

CHAPTER 1

SCOPE OF THE STUDY

'Thriving markets and human security go hand in hand; without one, we will not have the other'

- Kofi Annan, UN Secretary General

1.1 INTRODUCTION

Agriculture is a dynamic industry, constantly affected in various ways by changes in climate, technology, marketing and government policy. Consequently, little in agriculture remains the same for long. Therefore, most economic decisions are made under uncertainty because individual decision-makers are not aware of the complete set of alternative actions available to them or the possible outcomes associated with each action. This is especially true for the decisions faced by crop producers.

Until recently, South African markets for maize, wheat, sorghum and oilseeds were stringently controlled in single channel systems, with both producer and consumer prices set by government. Producers could only sell to government control boards, and consumers procured grains and oilseeds by simply placing an order with the relevant boards. There were no price risks and there was no need for traders.

The Agricultural Products Marketing Act No 47 of 1996 caused a revolution in the marketing of South African grain. The abrupt transition to a totally **deregulated** environment obviously necessitated vast adjustments. Because the marketing boards had handled marketing in the past, producers and consumers had gained little experience in the 'art' of grain marketing. After the reform, producers and consumers had to realize that prices can and do fluctuate from day to day, and

had to learn to cope with such risks. Consumers had to adjust to the fact that their opposition could now buy grain more cheaply than they did. A first generation of domestic agricultural traders had to emerge, and a proper trading infrastructure had to be created. Alternative structures to aid producers in the marketing of their crop had to be developed to perform market functions previously performed by the boards. The structures created include forward marketing, futures contracts and options on futures contracts. With these new structures, producers can market their crops during three different time intervals:

- pre-harvest;
- during the harvest; and
- after the harvest.

Producers have always been exposed to some risk of loss because future crop yield is uncertain and prices cannot be predicted with certainty. After the abolition of various control boards, price risk in the agricultural sector increased. Producers now have to establish their own prices and with that, price risk increases, which could have a negative effect on farm returns. Since expected yield times the expected price(s) generates an estimate of future gross revenues, investment risk is also linked to yield and price risks. With the aid of risk management instruments listed above, producers have to manage investment risk optimally to ensure farming in the future.

An ideal risk management instrument would cost little, reduce the chances of low net returns, and not sacrifice upside price potential. However, tradeoffs have to be made between these characteristics. Some instruments cost very little, but offer little downside protection, or they limit upside gains. Alternatively, they may cost a lot. A question faced by producers is how producers can determine which instrument is best suited for their individual farm operation.

Against this background, the question posed in this study is not how producers market their crop. The real question is whether a marketing decision support

system can be developed to manage investment risk faced by grain producers who have to market their crop.

1.2 JUSTIFICATION OF THIS STUDY

In agriculture, risk is unavoidable. Stochastic environmental factors strongly influence agricultural production processes, thereby creating uncertain financial outcomes. One group of environmental factors, namely climatological factors and biological factors (for example, infectious diseases), cause variability in the physical production process. The second source of uncertainty is market price variability, composed of variability in the prices of inputs and product prices. The factors which cause the uncertainty are fairly unpredictable and cannot be controlled by producers. Thus, producers have to try to anticipate and respond to these risky circumstances.

Successful marketing is one of the most important aspects of a modern crop farm business. Consequently, it has become important for producers to change their view on marketing. Gone are the days when a producer could simply deliver a product to the co-operative (which acted as an agent for a marketing board) without showing any further interest in the sale of the product. Farm planning starts at the market, while marketing planning and marketing management should form an integral part of overall farm management.

South African maize production can fluctuate considerably, mostly due to low and variable rainfall. The coefficient of variation in production levels during the past ten years is 32%, compared to 19% in the USA's production of maize. Moreover, compared to other maize producing countries, the South African maize crop in some years is in surplus of domestic consumption, while in other years it is in deficit, which increases the scope for domestic price fluctuations over and above the fluctuating world market prices tremendously.

This variability has vexed South African governments since early this century. Various schemes failed, and the single channel marketing system was eventually instituted in 1944/45 when wartime transportation problems and extortionate local hoarding compounded the problem. The single channel marketing system was maintained until April 1995, although statutory retail and wholesale price regulations on maize products were abolished in the 1960's and 1970's respectively. In 1987 the system of fixed prices to producers had already been replaced by a pooled system of initial and supplementary payments in order to limit the Maize Board's losses due to the narrow margins set by government.

The single channel marketing system, which had induced the establishment of large, centralized processing plants, was increasingly attacked. Initially, the criticism came from academics, because the system conflicted with the theory of profit margins. Then large consumers (processors), who wrongfully ascribed their decreasing markets to the system instead of the escalation in transport costs, joined the attack. Eventually the criticism became widespread as the government's setting of the board's domestic selling price became increasingly politicized. In 1994, the government announced that the single channel system would be abolished and invited all sectors of the maize industry to get together to devise a system which would allow the market to determine prices, whilst still giving producers some protection against abnormally low prices. A further condition was that the system had to be self-funding, which meant that a government-funded type of strategic reserve programme was not an option.

After long negotiations, a floor price system was devised in which the Maize Board set a levy on domestic consumption in order to subsidize exports, so that domestic prices to producers could be supported at pre-set minimum levels. Producers could either sell to domestic consumers or deliver to export pools, and the consumers were responsible for raising the levies. The system was instituted on 1 May 1995 for the 1995/96 marketing year. For the 1996/97

marketing year, the system was altered in some ways, but in October 1996 the Minister of Agriculture finally announced that the system would be terminated on 30 April 1997 and that all government interventions would be abolished from 1 May 1997 onwards. Producers are now faced with the responsibility of marketing their own crops. The Wheat Board and Oilseed Board were also abolished and the marketing responsibility now lies with the producer.

1.3 LITERATURE REVIEW

In agriculture, it is especially ideas and practices derived from decision analysis and the expected utility model that are used to analyse producers' decisions under risk. Overviews are given of the application of decision analysis in agriculture as presented by experts in the field of risky decision-making in agriculture, both at the theoretical and empirical level. Research topics that have been reviewed are listed below.

Operations research models are used to analyse, supply and demand structures (Hanf & Mueller, 1979; Hazell, 1992). To determine optimum farm cropping plans (Hazell, 1978; Mapp *et al.*, 1979; El-Nazer & McCarl, 1986) or to derive them theoretically (Collender & Silberman, 1985; Collins & Barry, 1986). Also, optimum hedging ratios are either derived theoretically (Bond & Thompson, 1985; Nelson, 1985) or are obtained by simulation (Baily & Richardson, 1985; Brandt, 1985; Lambert, 1984).

Some empirical studies examining the attitudes of farmers towards income risk are those of Randall (1986), Francisco and Anderson (1972), Dillon and Scandizzo (1978) and Binswanger (1980). The studies of Lovemore (1986), Lin, Dean and Moore (1974), Brink and McCarl (1978) and Scott and Baker (1972) focused on the choice of farm cropping plans as a decision under risk.

Decisions concerning the optimum level of pesticides are analysed in studies such as those of Charlson (1970), Webster (1977) and Thornton (1985). The use of fertilizer is examined in Moscardi and De Janvry (1977) and the amount of future reserve by Officer and Halter (1968). The adoption and utilisation of modern seed technology in the Phillipines is studied by Huijsman (1986), who analyses the hypothesis that the slow adoption of new technologies by poor farmers is caused by farmers' risk aversion. Specific attention is paid to risky decision-making by small subsistence farmers in underdeveloped countries by Roumasset, Boussard and Singh (1979) and Young, Landon and Mahama (1984).

Previous research conducted in South Africa on the topic of marketing decision support systems is very limited. Lombard (1993) did research based on a stochastic decision-making model for the evaluation of agricultural property transactions. De Waal (1991) conducted research on agricultural project management and Fraser (1991) investigated marketing systems in agriculture in the Ciskei region. The only research on decision support systems was done by Bestbier (1990), who developed a decision-making support system for the production and distribution scheduling of KVV distilleries. Moolman (1989) developed a computer-assisted management planning and decision support system, while Breen (1996) did research on the management of South African Estuaries. Lambrechts (1994) looked at the conceptualization and implementation of a marketing information and decision support system. Research based on risk management was done by Meiring (1994). He looked at the development and application of a decision-making support system for the economic evaluation of risk management at farm level. In addition, his study implemented a system to evaluate alternative risk management strategies for irrigation farmers in the region around the PK le Roux Dam.

Two aspects are striking in this literature. Firstly, literature on decision-making for producers, where risk is incorporated in the decision-making process, is

predominantly devoted either to total farm planning, especially crop production planning, or to specific production decisions such as fertilizer input decisions and pest management. Surprisingly little literature exists on producers' market-related decisions under risk. When marketing decisions were studied, so far, the studies were primarily concerned with the futures market. One such study is that of Allen, Heifner and Douglas (1985), who studied the impact of the futures market on marketing risk management. It is not very surprising that attention is directed to the futures market when producers' marketing behaviour is studied, since the futures market was developed as an aid to reducing price risks.

The second observation is the fact that no research has been conducted on the South African agricultural marketing environment since the dismantling of the various control boards. The only study, done during 1991, that focused on marketing systems in South Africa was done on the Ciskei region before the dismantling of the control Boards.

1.4 RESEARCH OBJECTIVES

Various marketing techniques have come into being since deregulation. They include grain pools, forward contracts, futures contracts, options on futures contracts, and cash markets. Producers must decide which marketing instruments to use. This decision is, of course, influenced by:

- the producer's marketing skills;
- the producer's risk profile;
- the producer's knowledge of the market;
- supply and demand; and
- the prices that can be realised by using the various marketing instruments.

Producers can now market their grain over a period of approximately twelve months. This means that producers retain ownership of their products over a

longer term than in the past. This entails additional costs for producers, but it also gives them an opportunity to ensure that they get the best possible price in the free market. The implications of the longer term for grain marketing include the risk that outstanding production credit may not necessarily be redeemed after the harvest as it was in the past. This affects the cash flow position of the producer and eventually influences the producer's capital investment abilities. Investment risk management is therefore now more important than ever before.

Strategies for coping with risk have been developed in a number of areas of agricultural decision-making. The development of these strategies in decision theory has opened the door to a more sophisticated treatment of producer decision behaviour under risk and uncertainty. Because of the complicated nature of uncertainty, researchers have chosen to implement only one or two risk strategies in their models at a time. However, at a time when producers are vulnerable to such serious risks as production, price and cost uncertainties, it is imperative to explore further methods of reducing such insecurity. Thus, the time is ripe for a closer examination of risk management instruments available in the marketing of crops. Producers now need to manage both production and price uncertainty.

The objectives of this study are:

- to develop a decision support system that producers can apply to assist them in minimize investment risk;
- to test whether this decision support system is applicable to the management of white maize, yellow maize, sunflower seed, soybeans and wheat; and
- to test whether any size farmer (from big producers to small producers) can apply this decision support system.

In the agricultural sector, risk management in the future will consist of an unlimited array of domestic and off-shore exchange contracts, on- and off-exchange traded derivatives and unconventional risk management instruments.

This study aims to serve South African agriculture by providing greater customisation and matching customer needs with the appropriate instruments. When uncontrollable risks are managed, businesses can focus on areas that provide the greatest return not only to business, but also to society.

1.5 LIMITATIONS OF THE STUDY

The research objectives presented in Section 1.4 must be interpreted within the following limitations of this investigation:

- The principal limitation of this investigation is the lack of available historical data. The South African Futures Exchange agricultural division only started trading in 1996. During the initial period, producers used the market as a guaranteed forward market and not as a price risk management instrument. The model should be tested in times of over- and under-supply.
- Only a few producers used in the investigation were actively using the futures market as a price risk management instrument. Therefore, the better results obtained by the model may be unjustifiable compared to the results obtained by the producers.
- In an investigation of this nature, is it impossible to compare one model (such as the one developed here) with a supposedly superior model. The primary reason for that is there is no such model for South African producers as yet.
- The tax implications of regular trading for any of these marketing instruments were not considered. The tax implications are, however, relevant when the trading rules are compared with a storage or a storage hedge strategy. Since this aspect was not taken into account, it must be considered to be one of the limitations of this investigation.
- Using the model on a crop like soybeans, which are not traded on SAFEX, does not prove that the decision support system provides better results than the individual soybean producer does. The main reason for this is the fact

that South Africa is a net importer of soybeans and that the South African price follows the international price. The prices obtained by producers in South Africa are normally close to the import parity price of soybeans. The pricing alternatives available to soybean producers are limited.

1.6 OUTLINE OF THIS STUDY

In order to accomplish the overall aim as described in Section 1.4, the following approach, which also serves as an outline of the study, is adopted:

- Chapter 2 provides a critical overview of grain production in South Africa. It establishes what the principal crops are and looks at the history of marketing in South Africa. This chapter therefore serves as a theoretical justification for the crops chosen for the application of the decision support system.
- Chapter 3 discusses risk management in agriculture with particular reference to risk management practices in South Africa. The chapter also analyses risk management instruments available to producers to manage investment risk.
- Chapter 4 investigates the history and development of futures markets and futures contracts.
- Chapter 5 discusses the development and application of options on futures contracts as a viable risk management instrument.
- Chapter 6 provides the theoretical description and development of a proposed decision support system to aid producers in managing their production risk. It also describes and empirically justifies the methodologies employed in determining the selection of farms to be simulated in the proposed model.

- Chapter 7 discusses the results of this investigation.
- Chapter 8 presents a summary of the study and identifies areas of further research.

1.7 CONCLUSION

Although the real contribution of agricultural crops to the gross domestic product (GDP) has declined since 1990, grain production remains of strategic importance to South Africa. The strategic importance of the South African grain industry lies in its forward and backward integration with the rest of the economy, the establishment and maintenance of food security, the creation of wealth in rural areas and its contribution to a healthy balance of payments.

South African producers face their most daunting challenge ever: to compete at the international level in a new free-market environment. Several factors will determine the continued viability of grain production in South Africa, including the capacity of producers to adapt to changing circumstances, correct interpretations of international and local market information, the transparency of various role players in the grain industry and successful use of marketing instruments.

Several risk management instruments are available to producers who wish to manage their investment risk. Producers need to understand how to use the various pricing instruments to manage market risks and how to select the most appropriate pricing instrument to accomplish their objectives. Some instruments manage only one of the primary market risks, while others may manage several sources of risk. Knowing how to use the various alternatives involves understanding the mechanics of such aspects as opening a trading account with SAFEX, placing orders with the broker and meeting margin requirements. It also

includes understanding obligations and responsibilities for delivery, and conditions under which contracts can be cancelled or modified.

The subsequent chapters explain the new agricultural environment, the risks it poses and risk management instruments available to producers to manage their investment risks.

CHAPTER 2

GRAIN PRODUCTION IN SOUTH AFRICA

Studying history is pointless unless one learns something from it.

- Anon.

2.1 INTRODUCTION

Variety and uncertainty characterise grain production in South Africa. Much of this variety stems from the uniqueness of each individual farm unit and its products. Location, capital structure, land, planting patterns, production methods, marketing strategies, and producer demography – all combine to make each farm a distinct unit. Given the globalisation of markets and rapidly changing requirements and technology, it is important to think and plan ahead. Peter Drucker (1995) aptly remarked about future predictions:

'In human affairs – political, social, economic or business – it is pointless to try and predict the future, let alone to attempt to look ahead 75 years. But it is possible and fruitful to identify major events that have already happened, irrevocably, and that will have predictable effects in the next decade or two.'

Maize, grain sorghum, wheat, barley, oats, rye, soybeans, beans and sunflower seed are the principal crops grown on commercial farms in South Africa. From these possible crops the following have been chosen as the outputs of the farm prototypes used in this study:

- maize,
- soybeans,

- wheat, and
- sunflower seed.

In South Africa many hectares are devoted to the production of these crops, which explains why these crops have been selected for this study. Furthermore, these types of crops have been chosen because, with the exception of soybeans, they were the first crops to be traded on a South African Commodity Exchange. Consequently, there are futures and option trading opportunities and forward contracting opportunities in these commodities. Although soybeans are not traded on SAFEX, they are traded on other world exchanges, for instance, the Chicago Board of Trade. The demand for the crops resulting from their processing and their ultimate consumption is also an important characteristic that distinguishes the production and marketing opportunities of each commercial grain farm. Each type of grain is discussed briefly below in terms of its importance, production quantity and economic implications for the periods before and after the reform process. The history of maize is also discussed, because of the importance of the crop to South African agriculture.

After the deregulation of the agricultural sector and especially the dismantling of the one-channel grain marketing system, it became apparent that structural changes would take place in the market. Marketing strategies changed and the timeous gathering and interpretation of information in order to function optimally became more important. This chapter focuses primarily on the development of the production of principal crops in South Africa, the marketing thereof and the challenges producers face in this new agricultural era.

2.2 SOUTH AFRICAN AGRICULTURE BEFORE THE REFORM PROCESS

The regulation, and eventual deregulation, of agricultural marketing in South Africa has to be viewed in the context of the evolution of South Africa's agricultural sector and the broader policy environment that shaped it.

