Appendix A.11).

In all farming areas of the Little Karoo, it is only the Uniondale area shows a comparative advantage for conventional wheat, although the DRC value is also higher which reflects social profits that are close to the break-even point. This can be ascribed to lower production costs when compared with other farming areas in the region.

Table 7.6 Policy analysis matrix for dryland wheat production in the Uniondale area (medics-wheat, minimum tillage) 1999/00 (Rands)

	Revenues	Costs		Net Profits
		Tradable inputs	Domestic factors	
Private prices	900.00	715.70	415.48	-231.18
Social prices	1 248.47	695.28	528.20	24.99
Divergences	-348.47	20.42	-112.72	-256.17

DRC = 0.95 NPCO = 0.72 NPCI = 1.02 EPC = 0.33 PC = -9.25 SRP = -0.21

The conventional tillage practices in Table 7.7 also follow that of other regions revealing comparative disadvantage for wheat, which is verified by production costs that are considerably higher than the gross receipts or revenues obtained by producers.

Table 7.7 Policy analysis matrix for dryland wheat production in the Bo-Langkloof area (medic-wheat, conventional tillage), 1999/00 (Rands)

	Revenues	Costs		Net Profits
		Tradable inputs	Domestic factors	
Private prices	1 350.00	2 855.90	423.65	-1 929.55
Social prices	1 872.71	2 751.01	818.93	-1 697.23
Divergences	-522.71	104.89	-395.28	-232.32

DRC = -0.93 NPCO = 0.72 NPCI = 1.04 EPC = 1.71 PC = 1.14 SRP = -0.12

With regard to incentive or disincentive indicators, an EPC of less than one in the Uniondale farming area means that the net effect of policies that alter prices in product markets is to reduce private profits and the combined transfer is thus negative. However, an indicator of incentives (PC) above one verifies policy transfers that allow private profits to be higher than social profits, although the matrices reveal negative values.

7.3.4 The Northwest area

The Northwest region has a predominantly Mediterranean climate with the exception of the eastern areas. The average annual rainfall varies from 50 mm in the north to 1 000 mm in sections of the Cederberg. Generally, the rainfall is low and erratic. More than 80 percent of this region has an annual rainfall of between 75 mm and 250 mm (Dyason 2001).

The northern part of the region is mainly pastoral with irrigated grapevine, fruit and vegetable production along the Olifants River. Grain, particularly wheat, is produced under dryland and irrigation with production in the latter having a fairly good quality and output compared to dryland production. However, this advantage is countered by high production costs when compared with dryland grain production (Durandt, 2001). As a result, wheat production under irrigation in this region is no longer prevalent.

The results in Table 7.8 indicate a comparative advantage for dryland wheat production in the Northwest region although the DRC is slightly weaker at 0.96 which reflects a threatening situation. This advantage can be attributed to low production costs especially tradable inputs, as some inputs including chemicals are not widely used in this region.

Table 7.8 Policy analysis matrix for dryland wheat production in the Urionskraal area (fallow-wheat system) 1999/00 (Rands)

	Revenues	Costs		Net Profits
		Tradable inputs	Domestic factors	
Private prices	900.00	897.84	288.82	-286.66
Social prices	1 248.47	853.34	380.55	14.58
Divergences	-348.47	44.50	-91.73	-301.24

DRC = 0.96 NPCO = 0.72 NPCI = 1.05 EPC = 0.01 PC = -19.66 SRP = -0.24

However, the interpretation of accompanying ratios like EPC and PC is similar to that of other regions.

7.3.5 Summary of indicators from the policy analysis matrices

The previous section omitted the discussion of NPCs for all regions because of a similarity in the values. Regarding the NPCO, it is estimated at 0.72 percent, which denotes approximately a 28 percent lower competitiveness rating for the domestic price of wheat (see tables in Sub-section 7.3.4). This divergence can be attributed to macroeconomic policies, for example, exchange rate policy, including political pressures on land prices, which can affect the wheat price. The reason underlying similar NPCO values can be assigned to the same domestic price that has been used in all enterprise budgets.

Therefore, the NPCIs in all matrices are above unity at approximately 1.03 percent. This figure reveals that policies are increasing the input costs to a level three percent higher than the world market prices, meaning that farmers are paying a premium for their inputs. This is verified by the existence of a 30 percent distortion in the price of diesel. Another contributing distortion is the 10 percent tariff on chemicals. Without the existence of these distortions, farmers would have better profits, particularly when using minimum tillage practices. The identical NPCI values also depict similarities in production structures and a similar tax on imported chemicals and fuel. Similarly, the SRPs (also not discussed in the previous section) reveal no increase in the system's revenues due to government policies (SRPs<0). As a result the calculated values are predominantly less than one as shown in Table 7.9 although this table does not show other indicators from PAMs.

Table 7.9 Indicators of comparative advantage from PAMs

Farming Area	DRC	EPC	PC	Output Transfers (R)	Tradable Input Transfers (R)	Domestic Factor Transfers (R)	Private Profitability (R)	Social Profitability (R)	Net Policy Effect (R)
Swartland-A1	-113.25	76.0	1.26	-766.63	79.55	-509.46	-1625.51	-1288.79	-336.72
Swartland-A2	0.48	0.50	0.22	-906.02	48.10	-178.16	224.40	1 000.36	-775.96
Middle Swartland A3	0.54	0.48	0.14	-871.18	44.67	-154.10	110.91	805.36	-694.45
Middle Swartland A4	1.55	-0.22	2.10	-871.18	56.84	-468.86	-874.75	-415.59	-459.16
Middle Swartland A5	0.40	0.54	0.37	-1 045.41	44.68	-132.49	519.92	1409.32	-889.40
Middle Swartland A6	0.40	0.54	0.38	-1 045.41	44.69	-198.25	556.68	1 448.53	-891.85
Ruens A7	1.69	0.51	-2.20	-871.18	73.45	-419.78	-962.32	-437.47	-524.85
Witsand/Heidelberg A8	1.23	-0.13	-3.97	-871.18	78.05	-372.63	-770.88	-194.28	-576.60
Malgas/Heidelberg A9	4.66	-2.72	1.51	-871.18	79.40	-472.90	-1 414.35	-936.68	-477.68
Malgas/Heidelberg A10	-2.17	2.33	1.13	-696.94	133.25	-582.27	-2 229.41	-1 981.49	-247.92
Touw/Ladismith A11	19.36	-	1.52	-418.16	62.84	-195.39	-838.34	-552.73	-285.61
Uniondale A12	0.95	0.33	-9.25	-348.47	20.42	-112.72	-231.18	24.99	-256.17
Bo-Langkloof A13	-0.93	1.71	1.14	-522.71	104.89	-395.28	-1 929.55	-1 697.23	-232.32
Montagu A14	-66.14	38.8	1.33	-261.35	57.10	-130.84	-752.91	-565.30	-187.61
Urionskraal A15	0.96	0.01	-19.66	-348.47	44.50	-91.73	-286.66	14.58	-301.24
Average	**5.08**	**6.91**	**1.60**	**-714.36**	**64.83**	**-294.32**	**-700.26**	**-224.43**	**-475.84**

Note: (R) signifies rand

7.3.5.1 Ratios

On average, the analysis indicates no comparative advantage for conventional wheat with certain values being negative to denote both comparative disadvantage and negative denominators. The variation in DRC values depicts underlying differences in soil types, climatic conditions, and methods of production, which may influence the input requirements and yields.

For comparison purposes, the DRC values are also computed using the export parity price. However, none of the regions have a comparative advantage (see Appendix B2). This is attributed to the low export parity price when compared with the import parity price as a result of marketing margins and transportation costs that are deducted from the former price. To conclude, producers have to look at alternative ways of reducing their costs of production as the comparative advantage in some of these areas is ascribed to tariff protection on domestic wheat. Accordingly, further improvements on minimum tillage practices can achieve desirable results.

On average, the indicators of incentives, particularly the PC, (as it reveals the net effect of policies), is mainly above one, which is a sign of distortions in product markets. This mainly results from government policies. Market failures on domestic factors such as land can also have an impact on this, although social profits are used to represent values of land for the same reason. This is mainly skewed towards regions that have no comparative advantage in wheat production due to intensive use of distorted inputs in these regions.

7.3.5.2 Profitabilities

In all farming areas, the analyses show variations in both private and social profitabilities. With regard to private profitability, the results mainly indicate a net loss to the farmers as shown in Table 7.9. Low private profits in these regions are also assigned to differences in soil types, climatic conditions, and production costs. In addition, transportation costs are also a prominent feature, as the farmers that farm at a considerate distance from the mills have to pay higher costs to transport their produce, thus obtaining relatively low prices for wheat. Generally, this shows that wheat production in the Western Cape is not competitive given current technologies, output values, input costs, and policy transfers. Under these circumstances farmers have to assess and compare alternative plans open to them for exploiting available resources at their disposal.

Furthermore, Table 7.9 shows that all farming areas that have a comparative advantage in conventional wheat production have positive social profits, which is an indication of efficient use of scarce resources, although the values are very low.

7.3.5.3 Policy effects

From the analysis, it has been observed that market prices diverge from their underlying social valuations mainly because of government policies. The actual policy that led to this situation is that of taxation on wheat, chemicals, and fuel. Table 7.9 shows negative values for factor transfers, which implies positive incentives for wheat farmers. This can be attributed to the primary factors of production, particularly land, because both social and the private value are determined in relation to alternative uses. Therefore factor transfers include some effect of the policies and market imperfections that influence the profitability of alternative crops. The capital gains tax on which land is subject to, will also be another distortion, although it is not considered in this study as it was implemented late in October 2001.

With regard to output transfers, all values from the selected farming areas are found to be negative which is a reflection of disincentives to farmers. This is also confirmed by the NPCI values that reveal a domestic wheat price that is lower than the world price. Consequently, input transfers also indicate disincentives, as positive values indicate that farmers are paying input prices that are higher than world prices.

However, in all farming areas the net transfer values are negative ($L<0$), which verifies that the conventional wheat system cannot earn excess profits without help from the government.

Furthermore, the results found in this study differ slightly from those in the study by Van Rooyen (2000) in which none of the areas reflected a comparative advantage for conventional wheat in the Western Cape. This difference can be associated with parity prices, and improvement in farming practices, for example, a gradual movement from monoculture to rotation systems and from conventional to minimum tillage practices.

7.4 PAM Results for an Organic Wheat System

7.4.1 Coefficients of PAM

Table 7.10 shows the indicators of comparative advantage from the basic PAM model. The most significant factors that affect the PAM calculations for organic wheat are high domestic factor costs and low estimated yields, resulting in a gap between private and social profits.

Using the DRC criterion, calculations indicate a weak comparative advantage of wheat if produced under organic management practices. However, the results differ slightly from those of conventional wheat that have extremely unpromising values. This difference is confirmed by the indicators in Table 7.10 where the results show four out of eight calculated matrices indicating a comparative advantage of organic wheat. At the same time, areas that do not have this advantage reveal DRC values that are closer to break-even, unlike the case shown under conventional farming practices. The low comparative advantage in these areas is associated with variations in soil type and climatic conditions with sandy soils demanding higher input use. Another source of divergences which will be discussed in the forthcoming section is traced to the misleading DRC criterion that is believed to understate activities that make intensive use of domestic factors like organic wheat farming, to favour those that make intensive use of tradable inputs like conventional wheat farming.

The nominal protection coefficient for output (NPCO) is calculated to be 0.85 in all matrices due to a similar import parity price. This result indicates that the domestic price of organic wheat is 15 percent lower than the world price as compared to conventional wheat which has a 28 percent divergence. This difference can be attributed to the differing distribution channels. Organic wheat is marketed directly to market outlets while conventional wheat is often sold through futures contracts. Generally, conventional wheat prices have been falling, a situation that can be traced back to the abolition of the single-channel fixed price system. Also, the simultaneous switching of land out of wheat into other crops, and a fall in the price of land in areas where wheat is produced, also exacerbated this problem (see Sub-section 6.4.2.1). The Western Cape was severely affected by this owing to the existing price differentiation according to both grade and location at producer level.

Table 7.10 Indicators of comparative advantage for organic wheat

Farming Areas	Output Transfers (R)	Tradable Input Transfers (R)	Domestic Factor Transfers (R)	Private Profitability (R)	Social Profitability (R)	Net Policy Effect (R)	DRC	NPCO	NPCI	EPC	PC	SRP
Swartland (sandy soils) C2	-537.68	24.97	-494.85	-107.53	-39.73	-67.80	1.03	0.85	1.01	0.60	2.70	-0.02
Swartland (sandy soils) C3	-537.68	24.97	-478.54	55.35	139.46	-84.11	0.91	0.85	1.01	0.64	0.40	-0.02
Swartland (clay-loam) C4	-537.68	21.17	-465.86	124.83	217.82	-92.99	0.87	0.85	1.01	0.66	0.57	-0.02
South Coast (clay loam) C5	-537.68	37.61	-565.50	-437.92	-428.13	-9.79	1.46	0.85	1.01	0.38	1.02	-0.00
South Coast (clay loam) C6	-537.68	43.39	-576.81	-701.88	-697.62	-4.26	1.87	0.85	1.01	0.28	1.01	-0.00
Little Karoo (clay loam) C7	-537.68	20.90	-441.31	613.79	731.06	-117.27	0.60	0.85	1.01	0.70	0.84	0.03
Little Karoo (sandy soils) C8	-537.68	52.18	-599.95	-761.91	-772.00	10.09	2.27	0.85	1.01	0.03	0.99	0.00
Northwest (sandy soils) C9	-537.68	25.02	-485.46	242.78	320.02	-77.24	0.77	0.85	1.01	0.59	0.76	-0.02
Average	**-537.68**	**31.28**	**-513.54**	**-121.56**	**-66.14**	**-55.42**	**1.22**	**0.85**	**1.01**	**0.49**	**1.04**	**-0.00**

The nominal protection coefficient for inputs (NPCI) is also equal at approximately 1.01 in all calculated matrices. This depicts similar production structures, as is the case in conventional wheat farming. The result shows that policies are causing increases in input costs that are nearly one percent higher than the world price, which can be associated with the taxation on fuel for the case of organic wheat farming. This also differs from conventional wheat results where the ratio reveals a three percent increase in input prices as a result of the taxation on fuel and chemicals.

The PC, which is a collective indicator of incentives, is approximately 1.04 percent on average, indicating that there will be fewer incentives either to the farmers or to the state even if wheat is produced organically. The low percentage of incentives accruing to farmers is due to an import tariff levied by government on wheat. Organic wheat farming is also likely to be affected by such policies. On the other hand, the incentives accruing to the state can be attributed to the taxation on fuel and chemicals.

The SRP, which is the ratio of the net transfer to social revenues, reveals no increases in gross receipts as a result of policies, as the values are for the main closer to zero in all matrices. However, it is uncertain as to what these values will be in the coming years, as some policies affecting organic farming are not yet implemented.

7.4.2 Net profits

Unlike the conventional wheat systems where only two (Swartland and the Middle Swartland) out of eight interpreted matrices reveal positive private profits, the results show that five out of eight areas would have positive private profits if wheat was produced under organic management. Results also display variations in private profits resulting from different soil types and climatic conditions that may influence the input requirements and the yield. This is clearly presented in Appendix C where enterprise budgets are differentiated according to different soil types that require different inputs. This excludes the yields as they are estimated to be similar in all regions in order to satisfy the model used in data collection. Furthermore, factors like transportation costs are also among the sources of variation in private profits and sometimes render options available to farmers unaffordable, for example, the South Coast area.

With regard to the efficiency of the system, the results reveal social profits that are predominantly positive. The interpretation of this result therefore indicates that the system can survive without any government assistance. In other words, the wheat system would have used scarce resources efficiently if produced under organic management practices. However, to answer the research question in Chapter One, the choice is clear for efficiency-minded economic planners, indicating that they must enact new policies to provide more private incentives for systems that can generate social profits like organic wheat farming. As the study is a comparison of the relative efficiency of different systems, the DRC serves as the proxy measure for social profits because minimising this ratio is thus equivalent to maximising social profits. However, the DRC for systems that make intensive use of domestic factors like organic farming is criticised (see Sub-section 7.4.4).

7.4.3 Policy transfers

A comparison of the extent of policy transfers between two different systems also requires ratios such as NPC and PC to be contrasted. As discussed in Sub-section 7.4.1, the results reveal a 13 percentage points difference in the divergence of the domestic wheat price from the world price, where it can be concluded that the divergence would be lower if wheat was produced under organic management.

Furthermore, the PC ratios calculated from various matrices reveal a degree of incentives. The incentives for farmers can be associated with a tariff on imported wheat, which provides some protection to the domestic industry, while those to the state can be attributed to a tax on imported fuel and chemicals.

7.4.4 Domestic resource cost ratio (DRC) versus social cost-benefit ratio (SCB)[10]

Most analysts consider it sufficient to note that various indicators produce identical criteria for distinguishing between comparative advantage and disadvantage (Monke and Pearson, 1996: 27). But policy makers need to use indicators to rank alternative activities, or to identify a single most desirable activity. Accordingly, Masters and Winter-Nelson, (1995: 244) observe that for any set of socially profitable activities, prioritising alternatives based on the DRC may lead to selection of activities that do not offer the greatest contribution to economic growth. This is because the DRC isolates the costs of domestic factors and understates the social profitability of activities that make intensive use of these resources instead of tradable inputs (see Table 7.11).

[10] The SCB ratio is explained in Sub-section 5.2.4.3

To reveal the difference between the DRC and SCB criteria, it is of importance to describe the net social profit (NSP) first because it operates hand in hand with these indicators. In the interpretation of the DRC and SCB ratios, the NSPs that are equal to zero indicate that each of the two ratios is equal to one. According to Gittinger's (1992: 373) project appraisal literature, the principal reason to apply economic analysis early in the production cycle is a need to compare mutually exclusive options, the ideal measure being net social profits (NSP):

$NSP\ (Q_o) = P_oQ_o - P_dQ_d - P_t\text{-}Q_t,$

where:

P_d = shadow price of domestic factors in the local currency;

P_0 and P_t = shadow prices of output and tradable inputs in foreign currency; and

Q_0 is a function of two composite inputs: domestic factors Q_d and tradable goods $Q_t,$

NSPs as calculated by the above formula are shown in the table below along with other indicators of comparative advantage. The procedure is unlike that used by Monke and Pearson, where social profits (H) are equal to E (revenues) minus F (tradable inputs) minus G (domestic factors). This understates the net social profit of domestic-input-intensive systems.

Table 7.11 Comparison between DRC and SCB for organic wheat

Farming Area	Revenues	Costs		NSP (Masters and Winter-Nelson, 1995)	NSP Monke and Pearson, 1996	SCB	DRC
		Domestic Factors	Tradable inputs				
Swartland C2	3 537.68	975.95	2 106.61	455.12	-39.73	0.87	1.03
Swartland C3	3 537.68	964.75	1 954.93	618.00	139.46	0.83	0.91
Swartland C4	3 537.68	949.87	1 904.13	683.68	217.82	0.81	0.87
South Coast C5	3 537.68	794.91	2 605.40	137.37	-428.13	0.96	1.46
South Coast C6	3 537.68	925.53	2 732.96	-120.81	-697.62	1.03	1.87
Little Karoo C7	3 537.68	679.43	1 685.88	1 172.37	731.06	0.67	0.60
Little KarooC8	3 537.68	781.71	2 928.02	-172.05	-772.00	1.04	2.27
North West C9	3 537.68	564.77	2 167.43	1 005.48	320.02	0.77	0.77
Average	**3 537.68**	**629.62**	**2 276.20**	**472.40**	**-66.14**	**0.87**	**1.22**

Contrary to the PAMs where net social profits are lower and reflect a negative value of R-66.14 on average, the above formula reveals higher profits on average of R472.40. This affirms that wheat activity would not be produced at a social cost if produced under organic management practices, as reflected by positive social profits, even in areas that show negative profits according to the PAM. However, to compare agricultural alternatives, the NSP is less useful because it is denominated in specific units with a physical numéraire, such as rands per hectare or per ton, which makes it difficult to compare the NSP values across different alternatives.

However, as with the DRC, profitable activities have an SCB between zero and one, and unprofitable activities have an SCB greater than one. Unlike the DRC, the SCB cannot become negative as shown in Table 7.11. Nevertheless, verification is made by using the same ratio on a conventional wheat system which also reflects positive values, although it also understates the comparative advantage of this system (see Appendix A). More importantly, the SCB is not affected by the classification of costs as either tradable or non-tradable, which is an empirically difficult aspect of the DRC. Therefore it is a better indicator as far as avoiding classification errors is concerned, than the DRC (Masters and Winter-Nelson, 1995: 245).

When using the SCB ratio, six out of eight calculated matrices reveal encouraging results with one matrix (South Coast, Appendix C5) that reflected comparative disadvantage under the DRC criterion also showing positive results. However, as the DRC also shows the comparative advantage of wheat produced under organic management, although slightly weaker, its biasedness (as it understates the relative profitability of this system) has to be noticed. This is of importance to public policy as this criterion can mislead policy makers in the allocation of resources as investment is encouraged into systems that contribute less to economic growth.

7.5 Sensitivity Analysis

The Policy Analysis Matrix is a static model that is based on fixed parameters. However, government policies can be strengthened or eroded by changes in economic conditions, and as a result, comparative advantage is considered as dynamic. Therefore, the systems' competitiveness can shift over time because of changes in three categories of economic parameters. These include long-run world prices of tradable outputs and inputs, social opportunity costs of domestic factors of production (labour, capital and land), and production technologies used in farming. Together, these three parameters determine the social profitability and comparative advantage (Monke and Pearson, 1989: 220).

Another influence results from changing climatic conditions, which in turn affects production, and thus comparative advantage. As a result, sensitivity analysis is conducted to identify the main deviations, and potentials, and to give decision-makers insights of possible risks of both conventional and organic wheat production. Therefore it is of importance to evaluate how sensitively the DRC and SCB values are subject to these changes. One crucial question about the sensitivity analysis is whether the hypothetical changes in input and output prices are likely to take place. However, without further research, forecasting these changes can be misleading.

Moreover, different scenarios are designed to estimate how much a change in any of the concerned factors would alter the comparative advantage of both organic and conventional wheat by calculating the values of the DRC and SCB. The definitions of various anticipated scenarios are presented in Tables 7.12 and 7.13. A discussion of the resultant changes in both systems will be discussed concurrently.

Table 7.12 Scenarios for conventional wheat

Selected Areas (Appendix A)	A1	A2	A3	A8	A10	A12	A13	A15
Basic Scenario (DRC)	**-113.25**	**0.48**	**0.54**	**1.23**	**-2.17**	**0.95**	**-0.93**	**0.96**
Basic Scenario (SCB)	***1.28***	***0.64***	***0.67***	***0.94***	***1.56***	***0.89***	***1.70***	***0.91***
Single input Scenarios								
1) 30% devaluation in exchange rate (DRC)	1.67	0.32	0.36	0.60	17.32	0.58	-2.33	0.51
SCB	*0.99*	*0.49*	*0.51*	*0.72*	*1.20*	*0.69*	*1.31*	*0.71*
2) 10 % decrease in the world price (DRC)	-5.29	0.56	0.64	1.78	-1.63	1.18	-0.79	1.31
SCB	*1.43*	*0.71*	*0.82*	*1.05*	*1.73*	*0.99*	*1.88*	*1.02*
3) Fuel up by 100 % (DRC)	-10.10	0.49	0.55	1.47	-1.55	0.95	-0.93	1.15
SCB	*1.33*	*0.65*	*0.68*	*0.99*	*1.66*	*0.92*	*1.78*	*0.97*
4) Labour costs up by 50% (DRC)	-115.06	0.50	0.56	1.26	-2.24	0.98	0.97	1.00
SCB	*1.28*	*0.63*	*0.67*	*0.95*	*1.56*	*0.90*	*1.71*	*0.93*
5) Fertiliser and chemicals up by 30% (DRC)	-6.62	0.53	0.61	1.51	-1.74	1.08	-0.68	1.21
SCB	*1.35*	*0.64*	*0.73*	*0.99*	*1.35*	*0.94*	*1.70*	*0.98*
6) Yield reduced by 10 % (DRC)	-4.11	0.57	0.66	1.95	-1.55	1.23	-0.76	1.41
SCB	*1.43*	*0.71*	*0.75*	*1.05*	*1.73*	*0.99*	*1.88*	*1.02*
Multiple input price changes								
7) Combination of 3, 4, & 5 (DRC)	-0.96	0.54	0.63	1.94	-1.36	1.01	-062	1.59
SCB	*1.39*	*0.71*	*0.75*	*1.04*	*1.74*	*0.98*	*1.97*	*1.04*
8) Combination of 1, 2 & 6 (DRC)	-19.35	0.42	0.48	0.95	-3.16	0.81	-1.12	0.77
SCB	*1.19*	*0.59*	*0.62*	*0.88*	*1.44*	*0.82*	*1.57*	*0.85*
9) Combination of all scenarios (DRC)	-3.17	0.47	0.54	1.34	-1.67	0.86	-0.70	1.14
SCB	*1.30*	*0.66*	*0.62*	*0.97*	*1.62*	*0.91*	*1.57*	*0.97*

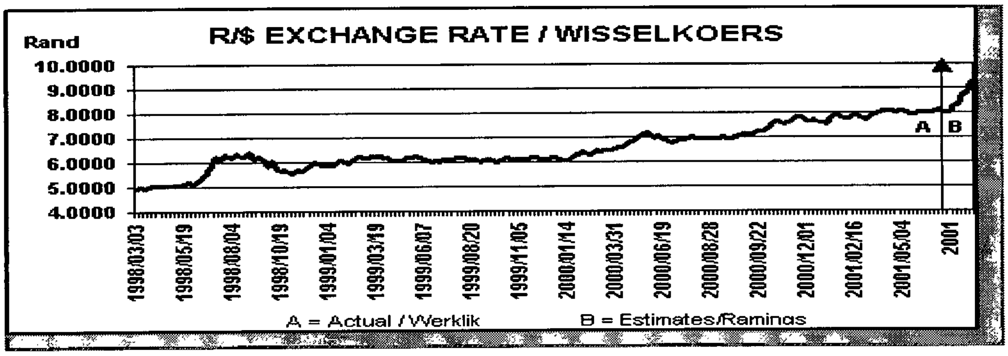
Table 7.13 Scenarios for organic wheat

Selected Areas (Appendix C)	*C2*	*C3*	*C4*	*C5*	*C6*	*C7*	*C8*	*C9*
Basic Scenario (DRC)	**1.03**	**0.91**	**0.87**	**1.46**	**1.87**	**0.60**	**2.27**	**0.77**
Basic Scenario (SCB)	***0.87***	***0.83***	***0.81***	***0.96***	***1.03***	***0.67***	***1.04***	***0.77***
Single input scenarios								
1) 30% devaluation in exchange rate (DRC)	0.59	0.55	0.53	0.69	0.81	0.38	0.83	0.43
SCB	*0.68*	*0.64*	*0.63*	*0.75*	*0.80*	*0.51*	*0.81*	*0.60*
2) 20% decrease in the world price (DRC)	1.06	1.00	0.98	1.17	1.26	0.81	1.27	0.94
SCB	*2.03*	*1.65*	*1.53*	*6.05*	*15.46*	*0.98*	*-13.91*	*1.58*
3) Fuel up by 100% (DRC)	1.07	0.95	0.89	1.61	2.14	0.62	2.83	0.80
SCB	*0.89*	*0.84*	*0.82*	*0.99*	*1.11*	*0.68*	*1.04*	*0.79*
4) Labour costs up by 50% (DRC)	1.04	0.90	0.87	1.48	1.91	0.61	2.42	0.78
SCB	*0.88*	*0.83*	*0.81*	*0.97*	*1.04*	*0.67*	*1.06*	*0.77*
5) Fertiliser up by 30% (DRC)	1.21	1.05	0.92	1.63	2.20	0.64	3.79	0.90
SCB	*0.93*	*0.89*	*0.83*	*0.99*	*1.08*	*0.70*	*1.12*	*0.83*
6) Certification costs reduced by 15% (DRC)	1.02	0.91	1.87	1.44	1.84	0.60	2.22	0.76
SCB	*0.87*	*0.82*	*0.80*	*0.96*	*1.03*	*0.67*	*1.05*	*0.77*
7) Yield increased by 10% (DRC)	0.82	0.75	0.87	1.06	1.30	0.51	1.43	0.61
SCB	*0.79*	*0.75*	*0.73*	*0.87*	*0.94*	*0.61*	*0.95*	*0.70*
Multiple input price changes								
8) Combined scenario of 3,4,5 & 6 (DRC)	1.27	1.10	0.95	1.83	2.62	0.66	6.39	0.96
SCB	*0.95*	*0.90*	*0.85*	*10.1*	*1.10*	*0.71*	*1.16*	*0.85*
9) Combination of 1, 2 and 7 (DRC)	0.68	0.62	0.60	0.82	0.98	0.43	1.03	0.50
SCB	*0.71*	*0.68*	*0.66*	*0.79*	*0.85*	*0.55*	*0.86*	0.63
10) Combination of all scenarios (DRC)	0.78	0.71	0.64	0.92	1.15	0.46	1.46	0.57
SCB	*0.78*	*0.74*	*0.69*	*0.83*	*0.90*	*0.58*	*0.95*	*0.70*

7.5.1 The effects of devaluation and a general increase in the prices of tradable inputs

Although the South African Rand is freely traded, which is an indication of the degree of confidence in the South African economy, it has been depreciating against the dollar since year-end 1999 (see Figure 7.1). This has both positive and negative connotations for the South African economy.

Figure 7.1 R/$ Exchange Rate



Source: Sagis, 2001

On one the hand, a nominal devaluation (scenario one) undertaken with appropriate fiscal and monetary policies can generate a real depreciation and increase a country's ability to sell those goods that make it internationally competitive, and to attract the investment needed for growth. This will have a significant impact on both conventional and organic wheat production as shown in collective scenario one. As a result, areas like the Rûens that do not have a comparative advantage in conventional wheat under basic scenarios will show a strong improvement in the DRC values (except the Malgas/Heidelberg and the Bo-Langkloof areas). However, if wheat is produced under organic management practices, the regions that reveal comparative disadvantage under basic scenarios, will have a comparative advantage under this hypothesis (except some areas of the South Coast and Little Karoo).

On the other hand, the result of devaluation is an immediate change in the relative prices of tradable versus non-tradable goods. In other words, the prices of imported goods and services increase, and hence producer's production costs rise. One good example of this event is the fuel price, which has been increasing gradually since 1999 (see Figure 6.1). As a result, mutual scenario (3) estimates a 100 percent increase in the price of fuel, which weakens the comparative advantage of wheat in the Western Cape. This will have a severe impact in areas that have high machinery variable costs like the Swartland and the South Coast. As a result, areas that have a weak comparative advantage in both systems will lose this in the future unless other means to increase comparative advantage are devised.

Wheat production, particularly monoculture production requires a lot of inputs such as fertilisers, weedicides, pesticides, and fungicides, which are believed to lead to soil fertility deterioration and pollution. As a result, forecasted price increases of these goods (mutual scenario 5) weaken the DRC and SCB values. This is depicted under conventional wheat practices. Therefore, if the potential environmental costs can be taken into account the results will reveal a critical situation. Similarly, organic wheat production, which is only subject to a few fertilisers, however, also reveals a threatening situation as producers pay a premium for these inputs. This condition is prevalent in those areas with a weak comparative advantage like the South Coast.

7.5.2 The effects of devaluation and a general price increase of non tradable goods and services

In South Africa, it is the primary objective of monetary policy to protect the value of the currency in order to obtain balanced and sustainable economic growth. This objective requires achievement of financial stability, that is price stability and stability of the financial sector. These two elements of the financial sector are closely related and failure to maintain one of these provides an uncertain operating environment for the other, with causality running in both directions. A good example of price instability is the current fuel crises, which has had an upward effect on the inflation rate. High inflation induces pressure on wages as workers demand higher wages to counteract inflation.