2.2.1 Principal crops produced in South Africa

2.2.1.1 *Maize*

Maize became known to Western Civilisation for the first time after the discovery of the New World by Columbus in 1492. The most developed Indian races in the Americas from Southern Canada to Southern Chile grew maize. It was, at that stage, already known in Haiti and Cuba (Van Rensburg, 1995). An indication of the real age of maize may be obtained from fossils of pollen grains unearthed 60 metres below Mexico City. Although these fossils have been estimated to be more or less 80 000 years old, they were found to be nearly identical with the pollen of modern maize in respect of their morphological properties.

After the second voyage of Columbus in 1493, the importation of maize seed to Spain from the West Indies began. Its cultivation spread rapidly to France, Italy, the Balkan States and North Africa, where, initially, maize was grown as a pastime in home gardens (Van Rensburg, 1995). The Portuguese called maize as 'milho'. From the beginning of the 16th century, the Portuguese took maize along in their exploration of the West Coast of Africa and the Far East.

The first written record of maize in South Africa is diary entry by Jan van Riebeeck, who noted in 1655 that a consignment of maize seed had arrived from Holland (Cownie, 1986). Van Riebeeck encouraged his burghers to grow maize.

However, because maize is a summer rainfall crop, it did not thrive in the dry summers of the Cape with its Mediterranean climate. South Africa's 1820 Settlers, did, however, see the value of maize and grew it on their farms in the Eastern Cape. Not long afterwards, the families who took part in the Great Trek of 1838 began to plant maize wherever they went (Cownie, 1986).

The weather and soil conditions in spring and early summer influence the timing of planting strongly. The soil must be dry enough to allow machinery into the fields, yet wet enough to ensure seed germination. Since maize needs a substantial frost-free growing span of 80 to 160 days to mature, planting must be delayed long enough to avoid late spring cold snaps, yet early enough to minimise vulnerability to early autumn frosts. In South Africa, planting starts from September and continues until early December.

As with most crops, the weather during the growing season is one of the main determinants of output. The logistic growth and survival model was determined to be a highly accurate representation of the growth, formation and survival of the maize kernels (Kaufman, 1986). The model is written as

$$Y_i = \frac{a}{1 + brt_i + e_i}$$

Where:

- a, b, and r are non-negative constants and $0 < r < 1$;
- e, is the disturbance term (error dependent on time t);
- t_i is the independent time variable (time series); and
- y_i is the dependent variable representing growth or survival.
- ($i = 1, 2, \dots, n$)

According to Kaufman (1986), it can be assumed that the reflection point (y_1) shows a short period in which most of the rapid growth takes place. Large variances in yield can be associated with problems occurring in the point of the growth cycle prior to t_1 . An especially critical time during the growing season is from January to middle February when pollination occurs. Hot weather and drought conditions at this stage of growth reduce yields because of impeded kernel set.

Grain production in South Africa fluctuates due to weather conditions and the number of hectares planted. Due to the fact that, in the past, government determined the producer prices, the prices used to vary very little, except for the normal increases. Table 2.1 shows the fluctuation in production and producer prices from 1931 to 1967.

The growth in maize production is mainly due to better farm management practices and an increase in the number of hectares planted. According to the Annual Report of the Mealie Industry Control Board (Union of South Africa, 1940a) the rapid increase in the number of hectares planted was mainly due to the fact that during the recession of the 1930's, producers needed to utilise their land on a more intensive basis than for grazing. Also, the main technical problems of production had been largely overcome and knowledge of maize production had reached the stage where producers found they could successfully grow maize in areas which had previously been regarded as marginal land. These trends continued well into the 1970's.

Table 2.1: Total production of maize and producer prices received from 1931 - 1967 (bags of 90,7 kg each)

Year	Production million bags ¹	Producer price - white maize ² (Rand)	Producer price - yellow maize (Rand)
1931-35	17.2	R0.75	
1936-40	22.4	0.88	
1941-45	20.3	1.39	
1946-50	26.5	2.14	
1950/51	32.3	2.50	2.50
1951/52	22.4	2.85	2.85
1952/53	37.9	3.00	3.00
1953/54	43.6	3.20	3.20
1954/55	41.7	3.10	3.10
1955/56	41.7	3.00	3.00
1956/57	47.1	2.95	2.95
1957/58	40.7	2.875	2.875
1958/59	43.8	2.825	2.825
1959/60	47.3	2.92	2.92
1960/61	58.2	3.125	3.05
1961/62	66.2	3.075	3.00
1962/63	67.3	2.80	2.75
1963/64	47.1	2.87	2.87
1964/65	49.5	3.00	3.00
1965/66	55.7	3.15	3.15
1966/67	106.2	3.575	3.50

Source: Union of South Africa (1938, 1939, 1940b, 1941b, 1942, 1943, 1944, 1945) & Central Statistical Services (1969:14,64).

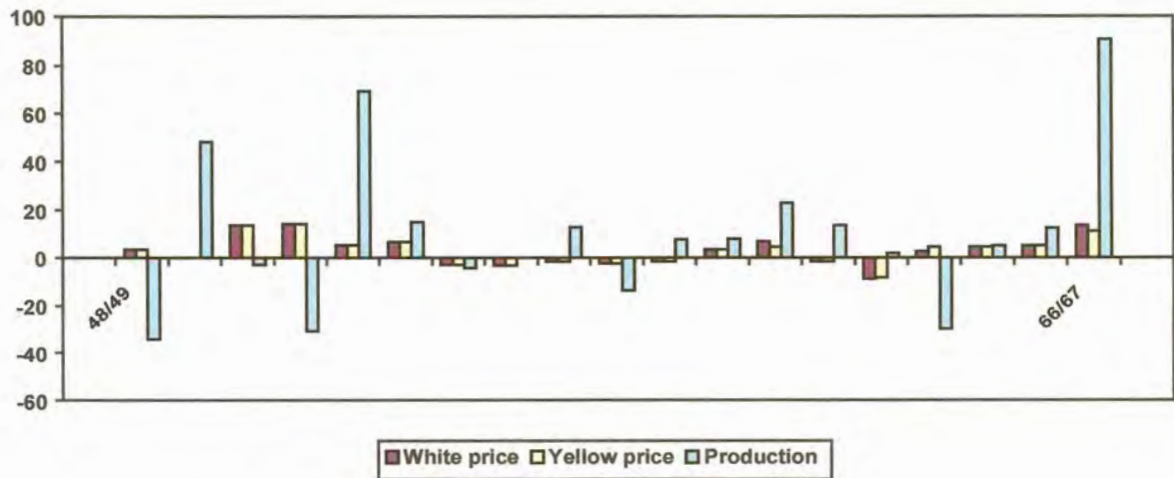
When one calculates the compound growth rates on the production and the prices received for white and yellow maize for the period from 1947/48 to 1966/67, it is important to note that the large fluctuation in the compound growth

¹ The production year runs from September to May.

² May-April net prices for best grades

rate of production is mainly due to weather conditions. Figure 2.1 presents the compound growth rates of production volumes and prices received from 1947/48 to 1966/67.

Figure 2.1: Compound growth rates (point-to-point) on production volume and maize prices from 1947/48 to 1966/67

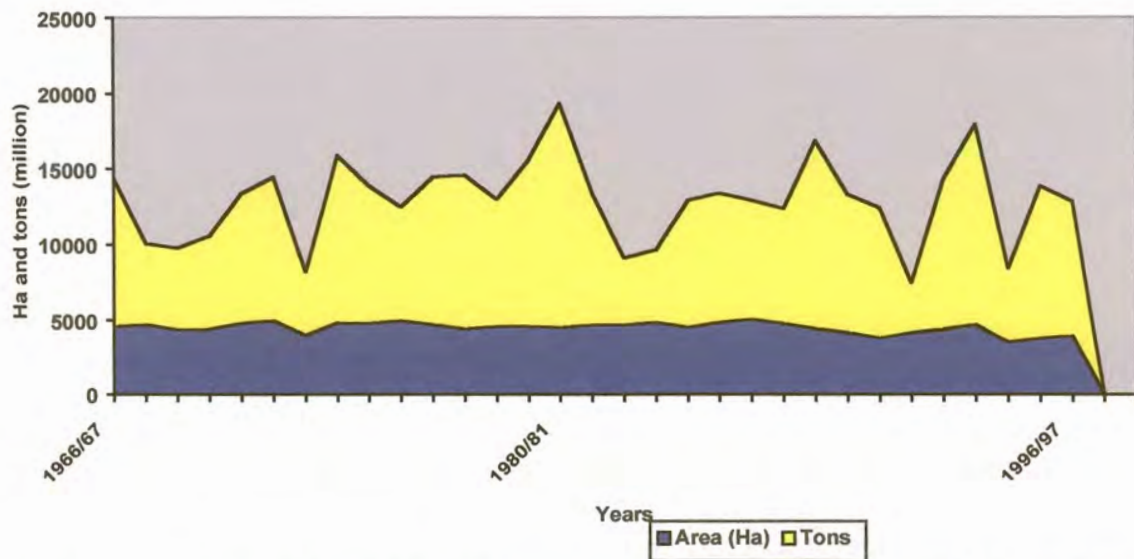


Source: Adapted Central Statistical Services (1969:14,64)

The compound growth rate for prices received shows few changes, possibly indicating that the objectives of the Marketing Act were achieved. Negative growth rates can be associated with periods of over-supply.

Figure 2.2 shows the fluctuation of South Africa’s production volumes for the period from 1966/67 to 1996/97, emphasising the sensitivity of maize to weather conditions.

Figure 2.2: Maize production and area planted for the period from 1966/67 to 1996/97



Source: Central Statistical Services (1996a) & Statistiek Suid-Afrika (1998)

Although the area planted fluctuated very little, from the smallest area (3 761 000 Ha in 1995/96 with an average yield of 2.7 tons per hectare) planted, to the largest area planted (5 063 000 Ha in 1986/87 with an average yield of 1.6 tons per hectare), the production volumes fluctuated drastically. The lowest production volume is 3 277 000 tons during the 1991/92 season, resulting in an average yield of 0.7 tons per hectare. This is due to the harsh South African weather conditions, especially during the critical kernel formation period. The marketing system that was used until 1994/95 was a single channel marketing scheme. This marketing system changed for the first time on 1 May 1995 to a surplus removal export pool.

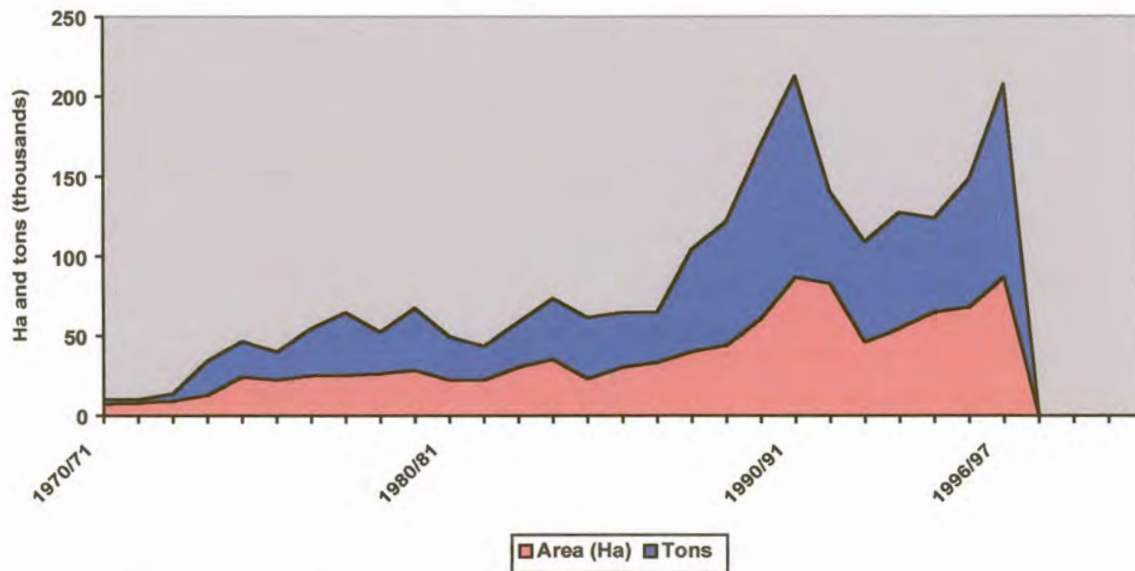
2.2.1.2 Soybeans

The soybean *Glycine max* Merrill is an upright annual legume with a wide morphological variety. Plant height varies between 50 cm and 120 cm and the growing period varies between 70 and 180 days (depending on the hybrids used and prevailing weather conditions). Due to the specific photoperiodic (hours of daylight) sensitivity of soybeans and the availability of genetic variation for this trait, it is possible to grow soybeans in a variety of climatological conditions.

Like most cash crops, soybeans thrive in deep, well-drained soil with a high fertility status. In South Africa, the planting of soybeans has mostly been restricted to heavier soils due to a potential nematode risk in lighter sandy soils and the fact that soybeans, compared to maize, performed better on heavy turf soils. Soybeans can be planted in areas with a rainfall in excess of 450 mm, or where special moisture conservation practices or irrigation is applied. Soybean production cannot be considered on soils where atrazine or related herbicides have been applied during the previous season (Smit, 1987). Depending on land management practices and soil types, producers can substitute maize for soybeans and *vice versa*.

Figure 2.3 indicates the fluctuation and overall increase in area planted and production volumes for soybeans for the period from 1970/71 to 1996/97.

Figure 2.3: Soybean production and area planted for the period from 1970/71 to 1996/97



Source: Central Statistical Services (1996a) & Statistiek Suid-Afrika (1998).

The initial increase in volume in the 1980's is due to the fact that more producers were willing to plant soybeans, that hybrid quality and variety had improved, and that a more scientific approach towards the production of soybeans had been adopted. The decline in soybean area planted in the 1991/92 season can probably be attributed to a shortage of irrigation water and more favourable price levels for rival products such as ground nuts and sunflower seed. The sharp increase in area planted after 1995 suggests that producers had realised the potential of soybeans as an alternative crop.

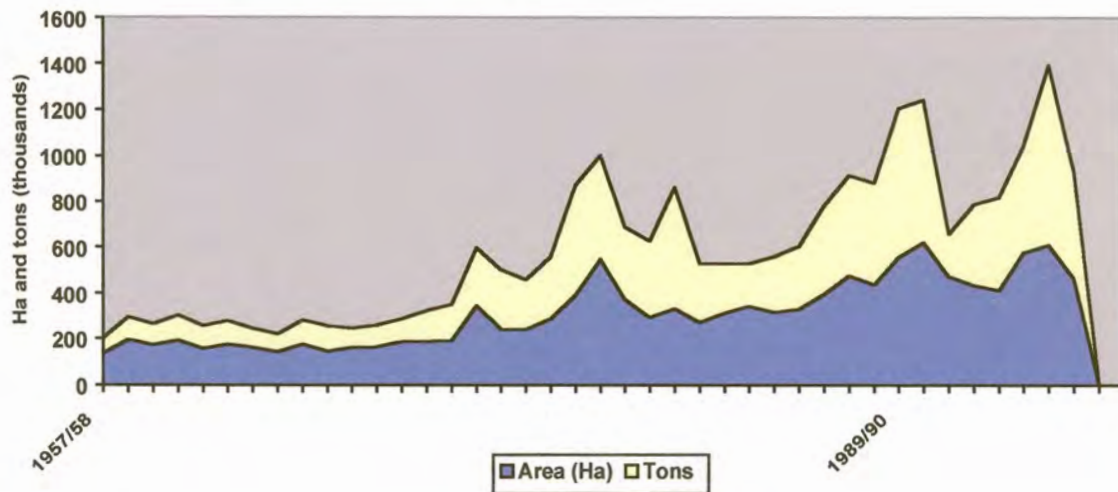
2.2.1.3 Sunflower seed

The sunflower, *helianthus annuus*, is distinguished from other cultivated crops by its single stem and conspicuous, large inflorescence. Sunflowers are very tolerant to different temperatures, with an average growth period of 70 to 114

days, and perform well in most temperature zones. Sunflowers are a highly cross-pollinated crop. Pollination occurs primarily by insects and only to a limited degree by wind. Sunflowers grow well in soils ranging in texture from sand to clay. They do not require soils as highly fertile as do crops such as maize, wheat or potatoes to produce satisfactory yields.

Figure 2.4 details the area planted and production volume of sunflower seed for the period from 1957/58 to 1996/97

Figure 2.4: Sunflower seed production and area planted for the period from 1957/58 to 1996/97



Source: Central Statistical Services (1996a) & Statistiek Suid-Afrika (1998)

The increase in the area planted can be attributed to better management practices, herbicide improvement and greater hybrid variety.