In addition to the above, the extension of labour legislation to agriculture will increase labour costs as the law requires the payment of overtime to workers, which includes work on public holidays and Sundays. Moreover, for other reasons, unions are also demanding higher wages for their members. This will also have a negative impact in agriculture, as many agricultural employees particularly farm workers are paid far less when compared with employees of the same level in other sectors.

Therefore, an anticipated 50 percent increase in labour costs (mutual scenario four) shows a slight change, particularly in the DRC values of regions like the Northwest, which have a break-even state of affairs. Following the argument that organic farming is more labour- intensive than conventional farming, does not hold in wheat production as the crop has low labour requirements. Hence, scenario four in Table 7.12 does not reveal a significant change in the SCB values.

7.5.3 The effects from decreasing costs of certification

In South Africa, the local based certification body (AFRISCO) has been established recently. Accompanied by the assumption that certification organisations will increase with time, therefore increased competition will lower the costs of certification. As a result, a 15 percent reduction in certification costs (scenario six, Table 7.13) is assumed. However, this will not have a significant impact in organic wheat farming as the table shows, because certification bodies are also subject to overhead costs charged by international accreditation companies.

7.5.4 The effects from decreasing output prices

The world prices for agricultural commodities are decreasing in the long-term. However, this is not always clear, as short-term fluctuations in prices disguise this trend. Bonnen and Schweikhardt (1998: 10) highlight the reasons for the decline in prices as follows:

The price elasticity of aggregate demand for agricultural products and the income elasticity of demand are usually relatively inelastic. Added to this is the fact that the rate of population growth in developed countries is relatively low, which results in a slow increase in demand for agricultural produce. On the supply side, the price elasticity of aggregate supply for agricultural products is also low, meaning that producers also react conservatively to changes in prices. At the same time the development of production technology (either cost saving or yield improving) tends to increase the supply of agricultural commodities at a faster rate than the demand for these commodities is increasing. Thus a downward pressure is put onto agricultural commodity prices in the long run. As a result, scenario two in Table 7.12 predicts a price decline of 10 percent for conventional wheat.

However, in organic wheat production, taking market demand into account, if too many farmers switch to organic production, the result will be overproduction in the long-term, i.e. another manifestation of the above explanation. As a result, scenario two in Table 7.12 predicts a price decline of 20 percent for organic wheat due to an increase in production. However, the effect on wheat prices of both organic and conventional systems will induce a notable change in the comparative advantage. As a result, the DRC and SCB values predominantly reveal comparative disadvantage.

7.5.5 The effect of changes in natural factors

The goal of new agricultural technologies is to improve yields at reduced costs. However, this is observed to hold only in the short-term, because in the long run the opposite is happening, for example, genetically engineering in crops. In 1998 research by USDA Economic Research Service found that genetically engineering in crops did not lead into increased yields, instead, reduced yields occurred as a result of crop failures. This is because of resistance that builds on crops, which in turn increase dependency on inputs that are costly and harmful to the environment [Benbrook (1998), and Fox (1997)].

Increased dependency on inputs that are detrimental to the environment as also used in conventional practices, will reduce the quality of natural resource base in the long run (Conway, 1995: 1). As a result of forecasted depletion of natural resources, therefore scenario six in Table 7.12 assumes a ten percent decrease in yields for conventional wheat. This will seriously affect the conventional wheat industry with comparative advantage being negative for the majority of wheat producing areas in the Western Cape. However, the rotation systems of the Swartland and Middle-Swartland still hold their advantage, which highlights the importance of sustainable practices such as minimum tillage practices.

Conversely, in organic farming, several authors observe lower yields of organic when compared with conventional wheat, particularly in the establishment phase, which is ascribed to an unbalanced system at this stage. However, with continuous production, an increase in yields has been observed as the system balances (Sub-section 2.5.3). As a result, scenario seven in Table 7.13 predicts a 10 percent increase in yields of organic wheat. Although this gives organic wheat an advantage over conventional wheat, relative international competitiveness will be affected as reflected in scenario two.

To conclude the chapter, combined scenarios under the DRC criterion reveal comparative disadvantage of conventional wheat in most areas with the exception of the Swartland and the Middle- Swartland that still reveal a strong advantage. In other words, this means that farmers must start looking at different alternatives of improving their production system or invest in alternative activities to conventional wheat. Conversely, the results, particularly scenario nine and ten in Table 7.13 indicate the potential comparative advantage of wheat in all wheat producing areas of the Western Cape when produced under organic management practices. These results hold especially when the SCB criterion is used and they can be ascribed to scenarios one, six and seven. In other words, the combined scenarios confirm the remark made in the previous sections that regardless of uncertainties wheat will have a comparative advantage in the Western Cape if produced under organic management practices.

CHAPTER EIGHT

CONCLUSION AND RECOMMENDATIONS

8.1 Introduction

The aim of this study was to examine whether wheat would have a comparative advantage if produced under organic management as compared to conventional production practices in the Western Cape. For conventional wheat practices, representative data on farm accounts were obtained from the Chief Directorate of Agriculture, Western Cape. However, for organic wheat practices where hard data were not available, expert assessment was used to provide valuable information. To make cross-production practices and cross-regional comparisons, the data were then used to construct the policy analysis matrices. Furthermore, to test validity of results, sensitivity analyses emphasising different considerations with regard to conventional and organic wheat systems were conducted.

This chapter contains a representation of final conclusions, a summary of results, policy considerations, limitations of the study, and a recommendations for further studies.

8.2 General Conclusion

The policy analysis matrix method was used to determine the comparative advantage and policy incentives on production of conventional and the hypothesised organic wheat industry in the Western Cape. The key indicators used in the analysis include DRC, NPC, EPC, PC, and SRP, input and output transfers, domestic factor transfers, and net policy effects. However, to address some of the shortcomings of the model used, the SCB was also incorporated into the analysis.

8.2.1 Domestic resource cost analysis

Results derived from the PAMs indicate a varying comparative advantage from slightly strong to weak, depending on practices, region, and rotation design. When import parity prices are used, the results reveal a relatively positive comparative advantage presented by low DRC values, particularly under conventional production practices. This observation is mainly skewed towards the Swartland and Middle Swartland areas, followed by Uniondale in the Little Karoo, and Urionskraal in the Northwest.

There is also a sharp contrast between tillage practices in conventional production systems, with minimum tillage contributing more to comparative advantage in wheat production than conventional tillage practices. A rotation design with crops that have a long production cycle has a negative impact on the comparative advantage of the next crop, as it will require intensive management using more inputs.

In a similar context, production under organic practices indicates a weak comparative advantage when measured with the DRC criterion. The deviation between the two systems can be ascribed to high domestic costs including machinery variable and fixed costs, especially fuel and depreciation, as a result of tillage practices. This is also exacerbated by the DRC criterion itself that favours tradable-intensive-input-use systems and understates the domestic-intensive-input-use systems like organic farming. However, the SCB indicates a slightly higher comparative advantage than the DRC criterion.

8.2.2 Transfers

It is difficult to associate the divergence between the actual market price and the world price of wheat that is revealed by the NPCOs as it is normally traced from distorting government policies. However, this divergence can be linked to a number of factors that are endogenous and also exogenous to the systems. The endogenous factors include natural conditions and cultivar type, which have an impact on the quality of wheat, and hence the price. The exogenous factors include macro-economic policies like the exchange rate policy. Another source of divergence rises from political pressures on land prices, which also has a negative impact on domestic wheat, and hence the commodity's price.

Within a similar framework, wheat is also protected by an import tariff. However, this does not impose any significant change in the prices of wheat, particularly in the Western Cape. It can be argued that domestic wheat prices are a little different compared with the level they would have been without an import tariff. However, a fall in the price of land in areas where wheat continued to be produced undermines the effect of an import tariff on wheat. This can also be one of the reasons for lower domestic wheat prices, especially in the Western Cape. Although organic wheat is a speciality product with a high price premium, it is also not excluded from these effects.

With regard to tradable inputs, their source of divergence is detected from distorting policies enacted by government, including a 10 percent tax on chemical inputs and a 30 percent tax on fuel, as revealed by the NPCIs. The deviation in NPCI values is also observed in the organic wheat system, although to a lesser extent, as it is not subjected to taxation on chemicals.

Conversely, domestic factor transfers do not reveal any divergences. However, positive factor transfers indicate a slight incentive to farmers. On the other hand, the net transfer as presented by the PC values indicates a certain degree of taxation of farmers by the state, especially under conventional wheat practices, due to intensive use of inputs that have a distorting effect. As a result, private profits although positive in some areas, are less than they would have been because of this effect.

8.2.3 Sensitivity analysis

The sensitivity analysis confirms that there is no comparative advantage for conventional wheat if input prices increase without any further improvement in production practices. Also, the analysis confirms that wheat production can have a comparative advantage if produced under organic practices.

8.3 Policy Considerations

8.3.1 General policy considerations

As already indicated in the previous chapters, the political transformation in South Africa in 1994, coupled with trade liberalisation and market deregulation, had a significant impact to the wheat sector. This implies *inter alia* a movement away from the governments' objective of food self-sufficiency towards a 'freer market environment'. A couple of other apparently conflicting trends influencing Western Cape producers are the trend to globalisation on the one hand, and the trend to individualisation on the other. By implication, local wheat producers have become part of the international playing field, but at the same time cannot be treated as a homogeneous group.

The integration of the domestic wheat sector into the international market is growing with an increasing demand for certain attributes from wheat, especially with regard to quality. Because wheat is not a homogenous product, but comprised of numerous quality characteristics, which means that, if domestic wheat do not have these characteristics, it is undesirable to the consumer. As a result, South Africa imported large quantities of wheat in the previous years to meet its domestic demands (see Table 4.2). This, coupled with increased domestic consumption requirements that exceeded domestic production (see Tables 4.3 and 4.4) confirms that the country is a net importer of wheat. As a net importer in general, this implies that domestic prices should converge on the import parity ceiling, and hence the use of import parity prices in this study. However, in good years, surplus that is produced is exported as the sector operates in a liberalised environment.

The findings of this study reveal a comparative advantage in some areas especially when import parity prices are incorporated into the accounts. This is unlike export parity prices that do not show a comparative advantage for wheat production for either system. In other words, the province will save more rands when wheat is produced as an import substitute instead of as an export product. However, the import parity prices are very high which implies that it will not be economically efficient to import both conventional and organic wheat. Therefore, it may be argued that the imported wheat be used in the coastal area, which also has a negative impact on the domestic price of wheat in the Western Cape.

Although imports have positive implications for the country, they also have a depressing effect on domestic prices and complete dependence on them can also lead to food insecurity, thus making the country more vulnerable to exogenous factors. This therefore justifies the argument that from an economic point of view wheat must be produced mainly for domestic consumption. However, taking consumer demands, globalisation, and the opening up of new markets into account, the Western Cape which has a traditionally secure market for its surplus wheat in the rest of South Africa, needs to re-evaluate its options and strategies. In other words, the competitiveness of the wheat industry in general depends on the industry's ability to evaluate the so-called demand chains rather than the traditional supply chains.

Organic wheat production, as one of the considered options, has a relatively small but growing market locally, but for the most part, local consumers are looking for low cost commodity-type products. On the other hand, the export market is characterised by consumers who are generally more sophisticated and specific in the kind of food they demand, and are willing to pay more. Therefore, producers have to engage the resources available to them in order to exploit this market.

Notwithstanding, there are a number of factors that impede the viability of wheat production in the Western Cape which also need to be taken into consideration by potential organic wheat farmers. In the past the Control Boards, operating as links between consumers and producers of wheat and maize, served to disseminate market information. This luxury is no longer available in South Africa, but the South African Grain Information Services (SAGIS) was founded in 1997 to fill this gap. There is no doubt that profitable economic decisions can only be taken if sufficient information is available in the market about the level of production and consumption and who the buyers and sellers are. This also includes questions like where consumers use the product, what quality consumers demand, what government policy is and what the state of affairs is in the international arena?

It is therefore of cardinal importance that role players in the South African grain market maintain open communication channels in order to understand one another's needs better. The survival of the grain industry, and wheat in particular will largely be determined by how transparent the market is. This, however, implies that market information must be freely available. There is also no doubt that this will strengthen the relationship of trust between producers and consumers, which will form the basis for successful grain marketing in South Africa in the future.

An aspect that receives insufficient attention at present is training producers to gather and interpret market information. There is also a major shortcoming among farmers in terms of using market instruments. However, farmers themselves should make it their business to keep abreast with the changing environment. It is also essential that policy makers, producers, and consumers be better informed of the issues before them, and of the consequences of alternative policy decisions.

In a similar context, the availability and location of infrastructure are among the most important factors determining the competitiveness of any industry, and the wheat industry is no exception. It is inexcusable, for example, that it cost less to transport wheat from the Gulf of Mexico to Gauteng than per rail from the Western Cape to Gauteng, which is an indication of a serious structural problem in the South African transport system. For this reason there have been signs over a considerable period of a growing substitution from rail to road transportation.

Within the infrastructural framework, storage capacity plays an important role in the stockpiling of grain in any country in the world. In South Africa, there is an excess of silo capacity in total as result of previous incentives whilst the distribution is less than optimal. Although the storage costs are about the same as in the USA, they are much higher in Australia. These problems are due to the nature of agriculture in certain regions like the Western Cape. Silo costs or storage costs are among the highest expenses a producer incurs. It is therefore essential for these costs to be as low as possible. Increasing silo throughput and encouraging competition between different silos can reduce these costs.

8.3.2 Organic-specific policy considerations

In the Western Cape, organic wheat farming can be a viable and environmentally benign alternative to conventional agriculture. Nevertheless, if organic farming is to reach its potential, private institutions and government agencies at all levels should be prepared to undertake more concerted efforts on its behalf.

8.3.2.1 Regulatory framework

On the one hand, it is also fair to say that organic agriculture, specifically the wheat sector even if it existed, would be difficult to compare with the organic sectors of other countries. This is because there is no legislative framework which forms the basis of organic agriculture. However, the positive reactions to the second draft regulation on organic farming emphasises the urgent need for continuation and finalisation of the process. Organic farmers therefore consider themselves to be disadvantaged as a result of the heavily supported organic sectors of the European Union, USA, Canada, and to a lesser extent Australia.

On the other hand, farmers and consumers in almost all countries rely on a system of private self-organised producer organisations and independent certifiers, which have, over the years, provided a mechanism of certification. However, the network of private certifiers needs to expand in developing countries like South Africa, where there is a need for a certification body that will be based on local standards that matches local resources and conditions. However, the standards also have to be accepted by the main importing countries as the domestic organic agriculture mainly targets the export market.

Another challenging issue for organic agriculture is that all countries may be expected to harmonise their rules and regulations with international guidelines governing organic agriculture. The establishment of such regulations requires broad-based involvement from all concerned, including government, industry and consumers so as to ensure that regulations are widely supported and are practicable. To ensure that evolving guidelines reflect emerging issues in organic production systems world-wide and meet the concerns of the consumers in all regions, countries should participate to the fullest extent possible in international fora dealing with the elaboration of rules governing organic agriculture.

8.3.2.2 Information dissemination and technical support

The major organic producing countries have invested by far the most in organic agricultural research, unlike emerging organic producing countries like South Africa that are still in their initial stages of development. The lack of extensive formal organic research combined with the highly site-specific nature of organic agriculture indicates a call for interested parties to take some initiative. This also suggests that it would be most advantageous for farmers themselves to participate fully in locally based, applied field research.

However, various bodies and institutions are already underway in terms of establishing and strengthening organic research in the Western Cape, including the Department of Agriculture, Agricultural Research Council, and the University of Stellenbosch. With regard to organic wheat, if organic agriculture becomes more widely accepted by traditional research institutions like SENSAKO, ARC (Grain crop Institute), co-operatives, and farmer's organisations, then the trajectory of current research efforts might change. Institutions like SAGIS and Cape Grain, although they do not have a comprehensive research but can also make a difference. Furthermore, the interested parties could also assist in developing relevant curricula for higher education and appropriate extension and communication programmes.

Researchers and other parties with interest in organic farming will greatly benefit from efficient collaboration and dissemination networks, and regular research fora that respond to the cross-sectoral and multi-disciplinary expertise needs of organic agriculture. A research network within the Western Cape, expanding to the rest of South Africa, with the purpose of harmonising research methods for better comparability of production related research results, can be a first step in this direction. The active involvement of associations of organic food producers would facilitate communication and co-operation between the industry and government. They would also contribute to the observance of organic food rules and regulations. These rules and regulations not only protect the consumer, but also protect conscientious organic producers from unfair competition by producers falsely claiming their produce is organic.