Sunflowers rank second to soybean among annual field crops grown throughout the world for the production of edible oil. Sunflowers are not highly drought-tolerant, but often produce satisfactorily when other crops are seriously damaged. Sunflowers possess several agronomic characteristics which support

an expansion of their production. They are deep-rooted and use soil moisture efficiently, and thus are better adapted to growing in drier regions than most crops. Sunflowers also have one of the shortest growing seasons of all economic crops in the world. This, together with the fact that less tillage is needed for many other crops, makes sunflowers a very good choice for producers.

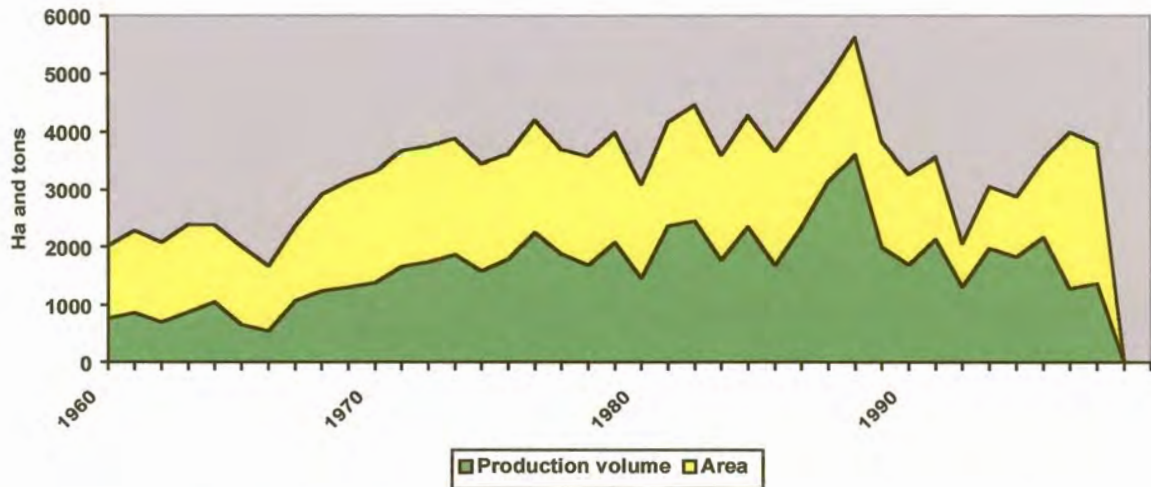
2.2.1.4 *Wheat*

The approximately 28 wheat species that are cultivated throughout in the world at present are characterised by their annual life cycle. Ontogenetically, this cycle can be divided into two phases, the vegetative and reproductive phases. The transition from a vegetative to a reproductive growth phase is controlled by specific environmental stimuli. Temperature and day length are probably the most important, and there is evidence that some wheat cultivars have more specific requirements in this regard than others. Winter wheat species require cold for flower initiation, whereas spring wheat is able to form ears without cold. Apart from the fact that a critical day length is necessary for some types of wheat, some plant cultivars are greatly influenced by longer photoperiods; for example, the number of spikelets depends on day length, and longer days increase the rate of spikelet initiation (Department of Agriculture, 1996).

The ideal climate for wheat is a cool, moist season for planting, growing and production, followed by a hot, dry season for harvesting. This type of climate occurs especially in the winter rainfall area, the south-western Cape. Other areas where wheat is grown include the eastern and north-eastern, central and north-western Free State Province, eastern Mpumalanga and the Springbok Flats.

Figure 2.5 indicates the area planted and production volume of wheat for the period from 1960 to 1997.

Figure 2.5: Wheat production and area planted for the period from 1960 to 1997



Source: Central Statistical Services (1996a) & Statistiek Suid-Afrika (1998).

The area planted increased slowly from 1967 to 1990, whereafter it slowly began to decrease. The lowest production level was experienced in 1966, with 548 000 tons of wheat produced, resulting in an average yield of 0.5 tons per hectare. The highest production level was during 1988 with 3 620 000 tons of wheat produced, resulting in an average yield of 1.8 tons per hectare. Wheat production seems less sensitive to weather conditions than maize production, possibly because a large area of wheat is planted in the winter rainfall area.

Until 1995, the Wheat Board was the only buyer of wheat in the Republic of South Africa. It bought wheat through its agents, who operated throughout the country. In most cases, the agents were ordinary farming co-operatives. Their main functions were to purchase and distribute these cereals (wheat, barley, oats and rye); to fix prices for the cereals and certain cereal products; to

supervise the maintenance of prices and to rationalise the wheat milling and baking industries.

2.2.2 Crop economics

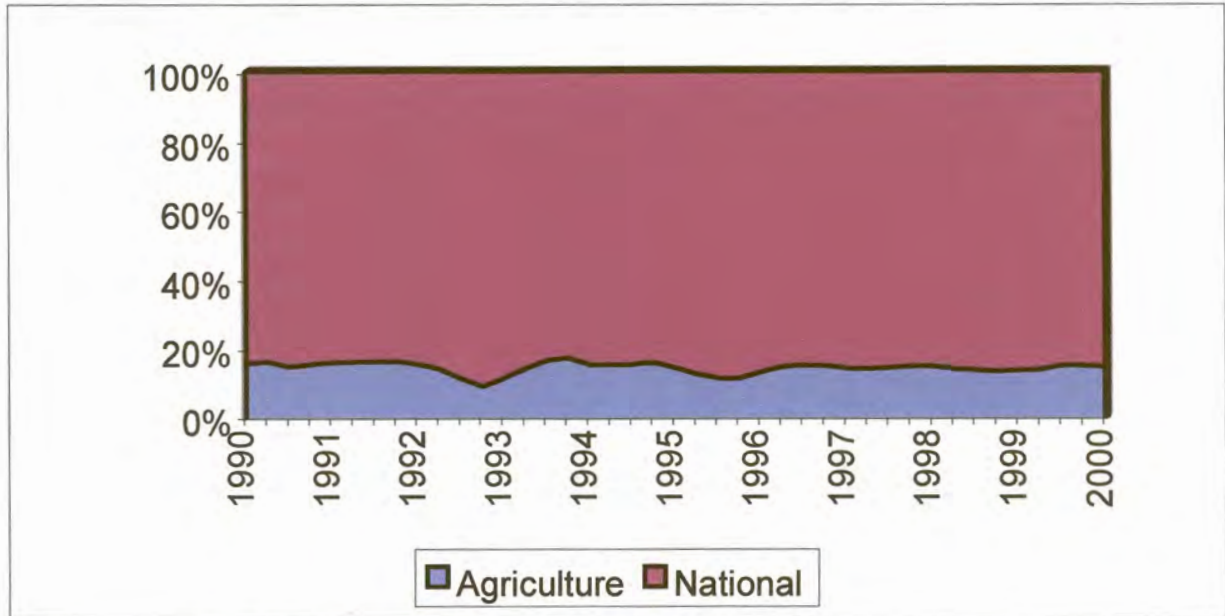
2.2.2.1 Contribution of agricultural crops

Although the real contribution of agricultural crops to the gross domestic product (GDP) has declined since 1990, grain production is still of strategic importance to South Africa. The strategic importance of the South African grain industry lies in its forward and backward integration with the rest of the economy, the establishment and maintenance of food security, the creation of wealth in rural areas and its contribution to a healthy balance of payments. The decline in the contribution of grain crops to the gross value of agriculture is probably due to the huge increase in horticultural produce since the early 1990's (<http://www.sbic.co.za>, 1999).

The contribution of agriculture to the total economy fluctuates significantly from quarter to quarter. These changes can primarily be attributed to two factors. Firstly, agriculture is dependent on climatic factors such as rainfall and temperature, which determine the yield of the various crops to a large extent. Secondly, most agricultural crops, and especially grain crops, are traditionally harvested and traded during only one or sometimes two quarters of the year. These are the causes of the cyclical nature of agriculture's contribution to the country's economy.

Figure 2.6 reflects the seasonal variation in agriculture's total contribution to the country's economy on a quarterly basis.

Figure 2.6: Percentage contribution of agriculture to the National GDP at factor cost (1995=100)



Source: Reserve Bank (1994, 1998, 2000)

Poor agricultural years such as the El Niño years of 1992 and 1995 are evident from the graph, lower peaks in the third quarter (36,4% decline from the previous year) and fourth quarter (51,7% decline from the previous year) of 1992 and a decrease of 26,9% in the third quarter of 1995 and a decrease of 31,3% in the fourth quarter of 1995. Note, however, that since 1996 the agricultural contribution to the national gross domestic product (GDP) of South Africa shows less variation. This phenomenon may be attributed to various reasons, *inter alia* that the production of most grain products has declined since the good harvest of 1996. Furthermore, the deregulation of the marketing boards has resulted in producers' marketing their grain over longer periods than was previously the case in order to meet the continuous demand of processors, and earn income dispersed throughout the year. From this it can be deduced that, since the deregulation of the market, producers have started marketing over a longer period than in the past (less seasonality).

2.2.2.2 *Exchange rate fluctuations and production cost of maize and wheat*

Maize and wheat are severely affected by any cost-price squeeze. Fluctuating climatic conditions, prices and increases in production costs will play an even more decisive role in the competitiveness of maize and wheat producers in future. Fluctuations in the value of the Rand have a direct impact on input costs. The effect will, however, differ from one region to the next, since both input costs and the composition of input costs differ from one region to the next.

Tables 2.2 and 2.3 illustrate that if the domestic prices of maize and wheat remain the same and the effective exchange rate ($\$/R$) declines, the competitive positions of South African maize and wheat products weaken. Within a liberalised agricultural environment, there is no guarantee that product prices will change to such an extent that this can counteract the effect of fluctuations in the exchange rate.

Table 2.2: Effect of fluctuation in the value of the Rand on the production cost of maize in various regions

Region	% Change in value of Rand			
	-10%	-20%	-30%	-40%
North West	3.21	6.43	9.64	12.86
Northern Province	3.23	6.45	9.68	12.91
Mpumalanga	3.20	6.41	9.61	12.81
Gauteng	3.25	6.51	9.76	13.02
KwaZulu-Natal	3.08	6.16	9.24	12.41
Eastern Free State	3.35	6.7	10.06	13.41
North-west Free State	3.47	6.94	10.42	13.89
Average	3.25	6.51	9.77	13.03

Source: <http://www.sbic.co.za> (1999)

Table 2.3: Effect of fluctuations in the value of the Rand on the production cost of wheat in various regions

Region	% Change in value of the Rand			
	-10%	-20%	-30%	-40%
Central Eastern Free State	3.59	7.17	10.76	14.35
Eastern Free State - Cape	3.45	6.89	10.34	13.78
Free State	3.31	6.62	9.93	13.24
Western Cape	3.33	6.66	9.99	13.32
Western Free State	3.88	7.77	11.65	15.53
Average	3.51	7.02	10.53	14.04

Source: <http://www.sbic.co.za> (1999)

If the value of the Rand declines in relation to the US dollar, the cost of the import of maize and wheat increases proportionally. This increase is equal to the depreciation of the Rand, which in a deregulated market exerts upward pressure

on domestic prices. Tables 2.2 and 2.3 also show that a depreciation of 10% in the Rand to the US dollar results in an increase of 3,25% and 3,51% respectively in the average production cost of maize and wheat. In this case, maize in the north-western Free State and wheat in the western Free State show the highest increases in terms of production costs.

Foreign exchange rates play an important role in production costs. With the deregulation of marketing, it is essential that producers take full cognisance of the influence of the Rand on product prices as well as on production costs. Producers should also note that these influences are not the same in both cases.

A mere six countries (the USA, China, Brazil, Mexico, France, Argentina) produce 75% of the world's maize supply. The USA alone produces 39% of the total (<http://www.iastate.edu>, 1999). Due to the USA's market share in the world's production, the USA is regarded as the world price leader. The US yellow maize price therefore serves as a barometer of international maize prices. When the relation between the US yellow maize price and variables such as production, consumption and closing maize stocks is examined, one finds that yellow maize world prices are determined mainly by the level of closing stocks of yellow maize in the USA (<http://www.sbic.co.za>, 1999). If the stock levels in the USA and the world are high, the price of yellow maize declines and *vice versa*. Production and consumption have an indirect effect on this price, in that production and consumption determine stock levels.

In a deregulated market environment and against the background of international trade liberalisation, the prices of grain in the local market are influenced to a large extent by international prices and the Rand-dollar exchange rate. It is clear that local producers will in future have to pay attention to production, consumption and closing stocks of grains on the world market, because these factors eventually determine the prices that producers receive in South Africa.

2.2.2.3 Growth rate comparisons

The volatility in the price of grain or the amount of price risk exposure can be analysed using the standard deviation and the coefficient of variation. The standard deviation is a measure of the dispersion of data around the average or mean. The coefficient of variation is the standard deviation expressed as a percentage of the mean (Brigham, Gapenski & Daves, 1999). Thus, it is possible to compare the dispersion of two or more sets of data that are expressed in different units. That is, it would be difficult to compare the amount of volatility in the maize and soybean markets using just the standard deviations of each, because soybean prices are higher than maize prices and thus one would expect the standard deviation for soybeans to be greater than for maize. Using the coefficient of variation (a percentage measure) allows for the comparison of volatility or risk between the two markets even though the two sets of data are not identical. Table 2.4 indicates the standard deviations and coefficient of variation of the point-to-point price growth rates of maize, wheat, sunflower seed, and soybeans for the period from 1970/71 to 1994/95.

Table 2.4: Standard deviation and coefficient of variation of price growth rates for the period from 1970/71 to 1994/95

	White maize	Yellow maize	Wheat	Sunflower Seed	Soybeans
Average growth rate	12.6%	12.9%	10.8%	11.4%	11.2%
Standard deviation	15.2	15.0	11.4	8.2	7.4
Coefficient of variation	1.2	1.2	1.1	0.7	0.7

Based on the standard deviations, the volatility of the yearly price growth rates of white and yellow maize range between -2.6% and 27.8% around the mean 68% of the time. Based on the standard deviations, the risk associated with maize price growth rates is more than double the risk associated with soybean price growth rates. If one compares the coefficient of variation, the risk associated with maize and wheat is more than the risk associated with sunflower seed and soybeans (the higher the coefficient of variation, the higher the risk).

2.2.2.4 *Correlation between the crops*

The degree to which prices and yields are related is usually measured by the correlation coefficient. Correlation is a statistic that measures the relationship between the movement in prices, or yields or area planted, of one crop and that of another. The prices, yields or area planted of crops can be either

- positively correlated, if the series moves in the same direction;
- negatively correlated, if the series moves in opposite directions; or
- uncorrelated, if there is no relationship between the movement of one crop and another.

A correlation coefficient of -1.0 means that if yield turns out to be lower than expected, prices will always be higher than expected. Conversely, a correlation coefficient of nil means that if yields are greater than expected, then there is a 50% chance that prices will be higher than expected and a 50% chance that prices will be lower than expected. That is, there is no relationship between yields and prices (Ferris, 1998). As long as commodities are not perfectly positively correlated, diversification between the crops can reduce the risk (either the price or the yield risk).

A strongly negative yield-price relationship is beneficial to producers because it tends to lower their income risk. Prices that are higher than expected tend to offset yields that are lower than expected, and prices lower than expected are typically offset by high yields. A strongly negative relationship between prices and yields is also important because it makes forward sales a risky proposition. Suppose, for example, that a producer forward contracts 100% of the expected production and then suffers a yield shortfall. Not only will the producer have to buy grain to meet contractual commitments, but he/she can be almost certain that the grain he/she has to buy is expensive. Table 2.5 indicates the different correlation coefficients of the various crops for the period from 1970/71 to 1994/95.

Table 2.5: Correlation coefficients of price, yield and areas planted of various crops for the period from 1970/71 to 1994/95

Correlation coefficient	White Maize	Yellow maize	Wheat	Sunflower seed	Soybeans
Price : yield	-0.556	-0.556	0.127	0.4710	0.683
Yield : area planted	0.071 ¹	0.071	0.246	0.763	0.867
Price : area planted (same year)	-0.147	-0.132	-0.830	0.727	0.841
Price : area planted (previous year price)	-0.483	-0.455	-0.821	0.727	0.653

¹ Yield represents the total production quantity of maize

It is clear from Table 2.5 that forward pricing for maize is risky, due to the relatively strong negative price-yield correlation. However, the risk associated with forward pricing for soybeans is more strongly positive. The yield-area planted correlation indicates the sensitivity of the crops to climate. It is clear that maize is very sensitive to weather conditions, whereas sunflowers and soybeans are less sensitive. Diversification between maize, wheat, sunflower seed and

soybeans is then a possibility producers can use to manage their price and yield risks.

By drawing the correlation matrixes of production volumes and price, one can determine whether these crops can be used to manage risk. Tables 2.6 and 2.7 represent the correlation matrix of production and price for the period from 1970/71 to 1994/95.

Table 2.6: Production correlation matrix for maize, wheat, sunflower seed and soybeans for the period from 1970/71 to 1994/95

	Maize	Wheat	Sunflower seed	Soybeans
Maize	x	0.014	0.396	0.114
Wheat	0.014	x	0.176	0.263
Sunflower	0.396	0.176	x	0.733
Soybean	0.114	0.263	0.733	x

From Table 2.6 it is clear that wheat and soybeans can be used as a possible strategy to diversify a farm that plants mainly maize. The production correlation between sunflower seed and soybeans indicates that there is a strong possibility of a good sunflower and soybean yield in the same year.