Moreover, people involved in all aspects of organic production, handling, storage, processing or the distribution of organic foods must be well trained in good agricultural practise (GAP), and good manufacturing practices (GMP). Accordingly, extension services must be developed to improve quality and safety of their products. The absence of adequate extension systems and poor access to training constitutes major barriers for the development of organic food production in general. Therefore working with national programmes in pilot activities could also assist better in integrating information to ensure that such techniques are available for farmers. Among the greatest initiatives in effective technical support is the establishment of farmer-field-schools that could evaluate on a local basis the contributions of organic production to food security through adaptive field trials. In the Western Cape, initiatives like Spier in Stellenbosch and Abalimi Basekhaya in Khayelitsha are the first step in this direction.

8.4 Limitations and Recommendations for Further Research

Although careful steps were taken to minimise the limitations of this study, it is only natural that some would be encountered. One likely source of limitations is the enterprise budgets used in the analysis. Enterprise budgets are important decision making tools. They can help individual producers determine the most profitable crops to grow, develop marketing strategies, obtain financing necessary to implement production plans, and make other farm business decisions. However, in organic farming there are complimentary relationships between production processes that can not be dealt with using enterprise budgets although several methods are outlined in this study to address this issue. It is therefore the whole farm measures that can fully take these close complementary relationships into account. This, however, suggests future research that will analyse organic farming further from a subsystem to a complete system.

Correspondingly, the study is based on modelling which also involves a considerable abstraction from and simplification of reality as it is very dependent on the underlying assumptions. This therefore calls for actual information that can be obtained from surveys and experimental plots rather than techniques from modelling including those that received attention in this paper such as standard budgets, and expert systems. The expert opinion in particular is criticised for producing poor quality data. However, to some extent, data quality and suitability has been observed to improve with the expert intensity, and researcher abilities.

Apart from limitations of the study, organic farming tends to reveal interesting research questions having implications for enhancement of sustainable production systems for and beyond organic agriculture. However, research in organic farming should move away from conventional-organic comparisons, to research solely within the organic framework although studies that compare conventional and organic cropping systems will prove useful for the foreseeable future. These include studies that determine the size of the organic industry, stability and growth of consumer interest in organic products.

As opposed to conventional farming, organic agriculture is claimed to be an environmental protection tool, and also to have a positive impact on rural employment. Thus, to identify external benefits, quantify in physical terms, and value the benefits associated with organic farming in economic terms would be an interesting area of research. Economic research needs in terms of the cost effectiveness of biological controls have also been highlighted. Furthermore, organic farmers, particularly in the Western Cape, have identified research needed on organic standards of various countries as they mainly target the export market.

Moreover, it has been recognised that small-scale farmers in South Africa are exposed to unfair competition from larger growers who are sometimes viewed as inefficient in terms of production. To establish long-term viable and stable economic growth in a nation, it is necessary to include small-scale farmers in a country's growth plan. Hence conversion planning for small-scale farmers should receive a great deal of attention from a research perspective.

With regard to organic food quality, food safety initiatives should continue to focus on scientific research, identifying and supporting research priorities designed to help fill the gaps in food safety knowledge. Further work needs to be carried out to investigate the quality characteristics of organically produced foods, as much of the past work has been inconclusive due to problems of experimental designs which did not adequately take account of large factors influencing product quality. There is also a need to move beyond conventional parameters for evaluating food quality to consider the long-term effects on human health.

In conclusion, it is clear that producers may be uncertain as how to come to terms with all the fore-mentioned factors and how to position themselves strategically. It is therefore essential for every role player in the market to accept responsibility and accountability for assisting farmers to cope with the changing business environment as this requires changes in production patterns and practices.

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APPENDICES

Appendix A Dryland conventional wheat budgets

Appendix A.1 Enterprise budget (R/ha) for wheat production in the Swartland (dryland wheat – wheat, conventional tillage)

	Private prices	Economic prices	Components of economic prices	
			Non-tradable	Tradable
GROSS REVENUE	**1980.00**	**2746.63**		
Grain	900*2.2 t = 1980.00	1248.4*2.2 = 2746.63		
Directly Allocable Variable Costs	**834.19**	**804.04**	**84.90**	**719.14**
Pre harvest:				
Planting material	180.00	180.00	18.00	162.00
Fertilizers	334.73	334.73	33.47	301.26
Chemicals	301.46	271.31	27.13	244.18
Common (contract transport)	18.00	18.00	6.30	11.70
Indirectly Allocable Variable Costs	**536.49**	**487.09**	**85.88**	**401.21**
Pre harvest costs				
Energy/Fuel	113.46	79.42	7.94	71.48
Repairs and Maintenance	187.96	187.96	37.59	150.37
Harvest costs				
Energy/Fuel	51.20	35.84	3.58	32.26
Repairs and Maintenance	183.37	183.37	36.67	146.70
Tyres	0.50	0.50	0.10	0.40
Fixed Costs	**2022.60**	**2354.10**	**338.68**	**17.83**
Interest on working capital (14.500 %)	77.59	77.59		
Labour Costs	40.73	40.73		
Licensing and Insurance: Machinery and Implements	356.50	356.50	338.68	17.83
Depreciation costs: Machinery and Implements	559.43	559.43		
Interest on machinery and implements (11.750 %)	550.85	550.85		
Land rental	649.73	649.73		

Budget summary: Wheat production (dryland) in the Swartland (wheat – wheat, conventional tillage), 1999/00 (R/ha)

	Private prices	Economic prices
Gross Revenue	**1980.00**	**2746.63**
Tradeables:	**2837.46**	**2757.91**
Purchased inputs	816.19	786.04
Machinery and implements costs	2003.27	1953.87
Contract/ higher services	18.00	18.00
Domestic factors	**768.05**	**1277.51**
Cost on working capital	77.59	77.59
Labour costs	40.73	40.73
Cost of land	649.73	649.73
Components of tradables		509.46

Policy analysis matrix for dryland wheat production in the Swartland, wheat – wheat, conventional tillage) 1999/00 (Rand)

	Revenues	Costs		Net Profits
		Tradable inputs	Domestic factors	
Private prices	1980.00	2837.46	768.05	-1625.51
Social prices	2746.63	2757.91	1277.51	-1288.79
Divergences	-766.63	79.55	-509.46	-336.72

DRC = -113.25 NPCO = 0.72 NPCI = 1.03 EPC = 76.01 PC = 1.26 SRP = -0.12

SCB = 1.28

Appendix A.2 Enterprise budget (R/ha) for wheat production in the Swartland (dryland wheat–wheat, minimum tillage)

	Private prices	Economic prices	Components of economic prices	
			Non-tradable	Tradable
GROSS REVENUE	**2340.00**	**3246.02**		**3755.88**
Grain	900*2.6 t = 2340.00	1248.4*2.6 t = 3246.02		
Directly Allocated Variable Costs	**889.87**	**859.52**	**95.95**	**763.57**
Pre harvest				
Planting material	172.80	172.80	17.28	155.52
Fertilisers	373.57	373.57	37.35	336.21
Chemicals	303.50	273.15	27.32	245.84
Contract (lime)	40.00	40.00	14.00	26.00
Indirectly Allocable Variable Costs	**152.06**	**134.31**	**22.75**	**111.56**
Pre harvest costs				
Energy/Fuel	37.13	25.99	2.60	23.39
Repairs and Maintenance	60.14	60.14	12.03	48.11
Harvest costs				
Energy/Fuel	21.59	15.11	1.51	13.60
Repairs and Maintenance	33.07	33.07	6.61	26.46
Fixed Costs	**1550.75**	**3101.11**	**60.16**	**3.17**
Interest on working capital (14.500 %)	68.86	68.86		
Labour Costs	16.02	16.02		
Licensing and Insurance: Machinery and Implements	63.33	63.33	60.16	3.17
Depreciation costs: Machinery and implements	157.37	157.37		
Interest on machinery and implements (11.750 %)	118.36	118.36		
Land rental	649.73	649.73		

Budget summary: Wheat production (dryland) in the Swartland area (wheat–wheat, minimum tillage), 1999/00 (R/ha)

	Private prices	Economic prices
Gross Revenue	**2340.00**	**3246.02**
Tradeables:	**1380.99**	**1332.89**
Purchased inputs	849.87	819.52
Machinery and implements costs	491.12	473.37
Contract/ higher services	40.00	40.00
Domestic factors	**734.61**	**912.77**
Cost on working capital	68.86	68.86
Labour costs	16.02	16.02
Cost of land	649.73	649.73
Components of tradables		178.16

Policy analysis matrix for dryland wheat production in the Swartland, (wheat–wheat, minimum tillage) 1999/00 (Rand)

	Revenues	Costs		Net Profits
		Tradable inputs	Domestic factors	
Private prices	2340.00	1380.99	734.61	224.40
Social prices	3246.02	1332.89	912.77	1000.36
Divergences	-906.02	48.10	-178.16	-775.96

DRC = 0.48   NPCO = 0.72 NPCI = 1.04   EPC = 0.50   PC = 0.22   SRP = -0.24

SCB = 0.64

Appendix A.3 Enterprise budget (R/ha) for wheat production in the Middle Swartland (dryland medics-wheat, minimum tillage)

	Private prices	Economic prices	Components of economic prices	
			Non-tradable	Tradable
GROSS REVENUE	**2250.00**	**3121.18**		**3611.43**
Grain	900*2.5 t = 2250.00	1248.4*2.5 = 3121.18		
Directly Allocated Variable Costs	**1003.73**	**976.41**	**137.64**	**838.77**
Pre harvest				
Planting material	169.40	169.40	16.94	152.46
fertilisers	401.03	401.03	40.10	360.93
Chemicals	273.31	245.98	24.60	221.38
Contract (lime)	75.00	75.00	26.25	48.75
Common (sample)	85.00	85.00	29.75	55.25
Indirectly Allocable Variable Costs	**119.87**	**102.52**	**83.76**	**89.61**
Pre harvest costs				
Energy/Fuel	32.21	22.55	2.26	20.30
Repairs and Maintenance	21.76	21.76	4.35	17.41
Harvest costs				
Energy/Fuel	25.66	17.96	1.80	16.16
Repairs and Maintenance	40.10	40.10	8.02	32.08
Tyres	0.15	0.15	0.03	0.12
Fixed Costs	**1411.14**	**2817.24**		
Interest on working capital (14.500 %)	65.55	65.55		
Labour Costs	15.25	15.25		
Licensing and Insurance: Machinery and Implements	70.84	70.84	67.30	3.54
Depreciation costs: Machinery and Implements	121.80	121.80		
Interest on machinery and implements (11.750 %)	92.10	92.10		
Land rental	649.73	649.73		

Budget summary: Wheat production (dryland) in the Middle Swartland area (medics-heat, minimum tillage), 1999/00 (R/ha)

	Private prices	Economic prices
Gross Revenue	**2250.00**	**3121.18**
Allocated costs		
Tradeables:	**1408.34**	**1363.67**
Purchased inputs	843.73	816.41
Machinery and implements costs	404.61	387.26
Contract/ higher services	160.00	160.00
Domestic factors	**730.75**	**952.15**
Cost on working capital	65.77	65.77
Labour costs	15.25	15.25
Cost of land	649.73	649.73
Components of tradables		221.40

Policy analysis matrix for dryland wheat production in the Middle Swartland, (medics-wheat, minimum tillage), 1999/00 (Rand)

	Revenues	Costs		Net Profits
		Tradable inputs	Domestic factors	
Private prices	2250.00	1408.34	730.75	110.91
Social prices	3121.18	1363.67	952.15	805.36
Divergences	-871.18	44.67	-221.40	-694.45

DRC = 0.54 NPCO = 0.72 NPCI = 1.03 EPC = 0.48 PC = 0.14 SRP = -0.22

SCB = 0.67

Appendix A.4 Enterprise budget (R/ha) for wheat production in the Middle Swartland (dryland medics-wheat, conventional tillage)

	Private prices	Economic prices	Components of economic prices	
			Non-tradable	Tradable
GROSS REVENUE	**2250.00**	**3121.18**		
Grain	900*2.50 = 2250.00	1248.4*2.5 = 3121.18		
Directly Allocated Variable Costs	**673.54**	**652.67**	**76.52**	**576.15**
Pre harvest				
Planting material	153.60	153.60	15.36	138.24
fertilisers	266.20	266.20	26.62	239.58
Chemicals	208.74	187.87	18.79	169.08
Contract (transport)	45.00	45.00	15.75	29.25
Indirectly Allocable Variable Costs	**181.23**	**159.41**	**26.79**	**132.62**
Pre harvest costs				
Energy/Fuel	72.72	50.90	5.09	45.81
Repairs and Maintenance	108.51	108.51	21.70	86.81
Harvest costs	**232.31**	**218.16**	**365.55**	**194.96**
Energy/Fuel	47.25	33.10	3.31	29.79
Repairs and Maintenance	184.57	184.57	36.91	147.66
Tyres	0.49	0.49	0.10	0.39
Fixed Costs	**2037.67**	**2037.67**		
Interest on working capital (14.500 %)	21.93	21.93		
Labour Costs	32.96	32.96		
Licensing and Insurance: Machinery and Implements	342.35	342.35	325.23	17.12
Depreciation costs: Machinery and Implements	489.45	489.45		
Interest on machinery and implements (11.750 %)	501.25	501.25		
Land rental	649.73	649.73		

Budget summary: Wheat production (dryland) in the Middle Swartland area (medics-wheat, conventional tillage), 1999/00 (R/ha)

	Private prices	Economic prices
Gross Revenue	**2250.00**	**3121.18**
Allocated costs	**2420.13**	**2363.29**
Tradeables:		
Purchased inputs	628.54	607.67
Machinery and implements costs	1746.59	1710.62
Contract/ higher services	45.00	45.00
Domestic factors	**704.62**	**1173.48**
Cost on working capital	21.93	21.93
Labour costs	32.96	32.96
Cost of land	649.73	649.73
Components of tradables		468.86

Policy analysis matrix for dryland wheat production in the Middle Swartland, (medics-wheat, conventional tillage), 1999/00 (Rand)

	Revenues	Costs		Net Profits
		Tradable inputs	Domestic factors	
Private prices	2250.00	2420.13	704.62	-874.75
Social prices	3121.18	2363.29	1173.48	-415.59
Divergences	-871.18	56.84	-468.86	-459.16

DRC = 1.55 NPCO = 0.72 NPCI = 1.02 EPC = -0.22 PC = 2.10 SRP = -0.12

SCB = 0.98

Appendix A.5 Enterprise budget (R/ha) for wheat production in the Middle Swartland (dryland lupins-wheat, minimum tillage)

	Private prices	Economic prices	Components of economic prices	
			Non-tradable	Tradable
GROSS REVENUE	**2700**	**3745.41**		
Grain	900*3 = 2700	1248.47 *3= 3745.41		
Directly Allocable Variable Costs	**920.53**	**893.21**	**109.82**	**783.39**
Pre harvest:				
Planting material	169.40	169.40	16.94	152.46
Fertilizers	395.83	395.83	39.58	356.25
Chemicals	273.31	245.98	24.60	221.38
Contract (transport)	82.00	82.00	28.70	53.30
Indirectly Allocable Variable Costs	**84.66**	**75.00**	**12.74**	**62.26**
Pre harvest costs				
Energy/Fuel	32.21	22.55	2.25	20.30
Repairs and Maintenance	52.45	52.45	10.49	41.96
Harvest costs	**66.30**	**58.60**	**78.13**	**52.25**
Energy/Fuel	25.66	17.96	1.80	16.16
Repairs and Maintenance	40.48	40.48	8.10	32.38
Tyres	0.16	0.16	0.03	0.13
Fixed Costs	**1108.59**	**1108.59**		
Interest on working capital (14.500 %)	73.82	73.82		
Labour Costs	25.25	25.25		
Licensing and Insurance: Machinery and Implements	71.79	71.79	68.20	3.58
Depreciation costs: Machinery and Implements	164.77	164.77		
Interest on machinery and implements (11.750 %)	123.23	123.23		
Land rental	649.73	649.73		

Budget summary: Wheat production (dryland) in the Middle Swartland area (lupins-wheat, minimum tillage), 1999/00 (R/ha)

	Private prices	Economic prices
Gross Revenue	**2700**	**3745.41**
Allocated costs		
Tradeables:	**1431.28**	**1386.60**
Purchased inputs	838.53	811.21
Machinery and implements costs	510.75	493.39
Contract/ higher services	82.00	82.00
Domestic factors	**748.80**	**949.49**
Cost on working capital	73.82	73.82
Labour costs	25.25	25.25
Cost of land	649.73	649.73
Components of tradables		200.69

Policy analysis matrix for dryland wheat production in the Middle Swartland, (lupins-wheat, minimum tillage), 1999/00 (Rand)

	Revenues	Costs		Net Profits
		Tradable inputs	Domestic factors	
Private prices	2700	1431.28	748.80	519.92
Social prices	3745.41	1386.60	949.49	1409.32
Divergences	-1045.41	44.68	-200.69	-889.40

DRC = 0.40 NPCO = 0.72 NPCI = 1.03 EPC = 0.54 PC = 0.37 SRP = -0.24

SCB = 0.57

Appendix A.6 Enterprise budget (R/ha) for wheat production in the Middle Swartland (dryland canola-wheat, minimum tillage)

	Private prices	Economic prices	Components of economic prices	
			Non-tradable	Tradable
GROSS REVENUE	**2700**	**3745.41**		
Grain	900*3 = 2700	1248.47*3 =3745.41		
Directly Allocable Variable Costs	**896.09**	**868.76**	**107.38**	**761.38**
Pre harvest:				
Planting material	169.40	169.40	16.94	152.46
Fertilizers	371.38	371.38	37.14	334.24
Chemicals	273.31	245.98	24.60	221.38
Contract transport)	82.00	82.00	28.70	53.30
Indirectly Allocable Variable Costs	**150.96**	**133.60**	**90.87**	**114.52**
Pre harvest costs	**84.66**	**75.00**	**12.74**	**62.26**
Energy/Fuel	32.21	22.55	2.25	20.30
Repairs and Maintenance	52.45	52.45	10.49	41.96
Harvest costs	**66.30**	**58.60**	**9.93**	**48.67**
Energy/Fuel	25.66	17.96	1.80	16.16
Repairs and Maintenance	40.48	40.48	8.10	32.38
Tyres	0.16	0.16	0.03	0.13
Fixed Costs	**1096.27**	**1096.27**	**68.20**	**3.59**
Interest on working capital (14.500 %)	71.50	71.50		
Labour Costs	15.25	15.25		
Licensing and Insurance: Machinery and Implements	71.79	71.79	68.20	3.59
Depreciation costs: Machinery and Implements	164.77	164.77		
Interest on machinery and implements (11.750 %)	123.23	123.23		
Land rental	649.73	649.73		

Budget summary: Wheat production (dryland) in the Middle Swartland area (canola-wheat, minimum tillage), 1999/00 (R/ha)

	Private prices	**Economic prices**
Gross Revenue	**2700**	**3745.41**
Allocated costs		
Tradeables:	**1406.84**	**1362.15**
Purchased inputs	814.09	786.76
Machinery and implements costs	510.75	493.39
Contract/ higher services	82.00	82.00
Domestic factors	**736.48**	**934.73**
Cost on working capital	71.50	71.50
Labour costs	15.25	15.25
Cost of land	649.73	649.73
Components of tradables		198.25

Policy analysis matrix for dryland wheat production in the Middle Swartland, (canola-wheat, minimum tillage), 1999/00 (Rand)

	Revenues	Costs		Net Profits
		Tradable inputs	Domestic factors	
Private prices	2700	1406.84	736.48	556.68
Social prices	3745.41	1362.15	934.73	1448.53
Divergences	-1045.41	44.69	-198.25	-891.85

DRC = 0.40 NPCO = 0.72 NPCI = 1.03 EPC = 0.54 PC = 0.38 SRP = -0.24

SCB = 0.56

Appendix A.7 Enterprise budget (R/ha) for wheat production in the Rûens (dryland wheat-medics, conventional tillage)

	Private prices	Economic prices	Components of economic prices	
			Non-tradable	Tradable
GROSS REVENUE	**2250**	**3121.18**		
Grain	900*2.5 = 2250	1248.47*2.5 = 3121.18		
Directly Allocated Variable Costs	**908.11**	**883.95**	**110.14**	**773.81**
Pre Harvest				
Planting material	184.80	184.80	18.48	166.32
Fertilisers	234.74	234.74	23.47	211.27
Chemicals	241.57	217.41	21.74	195.67
Contact work (hire)	42.00	42.00	14.70	27.30
General (soil analysis)	85.00	85.00	8.50	76.50
Harvest costs				
Contract work (transport)	45.00	45.00	15.75	29.25
General (grain)	75.00	75.00	7.50	67.50
Indirectly Allocable Variable Costs	**470.14**	**420.85**	**72.68**	**348.17**
Pre harvest costs				
Energy/Fuel	60.24	42.17	4.22	37.95
Repairs and Maintenance	60.99	60.99	12.20	48.79
Harvest costs				
Energy/Fuel	104.07	72.85	7.28	65.57
Repairs and Maintenance	244.36	244.36	48.87	195.49
Tyres	0.48	0.48	0.11	0.37
Fixed Costs	**1834.07**	**1834.07**	**236.96**	**12.47**
Interest on working capital (14.500 %)	72.65	72.65		
Labour Costs	35.50	35.50		
Licensing and Insurance: Machinery and Implements	249.43	249.43	236.96	12.47
Depreciation costs: Machinery and Implements	538.20	538.20		
Interest on machinery and implements (11.750 %)	403.70	403.70		
Land rental	534.59	534.59		

Budget summary: Wheat production (dryland) in the Rûens (medics-wheat, conventional tillage), 1999/00 (R/ha)

	Private prices	**Economic prices**
Gross Revenue	**2250**	**3121.18**
Allocated costs		
Tradeables:	**2569.58**	**2496.13**
Purchased inputs	821.11	796.95
Machinery and implements costs	1661.47	1612.18
Contract/ higher services	87.00	87.00
Domestic factors	**642.74**	**1062.52**
Cost on working capital	72.65	72.65
Labour costs	35.50	35.50
Cost of land	534.59	534.59
Components of tradables		419.78

Policy analysis matrix for dryland wheat production in the Rûens, (wheat-medics, conventional tillage), 1999/00 (Rands)

	Revenues	Costs		Net Profits
		Tradable inputs	Domestic factors	
Private prices	2250	2569.58	642.74	-962.32
Social prices	3121.18	2496.13	1062.52	-437.47
Divergences	-871.18	73.45	-419.78	-524.85

DRC = 1.69 NPCO = 0.72 NPCI = 1.03 EPC = 0.51 PC = -2.20 SRP = -0.17

SCB = 1.01

Appendix A.8 Enterprise budget (R/ha) for wheat production in the Witsand /Heidelberg region (dryland wheat–medics, less tillage)

	Private prices		Economic prices		Components of economic prices	
					Non-tradable	Tradable
GROSS REVENUE	**2250.00**		**3121.18**			**3611.43**
Grain	900*2.5 t = 2250.00		1248.47*2.5 t = 3121.18			
Directly Allocated Variable Costs	**847.36**		**828.67**		**115.37**	**713.30**
Pre harvest						
Planting material		175.20		175.20	17.52	157.68
Fertilisers		355.12		355.12	35.51	319.61
Chemicals		187.05		168.35	16.84	151.52
Common (sample)		85.00		85.00	29.75	55.25
Harvest costs						
Contract work (transport)		45.00		45.00	15.75	29.25
Indirectly Allocable Variable Costs	**494.79**		**435.43**		**76.85**	**358.58**
Pre harvest costs						
Energy/Fuel		120.54		84.38	12.05	72.33
Repairs and Maintenance		160.47		160.47	32.09	128.38
Harvest costs						
Energy/Fuel		77.32		54.12	5.41	48.71
Repairs and Maintenance		136.13		136.13	27.23	108.90
Tyres		0.33		0.33	0.07	0.26
Fixed Costs	**1922.67**		**3362.15**		**180.41**	**9.50**
Interest on working capital (14.500 %)		86.69		86.69		
Labour Costs		43.02		43.02		
Licensing and Insurance: Machinery and Implements		189.91		189.91	180.41	9.50
Depreciation costs: Machinery and Implements		472.58		472.58		
Interest on machinery and implements (11.750 %)		352.33		352.33		
Land rental		534.59		534.56		

Budget summary: Wheat production (dryland) in the Witsand /Heidelberg region (wheat–medics, less tillage), 1999/00 (R/ha)

	Private prices	Economic prices
Gross Revenue	**2250.00**	**3121.18**
Allocated costs		
Tradeables:	**2356.97**	**2278.92**
Purchased inputs	717.36	698.67
Machinery and implements costs	1509.61	1450.25
Contract/ higher services	130.00	130.00
Domestic factors	**663.91**	**1036.54**
Cost on working capital	86.69	86.69
Labour costs	43.02	43.02
Cost of land	534.20	534.20
Components of tradables		372.63

Policy analysis matrix for dryland wheat production in the Witsand /Heidelberg region (wheat–medics, less tillage) 1999/00 (Rands)

	Revenues	Costs		Net Profits
		Tradable inputs	Domestic factors	
Private prices	2250.00	2356.97	663.91	-770.88
Social prices	3121.18	2278.92	1036.54	-194.28
Divergences	-871.18	78.05	-372.63	-576.60

DRC = 1.23. NPCO = 0.72 NPCI = 1.03 EPC = - 0.13 PC = -3.97 SRP = -0.18

SCB = 0.94

Appendix A.9 Enterprise budget (R/ha) for wheat production in Malgas /Heidelberg region (dryland lucerne-wheat, minimum tillage

	Private prices	Economic prices	Components of economic prices	
			Non-tradable	Tradable
GROSS REVENUE	**2250.00**	**3121.18**		
Grain	900*2.5 t = 2250.00	1248.47*2.5 = 3121.18		
Directly Allocated Variable Costs	**988.36**	**984.44**	**144.69**	**799.76**
Pre harvest				
Planting material	175.20	175.20	17.52	152.68
Fertilisers	443.92	463.92	44.39	339.54
Chemicals	239.24	215.32	21.53	193.79
Common (sample)	85.00	85.00	29.75	55.25
Harvest costs				
Contract work (transport)	45.00	45.00	15.75	29.25
Indirectly Allocable Variable Costs	**635.63**	**560.15**	**94.42**	**465.73**
Pre harvest costs				
Energy/Fuel	167.49	117.24	11.72	105.52
Repairs and Maintenance	230.88	230.88	46.18	184.70
Harvest costs				
Energy/Fuel	84.14	58.90	5.89	53.01
Repairs and Maintenance	152.73	152.73	30.55	122.18
Tyres	0.40	0.40	0.08	0.32
Fixed Costs	**1946.76**	**3387.59**	**233.79**	**12.30**
Interest on working capital (14.500 %)	123.68	123.68		
Labour Costs	61.73	61.73		
Licensing and Insurance: Machinery and Implements	246.09	246.09	233.79	12.30
Depreciation costs: Machinery and Implements	614.13	614.13		
Interest on machinery and implements (11.750 %)	460.53	460.53		
Land rental	534.20	534.20		

Budget summary: Wheat production (dryland) in the Malgas /Heidelberg region (wheat – lucerne, minimum tillage), 1999/00 (Rands)

	Private prices	**Economic prices**
Gross Revenue	**2250.00**	**3121.18**
Allocated costs		
Tradeables:	**2944.74**	**2865.34**
Purchased inputs	858.36	854.44
Machinery and implements costs	1956.38	1880.90
Contract/ higher services	130.00	130.00
Domestic factors	**719.61**	**1192.51**
Cost on working capital	123.68	123.68
Labour costs	61.73	61.73
Cost of land	534.20	534.20
Components of tradables		472.90

Policy analysis matrix for dryland wheat production in the, Malgas /Heidelberg region (wheat–lucerne, minimum tillage) 1999/00 (Rands)

	Revenues	Costs		Net Profits
		Tradable inputs	Domestic factors	
Private prices	2250.00	2944.74	719.61	-1414.35
Social prices	3121.18	2865.34	1192.51	-936.68
Divergences	-871.18	79.40	-472.90	-477.68

DRC = 4.66 NPCO = 0.72 NPCI = 1.03 EPC = -2.72 PC = 1.51 SRP = -0.15

SCB = 1.15

Appendix A.10 Enterprise budget (R/ha) for wheat production in the Malgas /Heidelberg (dryland lucerne-wheat, conventional tillage)

	Private prices	Economic prices	Components of economic prices	
			Non-tradable	Tradable
GROSS REVENUE	**1800.00**	**2496.94**		
Grain	900*2.0 t = 1800	1248.47*2.0 = 2496.94		
Directly Allocated Variable Costs	**940.02**	**914.87**	**175.54**	**739.33**
Pre harvest costs				
Planting material	182.50	182.50	18.25	164.25
Fertilisers	283.00	283.00	56.60	226.40
Chemicals	251.52	226.37	22.64	203.73
Contract work (hire)	42.00	42.00	14.70	27.30
Common (sample)	85.00	85.00	29.75	55.25
Harvest costs				
Contract work (grain)	36.00	36.00	12.60	23.40
Common (grain)	60.00	60.00	21.00	39.00
Indirectly Allocable Variable Costs	**876.56**	**768.46**	**128.47**	**639.99**
Pre harvest costs				
Energy/Fuel	282.85	198.00	19.80	178.20
Repairs and Maintenance	389.40	389.40	77.88	311.52
Harvest costs				
Energy/Fuel	77.51	54.26	5.43	48.83
Repairs and Maintenance	126.39	126.39	25.28	101.11
Tyres	0.41	0.41	0.08	0.33
Fixed Costs	**1918.63**	**2073.02**	**278.26**	**14.65**
Interest on working capital (14.500 %)	157.13	157.13		
Labour Costs	82.98	82.98		
Licensing and Insurance: Machinery and Implements	292.90	292.90	278.26	14.65
Depreciation costs: Machinery and Implements	650.48	650.48		
Interest on machinery and implements (11.750 %)	495.14	495.14		
Land rental	534.20	534.20		

Budget summary: Wheat production (dryland) in the Malgas /Heidelberg region (lucerne-wheat, conventional tillage), 1999/00 (R/ha)

	Private prices	Economic prices
Gross Revenue	**1800.00**	**2496.94**
Allocated costs		
Tradeables:	**3255.10**	**3121.85**
Purchased inputs	717.02	691.87
Machinery and implements costs	2315.08	2206.98
Contract/ higher services	223.00	223.00
Domestic factors	**774.31**	**1356.58**
Cost on working capital	157.13	157.13
Labour costs	82.98	82.98
Cost of land	534.20	534.20
Components of tradables		582.27

Policy analysis matrix for dryland wheat production in the Malgas /Heidelberg region (lucerne-wheat, conventional tillage) 1999/00 (Rands)

	Revenues	Costs		Net Profits
		Tradable inputs	Domestic factors	
Private prices	1800.00	3255.10	774.31	-2229.41
Social prices	2496.94	3121.85	1356.58	-1981.49
Divergences	-696.94	133.25	-582.27	-247.92

DRC = -2.17   NPC O= 0.72   NPCI = 1.04   EPC = 2.33   PC = 1.13   SRP = -0.10

SCB = 1.56

Appendix A.11 Enterprise budget (R/ha) for wheat production in Touw /Ladismith area (dryland fallow-wheat, minimum tillage)