Table 2.7: Price correlation matrix for white and yellow maize, wheat, sunflower seed and soybeans.

	White maize	Yellow maize	Wheat	Sunflower Seed	Soybeans
White maize	x	0.992	0.968	0.971	0.969
Yellow maize	0.992	x	0.962	0.966	0.961
Wheat	0.968	0.962	x	0.972	0.983
Sunflower seed	0.971	0.966	0.972	x	0.986
Soybean	0.969	0.961	0.983	0.986	x

It would not help to use different crops to manage price risk because there is a strong price correlation between all the crops. This was mainly due to the fact that all the prices before 1995 were controlled by the various marketing boards. With the reform process came the dismantling of the marketing boards, resulting in price risk. It is therefore necessary to investigate different marketing instruments available to producers to manage their marketing risk. In Chapter 3, Chapter 4 and Chapter 5, the different marketing instruments available to producers are discussed.

2.3.1 THE REFORM PROCESS

2.3.2 The Marketing Act

By the early 1860's, agricultural production in the area that is today South Africa was sufficient to meet the consumption requirements of its population. Farming in much of the interior could be characterised as subsistence-based. Commercially-oriented agricultural production was largely limited to the coastal

areas. The main exception was wool farming, which extended into the country's southern interior. Wheat, fruit, butter, beef and maize were produced for internal consumption, whilst wool, wine, hides and ostrich feathers were produced for export.

The discovery of diamonds and gold in the interior in 1867 and 1886 respectively led to a dramatic change in the economic landscape. The level of urban settlement grew rapidly, the demand for agricultural commodities expanded, and prices rose accordingly. Although there was a supply response, local production had to be supplemented by imports that were transported by the growing rail network. By 1899, South Africa was importing large quantities of wheat, maize, meat, eggs, milk and butter (Van Rensburg, 1995).

From 1910 until the early 1920's, the average annual production of maize in the Union of South Africa amounted to approximately 12 000 000 bags (the bag size was 200 lb or 90.7kg). During this period, the production of grain was adjusted to the demand while export surpluses were small and posed no serious problem for the industry. During the 1920's the maize producers generally received relatively high prices for maize products. Since 1924 the production of maize showed a steady increase, but without a corresponding increase in the demand. As a result, one third of the marketable crop had to be sold on overseas markets. A great spirit of optimism reigned, not only on the agricultural front, but throughout the whole economy. Despite the good crops during the 1927/28 and 1928/29 seasons and the good crop expected for the 1929/30 season, the average domestic price in 1929 for grade two maize ex silo was, for instance, a satisfactory R12,90/t (15/1d a bag) (Nampo, 1993).

From 1929 onwards, the prices of agricultural products began to fall dramatically. Not only in the Union of South Africa and the USA, but throughout the whole world, maize prices dropped. For instance, the price of maize in the United

Kingdom fell from R16,64/t in 1929 to R10,80/t in 1930. The domestic average producer price for 1930/31 reached the low figure of R7,44/t or 10/2d a bag (Nampo, 1993). World prices for maize receded to such low levels that the position of maize producers in the Union of South Africa became desperate. In an endeavour to alleviate the situation, the Mealie Control Act No 39 of 1931 was passed in Parliament. Subsequent to this Act, the state sought to influence the marketing of maize and other agricultural products indirectly. The new Act marked the advent of a new policy of direct state intervention in the marketing of maize, with the specific object of artificially raising local producers' prices above the depressed world levels that prevailed after 1931. The purpose was to ensure a higher average return to the maize grower in the Union.

When, under conditions of free marketing, an export surplus of maize was produced in the Union, the internal demand-supply relationship was overshadowed by the world relationship of supply and demand, because, if export were to be allowed, it would be the function of market forces to establish an internal price level that would be equal to the net realisation on the world market (that is, to export parity price). Export parity would become the basic price-determining factor and local prices would fluctuate only in conformity with the movement of world prices. When the Mealie Control Act sought to establish a producers' price on the internal market higher than export parity, conditions had to be created under which maize would be relatively more scarce for the consumer in the Union than overseas (Union of South Africa, 1938-1939, 1940b, 1941b, 1942-1946). This Act compelled local purchasers to buy and export a portion of the exportable surpluses.

In 1935 the Mealie Industry Control Board was established under the Mealie Control Act to act as an advisory body. In 1937 the Marketing Act No 26 of 1937 was placed on the Statute Books, and soon schemes under this Act took the place of the Mealie Control Act of 1931. The position of maize producers had

not changed materially in the intervening years and controlling producer prices were still low.

The legal framework of controlled marketing in South Africa is already set out in the Marketing Act of 1937. The main objectives of the Marketing Act of 1941 were:

- to promote stability in the prices of agricultural products;
- to narrow the gap between the producer price and the consumer price by means of rationalisation; and
- to increase the productive efficiency of farming.

The 1941 Act with its subsequent amendments was replaced in 1968 by the Marketing Act of 1968 (Act 59 of 1968). The intention of the 1941 and 1968 acts was to increase the productivity of the farming industry and the efficiency of allied marketing, processing and distributive industries to the general benefit of the producing and consuming communities. To achieve these objectives, the Marketing Act of 1968 provided for marketing schemes specifically tailored to the needs of the various products. These schemes cover domestic and export marketing arrangements, market promotion and all aspects of marketing research.

The Marketing Act of 1968 provides for five main types of marketing schemes. These include (World Bank, 1994):

- Single-channel fixed price schemes – producers were legally obliged to market their products through the board or its appointed agents, and prices were fixed for each season. Major domestic crops such as maize, winter grains (wheat, barley and oats), industrial milk and cream fell into this category.

- Single-channel pool schemes – producers marketed their products through a pool conducted by the various agricultural boards who paid advance payments upon receipt of the product. Deferred payments were made when the final realisation of the pool, after deduction of pool expenses, was known. Crops facing a relatively elastic demand, for example, export crops such as oilseeds, leaf tobacco, chicory, buckwheat, lucerne seed, deciduous fruit, citrus, rooibos tea, wool and mohair fell into this category.
- Surplus-removal schemes – producers sold their produce on an open market. The relevant board intervened when prices dropped below a fixed minimum price by purchasing surplus for distribution and resale at a later date. Crops such as grain sorghum, dry beans, potatoes, slaughtered stock and dairy produce fell into this category.
- Supervisory schemes – the relevant board acted in a supervisory capacity and as a mediator in arranging price and purchase contracts between producers and buyers. Producers could only sell to firms at a price in accordance with the grade of the product. Products included canning fruit and cotton.
- Sales promotion schemes – this was confined to karakul pelts. The scheme for karakul pelts was aimed at enabling the board to promote the sales of pelts locally and abroad by means of publicity.

Based on Rand values, until the early 1980's, about 80% of agricultural production was marketed in terms of the schemes mentioned above. Of the remaining 20%, about one half fell under other legislation, for example, quotas, and the other half was uncontrolled and consisted mainly of fresh vegetables.

Under the Marketing Act, the following control measures were enforced (RSA, 1970):

- For maize, the Republic was divided into three areas, namely Areas A and B and the exempted area. In Area A, the Maize Board was the sole buyer of maize; in Area B, producers could sell maize only to registered traders, such as co-operatives, who bought for their own account. In the exempted area, producers were at liberty to sell their maize to any person at the best prices obtainable in that area.
- For winter cereals, such as wheat, barley, oats and rye, the Wheat Control Board undertook marketing. The Board was the sole buyer and seller of these cereals, which were produced in or imported to the Republic.
- In respect of oilseeds, a scheme for regulating the marketing of groundnuts, sunflower seed, and soybeans under the Marketing Act was published in March 1968 (to include the marketing of soybeans) to replace the Oilseeds Control Scheme that had been in operation since July 1961.

With the 1968 Act, came certain limitations. The production area of maize comprised the then Transvaal and Orange Free State provinces and the magisterial districts of Bellville, Dannhauser, Dundee, Escourt, Glencoe, Gordonia, Hartswater, Hay, Herbert, Hopetown, Kenhardt, Kimberley, Kliprivier, Newcastle, Paulpietersburg, Phillipstown, Prieska, Utrecht, Vryburg, Vryheid and Warrenton. Producers in the production area were prohibited from selling their maize to anyone other than the Maize Board. Since the bulk of South African maize is produced in the production area, the Maize Board had virtually full control over the producer price and disposal of all maize marketed in the country. Under the Act the Winter Cereal Scheme prohibited any trading in winter cereals (that is wheat, barley, and oats) except through or with the permission of the

Wheat Board. The Oil Seed Board determined the producer prices of oil seeds and marketed these oilseeds. Although the boards marketed the crop on behalf of the producers, all price negotiations were taken away from the producers.

2.3.2 Historical perspectives on grain marketing in South Africa

2.3.2.1 The period from 1937 to the 1980's

According to De Swardt (1983), the period from 1929 to 1936 represented a watershed in South African agriculture and marked the end of pioneer farming and the beginning of commercial farming. This can be seen clearly in the production of and areas planted with maize, wheat, sunflowers and soybeans, as discussed in Section 2.2.1.

According to Frankel (1988) the Marketing Act of 1968 created a more stable market environment. It also allowed technological and economic development, created opportunities to develop infrastructure and structures whereby certain earlier shortcomings in the marketplace could be addressed. Some areas that changed were storage, refrigeration, processing, transportation, export, market information and trading systems and facilities. In general, the aim of the marketing system was to raise domestic producer and consumer prices to levels comparative to those on world markets.

2.3.2.2 The 1980's

The 1980's were characterised by declining profitability in agriculture in general and a weakening in primary producers' terms of trade. The Co-ordinating Committee of Agricultural Marketing Boards (RSA, 1987) estimates the nominal

protection coefficient for yellow maize at between 1.2 and 2.8 during the period from 1986 to 1987. The resulting rise in production was overshadowed by the welfare losses for consumers.

Maize is produced primarily for the domestic market. White maize is an important staple diet in South Africa, and is not generally available for export to elsewhere in the world. Before 1987, the producer price was frequently set above export parity, generating exportable surpluses that had to be sold at a loss.

The marketing system was reformed in early May 1987. From 1932 until 1986, the Minister of Agriculture had set the producer prices of maize. The new marketing arrangements meant that the Maize Board was itself responsible for determining maize prices (Maize Board, 1988). In practice, pre-planting maize prices were made known to the producer. Three basic processes could be distinguished in determining prices for a specific marketing season (Maize Board, 1988):

- **Price scenario** referred to a price indication based on current market conditions made known to maize producers before planting time. The most important market factors influencing the processes of price determination included the crop size, international market conditions, exchange rates, domestic demand, marketing costs, operational financing and government aid, if any.
- **Delivery price** was determined on the same basis as the price scenario, based on current market conditions that applied in March and April (the end of every marketing year). The delivery price was paid over to producers upon delivery of maize to agents of the Maize Board during the following marketing season.

- **The final price** was the result of the actual course taken by the market factors during a marketing season. Surpluses were paid out as a supplementary payment to producers.

A unitary pricing system was still followed, but the Maize Board no longer had the power to carry over surpluses or losses arising from exports. The Board could not use loans to finance a particular marketing year. From 1987, the producer price was essentially operated as a pooled price based on actual performance.

A policy document of the South African Agricultural Union (SAAU) (1988), stated: 'Various reasons, including inadequate exposure to direct marketing forces, have contributed to some of the problems experienced in agriculture.' To reverse this trend, the SAAU proposed the following: 'Agriculture and producers will in future (have to) be exposed even more fully to market forces as modified and supported by the implementation of mechanisms available in terms of the Marketing Act and other relevant agricultural legislation.'

2.3.2.3 *The 1990's*

With the widening of the price gap between the Maize Board's buying and selling prices, the single-channel marketing system came under pressure. As it stood, the system provided an incentive to use maize on-farm as a feedstock rather than to sell it to the Board and to incur the levies. Likewise, the price gap provided an incentive for those who used large amounts of yellow maize as feedstock to invest in maize production³.

³ It is reported that the largest commercial producer of maize is the leading poultry producer.

On 25 June 1992, the Minister of Agriculture appointed the Committee of Inquiry into the Marketing Act (CIMA) under the chairmanship of Professor WE Kassier, to 'conduct an in depth inquiry into and to report to the Minister of Agriculture on the marketing of agricultural products under the abbreviated heading "Marketing Act 59 of 1968, quo vadis?"' (RSA, 1992).

The first question that the Committee needed to answer was whether the Marketing Act had achieved the goals that were originally set. According to Groenewalt (1992), the answer was that it did not. The goal of efficient production had not been achieved, as productivity indices showed only a slight increase over the preceding three decades. The stabilisation of producer prices had been achieved in some industries, but this had not been accompanied by income stabilisation. Fair and equal access to as many producers as possible was thwarted by discriminatory legislation with a bias in favour of large-scale farming. The promotion of demand and consumption had not been achieved either.

In the executive summary of the CIMA report (RSA, 1992), the following findings were noted:

- CIMA argued that the Marketing Act had not achieved its intended goals and objectives.
- Different types of statutory levies could be imposed on controlled and uncontrolled products under the Marketing Act. The Committee was of the opinion that a case could possibly be made for the imposition of a statutory levy on all products to finance research and to generate information. The Committee was, however, not in favour of statutory levies to finance the SAAU and its affiliates.

- The Committee believed that the responsibility for quantitative import/export controls and the imposition of tariffs should rest with an independent statutory body acting in consultation with the responsible Minister(s).
- The Marketing Act had merit, provided that some of the powers that vested in the Act were not devolved to such an extent that vested interests may dominate society's welfare. To this end it would seem sensible to retain the Act as well as a national marketing body, albeit with a different composition.

To implement its findings, the Committee recommended (RSA, 1992):

- that mechanisms be established to ensure a legitimate and transparent process of reform;
- that transitional arrangements be made to correct some major flaws in the current system; and
- that policies and structures within which new role players can operate should be put in place.

As a result of the investigation and recommendations by the Committee, a new maize marketing scheme that replaced the fixed one-channel grain marketing scheme became operative on 1 May 1995. The basic characteristics of the new maize marketing system implied that in future the Maize Board (as well as the Wheat and Oilseeds Boards) would no longer operate actively on the domestic market, other than as buyers to remove surpluses on a pooled basis. Formerly controlled markets were deregulated. At the end of 1996, the Marketing of Agricultural Products Act (Act No 47 of 1996) was passed, providing for certain limited interventions such as registration and information collection.

The 1968 Act and the 1996 Act were designed to be enabling. As such they both implied the deregulation of statutory power from Parliament to the Minister to take certain decisions with the force of law, without further input from Parliament. They specified a process, including advice from a statutory council, through which all ministerial decisions should go, and specified the type and extent of market interventions that would be allowed. The Agricultural Products Act is based on the view that state intervention in agricultural markets should be the exception rather than the rule. During 1996 the functions of the Maize Board were terminated. Producers are now responsible for the marketing of their own maize. The 1996/97 season was also the last season when the price of wheat was fixed.

By early 1998, all control boards dealing with maize, sorghum, oilseeds, wool, meat, wheat, cotton, mohair, lucerne, citrus, deciduous fruit, dried fruit, milk and canned fruit had ceased to operate (except for residual legal and technical functions). Price controls were removed and single-channel markets disappeared with the abolition of control boards.

As the marketing arrangements for various commodities become less regulated, there is a danger that the potential benefits of deregulation may be counteracted by market concentrations that were nurtured by the control board system. The government will have to monitor the impact of market concentration on the efficient performance of deregulated agricultural markets. Where problems are identified, the government will have the option of utilising competition legislation operating in terms of the Department of Trade and Industry, or taking sector-specific initiatives.

The implementation of the 1996 Act has resulted in several developments:

- The representatives of commercial farmers have lost their most important vehicle for influencing net producer prices. Producer representatives have been forced to seek out new ways of affecting prices.
- The termination of levies for the funding of the SAAU's activities, together with the establishment of trusts for the receipt of control board assets, has shifted the balance of power between the SAAU and its commodity affiliates. The affiliates are now in a better position than the SAAU to argue for the allocation of trust monies to fund their activities.
- Since South Africa became a signatory to the World Trade Organisation's Agreement on Agriculture, the parameters within which South African agricultural commodity prices are set have been influenced more and more by world prices, exchange rates and the level of import protection. As the powers of control boards decreased, so the representatives of farmers and processors have increasingly tried to prevail upon government to use the tariff regime to protect them.