	Private prices	Economic prices	Components of economic prices	
			Non-tradable	Tradable
GROSS REVENUE	**1080.00**	**1498.16**		
Grain	900*1.2 t = 1080	1248.47*1.2 t = 1498.16		
Directly Allocated Variable Costs	**1027.72**	**998.11**	**110.31**	**887.80**
Pre harvest				
Planting material	158.40	158.40	15.84	142.56
Fertilisers	531.20	531.20	53.12	478.08
Chemicals	296.12	266.51	26.65	239.86
Contract work (hire)	42.00	42.00	14.70	27.30
Indirectly Allocable Variable Costs	**198.69**	**165.46**	**25.34**	**140.13**
Pre harvest costs				
Energy/Fuel	75.73	53.01	5.30	47.71
Repairs and Maintenance	58.59	58.59	11.72	46.87
Harvest costs				
Energy/Fuel	35.07	24.55	2.46	22.09
Repairs and Maintenance	29.17	29.17	5.83	23.34
Tyers	0.14	0.14	0.03	0.11
Fixed Costs	**540.01**	**661.45**	**59.74**	**3.14**
Interest on working capital (14.500 %)	8.41	8.41		
Labour Costs	27.10	27.10		
Licensing and Insurance: Machinery and Implements	62.88	62.88	59.74	3.14
Depreciation costs: Machinery and Implements	138.04	138.04		
Interest on machinery and implements (11.750 %)	103.58	103.58		
Land rental	351.92	351.92		

Budget summary: Wheat production (dryland) in the Touw/Ladismith area, (fallow – wheat, minimum tillage) 1999/00 (R/ha)

	Private prices	Economic prices
Gross Revenue	**1080.00**	**1498.16**
Allocated costs		
Tradeables:	**1530.91**	**1468.07**
Purchased inputs	985.72	956.11
Machinery and implements costs	503.19	469.96
Contract/ higher services	42.00	42.00
Domestic factors	**387.43**	**582.82**
Cost on working capital	8.41	8.41
Labour costs	27.10	27.10
Cost of land	351.92	351.92
Components of tradables		195.39

Policy analysis matrix for dryland wheat production in the Touw/Ladismith area, (fallow–wheat, minimum tillage) 1999/00 (rands)

	Revenues	Costs		Net Profits
		Tradable inputs	Domestic factors	
Private prices	1080.00	1530.91	387.43	-838.34
Social prices	1498.16	1468.07	582.82	-552.73
Divergences	-418.16	62.84	-195.39	-285.61

DRC = 19.36 NPCO = 0.72 NPCI = 1.04 EPC = -14.98 PC = 1.52 SRP = -0.19

SCB = 1.24

Appendix A.12 Enterprise budget (R/ha) for wheat production in the Uniondale area (dryland medic-wheat, minimum tillage)

	Private prices	Economic prices	Components of economic prices	
			Non-tradable	Tradable
Gross Revenue	**900.00**	**1248.47**		
Grain	900*1.00 t = 900	1248.47*1.0 = 1248.47		
	414.50	**410.15**	**62.26**	**347.89**
Directly Allocated Variable Costs				
Pre harvest	107.80	107.80	10.78	97.02
Planting material	178.20	178.20	17.82	160.38
Fertilisers	43.50	39.15	3.91	35.24
Chemicals	85.00	85.00	29.75	55.25
General (sample)				
Indirectly Allocable Variable Costs	**106.64**	**90.57**	**14.37**	**76.20**
Pre harvest costs				
Energy/Fuel	35.22	24.65	2.47	22.19
Repairs and Maintenance	26.94	26.94	5.39	21.55
Harvest costs				
Energy/Fuel	18.33	12.83	1.28	11.54
Repairs and Maintenance	25.69	25.69	5.14	20.55
Tyres	0.46	0.46	0.09	0.37
Fixed Costs	**573.42**	**1338.84**	**36.09**	**1.90**
Interest on working capital (14.500 %)	31.80	31.80		
Labour Costs	31.76	31.76		
Licensing and Insurance: Machinery and Implements	37.99	37.99	36.09	1.90
Depreciation costs: Machinery and Implements	89.58	89.58		
Interest on machinery and implements (11.750 %)	66.99	66.99		
Land rental	351.92	351.92		

Budget summary: Wheat production (dryland) in the Uniondale area (medic-wheat, minimum tillage), 1999/00 (R/ha)

	Private prices	**Economic prices**
Gross Revenue	**900.00**	1248.47
Allocated costs		
Tradeables:	**715.70**	**695.28**
Purchased inputs	329.50	325.15
Machinery and implements costs	301.20	285.13
Contract/ higher services	85.00	85.00
Domestic factors	**415.48**	**528.20**
Cost on working capital	31.80	31.80
Labour costs	31.76	31.76
Cost of land	351.92	351.92
Components of tradables		112.72

Policy analysis matrix for dryland wheat production in the Uniondale area, (medic-wheat, minimum tillage) 1999/00 (rands)

	Revenues	Costs		Net Profits
		Tradable inputs	Domestic factors	
Private prices	900.00	715.70	415.48	-231.18
Social prices	1248.47	695.28	528.20	24.99
Divergences	-348.47	20.42	-112.72	-256.17

DRC = 0.95 NPCO = 0.72 NPCI = 1.02 EPC = 0.33 PC = -9.25 SRP = -0.21

SCB = 0.89

Appendix A.13 Enterprise budget (R/ha) for wheat production in Bo-Langkloof area (dryland medic-wheat, conventional tillage)

	Private prices	Economic prices	Components of economic prices	
			Non-tradable	Tradable
GROSS REVENUE	**1350.00**	**1872.71**		
Grain	900*1.50 t = 1350.00	1248.47*1.5 t = 1872.71		
Directly Allocated Variable Costs				
Pre harvest	**1464.99**	**1420.91**	**142.09**	**1278.82**
Planting material	314.00	314.00	31.40	282.60
Fertilisers	885.60	885.60	88.56	797.04
Chemicals	245.90	221.31	22.13	199.18
Indirectly Allocable Variable Costs	**455.49**	**399.68**	**64.24**	**335.44**
Pre harvest costs				
Energy/Fuel	131.02	99.71	9.97	89.74
Repairs and Maintenance	131.62	131.62	26.32	105.29
Harvest costs				
Energy/Fuel	81.68	57.18	5.72	51.46
Repairs and Maintenance	110.37	110.37	22.07	88.31
Tyres	0.80	0.80	0.16	0.64
Fixed Costs	**1067.15**	**1323.59**	**188.95**	**9.94**
Interest on working capital (14.500 %)	6.20	6.20		
Labour Costs	65.53	65.53		
Licensing and Insurance: Machinery and Implements	198.89	198.89	188.95	9.94
Depreciation costs: Machinery and Implements	420.57	420.57		
Interest on machinery and implements (11.750 %)	310.96	310.96		
Land rental	351.92	351.92		

Budget summary: Wheat production (dryland) in the Bo-Langkloof area (medic-wheat, conventional tillage), 1999/00 (Rands)

	Private prices	**Economic prices**
Gross Revenue	**1350.00**	**1872.71**
Allocated costs		
Tradeables:	**2855.90**	**2751.01**
Purchased inputs	1469.99	1420.91
Machinery and implements costs	1385.91	1330.10
Domestic factors	**423.65**	**818.93**
Cost on working capital	6.20	6.20
Labour costs	65.53	65.53
Cost of land	351.92	351.92
Components of tradables		395.28

Policy analysis matrix for dryland wheat production in the Bo-Langkloof area (medic-wheat, conventional tillage), 1999/00 (Rands)

	Revenues	Costs		Net Profits
		Tradable inputs	Domestic factors	
Private prices	1350.00	2855.90	423.65	-1929.55
Social prices	1872.71	2751.01	818.93	-1697.23
Divergences	-522.71	104.89	-395.28	-232.32

DRC = -0.93 NPCO = 0.72 NPCI = 1.04 EPC = 1.71 PC = 1.14 SRP = -0.12

SCB = 1.70

Appendix A.14 Enterprise budget (R/ha) for wheat production in Montagu Mountain Farm area (dryland pasture–fallow-wheat) 99/00

	Private prices	Economic prices	Components of economic prices	
			Non-tradable	Tradable
GROSS REVENUE	**675.00**	**936.35**		
Grain	900*0.75 t = 675.00	1248.47*0.75 = 936.35		
Directly Allocated Variable Costs	**423.11**	**403.85**	**40.39**	**363.46**
Pre harvest				
Planting material	140.80	140.80	14.08	126.72
Fertilisers	89.70	89.70	8.97	80.73
Chemicals	192.61	173.35	17.34	156.02
Indirectly Allocable Variable Costs	**244.74**	**206.90**	**32.54**	**174.36**
Pre harvest costs				
Energy/Fuel	97.05	67.94	6.79	61.15
Repairs and Maintenance	94.26	94.26	18.85	75.41
Harvest costs				
Energy/Fuel	29.11	20.38	2.04	18.34
Repairs and Maintenance	24.21	24.21	4.84	19.37
Tyres	0.11	0.11	0.02	0.09
Fixed Costs	**508.14**	**729.58**	**57.91**	**3.05**
Interest on working capital (14.500 %)	46.86	46.86		
Labour Costs	27.26	27.26		
Licensing and Insurance: Machinery and Implements	60.96	60.96	57.91	3.05
Depreciation costs: Machinery and Implements	155.32	155.32		
Interest on machinery and implements (11.750 %)	117.74	117.74		
Land rental	351.92	351.92		

Budget summary: Wheat production (dryland) in Montagu Mountain Farm area (pasture-fallow-wheat, wheat fallow system), 1999/00 (Rands)

	Private prices	**Economic prices**
Gross Revenue	**675.00**	**936.35**
Allocated costs		
Tradeables:	**1001.87**	**944.77**
Purchased inputs	423.11	403.85
Machinery and implements costs	578.76	540.92
Domestic factors	**426.04**	**556.88**
Cost on working capital	46.86	46.86
Labour costs	27.26	27.26
Cost of land	351.92	351.92
Components of tradables		130.84

Policy analysis matrix for dryland wheat production in Montagu Mountain Farm area (pasture-fallow-wheat, wheat fallow system), 1999/00 (Rands)

	Revenues	Costs		Net Profits
		Tradable inputs	Domestic factors	
Private prices	675.00	1001.87	426.04	-752.91
Social prices	936.35	944.77	556.88	-565.30
Divergences	-261.35	57.10	-130.84	-187.61

DRC = -66.14 NPCO = 0.72 NPCI = 1.06 EPC =38.82 PC = 1.33 SRP = -0.20

SCB = 1.46

Appendix A.15 Enterprise budget (R/ha) for wheat production in Urionskraal area (dryland wheat, wheat fallow system)

	Private prices	Economic prices	Components of economic prices	
			Non-tradable	Tradable
GROSS REVENUE	**900.00**	**1248.47**		**1444.57**
Grain	900*1.0 t = 920.00	1248.47*1.0 t = 1248.47		
Directly Allocated Variable Costs	**389.67**	**373.27**	**50.63**	**322.64**
Pre harvest				
Planting material	48.40	48.40	4.84	43.56
Fertilisers	124.05	124.05	12.40	111.65
Chemicals	163.97	147.57	14.75	132.81
Harvest costs				
Contract work (transport)	53.25	53.25	18.64	34.62
In Directly Allocable Variable Costs	**207.81**	**179.71**	**29.39**	**150.32**
Pre harvest costs				
Energy/Fuel	80.24	56.17	5.62	50.56
Repairs and Maintenance	100.15	100.15	20.03	80.12
Harvest costs				
Energy/Fuel	13.42	9.39	0.94	8.45
Repairs and Maintenance	14.00	14.00	2.80	11.20
Fixed Costs	**368.82**	**536.51**	**11.71**	**0.62**
Interest on working capital (14.500 %)	42.74	42.74		
Labour Costs	25.72	25.72		
Licensing and Insurance: Machinery and Implements	12.33	12.33	11.71	0.62
Depreciation costs: Machinery and Implements	150.16	150.16		
Interest on machinery and implements (11.750 %)	137.87	137.87		
Land rental	220.36	220.36		

Budget summary: Wheat production (dryland) in the Urionskraal area (wheat fallow system), 1999/00 (R/ha)

	Private prices	**Economic prices**
Gross Revenue	**900.00**	**1248.47**
Tradeables:	**897.84**	**853.34**
Purchased inputs	336.42	320.02
Machinery and implements costs	508.17	480.07
Contract/ higher services	53.25	53.25
Domestic factors	**288.82**	**380.55**
Cost on working capital	42.74	42.74
Labour costs	25.72	25.72
Cost of land	220.36	220.36
Components of tradables		91.73

Policy analysis matrix for dryland wheat production in the Urionskraal area (wheat fallow system, 1999/00 (Rands)

	Revenues	Costs		Net Profits
		Tradable inputs	Domestic factors	
Private prices	900.00	897.84	288.82	-286.66
Social prices	1248.47	853.34	380.55	14.58
Divergences	-348.47	44.50	-91.73	-301.24

DRC = 0.96 NPCO = 0.62 NPCI = 1.05 EPC = 0.01 PC = -19.66 SRP = -0.24

SCB = 0.91

Appendix B The comparative advantage of wheat using the export parity price

Although a net importer of wheat, a significant quantity of wheat in South Africa is exported in only three out of ten years, especially in the surplus producing areas such as the Western Cape province. In those years, the domestic price of wheat will change from import parity to export parity (Troskie 2000:12). As a strong indicator of comparative advantage, it is therefore necessary to calculate the domestic resource cost ratios from all farming areas selected for this study using the export parity prices to ascertain whether the country will gain if wheat is produced as an import substitute. In the calculation of the export parity price, Cape Town harbour is used.

Appendix B1 Calculation of export parity prices for conventional wheat

CIF Gulf Value ($/t)	Exchange rate (R/$)	USA HRWW (fob) Gulf R/t	SA fob price (90% of fob price) (R/t)	Financing (prime rate 14%) (R/t) (-)	Transport costs (R/t) (-)	Loading costs (R/t) (-)	Storage costs (-)	FOB (R/t)
145.00	7.44	1 078.80	970.92	102.38	32.00	75.37	65.00	696.17

Source: 1) SAGIS 2001

2) Troskie 2001

Appendix B2 Indicators of PAMs using the export parity price

Farming Area	Revenues	Costs		Social Profits	DRC
		Tradable inputs	Domestic factors		
Swartland	1531.57	2757.91	1277.51	-2503.85	-1.04
Swartland	1810.04	1332.89	912.77	-435.62	1.91
Middle Swartland	1740.43	1363.67	952.15	-575.39	2.52
Middle Swartland	1740.43	2363.29	1173.48	-1796.34	-1.88
Middle Swartland	2088.51	1386.60	949.49	-247.58	1.35
Middle Swartland	2088.51	1362.15	934.73	-208.37	1.29
Ruens	1740.43	2496.13	1062.52	-818.22	-1.41
Witsand/Hedelberg	1740.43	2278.92	1036.54	-1575.03	-1.92
Malgas/Heidelberg	1740.43	2865.34	1192.51	-1124.91	-1.06
Malgas/Heidelberg	1392.34	3121.85	1356.58	-3086.09	-0.78
Touw/Ladismith	835.40	1468.07	582.82	-1215.49	-0.92
Uniondale	696.17	695.28	528.20	-527.31	593.48
Bo-Langkloof	1044.26	2751.01	818.93	-2525.68	-0.48
Montagu Mountain	522.13	944.77	556.88	-2525.65	-1.32
Urionskraal	696.17	853.34	380.55	-537.72	-2.42

The DRCs in the table above indicate no comparative advantage for conventional wheat in the Western Cape. In other words, this means that it will cost the country to produce wheat as an export.

C Dryland organic wheat budgets

Appendix C1

NET MARGIN					Page 1
ORGANIC WHEAT	AGRONOMY		Organic produce		
Country South Africa			Land Type NVT		
Province Free State			Farming Area Ficksburg		
Status T			Farming Unit		
Usage S					
Dryland winter wheat after cow peas					

	Unit	Price Per Unit	Qty	Per Ha	Value Per Yield Unit
Gross Income					
Product Income (Crops)					
Grain					
Organic wheat	Ton	1500	2.50	3750	1500
Marketing costs				**0.00**	**0.00**
Gross Income minus Marketing Costs				**3750.00**	**3750.00**
Allocatable Variable Costs				**1574.75**	**629.90**
Directly Allocatable Variable Costs				**1083.80**	**433.52**
PRE HARVEST COSTS				**1083.80**	**433.52**
Plant material					
Limpopo	Kilogram	5.00	30.00	150.00	60.00
Fertiliser					
Atlas	Ton	340.66	1.82	620.00	248.00
Pest control					
Parasitic wasps	Herd	30.00	1.00	30.00	12.00
Fungicide control					
EM	Litre	23.00	0.60	13.80	5.52
General					
Wheat insurance	Hectare	270.00	1.00	270.00	108.00
HARVEST COSTS				**0.00**	**0.00**
MARGIN ABOVE DIRECTLY ALLOCATABLE VARIABLE COSTS				**2666.20**	**1066.48**
In Directly Allocatable Variable Costs				**490.95**	**196.38**
PRE HARVEST COSTS				**360.10**	**144.04**
Energy				143.96	57.59
Repairs and Maintenance				216.14	86.45
HARVEST COSTS				**130.85**	**52.34**
Energy				71.93	28.77
Repairs and Maintenance				58.62	23.45

		NET MARGIN			Page 2
ORGANIC WHEAT		AGRONOMY		Organic produce	
	Country South Africa			**Land Type** NVT	
	Province **Free State**			**Farming Area** Ficksburg	
	Status T			**Farming Unit**	
	Usage S				
Dryland winter wheat after cow peas					

	Unit	Price Per Unit	Qty	Per Ha	Value Per Yield Unit
Tyres				0.31	0.12
TOTAL PRE HARVEST COSTS				**1443.90**	**577.56**
TOTAL HARVEST COSTS				**130.85**	**52.34**
GROSS MARGIN ABOVE TOTAL ALLOCATABLE VARIABLE COSTS				**2175.25**	**870.10**
Interest on Working Capital (14.5 %)				**100.95**	**40.38**
Regular Labour Costs				**79.05**	**31.62**
Licensing and Insurance: Machinery and Implements				**125.13**	**50.05**
Depreciation Costs: Machinery and Implements				**374.00**	**149.60**
Interest: Machinery and Implements (11.750)				**277.02**	**110.81**
Overhead/Other				**53.33**	**21.33**
Certification Costs	Hectare	48.00	1.00	5.33	2.13
Inspection costs	Hectare	5.33	1.00	48.00	19.20
MARGIN ABOVE SPECIFIED COSTS				**1167.77**	**466.31**

Appendix C2 Enterprise budget (R/ha) for organic wheat production in area in the Swartland area (wheat after medics in sandy soils)

	Private prices	Economic prices	Components of economic prices	
			Non-tradable	Tradable
GROSS REVENUE	**3000**	**3537.68**		
Grain	1500*2 = 3000	1768.84*2 = 3537.68		
Directly Allocated Variable Costs	**1515.58**	**1515.58**	**385.68**	**963.62**
Pre harvest				
Planting material	284.90	284.90	28.49	256.41
Green manure	166.28	166.28		
Fertilisers	709.40	709.40	70.94	638.46
Wheat insurance	270.00	270.00	256.50	13.50
Soil Analysis	85.00	85.00	29.75	55.25
In Directly Allocable Variable Costs	**248.59**	**223.62**	**38.91**	**184.71**
Pre harvest costs				
Energy/Fuel	57.56	40.29	4.03	36.26
Repairs and Maintenance	123.49	123.49	24.70	98.79
Harvest costs				
Energy/Fuel	25.66	17.96	1.80	16.16
Repairs and Maintenance	41.88	41.88	8.38	33.50
Fixed Costs	**1343.36**	**1343.36**	**70.26**	**53.31**
Interest on working capital (14.500 %)	131.31	131.31		
Labour Costs	28.63	28.63		
Licensing and Insurance: Machinery and Implements	45.02	45.02	42.77	2.25
Depreciation costs: Machinery and Implements	233.90	233.90		
Interest on machinery and implements (11.750 %)	176.22	176.22		
Land rental	649.73	649.73		
Producer License and inspection	78.55	78.55	27.49	51.06

Budget summary: Organic wheat production (dryland) in the in the Swartland region, 1999/00 (R/h)

	Private prices	Economic prices
Gross Revenue	**3000**	**3537.68**
Tradeables:	**2131.58**	**2106.61**
Purchased inputs	994.30	994.30
Machinery and implements costs	703.73	678.76
Wheat insurance	270.00	270.00
Soil analysis	85.00	85.00
Producer license and inspection	78.55	78.55
Domestic factors	**975.95**	**1470.80**
Cost on working capital	131.31	131.31
Labour costs	28.63	28.63
Cost of land	649.73	649.73
Cost of green manure	166.28	166.28
Components of tradables		494.85

Policy analysis matrix for dryland organic wheat in the Swartland, 1999/00 (Rands)

	Revenues	Costs		Net Profits
		Tradable inputs	Domestic factors	
Private prices	3000	2131.58	975.95	-107.53
Social prices	3537.68	2106.61	1470.80	-39.73
Divergences	-537.68	24.97	-494.85	-67.80

DRC =1.03 NPCO = 0.85 NPCI = 1.01 EPC = 0.60 PC = 2.70 SRP = -0.02

SCB = 0.87

Appendix C3 Enterprise budget (R/ha) for organic wheat production in the Swartland (wheat after lupin, sandy soils, 300mm row spacing)

	Private prices	Economic prices	Components of economic prices	
			Non-tradable	Tradable
GROSS REVENUE	**3000**	**3537.68**		
Grain	1500*2 = 3000	1768.84*2 = 3537.68		
Directly Allocated Variable Costs	**1378.68**	**1378.68**	**371.99**	**840.41**
Pre harvest				
Planting material	148.00	148.00	14.80	133.20
Fertilisers	709.40	709.40	70.94	638.46
Green manure	166.28	166.28		
Wheat Insurance	270.00	270.00	256.50	13.50
Soil Analysis	85.00	85.00	29.75	55.25
In Directly Allocable Variable Costs	**241.49**	**216.52**	**37.50**	**179.03**
Pre harvest costs				
Energy/Fuel	57.56	40.29	4.03	36.26
Repairs and Maintenance	116.39	116.39	23.29	93.11
Harvest costs				
Energy/Fuel	25.66	17.96	1.80	16.16
Repairs and Maintenance	41.88	41.88	8.38	33.50
Fixed Costs	**1324.48**	**1324.48**	**69.05**	**53.25**
Interest on working capital (14.500 %)	120.11	120.11		
Labour Costs	28.63	28.63		
Licensing and Insurance: Machinery and Implements	43.75	43.75	41.56	2.19
Depreciation costs: Machinery and Implements	230.52	230.52		
Interest on machinery and implements (11.750 %)	173.19	173.19		
Land rental	649.73	649.73		
Producer license and inspection	78.55	78.55	27.49	51.06

Budget summary: Organic wheat production (dryland) in the in the Swartland area 1999/00 (R/ha)

	Private prices	**Economic prices**
Gross Revenue	**3000**	**3537.68**
Tradeables:	**1979.90**	**1954.93**
Purchased inputs	857.40	857.40
Machinery and implements costs	688.95	663.98
Wheat insurance	270.00	270.00
Soil analysis	85.00	85.00
Inspection costs	78.55	78.55
Domestic factors	**964.75**	**1443.29**
Cost on working capital	120.11	120.11
Labour costs	28.63	28.63
Cost of land	649.73	649.73
Green manure	166.28	166.28
Components of tradables		478.54

Policy analysis matrix for dryland organic wheat production in the Swartland, 1999/00 (Rands)

	Revenues	Costs		Net Profits
		Tradable inputs	Domestic factors	
Private prices	3000	1979.90	964.75	55.35
Social prices	3537.68	1954.93	1443.29	139.46
Divergences	-537.68	24.97	-478.54	-84.11

DRC =0.91 NPCO = 0.85 NPCI = 1.01 EPC = 0.64 PC = 0.40 SRP = -0.02

SCB =0.83

Appendix C4 Enterprise budget (R/ha) for organic wheat production in Swartland (wheat after medics in the clay-loam soils)

	Private prices	Economic prices	Components of economic prices	
			Non-tradable	Tradable
GROSS REVENUE	**3000**	**3537.68**		
Grain	1500*2 = 3000	1768.84*2 = 3537.68		
Directly Allocated Variable Costs	**1260.84**	**1260.84**	**360.21**	**734.35**
Pre harvest				
Planting material	284.90	284.90	28.49	256.41
Fertilisers	330.40	330.40	33.04	297.36
Green manure	166.28	166.28		
Weed control (propane gas)	124.26	124.26	12.43	111.83
Wheat insurance	270.00	270.00	256.50	13.50
Soil analysis	85.00	85.00	29.75	55.25
In Directly Allocable Variable Costs	**242.35**	**221.18**	**39.30**	**181.88**
Pre harvest costs				
Energy/Fuel	44.91	31.44	3.14	28.30
Repairs and Maintenance	129.90	129.90	25.98	103.92
Harvest costs				
Energy/Fuel	25.66	17.96	1.80	16.16
Repairs and Maintenance	41.88	41.88	8.38	33.50
Fixed Costs	**1372.18**	**1372.18**	**66.35**	**53.11**
Interest on working capital (14.500 %)	110.51	110.51		
Labour Costs	23.55	23.55		
Licensing and Insurance: Machinery and Implements	40.90	40.90	38.86	2.05
Depreciation costs: Machinery and Implements	269.32	269.32		
Interest on machinery and implements (11.750 %)	199.62	199.62		
Land rental	649.73	649.73		
Producer license and inspection	78.55	78.55	27.49	51.06

Budget summary: Organic wheat production (dryland) in the Swartland region, 1999/00 (R/ha)

	Private prices	**Economic prices**
Gross Revenue	**3000**	**3537.68**
Tradeables:	**1925.30**	**1904.13**
Purchased inputs	739.56	739.56
Machinery and implements costs	752.19	731.02
Wheat insurance	270.00	270.00
Soil analysis	85.00	85.00
Inspection costs	78.55	78.55
Domestic factors	**949.87**	**1415.73**
Cost on working capital	110.51	110.51
Labour costs	23.35	23.35
Cost of land	649.73	649.73
Green manure	166.28	166.28
Components of tradables		465.86

Policy analysis matrix for dryland organic wheat production in the Swartland region, 1999/00 (Rands)

	Revenues	Costs		Net Profits
		Tradable inputs	Domestic factors	
Private prices	3000	1925.30	949.87	124.83
Social prices	3537.68	1904.13	1415.73	217.82
Divergences	-537.68	21.17	-465.86	-92.99

DRC =0.87 NPCO = 0.85 NPCI = 1.01 EPC = 0.66 PC = 0.57 SRP = -0.02

SCB = 0.81

Appendix C5 Enterprise budget (R/ha) for organic wheat production in the South Coast (wheat after medics in clay-loam soils)

	Private prices	Economic prices	Components of economic prices	
			Non-tradable	Tradable
GROSS REVENUE	**3000**	**3537.68**		
Grain	1500*2 = 3000	1768.84*2 = 3537.68		
Directly Allocated Variable Costs	**1237.33**	**1237.33**	**371.27**	**743.89**
Pre harvest				
Planting material	269.50	269.50	26.95	242.55
Fertilisers	330.40	330.40	33.04	297.36
Green manure	122.17	122.17		
Weed control (propane gas)	124.26	124.26	12.43	111.83
Wheat insurance	270.00	270.00	256.50	13.50
Soil analysis	85.00	85.00	29.75	55.25
Harvest costs				
Contract work (transport)	36.00	36.00	12.60	23.40
In Directly Allocable Variable Costs	**411.74**	**374.13**	**66.06**	**308.07**
Pre harvest costs				
Energy/Fuel	60.56	42.39	4.24	38.15
Repairs and Maintenance	160.18	160.18	32.04	128.14
Harvest costs				
Energy/Fuel	64.80	45.36	4.54	40.82
Repairs and Maintenance	126.20	126.20	25.24	100.96
Fixed Costs	**1786.85**	**1786.85**	**128.17**	**56.36**
Interest on working capit (14.500 %)	108.51	108.51		
Labour Costs	29.64	29.64		
Licensing and Insurance: Machinery and Implements	105.98	105.98	100.68	5.30
Depreciation costs: Machinery and Implements	536.81	536.81		
Interest on machinery and implements (11.750 %)	392.77	392.77		
Land rental	534.59	534.59		
Producer license and inspection	78.55	78.55	27.49	51.06

Budget summary: Organic wheat production (dryland) in the in the South Coast, 1999/00 (R/ha)

	Private prices	**Economic prices**
Gross Revenue	**3000**	**3537.68**
Allocated costs		
Tradeables:	**2643.01**	**2605.40**
Purchased inputs	726.16	726.16
Machinery and implements costs	1447.30	1409.69
Contract/ higher services	36.00	36.00
Soil analysis	85.00	85.00
Wheat insurance	270.00	270.00
Producer license and inspection	78.55	78.55
Domestic factors	**804.68**	**1370.18**
Cost on working capital	108.51	108.51
Labour costs	29.64	29.64
Cost of land	534.59	534.59
Green manure	131.94	131.94
Components of tradables		565.50

Policy analysis matrix for dryland organic wheat production in the South Coast, 1999/00 (Rands)

	Revenues	Costs		Net Profits
		Tradable inputs	Domestic factors	
Private prices	3000	2643.01	794.91	-437.92
Social prices	3537.68	2605.40	1360.41	-428.13
Divergences	-537.68	37.61	-565.50	-9.79

DRC = 1.46 NPCO = 0.85 NPCI = 1.01 EPC =0.38 PC = 1.02 SRP = -0.00

SCB = 0.96

Appendix C6 **Enterprise budget (R/ha) for organic wheat production in the South Coast (wheat after lupins in clay-loam soils)**

	Private prices	Economic prices	Components of economic prices	
			Non-tradable	Tradable
GROSS REVENUE	**3000**	**3537.68**		
Grain	1500*2 = 3000	1768.84*2 = 3537.68		
Directly Allocated Variable Costs	**1317.33**	**1317.33**	**379.27**	**815.89**
Pre harvest				
Planting material	269.50	269.50	26.95	242.55
Fertilisers	410.40	410.40	41.04	369.36
Green manure	122.17	122.17		
Weed control (propane gas)	124.26	124.26	12.43	111.83
Wheat insurance	270.00	270.00	256.50	13.50
Soil analysis	85.00	85.00	29.75	55.25
Harvest costs				
Contract work (transport)	36.00	36.00	12.60	23.40
In Directly Allocable Variable Costs	**460.54**	**417.15**	**73.31**	**343.84**
Pre harvest costs				
Energy/Fuel	88.59	62.01	6.20	55.81
Repairs and Maintenance	203.69	203.69	40.74	162.95
Harvest costs				
Energy/Fuel	56.03.	39.22	3.92	35.30
Repairs and Maintenance	112.23	112.23	22.45	89.78
Fixed Costs	**1808.87**	**1808.87**	**124.23**	**56.16**
Interest on working capit (14.500 %)	115.72	115.72		
Labour Costs	37.91	37.91		
Licensing and Insurance: Machinery and Implements	102.04	102.04	96.94	5.10
Depreciation costs: Machinery and Implements	541.78	541.78		
Interest on machinery and implements (11.750 %)	398.28	398.28		
Land rental	534.59	649.73		
Producer license and inspection	78.55	78.55	27.49	51.06

Budget summary: Organic wheat production (dryland) in the South Coast 1999/00 (R/ha)

	Private prices	**Economic prices**
Gross Revenue	**3000**	**3537.68**
Tradeables:	**2776.35**	**2732.96**
Purchased inputs	804.16	804.16
Machinery and implements costs	1502.64	1459.25
Wheat insurance	270.00	270.00
Soil analysis	85.00	85.00
Inspection costs	78.55	78.55
Contract work	36.00	36.00
Domestic factors	**925.53**	**1502.34**
Cost on working capital	115.72	115.72
Labour costs	37.91	37.91
Cost of land	649.73	649.73
Green manure	122.17	122.17
Components of tradables		576.81

Policy analysis matrix for dryland organic wheat production in the South Coast 1999/00 (Rands)

	Revenues	Costs		Net Profits
		Tradable inputs	Domestic factors	
Private prices	3000	2776.35	925.53	-701.88
Social prices	3537.68	2732.96	1502.34	-697.62
Divergences	-537.68	43.39	-576.81	-4.26