2.4 AFTER THE REFORM PROCESS

Different commodities have been deregulated at different times and at different rates. As a result, the impact of deregulation has become clearer for some commodities than for others. Furthermore, deregulation has taken place in conjunction with a broader series of reforms to the agricultural sector and the wider economy. It is therefore difficult to isolate the effect of domestic market deregulation from other developments, such as the relaxation of exchange controls, international trade liberalisation, movements in world prices, and

fluctuating production conditions. One must therefore exercise caution when one tries to draw conclusions on the impact of market deregulation *per se*. Nevertheless, the response to reforms to date by farmers and the private sector has been impressive. Some of the most important developments across the broad spectrum of agriculture can be summarised as follows (Baily, 1999):

- A large number of organisations have emerged to compete with Outspan and Unifruco in the exportation of citrus and deciduous fruit.
- There has been an acceleration in the establishment of new enterprises in the food and agricultural sector.
- The real value of South Africa's agricultural trade, exports in particular, has grown significantly.
- Real retail food prices have not increased since 1992, in spite of the Rand's depreciation in real terms against the US dollar between 1994 and 1998.
- There has been a shift in production patterns in response to changes in the relative risks and prices with which producers are confronted.
- Real land prices continued to fall in the mid 1990's.

It is important that government ensures that the response of the agricultural sector and related industries to deregulation is monitored and evaluated on an ongoing basis. This will make it easier for government to assess properly whether further initiatives are necessary to improve the efficiency of South Africa's deregulated markets. Furthermore, it will make an objective evaluation of the likely costs and benefits of any future statutory interventions much easier.

The following lessons can be drawn from the South African experience since the mid-1990's:

- In order to achieve the best results possible based on the liberalisation of domestic and international agricultural markets, a stable macro-economic environment and a basic level of infrastructure (transport, storage and communications) must be in place.
- In particular, where there is the potential for the price of a commodity to swing between export and import parity-related prices, it is crucial that producers, processors and traders should have access to as wide a range of price risk management mechanisms as possible.
- The success of the reform process so far, and the fact that it has operated relatively smoothly to date, is due to the fact that there was strong political backing for the reform process. Furthermore, by the 1990's most of the South African control boards worked extensively through their agents. Most did not own the marketing infrastructure, or handle, store, process, or finance agricultural production or marketing activities themselves. As a result, the closure of the control board system did not create a significant vacuum in the marketing chain.

A crucial aspect of the existing business and investment environment in the agricultural sector relates to the consistency and predictability of government decision-making around agricultural marketing. The government has been clear in its view regarding the division of responsibilities between government and the private sector.

The deregulation of South Africa's agricultural marketing and trade, particularly in the context of a shift towards the freer trade of agricultural commodities within

the South African Developing Countries (SADC) region means that there may be greater opportunities for countries such as Zimbabwe and Zambia to expand their agricultural exports to South Africa. Furthermore, they could benefit from access to South Africa's sophisticated price risk management mechanisms. However, such benefits are, to a significant extent, dependent on there being a domestic policy environment in these countries conducive to such trade, and a move away from *ad hoc* market interventions and restrictions over exports.

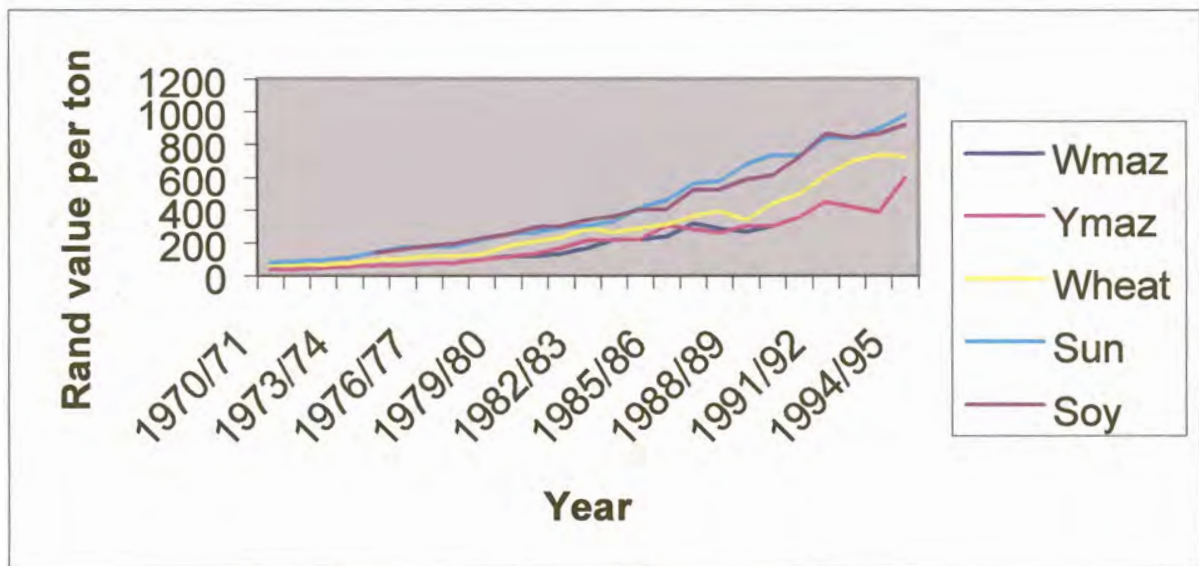
South Africa's deregulation has already had an impact on other members of the Southern African Customs Union (SACU) (Botswana, Lesotho, Namibia and Swaziland). Since independence, policy in these countries has been designed to encourage agricultural self-sufficiency (particularly in respect of staple grains) by means of the inflation of producer prices. Notwithstanding their membership of a customs union, the main policy instrument has been restrictive issuing of import permits for agricultural commodities. In spite of their self-sufficiency policies, all four members of SACU are, to a greater or lesser extent, structural net importers of maize, wheat and most other agricultural commodities, mainly via South Africa.

The implementation of restrictions on agricultural imports from South Africa was facilitated by the existence of the South African control boards. For example, the Maize Board would only issue export permits for maize destined for SACU countries if the applicant could produce a corresponding import permit from the government of the destination country. This is not to say that informal trade did not take place. However, it is clear that South Africa's deregulation of its controlled marketing system has made it much more difficult for SACU member countries to implement import restrictions which have welfare benefit implications for the majority of their citizens.

2.4.1 Producer prices

The biggest change in the agricultural market in future can be expected in producer price levels. Producers now have to establish their own selling prices, whereas previously the various agricultural boards had performed this task. There was no price volatility. Since the reform process, the level of volatility has changed dramatically. Figures 2.7 and 2.8 indicate how the volatility of maize prices has changed since the period before the reform process and thereafter.

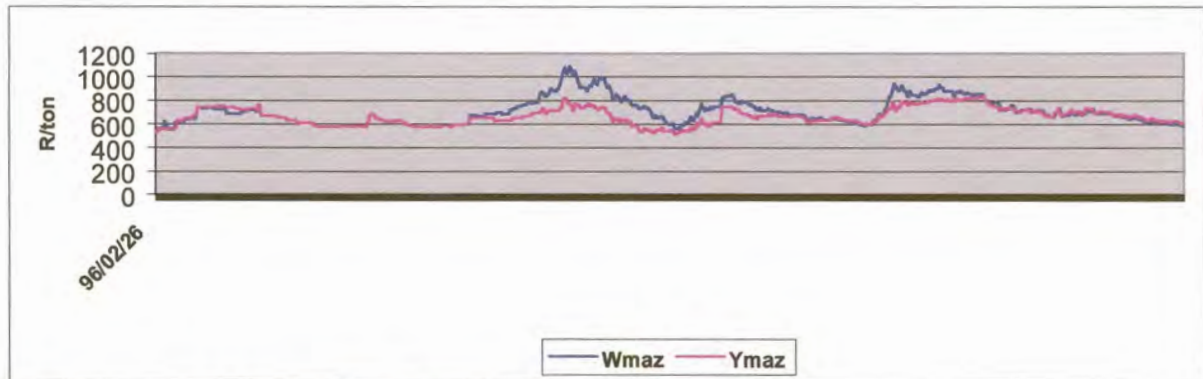
Figure 2.7: Prices before the reform process



Source: Central Statistical Services (1996:7,10,18,20)

This figure clearly indicates that there was a steady rise in prices received for these commodities from 1970/71 to 1995/96. A very important aspect is that the prices were fixed throughout the marketing year and that the producers and processors knew exactly what the price of a commodity would be for the rest of the marketing season. Although the prices changed yearly, the prices were constant throughout a given marketing season.

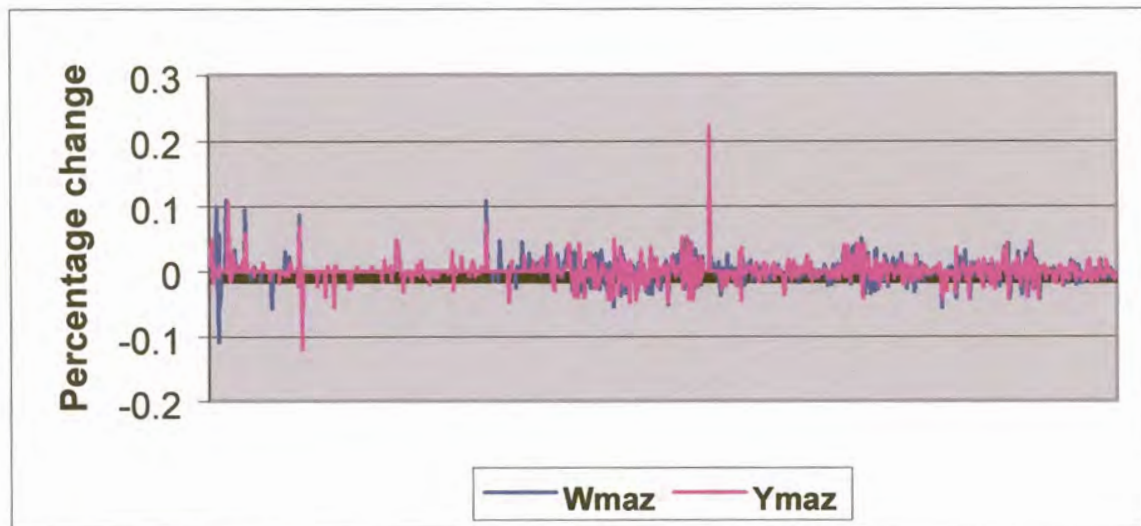
Figure 2.8: Closing prices of white and yellow maize (July contract) from 26 February 1996 to 12 April 2000



Source: SAFEX (1999, 2000)

It is clear from the figure that white and yellow maize experienced frequent price movements, resulting in high price variability. The higher the price changes, the greater the price risk for both producer and processor. The producer now has to use basic fundamental analysis, supported by basic technical analysis, to try to determine the general price movement. The same variability occurs with other agricultural commodities. Figure 2.9 indicates the daily price movements of white maize and yellow maize.

Figure 2.9: Daily price movement of white and yellow maize (July contract) for the period from 26 February 1996 to 12 April 2000



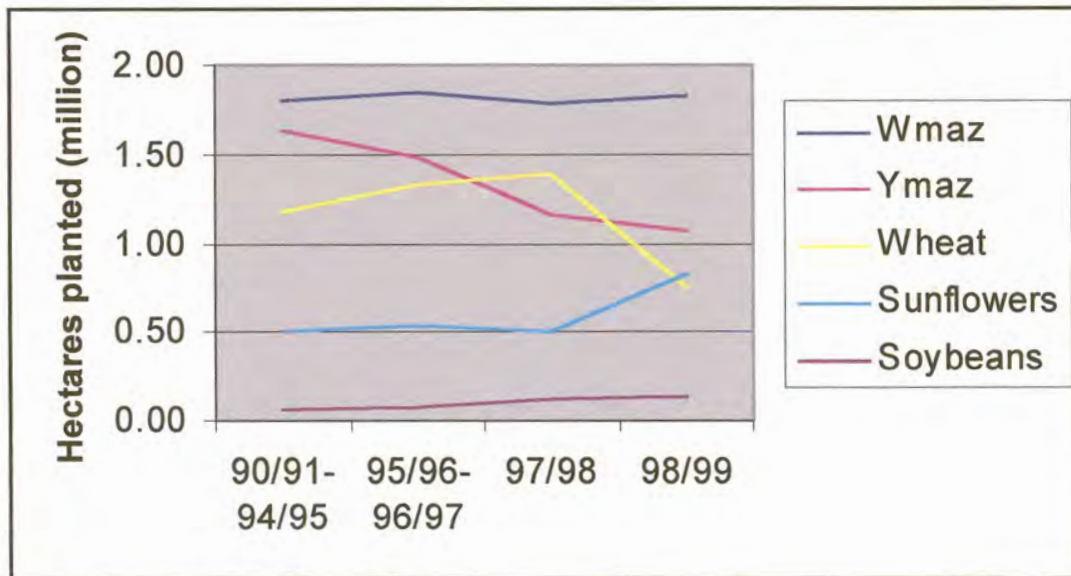
Source: SAFEX (2000)

It is clear from the figure that both white maize and yellow maize experienced a nearly daily price movement, resulting in high price variability. The same nearly daily price movement was present with sunflower seed prices and wheat prices. Soybeans tended to be less sensitive to price movements. The primary reason for this is that soybeans are not traded on a futures market, but are traded locally. Heavy price movements for soybeans only occur near the end of the marketing season, when there are normally low stock levels.

2.4.2 Production patterns

Producers have started to adjust their planting patterns. These changes are a response to changes in the relative risks (production risk and price risk) and relative prices with which producers are confronted. Figure 2.10 and Table 2.8 show how the areas planted with different crops have changed, compared to the early 1990's.

Figure 2.10: Average commercial area (Ha) planted to different crops in the



1990's

Source: Central Statistical Services (1996) & National Crop Estimating Committee (NCEC) (1999a, 1999b)

With the dismantling of the system of guaranteed markets and guaranteed seasonal prices and the reduction of import protection, it is to be expected that there will be changes in cropping patterns. There has been a shift to oilseeds (sunflower seed and soybeans) from maize and wheat in the northern production areas and from wheat to canola and grazing in the Western Cape. This shift can be partly attributed to the fact that there are no longer guaranteed seasonal prices and to the opening of export opportunities for higher value commodities. The first indication of changing cropping patterns can be found in the maize industry. Although the total area planted with maize has decreased in the last few years, this change was mainly in terms of area planted with yellow maize. As is shown in Figure 2.10, producers have planted more white maize relative to yellow maize since 1996, whereas there was previously only a small difference in the areas planted. That was because of the small difference between the net prices received for white and yellow maize. Data show that the process of

market deregulation has shifted producer and trader sentiment in favour of white maize.

Table 2.8: Average commercial area (Ha) planted/intention to plant for winter crops in selected areas

Crop	Average area 90/91 – 94/95	Average area 95/96 – 96/97	Average area 97/98	Average area 98/99	Intention to plant 99/00
Wheat (W/ Cape)	362 572	401 900	400 000	300 000	280 500
Wheat (Free State)	664 643	760 500	790 000	350 000	243 000
Wheat (national)	1 174 000	1 328 475	1 382 300	748 000	613 500
Canola	-	-	13 000	17 000	21 200
Lupins	-	-	1 889	16 300	25 000

Source: Central Statistical Services (1996) & National Crop Estimating Committee (NCEC) (1999a, 1999b).

The Western Cape first experienced an increase in the area planted with wheat from 1990/91 to 1994/95 and in the 1995/96 to 1996/97 seasons. In the next marketing season, the area planted with wheat stayed nearly constant, followed by a sharp decline in the 1999/00 season for both the Western Cape and the Free State Province. From Table 2.8 it is clear that producers have moved away from wheat to substitute crops, especially lupins.

Table 2.9 indicates the correlation coefficient of area planted before the 1995 marketing season and thereafter.

Table 2.9: Correlation matrix of area (Ha) planted before and after the reform process

	Maize		Wheat		Sunflower		Soybeans	
	Before	After	Before	After	Before	After	Before	After
Maize	x	x	0.45	0.51	-0.72	-0.51	-0.55	-1.00
Wheat	0.45	0.51	x	x	-0.51	-1.00	-0.55	-0.51
Sunflower	-0.72	-0.51	-0.51	-1.00	x	x	0.83	0.52
Soybeans	-0.55	-1.00	-0.55	-0.52	0.83	0.52	x	x

There is a strong negative correlation between maize and soybeans and between wheat and sunflower seed. This is an indication that more producers have discovered all the positive effects of soybean production above those of maize (*cf.* Figure 2.10). This correlation matrix confirms the shift in the planting patterns of producers after the 1995 marketing season. Producers now realise that the previously 'safe' crops are not that 'safe' any longer.

2.4.3 Balance of trade

It is foolish to read too much into year to year changes in South Africa's trade statistics, due to rainfall variations and world price movements (as in 1996). Nevertheless, Table 2.10 demonstrates that even in years affected by drought, as was the case in 1992 and 1995, South Africa is a net exporter of agricultural commodities.

Table 2.10: Free-on-board values of agricultural imports and exports (1990 to 1998)

Year	Agricultural exports (%) of total exports	Agricultural imports (%) of total imports
1990	8.6	4.9
1991	8.9	5.5
1992	7.8	8.5
1993	6.8	6.4
1994	8.8	6.1
1995	7.9	6.9
1996	9.2	6.7
1997	8.5	6.6
1998	N/A	N/A
Annual rate of change in agriculture	%	%
1990-1998	12.9	21.7
1994-1998	15.3	21.1
1997-1998	5.3	11.7

Source: RSA (1999)

The liberalisation of agricultural trade, taken together with a gradual move away from exchange controls, has not, to date, had a negative impact on South Africa's balance of agricultural trade and has not had a destabilising impact at the macro-economic level.

2.5 A NEW AGRICULTURAL WORLD ORDER

The General Agreement on Tariffs and Trade (GATT) has been the principal instrument regulating world trade in the period since World War II. One of the objectives of GATT has been to liberalise world trade by reducing or removing both tariff and non-tariff barriers. For this purpose, GATT has organised several rounds of trade negotiations. The last in this series of trade negotiations was the Uruguay Round which was launched in Punta del Este, a city in Uruguay, in September 1986.

One of the most important ways in which the Uruguay Round of Trade Negotiations was different from all previous rounds was that, whereas the previous rounds had been primarily geared to reducing barriers to trade transactions imposed at the border, the Uruguay Round sought to regulate economic activities inside the sovereign territory of GATT member states. Thus the Uruguay Round went beyond trans-border trade and intruded into the sovereign economic space of the negotiating partners. This was achieved by bringing within the scope of the negotiations trade in services, the regulation of investment measures and the inclusion of provisions for higher levels of protection for intellectual property rights.

During the Uruguay Round, most of the non-tariff barriers to trade were eliminated and replaced with tariff equivalents. In South Africa the greater openness to imports could lead to lower floor prices over the short term as tariffs are reduced over time and subsidised international producers are able to access the South African market. This could also lead to a decline in total agricultural production, due to the negative effect of imports. Government should consider carefully the impact that different tariff levels may have on key agricultural products and the effect on total production that contributes to the overall availability of food in South Africa (<http://www.sbic.co.za>, 1999).

The agricultural trade agreement was designed to achieve more open and fair trading in agricultural commodities by reducing export subsidies, tariffs and non-tariff barriers and domestic support structures. The agreement did result in a significant reform of the rules for agricultural trade, with some of the most important changes being tariffication (the conversion of non-tariff barriers to bound tariffs), the binding of all tariffs (commitments to the maximum tariff that can be applied at the border), bans on new export subsidies, and bindings on existing export subsidies (Ingco, 1995). The agreement has established a long-term trend toward much freer markets, including agricultural markets, around the world.

2.6 CONCLUSION

Over the years, there has been much direct and indirect intervention in the agricultural sector in the Republic of South Africa. The situation and mode of thinking in the 1930's, namely that a small body of responsible and well-informed individuals could perform better than a market consisting of a large number of poorly organised and financially weak producers with conflicting interests, has given way to a view that a more liberated economy with more exposure to market forces is needed.

An analysis of the Marketing Act of 1968 shows that it makes allowance for an extraordinarily wide spectrum of activities with extensive powers vested in boards and the Minister. However, over the years, the functioning of the schemes and the respective control boards which were instituted under the umbrella of the Act revolved mostly around only a few of the provisions of the Act. This involved the imposition of levies and special levies, surplus removal schemes, single-channel schemes and the manipulation of prices. Quantitative

import and export control was maintained via Section 87 of the Act. Apart from these rather stringent provisions, most of the boards have been engaged in various deregulation exercises in the last few years. The boards are no longer involved. The only import 'control' that still exists is that when the price of maize in America decreases below a certain level, the Government can institute an import levy to protect South African prices to a certain extent.

In the past, with annual prices fixed by the boards, the procurement and marketing of grain in South Africa was relatively simple. There was no competition between suppliers and buyers on the basis of price, as the boards bought from every seller and also sold to every buyer at a fixed price. The domestic market was also insulated against the volatility of international prices and the supply and demand factors that influenced these prices.

Theory suggests that one of the basic building blocks of a free market is 'perfect information'. This implies that adequate, standardised, up-to-date and reliable information is available to all role players in the market and that all role players must have equal access to this information. 'Perfect information' also implies that agricultural role players must be able to make meaningful deductions about the market from the information available in order to ensure strategic, sustainable growth and involvement in agriculture over the long term.

During the 1990's things have changed dramatically for South African producers. The boards were dismantled and producers are now responsible for their own marketing. In response to these changes, the Agricultural Futures and Options market has become active. In the following chapters, the origin of futures markets world-wide as well as in South Africa is discussed, as well as risk management strategies available to producers to manage their business risk better.

CHAPTER 3

FARM RISK MANAGEMENT

He is no wise man that will quit a certainty for an uncertainty.

Samuel Johnson (1709 – 1784)

3.1 INTRODUCTION

Elements of risk pervade every phase of economic activity. Most economic decisions are made on the basis of imperfect knowledge about the future, because individual decision-makers are not aware of the complete set of alternative actions available to them or all the possible outcomes associated with each action. This is especially true for the decisions faced by grain producers. The natural and economic environments within which these producers operate interact to complicate decision-making. Weather, insects and weeds make planting, fertiliser, herbicide and insecticide decisions extremely difficult and cause yields to fluctuate enormously. The competitive environment within which producers operate subjects them to wide fluctuations in price.

As little as a decade ago, South African agriculture was characterised by subsidies and other concessions, which supported producers, not only in difficult times, but also in prosperous times. During the 1990's the last agricultural control boards were abolished and the agricultural sector was deregulated. Both the playing field and the rules of the crop marketing game in the South African agricultural sector changed in a short space of time. Therefore, South African producers had to reposition themselves to adapt to these changes. To be a successful producer, a producer needs to look at a deliberate, considered and

knowledgeable approach to risk management as a vital part of the planning process.

Risk management involves choosing between alternatives to reduce the effects of the various types of risk. It typically requires an evaluation of trade-offs between changes in risk, changes in expected returns, and entrepreneurial freedom, as well as other variables. This chapter highlights the types of risks faced by producers in the agricultural environment in South Africa and focuses on different risk management strategies (excluding those available through the South African Futures Exchange) available to producers.

3.2 FARM RISK

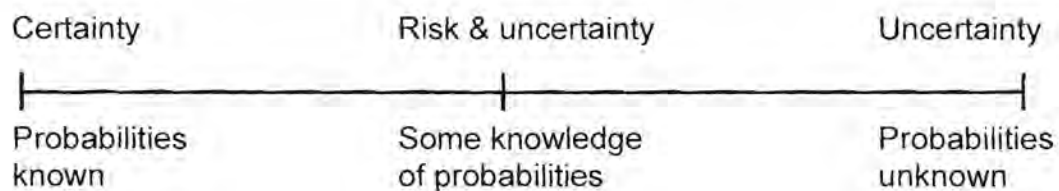
3.2.1 Quantifying risk

The defined goals of financial management are generally seen as surviving, avoiding financial distress and bankruptcy, beating the competition, maximising sales or market share, minimising costs and maintaining a steady growth in profits. Ross *et al.* (1996) simply define the goal of financial management as maximising shareholders' wealth, in other words, maximising the wealth of the owners of the business. For crop producers, this can be defined as the maximisation of sustainable net worth (assets minus liabilities). For crop producers to succeed in today's economic climate and global markets, they should plan their farms so that they maximise their net worth over a sustained period within the prevailing market and economic conditions. All the financial alternatives must be carefully weighed and the most profitable alternative must be selected.

Risk refers to a situation where the outcome is unknown, but the probability of alternative outcomes is known. Risk affects an individual's welfare, and is often

associated with adversity and loss (Bodie & Merton, 1998). Risk is uncertainty that 'matters' and may involve the probability of losing money, possible harm to human health, repercussions that affect resources (irrigation, credit), and other types of events that affect a person's welfare. By contrast, uncertainty is a situation where the probabilities of different outcomes are unknown. Uncertainty is necessary for risk to occur, but uncertainty needs not lead to a risky situation. A common example of uncertainty is the price changes in agricultural markets. A producer has no real basis for assigning a probability to the occurrence of any price at some point in the future. Price outcomes are uncertain and influenced by conditions in world markets, government policy, monopolies, politics and other factors. The degree of uncertainty surrounding the event determines the extent of risk. In many cases, the distinction between a risky situation and an uncertain situation is blurred. This phenomenon is represented in Figure 3.1 as a continuum.

Figure 3.1: Risk and uncertainty as a continuum of possible situations



Risk is presented on the continuum by the middle area where some information is known about the probability of certain outcomes.

For an individual producer, risk management involves finding the preferred combination of activities with uncertain outcomes and varying levels of expected return. One might say that risk management involves choosing between alternatives to reduce the effects of investment risk on a farm, and in so doing, to affect the farm's welfare position. Some risk management strategies (such as

diversification) reduce risk within the farm's operation, others (such as production contracting) transfer risk to beyond the farm, and still others (such as maintaining liquid assets) build the farm's capacity to bear risk. Risk management typically requires the evaluation of trade-offs between changes in risk, expected returns, entrepreneurial freedom, and other variables.

3.2.2 Types of risk

Some risks are unique to agriculture, such as the risk of adverse weather, which can significantly reduce production levels within a given year. Other risks, such as the price or institutional risk discussed below, are common to all businesses, and, for producers, they reflect an added economic cost. If the producer's cost-benefit trade-off favours minimisation, then the crop producer can attempt to lower the possibility of adverse effects. These risks include the following (Hardaker, Huirine & Anderson, 1997; Boehlje & Trede, 1977; Baquet, Hambleton & Jose, 1997; Fleischer, 1990):

- **Yield risk** occurs because agriculture is affected by many uncontrollable events. These events are often related to weather, including excessive or insufficient rainfall, extreme temperatures, hail, insect plagues and diseases. Technology plays a key role in reducing production risk in farming. The rapid introduction of new crop varieties and production techniques offers the potential for improved efficiency, but may at times yield poor results, particularly in the short term. On the other hand, there is always the threat of the obsolescence of certain practices (for example, if one uses machinery for which parts became unavailable), which creates another, and different, kind of risk.
- **Price risk** refers to risks associated with changes in the price of outputs or inputs that may occur after production has begun. In agriculture, production

is generally a lengthy process. Livestock production, for example, typically requires ongoing investments in feed and equipment that may not produce returns for several months or years. Because markets are generally complex and involve both domestic and international considerations, producer returns may be dramatically affected by events in far-off regions of the world.

- **Institutional risk** results from changes in policies and regulations that affect agriculture. This type of risk generally manifests itself as unanticipated production constraints or price changes for inputs or for outputs. For example, changes in government legislation regarding the use of pesticides (for crops) or drugs (for livestock) may alter the cost of production, or a foreign country's decision to limit imports of a certain crop may reduce that crop's price. Other institutional risks may arise from changes in policies affecting restrictions in conservation practices or land use, or changes in income tax policy or credit policy. The dismantling of the control boards in South Africa serves as an example of how institutional risk can alter marketing policies and influence the producers' responsibility in farm management.
- Producers are also subject to the **personal risks** that are common to all businesses. Disruptive changes may result from events such as death, divorce, injury, or the poor health of a principal on the farm. In addition, the changing objectives of individuals involved in the farming business may have significant effects on the long-term performance of the operation.
- **Exchange rate risk** is the danger of an unexpected change in the exchange rate between the dollar and the Rand, thus affecting the import and export parity prices of South African commodities. As the Rand weakens against the dollar, import parity prices increase and *vice versa*. A weaker Rand therefore implies a higher local price for commodities. The South African

market is strongly influenced by the exchange rate and this makes it difficult to manage all the risks faced by producers.

- **Financial risk** differs from the risks previously described in that it results from the way the farm's capital is obtained and financed. A producer may be subject to fluctuations in interest rates on borrowed capital, or face cash flow difficulties if there are insufficient funds to repay creditors. The use of borrowed funds means that a portion of the returns from the farm must be allocated to meeting debt payments. Even when the farm is financed fully by the owner, the owner's capital is still exposed to the probability of any lowering of equity or net worth. Financial risk has three basic components:
 - the cost and availability of debt capital;
 - the ability to meet cash flow needs in a timely manner; and
 - the ability to maintain and increase equity.

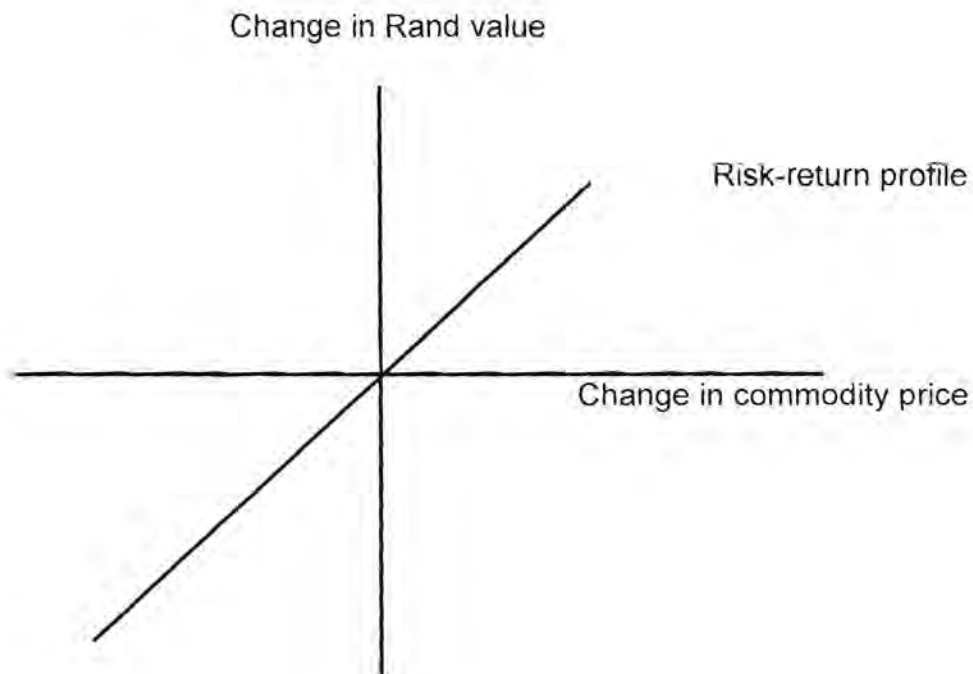
Of the three basic components, the ability to meet cash flow needs in a timely manner is especially important because of a variety of ongoing farm obligations, such as cash input costs, cash lease payments, tax payments, debt repayment and family living expenses.

Production, marketing and financial risks on most farms are interrelated. The ability to repay debt obligations depends on production levels and prices received for the products. Financing the production and storage of commodities depends on borrowing ability if a producer is using a production loan. Therefore, all three types of risk must be considered together. Producers differ greatly in terms of their willingness to take financial risks and their ability to survive unfavourable outcomes.

The basic tool for identifying and measuring a producer's exposure to financial risk is the risk-return profile. The risk-return profile is a graph showing the

relationship between changes in the price and changes in the value of a farm (Ross *et al.*, 1996). This is illustrated in Figure 3.2.

Figure 3.2: Risk profile

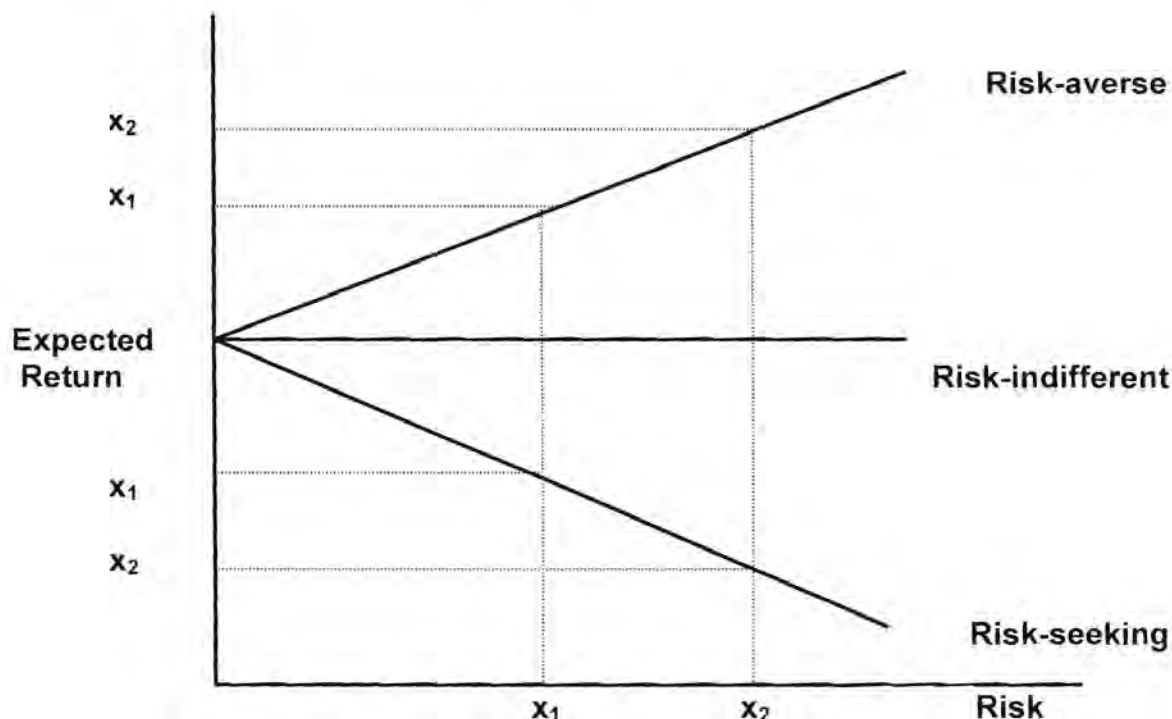


From Figure 3.2, the following two conclusions can be reached.