DRC = 1.87 NPCO = 0.85 NPCI = 1.01 EPC = 0.28 PC = 1.01 SRP = -0.00

SCB = 1.03

Appendix C7 Enterprise budget (R/ha) for organic wheat production in Little Karoo (wheat after medics in clay-loam soils)

	Private prices	Economic prices	Components of economic prices	
			Non-tradable	Tradable
GROSS REVENUE	**3000**	**3537.68**		
Grain	1500*2 = 3000	1768.84*2 = 3537.68		
Directly Allocated Variable Costs	**1242.98**	**1242.98**	**355.44**	**691.38**
Pre harvest				
Planting material	237.16	237.16	23.72	213.44
Fertilisers	330.40	330.40	33.04	297.36
Green manure	196.16	196.16		
Weed control (propane gas)	124.26	124.26	12.43	111.83
Wheat insurance	270.00	270.00	256.50	13.50
Soil analysis	85.00	85.00	29.75	55.25
In Directly Allocable Variable Costs	**189.54**	**168.64**	**28.86**	**139.79**
Pre harvest costs				
Energy/Fuel	47.03	32.92	3.30	29.63
Repairs and Maintenance	94.28	94.28	18.86	75.42
Harvest costs				
Energy/Fuel	22.62	15.83	1.58	14.25
Repairs and Maintenance	25.22	25.22	5.04	20.18
Tyres	0.39	0.39	0.08	0.31
Fixed Costs	**953.69**	**953.69**	**57.01**	**52.61**
Interest on working capit (14.500 %)	89.32	89.32		
Labour Costs	42.03	42.03		
Licensing and Insurance: Machinery and Implements	31.07	31.07	29.52	1.55
Depreciation costs: Machinery and Implements	206.86	206.86		
Interest on machinery and implements (11.750 %)	153.94	153.94		
Land rental	351.92	351.92		
Producer license and inspection	78.55	78.55	27.49	51.06

Budget summary: Organic wheat production (dryland) in the Little Karoo, 1999/00 (R/ha)

	Private prices	**Economic prices**
Gross Revenue	**3000**	**3537.68**
Tradeables:	**1706.78**	**1685.88**
Purchased inputs	691.82	691.82
Machinery and implements costs	581.41	560.51
Wheat insurance	270.00	270.00
Soil analysis	85.00	85.00
Inspection costs	78.55	78.55
Domestic factors	**679.43**	**1120.74**
Cost on working capital	89.32	89.32
Labour costs	42.03	42.03
Cost of land	351.92	351.92
Green manure	196.16	196.16
Components of tradables		441.31

Policy analysis matrix for dryland organic wheat production in the Little Karoo, 1999/00 (Rands)

	Revenues	Costs		Net Profits
		Tradable inputs	Domestic factors	
Private prices	3000	1706.78	679.43	613.79
Social prices	3537.68	1685.88	1120.74	731.06
Divergences	-537.68	20.90	-441.31	-117.27

DRC =0.60 NPCO = 0.85 NPCI = 1.01 EPC = 0.70 PC = 0.84 SRP = -0.03

SCB = 0.67

Appendix C8 Enterprise budget (R/ha) for organic wheat production in area in Little Karoo (wheat after lupin in sandy soils)

	Private prices	Economic prices	Components of economic prices	
			Non-tradable	Tradable
GROSS REVENUE	**3000**	**3929.68**		
Grain	1500*2 = 3000	1768.84*2 = 3537.68		
Directly Allocated Variable Costs	**1649.46**	**1649.46**	**396.09**	**1057.22**
Pre harvest				
Planting material	284.90	284.90	28.50	256.41
Fertilisers	813.40	813.40	81.34	732.06
Green manure	196.16	196.16		
Wheat insurance	270.00	270.00	256.50	13.50
Soil analysis	85.00	85.00	29.75	55.25
In Directly Allocable Variable Costs	**473.45**	**421.27**	**72.09**	**349.18**
Pre harvest costs				
Energy/Fuel	113.66	79.56	7.96	71.60
Repairs and Maintenance	188.98	188.98	37.80	151.18
Harvest costs				
Energy/Fuel	60.26	42.18	4.22	37.96
Repairs and Maintenance	110.16	110.16	22.03	88.13
Tyres	0.39	0.39	0.08	0.31
Fixed Costs	**1639.00**	**1639.00**	**131.75**	**56.55**
Interest on working capit (14.500 %)	154.95	154.95		
Labour Costs	78.68	78.68		
Licensing and Insurance: Machinery and Implements	109.75	109.75	104.26	5.49
Depreciation costs: Machinery and Implements	495.25	495.25		
Interest on machinery and implements (11.750 %)	369.90	369.90		
Land rental	351.92	351.92		
Producer license and inspection	78.55	78.55	27.49	51.06

Budget summary: Organic wheat production (dryland) in the Little Karoo, 1999/00 (R/ha)

	Private prices	**Economic prices**
Gross Revenue	**3000**	**3537.68**
Tradeables:	**2980.20**	**2928.02**
Purchased inputs	1098.30	1098.30
Machinery and implements costs	1448.35	1396.17
Wheat insurance	270.00	270.00
Soil analysis	85.00	85.00
Inspection costs	78.55	78.55
Domestic factors	**781.71**	**1381.66**
Cost on working capital	154.95	154.95
Labour costs	78.68	78.68
Cost of land	351.92	351.92
Green manure	196.16	196.16
Components of tradables		599.95

Policy analysis matrix for dryland organic wheat production in the Little Karoo, 1999/00 (Rands)

	Revenues	Costs		Net Profits
		Tradable inputs	Domestic factors	
Private prices	3000	2980.20	781.71	-761.91
Social prices	3537.68	2928.02	1381.66	-772.00
Divergences	-537.68	52.18	-599.95	10.09

DRC =2.27 NPCO = 0.85 NPCI = 1.01 EPC = 0.03 PC = 0.99 SRP = 0.00

SCB = 1.04

Appendix C9 **Enterprise budget (R/ha) for organic wheat production in the North West (wheat after pasture in sandy soils)**

	Private prices	Economic prices	Components of economic prices	
			Non-tradable	Tradable
GROSS REVENUE	**3000**	**3537.68**		
Grain	1500*2 = 3000	1768.84*2 = 3537.68		
Directly Allocated Variable Costs	**1529.46**	**1529.46**	**384.08**	**949.22**
Pre harvest				
Planting material	284.90	284.90	28.49	256.41
Fertilisers	693.40	693.40	69.34	624.06
Green manure	196.16	196.16		
Wheat insurance	270.00	270.00	256.50	13.50
Soil analysis	85.00	85.00	29.75	55.25
In Directly Allocable Variable Costs	**288.53**	**263.51**	**46.89**	**216.62**
Pre harvest costs				
Energy/Fuel	68.94	48.26	4.83	43.43
Repairs and Maintenance	190.11	190.11	38.02	152.09
Harvest costs				
Energy/Fuel	14.16	9.82	0.98	8.84
Repairs and Maintenance	15.32	15.32	3.06	12.26
Fixed Costs	**939.23**	**939.23**	**54.49**	**52.48**
Interest on working capit (14.500 %)	112.34	112.34		
Labour Costs	35.91	35.91		
Licensing and Insurance: Machinery and Implements	28.43	28.43	27.00	1.42
Depreciation costs: Machinery and Implements	264.26	264.26		
Interest on machinery and implements (11.750 %)	199.38	199.38		
Land rental	220.36	220.36		
Producer license and inspection	78.55	78.55	27.49	51.06

Budget summary: Organic wheat production (dryland) in the North West 1999/00 (R/ha)

	Private prices	**Economic prices**
Gross Revenue	**3000**	**3537.68**
Tradeables:	**2192.45**	**2167.43**
Purchased inputs	978.30	978.30
Machinery and implements costs	780.60	755.58
Wheat insurance	270.00	270.00
Soil analysis	85.00	85.00
Inspection costs	78.55	78.55
Domestic factors	**564.77**	**1050.23**
Cost on working capital	112.34	112.34
Labour costs	35.91	35.91
Cost of land	220.36	220.36
Green manure	196.16	196.16
Components of tradables		485.46

Policy analysis matrix for dryland organic wheat production in the Little Karoo, 1999/00 (Rands)

	Revenues	Costs		Net Profits
		Tradable inputs	Domestic factors	
Private prices	3000	2192.45	564.77	242.78
Social prices	3537.68	2167.43	1050.23	320.02
Divergences	-537.68	25.02	-485.46	-77.24

DRC = 0.77 NPCO = 0.85 NPCI = 1.01 EPC = 0.59 PC = 0.76 SRP = -0.02
SCB = 0.77

Appendix D The comparative advantage of organic wheat using the export parity price

Appendix D1 Determination of an export parity price for organic wheat

CIF Gulf Value ($/t)	Exchange rate (R/$)	USA HRWW (fob) Gulf R/t	SA fob price (90% of fob price) (R/t)	Financing (prime rate 14%) (R/t) (-)	Transport costs (R/t) (-)	Loading costs (R/t) (-)	Storage costs (-)	FOB (R/t)
214.94	7.44	1 599.15	1 439.23	102.38	32.00	75.37	65.00	1164.47

Source: 1) Troskie, 2001

2) Moffett, 2001

Appendix D2 Indicators from the matrices using the export parity price

Farming Area	Revenues	Costs		Social Profits	DRC	SCB
		Tradable inputs	Domestic factors			
Swartland C2	2328.84	2106.61	1470.80	-1248.57	6.62	1.32
Swartland C3	2328.84	1954.93	1443.29	-1069.38	3.86	1.25
Swartland C4	2328.84	1904.13	1415.73	-991.02	3.33	1.23
South Coast C5	2328.84	2605.40	1360.41	-1636.97	-4.92	1.46
South Coast C6	2328.84	2732.96	1502.34	-1906.46	-3.72	1.57
Little Karoo C7	2328.84	1685.88	1120.74	-477.78	1.74	1.21
Little KarooC8	2328.84	2928.02	1381.66	-1980.84	-2.31	1.59
North West C9	2328.84	2167.43	1050.23	-888.41	6.49	1.17
Average	2328.84	2276.20	1343.15	-1274.93	1.39	1.35

The above results indicate that even if wheat would be produced under organic management practices it would not have the comparative advantage. Similar to conventional wheat, this means that organic wheat must be produced as an import substitute.

Appendix D3 Certification costs

The organic enterprise budgets are comprised of two sets of certification costs, that is, annual inspection and producer license costs. The producer license cost is compounded over a period of ten-years, because in organic production there is a long waiting period between costs and returns with the capital sunk today in the expectation of obtaining a higher income in five or ten years time. The reason for this undertaking is because the farmer needs to obtain the credit and also to be able to evaluate the true cost of obtaining this credit from different sources. Another reason is for the farmer to be able to determine the relative profitability of alternative investments characterised by streams of varying cash outlays and receipts over time. In the calculations the simple interest form is used with interest accruing only on the original sum (Chisholm AH and Dillon 1971 1).

$S_n = P\ (1+i)^n$

$= 7000\ (1+i)^{10}$

$= 7000\ (4.0456) = 28319.20 \div$ number of hectares (>400 ha)

Where P: is the present value

i: the relevant compound interest as a decimal

n: the number of years involved

S_n is the terminal value after n years of the sum P

Appendix E Green Manure Enterprise Budgets

Appendix E1 Enterprise budget for dryland medics in the Middle Swartland

GROSS MARGIN

Medic | Pasture and Forage | Maintenance

Country South Africa
Province Western Cape
Status P
Usage T

Land Type NVT
Farming Area Middle Swartland
Farming Unit

Less tillage practices
Moreesburg

	Unit	Price Per Unit	Qty	Per Ha	Value Per Yield Unit
Gross Income				0.00	0.00
Marketing costs				0.00	0.00
Gross Income minus Marketing Costs				0.00	0.00
Allocatable Variable Costs				151.30	0.00
Directly Allocatable Variable Costs				144.81	0.00
PRE HARVEST COSTS				144.81	0.00
Weed control					
Ekatin	Litre	94.73	0.38	35.52	0.00
Cysure	Litre	166.00	0.60	99.60	0.00
Pest control					
Rogor	Litre	19.38	0.50	9.69	0.00
HARVEST COSTS				0.00	0.00
MARGIN ABOVE DIRECTLY ALLOCATABLE VARIABLE COSTS				-144.81	0.00
In Directly Allocatable Variable Costs				7.35	0.00
PRE HARVEST COSTS				7.35	0.00
Energy				2.36	0.00
Repairs and Maintenance				4.99	0.00
HARVEST COSTS				0.00	0.00
TOTAL PRE HARVEST COSTS				152.16	0.00
TOTAL HARVEST COSTS				0.00	0.00
GROSS MARGIN ABOVE TOTAL ALLOCATABLE VARIABLE COSTS				-152.16	0.00
Interest on Working Capital				13.35	0.00
Regular Labour Costs				0.77	0.00
MARGIN ABOVE SPECIFIED COSTS				-166.28	0.00

Appendix E2 Enterprise budget for dryland medics in the South Coast

GROSS MARGIN

Medic	Pasture and Forage	Maintenance
Country South Africa		**Land Type** NVT
Province Western Cape		**Farming Area** South Coast
Status P		**Farming Unit**
Usage T		

Dryland medic maintenance
Less tillage practices
Heidelberg-Witsand region

	Unit	Price Per Unit	Qty	Per Ha	Value Per Yield Unit
Gross Income				0.00	0.00
Marketing costs				0.00	0.00
Gross Income minus Marketing Costs				0.00	0.00
Allocatable Variable Costs				107.65	0.00
Directly Allocatable Variable Costs				102.43	0.00
PRE HARVEST COSTS				102.43	0.00
Weed control					
Ekatin	Litre	49.76	0.50	24.88	0.00
Agill	Litre	166.00	0.60	71.05	0.00
Pest control					
Rogor	Litre	26.00	0.25	6.50	0.00
HARVEST COSTS				0.00	0.00
MARGIN ABOVE DIRECTLY ALLOCATABLE VARIABLE COSTS				-102.23	0.00
In Directly Allocatable Variable Costs				5.23	0.00
PRE HARVEST COSTS				5.23	0.00
Energy				2.14	0.00
Repairs and Maintenance				3.09	0.00
HARVEST COSTS				0.00	0.00
TOTAL PRE HARVEST COSTS				107.65	0.00
TOTAL HARVEST COSTS				0.00	0.00
GROSS MARGIN ABOVE TOTAL ALLOCATABLE VARIABLE COSTS				-107.67	0.00
Interest on Working Capital				13.74	0.00
Regular Labour Costs				0.77	0.00
MARGIN ABOVE SPECIFIED COSTS				-122.14	0.00

Appendix E3 Enterprise budget for dryland medics in the Little Karoo

GROSS MARGIN

Medic | Pasture and Forage | Maintenance

Country South Africa | **Land Type** 1

Province Western Cape | **Farming Area** Uniondale

Status P | **Farming Unit**

Usage T

Dryland medic maintenance

Less tillage practices

	Unit	Price Per Unit	Qty	Per Ha	Value Per Yield Unit
Gross Income				0.00	0.00
Marketing costs				0.00	0.00
Gross Income minus Marketing Costs				0.00	0.00
Allocatable Variable Costs				173.04	0.00
Directly Allocatable Variable Costs				131.19	0.00
PRE HARVEST COSTS				131.19	0.00
Weed control					
Fusilade sup	Litre	84.46	1.50	139.19	0.00
HARVEST COSTS				0.00	0.00
MARGIN ABOVE DIRECTLY				-131.19	0.00
ALLOCATABLE VARIABLE COSTS					0.00
					0.00
In Directly Allocatable Variable Costs				41.85	0.00
PRE HARVEST COSTS				41.85	0.00
Energy				19.61	0.00
Repairs and Maintenance				22.25	0.00
Tyres				0.00	0.00
HARVEST COSTS				0.00	0.00
TOTAL PRE HARVEST COSTS				173.04	0.00
TOTAL HARVEST COSTS				0.00	0.00
					0.00
GROSS MARGIN ABOVE TOTAL				-173.04	0.00
ALLOCATABLE VARIABLE COSTS					
					0.00
Interest on Working Capital				16.10	0.00
Regular Labour Costs				6.997	0.00
MARGIN ABOVE SPECIFIED COSTS				-196.13	0.00