- Increases in commodity prices increase the value of the farm (upward sloping line). Due to the slope (influenced by the sensitivity of the crop price to price changes), the exposure to price fluctuations increases and a producer may wish to take steps to reduce that exposure.
- Risk management optimises rather than maximises returns. In *The Wall Street Journal* of 26 April 1994, Tim Ferguson described risk management as a principle 'to spread risk and reward so that uncertainty does not inhibit commerce'. In both financial and agricultural businesses, risk management strategies are often utilised in the expectation of outperforming the market.

It is important to specify a generally acceptable level of risk. The three basic risk preference behaviours are depicted in Figure 3.3.

Figure 3.3: Crop producer risk preferences



Source: Gitman (1998)

As risk goes from x_1 to x_2 , the expected return for a risk-indifferent producer does not change. A risk-seeking producer has an attitude towards risk which means he/she will accept a decreased return for increased risk. In the case of a risk-averse producer, the expected return must increase for an increase in risk. The risk disposition of each producer can be measured and producers tend to accept only those risks with which they feel comfortable. In this study, risk-averse producers are assumed to be producers who generally tend to be conservative

rather than aggressive when accepting risk. This implies that such producers require a higher return (from x_1 to x_2) as the risk increases from x_1 to x_2 .

3.2.3 Risk management strategies

Producers face several alternatives when they want to minimise risk. Where the risk situation prevails and probabilities for economic loss can be determined, insurance may be available. If the risk situation involves only subjective estimates of probabilities, financial management strategies (the use of risk-adjusted interest rates) should be considered. As indicated above, uncertainty describes those situations in which there is no certainty of the probabilities of certain outcomes. In such cases, decision-makers cannot buy insurance to guarantee an outcome or compensate for a loss if the situation has various opportunities but is fraught with problems of uncertainty. Other strategies must be pursued in order to manage variables in uncertain situations effectively. An important aspect that could increase farm risk is a change in market prices and/or the marketing environment in which producers operate. Changes in market prices result in price risk. Crop producers can divide their marketing activities into three broad time frames to manage price risk effectively. These are:

- pre-harvest;
- harvest; and
- post-harvest.

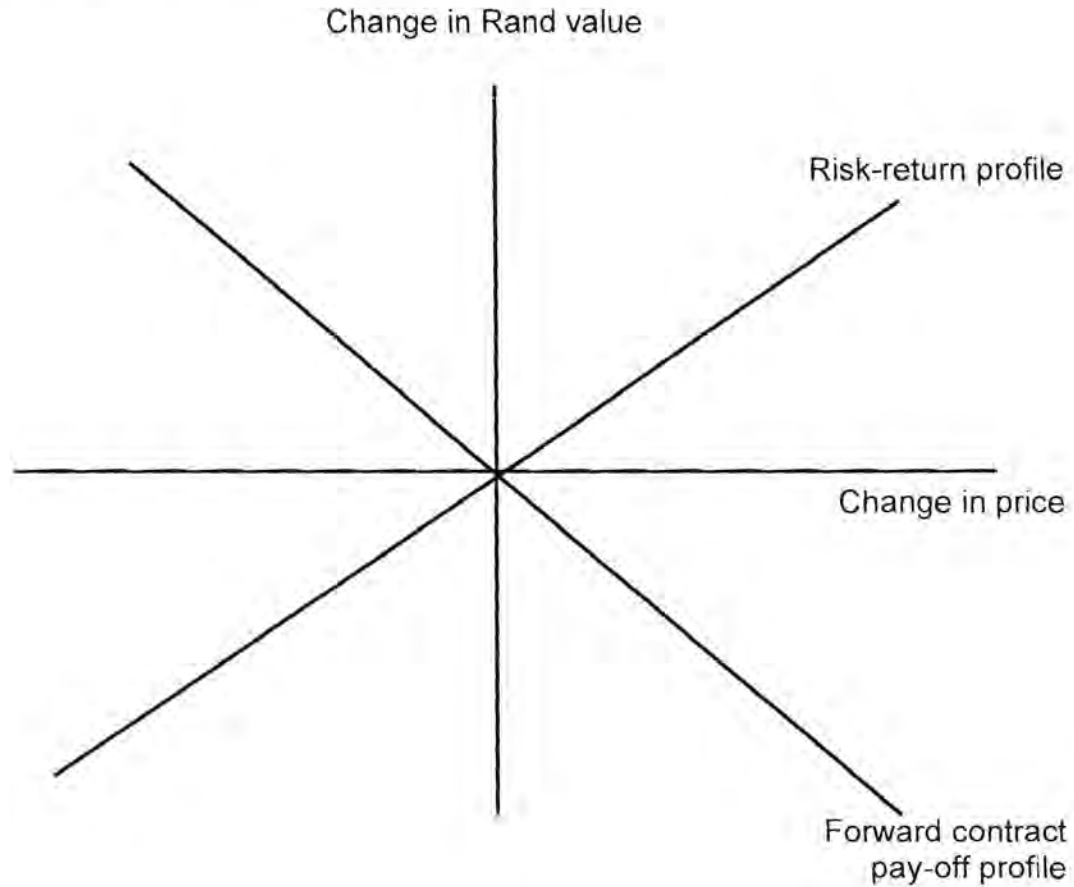
Due to production risks, it is rarely an informed decision to price 100% of the expected production before harvest. Instead, it is advantageous to consider various pricing strategies that can be used for a portion of the crop(s). In Sections 3.2.3.1 to 3.2.3.8, different strategies available to producers are

discussed. The roles of futures contracts and option contracts are extensively discussed in Chapters 4 and 5.

3.2.3.1 *Forward contracts*

A forward contract is an agreement between a producer and a buyer to deliver a given amount of a commodity in exchange for payment at a later date (Helmberger & Chavas, 1996). A properly written forward contract is a legal obligation enforceable in court requiring delivery of a commodity of specific quantity and quality to a given location during a predetermined time period. Since crop production is subject to uncertainty, producers are rarely advised to sell forward contracts on their entire expected crop. The characteristics of forward contracts, in contrast with those of standardised futures contracts, reflects the needs and characteristics of both sellers and buyers. In Figure 3.4, the payoff from selling a forward contract is superimposed on the original risk-return profile of a crop producer (cf. Figure 3.2).

Figure 3.4: Forward contract payoff profile



If the actual price of the crop is higher than the expected price, the producer (seller) loses because less than the market price is received, leading to a decline in the value to the producer. However, this decline in value is offset by the profit on the forward contract. Thus, the forward contract provides a perfect hedge (to take a position that offsets an existing position in order to reduce the price risk in the open position).

Since maintenance margins are not required, one disadvantage of forward contracts is the possibility of default. There is no exchange to guarantee the execution of a contract, as is the case with futures (see Chapter 4). Another feature is that the value of the forward contract is conveyed only at the contract's

maturity. No payment is made either at the origination and signing of the contract, or during the term of the contract.

The use of a cash forward contract effectively locks in a price that the producer will receive for a specific quantity of output. A cash forward contract has the advantage of ensuring that the producer gets a guaranteed minimum price, but it normally also eliminates the possibility of receiving higher prices if market conditions change in the producer's favour. There are four principal types of forward contracts. They are (Nelson, 1985; Fleisher, 1990):

- **Fixed price contracting.** At the time the contract is signed, the price is determined. This price is often based on the futures price quotation for a contract whose expiration follows the delivery time closely. The quantity, quality, and time and place of delivery are also often decided when the contract is initiated.
- **Deferred price contracting.** A deferred pricing forward contract is a binding contract to deliver a specific quantity or a specific number of hectares' output and quality of product to the purchaser at a time specified in the agreement. The buyer and seller agree to some price quotation upon which the price to be paid will be based. The futures contract price, minus some adjustment for the risk assumed by the purchaser, and posted elevator prices on a pre-selected day are commonly used price indexes. Postponement in setting the price distinguishes the deferred price contract from other contractual arrangements. The seller is usually given the option of deciding when to establish the price.
- **Minimum price forward contracting.** This refers to a binding contract to deliver a specific quantity or a specified number of hectares' output and quality of product to the purchaser at a time specified in the agreement. A

guaranteed minimum price is set, but the contract provides for a higher price if the market price increases.

- **Pooled sales.** Upon delivery of a crop to a marketing agent, the seller is given a cash advance. After the marketing agent has concluded all sales, the producer is given an additional payment that depends on the success of the marketing agent in selling the crops of all members of the pool. The producer receives an average price determined by the average price the pooled sales generated. Co-operatives and their members are the primary users of such contracts.

Forward contracting, and the closely related practices of minimum price forward contracting and deferred pricing forward contracting, are the forms of forward contracting most commonly used by agricultural producers. Deferred pricing and minimum price forward contracting are often used in situations where producers want to ensure markets for specialized or perishable commodities or buyers want to ensure sufficient supplies. This is commonly the case when fruit and vegetables are grown for processing at a local plant. Processors with a substantial investment in plant and equipment in one location are often willing to pay prices that reflect local market conditions to ensure supplies at that time and in future years, even though the price paid to producers is above the minimum price established in the contract for that year.

Minimum price forward contracting guarantees a minimum price. In contrast to cash forward contracting, minimum price forward contracting allows for a higher price to be paid if the market price increases. The likelihood of receiving a higher price depends on where the initial price is set relative to market prospects. However, producers are expected to pay some premium for the privilege of a guaranteed minimum price.

Deferred pricing contracts carry the same delivery requirements as other types of forward contracts. However, pricing is accomplished via an agreement on some future standard price quotation upon which the final price is based. Deferred pricing contracts can pose specific problems for producers who have agreed to use the elevator's posted price (for South Africa, that normally represents the Randfontein spot price, because delivery of all futures contracts is based on ex-silo Randfontein prices). A buyer with many outstanding delayed pricing contracts and relatively few other buying opportunities may be tempted to accept lower-than-competitive prices during the time in which the outstanding contracts are fixed.

Participants in a pooled sales scheme deliver their crops to the pool system and receive an advance payment price for the crops delivered. This price is derived from a conservative estimate and the expected total amount of crops received by the pool system. The marketer of the pool system is responsible for selling the crops. After all marketing expenses, storage and other expenses have been met, the net amounts are paid to the participating producers.

A pool sales scheme is normally a good alternative if the producer expects the price of the crop to increase during the marketing season. If the producer seeks protection against price declines, it is the producer's responsibility to determine whether the pool system is protected from negative price movements. There are a number of advantages and disadvantages associated with pool marketing. These are listed below:

- Advantages:
 - easy choice for producer;
 - any volume of crop can be delivered to the pool scheme;
 - it is a proved marketing mechanism;
 - price risk is lowered due to a relatively long marketing time; and
 - producers combine strengths to gain a stronger influence on market

prices.

- Disadvantages:
 - producers carry the price risk if the pool scheme is unprotected from negative price movements; and
 - final payment can take longer than a year.

When hedging with futures (see Chapter 4), producers must pay commissions and forgo higher earning potential on money placed in margin accounts. Producers who use cash forward contracts may incur such costs indirectly, to the degree that local buyers lower prices paid to cover their hedging costs. Moreover, the prices obtained by hedgers may differ from the price expected at delivery by the amount that speculators require as compensation for standing by to take hedgers' trades and/or for bearing risks.

3.2.3.2 *Spot market*

Some buyers are willing to purchase crops at a specific price from producers on the day of delivery. This price is referred to as the spot (cash) price. It fluctuates from day to day and reflects local and world market conditions. A spot sale represents the least flexible but least risky pricing tool. The producer receives the price of the day, and payment is immediate. The producer makes no precommitment to the buyer about price, quantity, or to whom delivery will be made (Branson & Norvell, 1983). Pricing occurs when delivery is complete. According to Bodie, Kane & Markus (1998), there are several advantages and disadvantages to spot marketing:

- Advantages:
 - easy to implement;
 - price risk limited to growing period; and

- price and yield risk separated in decision-making.
- Disadvantages:
 - limited flexibility (tax planning, cash flows);
 - price often at seasonal low; and
 - selling decisions made during busy time (harvest time).

Since the amount of crops produced in South Africa is not known with certainty until harvest time, producers usually refrain from pricing all their anticipated production prior to harvest, leaving some portion of the crop(s) to be marketed during or after the harvest.

3.2.3.3 *Production contracts*

Price uncertainty can be reduced through various forms of contracting. The problems of basis risk (see Chapter 4), variation margin deposits, the timing of the contracts, and the existence of transaction costs are undoubtedly contributing factors to the relatively greater popularity of forward and production contracts. In a production contract, the timing of delivery can usually be set to meet the buyer and/or seller's needs. The forward price is locked in just as with futures contracts, but no margin deposit is required. Production contracts typically give the buyer of the commodity considerable control over the production process (Perry, 1989). These contracts usually specify in detail the production inputs supplied by the contractor, the quality and quantity of a particular commodity that is to be delivered, and the compensation that is to be paid to the producer.

Firms commonly enter into production contracts with producers to ensure timeliness and quality of commodity deliveries, and to gain control over the methods used in the production process. Production contracting is favoured

when specialised inputs and complex production technologies are used, and the end product must meet rigid quality levels and possess uniform characteristics.

Production contracting is also favoured when there are oversupply and under-supply problems; the risk-return trade-offs are advantageous to both the producer and the contracting firm; production technologies are specific, uniform, and knowledge-based; centralised management is feasible; and the commodity is highly perishable (Kliebenstein & Lawrence, 1995; Barry, Sonka & Lajili, 1992; Farrell, 1969). In addition, crop producers may prefer to keep fixed capital assets off their balance sheets for liquidity purposes (Barry, 1984). Producers may, however, face the possibility of having to buy themselves out of a production contract if lower-than-expected yields cause production to fall below the quantity specified in the contract.

3.2.3.4 *Diversification*

Product diversification is a method through which producers can avoid having all their income totally dependent on one undertaking. If profit from one commodity is poor, the returns from other commodities may prevent total profit from falling below acceptable levels. The extent to which diversification can reduce income variability for a farm depends on the price and yield correlations for the selected commodities. If prices or yields for commodities tend to move up and down together, little is gained by diversification. When yields and/or prices for selected commodities move in opposite directions, income variability is reduced. The extent to which income is evenly spread depends on the corresponding proportion of income derived from each commodity. If only a small proportion of income comes from one commodity during good years, it has little effect on total income if disaster strikes to the commodity from which income is normally derived.

Many factors may contribute to a producer's decision to diversify. The underlying theory suggests that producers are more likely to diversify if they confront greater risks, are relatively risk-averse, and face small reductions in expected returns in response to diversification. Other factors may also be important. Weather is a primary factor influencing crop yields. Crops with the same growing season tend to experience the same weather, and their yields tend to have a strong positive correlation. The yield relationship between crops that have different growing seasons and are susceptible to different insects and diseases will be lower.

Depending on a farm's situation, the costs of diversifying may outweigh the benefits. A major problem with commodity diversification is the loss in efficiency and returns from specialised production (Barry, Hopkin & Baker, 1988). These losses could outweigh the value of any risk reduction from diversification. Consequently, specialisation often increases rather than decreases as farms become more commercialised to gain higher expected returns. The result is greater emphasis on other methods of risk management. Diversifying requires a broader range of management expertise and labour, good productive capacity of the land, and reasonable market potential in the surrounding area (Dodson, 1993).

As a result, producers face trade-offs when they examine diversification versus specialisation as a strategy. Specialisation can refine the expertise needed for a particular productive activity, and may also lead to the economics of scale that lower per unit production costs, increasing the profitability of the operation. A producer's decision to specialise (or diversify) may be motivated purely by expected profits, with no consideration given to reducing risk. Conversely, the benefits associated with diversifying arise through the potential offsetting

revenue interactions among enterprises, and the complementarity of equipment and activities that are used within the farming operation (Scherer, 1980).

3.2.3.5 *Liquidity maintenance*

Another aspect of financial risk management is the extent of liquidity. This refers to a producer's ability to generate cash quickly and efficiently in order to meet short-term financial obligations. The liquidity issue relates to cash flow. In the case of a farm, liquidity is affected by whether, when adverse events occur, a producer has assets (or other monetary sources) that can easily be converted to cash to meet financial demands. There are three fundamental types of cash demand for a farm business:

- Transactions that demand liquidity. This need arises from the normal operation of the farm enterprise.
- A precautionary demand for liquidity. This may be necessary to respond to business adversity or to meet unexpected demands for cash.
- Investment demand or speculative demand for liquidity. This demand enables the business to respond to new or unforeseen investment opportunities.

One method of determining liquidity is to use a cash flow budget. A cash flow budget lists projected cash inflows and outflows for a specific period. The cash flow budget provides a timed format for examining the financial condition of the farming enterprise, detecting potential problems and suggesting alternative approaches that could be employed to solve these problems. Cash flow requirements consist of the following expenditures:

- operating inputs (seed, fertiliser, pesticides, lime, soil tests, scouting, crop insurance, etc.);

- machinery costs (fuel, lubrication, repairs, custom hire, machine rental, down payments on new or replacement items);
- personnel costs (wages, salaries, other labour costs, family living expenses, income tax);
- miscellaneous costs (farm insurance, consultants' fees, tools, supplies, etc.); and
- debt payment (principal and interest on term loans, interest only on operating loans).

Using the cash flow budget, it is possible for producers to determine their production costs per hectare. If they know their production costs, producers can adjust their marketing by:

- providing a pricing objective by discovering break-even prices;
- determining the portion of the total crop that must be sold at a particular price to ensure that they can meet cash commitments;
- determining the portion of the crop that can be left unpriced once minimum earnings and cash flow commitments have been realised;
- understanding the earnings and cash flow implications of selling the crop at a particular price; and
- reducing emotional involvement while adding focus and discipline to the marketing decision.

The degree of marketing flexibility in a given financial situation can be estimated by means of the cash flow risk ratio. The cash flow risk ratio determines what percentage of the crop must be sold at the expected market price to meet cash obligations such as input cost, interest cost and rent cost demand. It is calculated as follows:

$$\text{Cash flow risk ratio} = \frac{\text{Cash flow break – even price per hectare}}{\text{Expected market price (R/ton)}}$$

Given a constant market price, the break-even price increases or decreases as yields change. If the yield declines, the percentage of the total crop (that is sold at the expected market price) required to meet cash flow needs increases. After cash flow needs have been met, the remaining production can be marketed using methods intended to gain the highest possible net price.

Producers who have low cash flow needs and substantial operating capital and borrowing capacity have more flexibility in terms of how they market their commodities. Their marketing strategy is dictated mainly by their expectations of price movements, storage costs and income tax management.

Cash flow requirements can be very different for different producers. The amount of outstanding debt serviced and whether land has been purchased or rented have the greatest impact. The following example illustrates the differences in cash flow demand and how this affects the cash flow risk ratio. Four hypothetical producers all plant 600 hectares of maize in Mpumalanga annually, using similar technology on similar land. Only their land holding and debt situations differ.

- Producer 1 holds title to all the land he farms and is debt-free.
- Producer 2 cash rents his entire land base, and has some debt because he needed to purchase machinery.
- Producer 3 has a 50 percent lease agreement on all his land, and also owes an amount of money on machinery.

- Producer 4 recently purchased 250 hectares of cropland and cash rents another 350 hectares. He has the same machinery debts as Producer 2 and Producer 3.

The cash flow requirements for one crop (maize) are set out in Table 3.1.

Table 3.1: Hypothetical cash flow requirements for maize on a 600-hectare farm

Item	1	2	3	4
Operating inputs	426 000	426 000	426 000	426 000
Machinery costs	222 000	222 000	222 000	222 000
Personnel costs	96 000	96 000	96 000	96 000
Insurance (short-term)	48 000	48 000	48 000	48 000
Land costs (rent)	0	72 000	36 000	42 000
Miscellaneous costs	48 000	48 000	48 000	48 000
Debt payments	0	50 000	50 000	50 000
Total cash flow needs	840 000	962 000	926 000	932 000
Hectares planted	600	600	600	600
Cash flow cost per hectare	1 400	1 603	1 543	1 553
Expected or actual yield (ton per Ha)	3.25	3.25	3.25	3.25
Cash cost break-even price	431	493	475	478
Expected market price (R/ton)	640	640	640	640
Cash flow risk ratio	67.3%	77.0%	74.2%	74.7%

The cash flow risk ratio indicates what percentage of the crop must be sold at the expected market price to meet all cash obligations. Once that demand has been met, the remaining production can be marketed using methods intended to gain the highest possible net price, regardless of risk. Producer 1 has 32.7% (100% - 67.3%) of his crop available for speculation. The higher the cash flow risk ratio,

the more important it is to lock in a price at or above the break-even price when it is available, and the less the producer can afford to speculate on the possibility of achieving a higher price. A cash flow risk ratio greater than 100% means that it is possible that savings and/or borrowings will have to be used to meet the cash flow needs for a given year. It is important to calculate the cash flow risk ratio for each of the major crops produced by a producer. Although the cash flow risk ratio can be used as a standard for pricing decisions, it is not necessarily a price goal. A price goal must be based on the needs of a business combined with price levels currently and potentially offered by the market. The price goal changes from year to year, or even more often, depending on changing market conditions. In some years, the market may not offer a break-even price at any time, and strategies to minimise loss are then needed.

But what about producers who diversify their crops to manage production risk? They can also use the cash flow budget to manage price risk. The following example illustrates how the cash flow budget can assist a producer in determining how much must be sold at a given price. In the example, a farmer, Dave Diversify, who is debt-free, holds the title to a 600-hectare farm in Mpumalanga. There he plants 200 hectares each of maize, sunflower seed, and sorghum. The cash flow budget of Dave Diversify is set out in Table 3.2.

Table 3.2: Cash flow requirements for a diversified farm

Item	Maize	Sunflower	Sorghum
Operating inputs	142 000	80 000	127 000
Machinery costs	74 000	70 000	74 000
Personnel costs	32 000	32 000	32 000
Insurance (short-term)	16 000	12 000	15 000
Miscellaneous costs	16 000	16 000	16 000
Total cash flow needs	280 000	210 000	264 000
Cash flow cost per hectare	1 400	1 050	1 320
Expected or actual yield	3.25	1.3	3.5
Cash cost break-even price	431	808	377
Expected market price ¹	600	1 050	640
Total cash receipts	390 000	273 000	448 000
Cash flow risk ratio	71.8%	76.9%	58.9%
Farm living expenses ²	100 000	100 000	100 000
Contribution margin	591	413	380
Quantity available for speculation	59	-153	320
Break-even price	584.62	1 192.31	520.00
Margin of safety	2.56%	-13.55%	18.75%

Sorghum has the lowest cash flow risk and Dave Diversify has 41.1% (100% - 58.9%) of his sorghum left to speculate with. The higher the cash flow risk ratio, the more important it is to lock in a price at or above the break-even price when it is available, and the less a producer can afford to speculate on the possibility of achieving a higher price.

¹ Market price represents the net amount after all marketing costs have been subtracted.

² A total of R300 000 of farm living expenses is allocated for the number of hectares planted with each crop.

An alternative method, called the **contribution margin approach**, can also be used. The contribution margin determines how much of the crop must be sold at the expected market price to cover variable cost and fixed costs. The formula for the contribution margin is the following:

$$\text{Contribution margin} = \text{Fixed cost} / \text{Contribution per ton}$$

To determine the contribution per ton, the following formula applies:

$$\text{Contribution per ton} = \text{Selling price per ton} / \text{Input costs per ton}$$

From Table 3.2, it is clear that Dave has 59 tons of maize available for speculating. The cash flow break-even price is a reference point indicating the availability of surplus cash for potential shortfalls. In Table 3.2 the break-even price for maize is R584.62 per ton; that is the price needed to cover all costs. A price above R584.62 per ton implies a profit. The margin of safety indicates the amount that sales may decrease before a producer will suffer a loss. The margin of safety only calculates the percentage by which the net market price of the crop can decrease before a producer will suffer a loss. In the example, the market price of maize can decrease by only 2.56% before Dave Diversify will suffer a loss.

Any opportunity for any business organisation to earn a profit implies taking some risk. Although it is not generally described as a business asset, the ability and willingness to assume risk is critical. Every farm is likely to differ in its capacity to assume a given type of risk-exposure. **Ability** (or *capacity*) to assume risk differs from a **willingness** to assume risk, but either one can limit the risk exposure a firm accepts. Producers who recognise and prudently use their capacity to assume risk are likely to enhance their chances of financial success.

One way to consider a farm's capacity to assume risk is to describe it as a chain with five links:

- The first link is net earnings as a percentage of the value of the farm's crop production, which shows the farm's capacity to absorb losses resulting from reductions in yields or price.
- The second link is the working capital of the farm business. This indicates whether the business has sufficient cash flow (and current assets) to cover operating losses that occur in the first link.
- The third link is current debt repayment capacity, which refers to the farm's ability to rely on a carry-over operating loan to finance operating losses.
- The fourth link is owner's equity, which is the business's ability to sell assets to restructure its finances.
- The last link is collateral, which is the legal right to the owner's equity.

3.2.3.6 *Storage*

Storing grain that is not priced places the producer in a speculative position. Instead of just storing grain out of habit, the producer needs to determine whether there is an economic incentive to store. To determine this, the producer needs to know the costs associated with storing the grain (storage rates, handling charges, shrinkage, interest and opportunity cost). Next, the producer must determine whether expected cash prices might rise in the future. Lastly, the producer must determine whether the expected cash price increase is large enough to more than offset the associated storage costs. Deciding how long to store a crop depends upon a number of factors. Changes in futures prices, basis levels, delivery opportunities and interest rates all play a role. Long-term storage is profitable only if prices rise enough over the storage period to cover storage and interest costs.

Throughout this study, it is assumed that producers do not have farm storage facilities and make use of commercial storage silos. This physical storage cost ranges up to about 21 cents (SAFEX price in 1998/1999) per ton per day. A more significant cost is related to the interest rates that apply to each individual producer. For example, for a producer with outstanding debt accruing interest at 24% per year, the interest cost of storing maize, with a spot price of R650/ton, is R13/ton per month. In other words, the producer needs to make over R764/ton six months after the harvest to justify the interest cost. Another producer who has no debt may only need a R34.20/ton higher price to cover the interest cost of storing maize with a spot price of R650/ton for six months. Both producers, however, are also exposed to the risks of spoilage and theft as they store their grain.

Another important fact to consider is that holding unpriced grain in storage is a speculative venture. If prices decline instead of rising after harvest, the producer stands to lose in two ways. First, the producer loses if the price received for the grain when it is sold is lower than it was at harvest. Secondly, the producer must pay the storage cost.

Storing unpriced grain has specific advantages and disadvantages (Cramer, Jensen & Southgate, 1997) as listed below:

- Advantages:
 - storage extends the marketing season;
 - producers can take advantage of higher prices if they occur; and
 - producers can deliver when supply decreases
- Disadvantages:
 - prices may not increase enough to cover storage cost;
 - stored grain can lose quality; and
 - producers are unprotected against falling prices.

3.2.3.7 *Other methods of risk management*

The list of strategies and tools discussed above is by no means complete. Producers commonly use many other strategies for farm risk management. Some of these additional strategies include the following:

- **Adjusting input- and output-levels.** Producers can respond to risk by altering output levels, input use, or some combination of the two. Research indicates that a higher selling price risk for producers results in lower levels of both input use and final output (Sandmo, 1971; Ishii, 1977; Just & Pope, 1978; Robinson & Barry, 1997;). Given that risk preferences and circumstances can vary greatly across producers, the final input and output levels chosen by producers can, accordingly, vary considerably for individuals in similar situations.
- **Culture practices.** Culture practices can be used to reduce yield and income risk. One such practice involves planting short-season varieties that mature earlier in the season, protecting producers against the risk of early frost and yield loss. Supplemental irrigation due to abnormal weather is another means to protect against yield loss.
- **Excess machine capacity.** A producer may have enough machine capacity so that planting and harvesting crops can occur more rapidly than needed under normal weather conditions. By having such resources, the producer can avoid delays at either planting or harvest that may reduce yield losses.
- **Vertical integration.** Vertical integration is one of several strategies that fall under the umbrella of 'vertical co-ordination'. Vertical co-ordination includes

all the ways in which output from one stage of production and distribution is transferred to another stage. Farming has traditionally operated in an open production system, where a commodity is purchased from a producer at a market price determined at the time of purchase. The use of open production has declined, and vertical co-ordination has increased as consumers have become increasingly sophisticated and improvements in technology have allowed greater product differentiation (Allen, 1997). A vertically integrated firm, which retains ownership control of a commodity across two or more levels of activity, represents one type of vertical co-ordination.

- **Maintaining financial reserves and leveraging.** Leveraging refers to the producer's use of debt to finance the operation. Increasing the farm's leverage increases the capital available for production, allowing expansion of the business, but also entails incurring a repayment obligation and creates the risk of loan default because of the risks inherent in the farming business.
- **Leasing inputs and hiring custom work.** Producers can also manage their farming risks by either leasing inputs (including land) or only hiring workers during harvest or other peak months. Leasing refers to a capital transfer agreement that provides the lessee with control over assets owned by someone else for a given period, using a mutually agreed-upon rental arrangement (Perry, 1989). Producers can lease land, machinery, equipment, or livestock. Producers who hire custom help (who provide skilled labour and their own equipment) can lower the costs associated with committing capital to fixed inputs. With the use of custom workers (or hired or contract labour), the producer has a great deal of flexibility, potentially lowers costs, and obtains specialised labour (Perry, 1989). The use of such arrangements may, however, increase the producers' risk because they would have less control over resources than if they owned equipment outright or if workers were hired full-time.

- **Insurance.** Insurance is often used by crop producers to mitigate yield and revenue risk, and is obviously prevalent outside agriculture. Property, health, automobile and liability insurance are all forms of insurance regularly purchased by individuals to mitigate risk.
- **Off-farm employment and other types of off-farm income.** Earning off-farm is another strategy that producers may use to mitigate the effects of agricultural risk on farm and family household income. Not only can off-farm income supplement household income, it may also provide a more reliable stream of income than farm returns.
- **Flexibility.** To meet the challenge of uncertainty, the producer should plan for flexibility. Flexibility involves modifying the most profitable business plan to avoid losses or pursue new opportunities (Casavant & Infanger, 1994). Flexibility is a characteristic of a producer's attitude. The flexible producer is willing to try out new ideas, seeking new information sources, testing new techniques and experiment with new production processes. The potential for growth and profitability is the reward for a flexible attitude. Flexibility does not directly reduce risk, but it provides a means of coping with risk. One way to increase flexibility is to reduce fixed costs relative to variable costs. By doing so, producers are not hampered by expensive machinery that limits their choice of crops. They can easily change to different crops without sitting with idle expensive machinery. Short-term assets can be changed more often than long-term assets. Another way to achieve flexibility is to choose non-specific resources instead of specific resources. General-purpose buildings and machines are preferable to specialised buildings and machinery. However, with a flexible farm, the producer loses the benefits of specialisation. The higher total costs of flexibility may make this choice infeasible.

Other methods of risk management in farming are also important, and focus on other types of issues than those specific to production, marketing and finance. Legal risks and issues associated with farm liability have become increasingly important. In addition, tax concerns are a key issue in managing the income risks associated with year-to-year income flows, as are estate transfers from one generation to generation (Keller, 1998; Keller & Rigby-Adcock, 1998; Bacquet, *et al.*, 1997).

3.3 DEVELOPING A MARKETING PLAN

One of the most important steps in marketing commodities profitably is to develop a sound marketing plan. A good marketing plan allows producers to control important decisions concerning when and how to market the crop. The marketing plan is a written plan that clearly delineates what is to be done in the marketing programme.

The four basic steps in developing a marketing plan are:

- estimating a break-even price;
- determining market or price objectives;
- following through with the plan; and
- evaluating the marketing programme.

Market or price objectives vary from producer to producer. Producers need to assess their financial goals. These goals depend on capital constraints, current debt load, cash flow requirements, and the producer's risk attitude. Producers must establish price objectives that meet these goals. These objectives must be realistic for the current market as well as the expected market conditions. An acceptable market objective is to limit losses in the short run and to guarantee

long-term farming prospects. Producers must evaluate and take action on those marketing alternatives to achieve market goals and price objectives.

The most difficult part of any marketing plan is carrying it out. When markets start to move either up or down, the producers' outlook and opinions might change. It is important that producers develop a plan that they will feel comfortable carrying out, and producers must be willing to implement provisions for unexpected developments.

Once a marketing season is completed the producer must evaluate the marketing programme. It is important that any modifications and changes to the programme must be made before the new season starts and that every season must be handled in isolation. Any given specific marketing plan might not be applicable for every marketing season. A good marketing plan should be part of an integrated management approach to the farm business.

3.4 CONCLUSION

The resource limitations of producers, unpredictable weather patterns and fluctuating economic and market conditions make yearly planning difficult. Nevertheless, an understanding of the principles of financial management can help producers to maximise their net worth over a sustainable period.

Financial measures are intended to help producers analyse their farm activities from a financial standpoint and provide useful information needed to make good management decisions. By themselves, the financial measures discussed do not provide answers – they need to be reviewed in relation to each other and to other farm and non-farm activities. It is not possible to control or predict all the factors that influence the final outcome of any farm decision. Nor is it possible to

have available all of the information that would be ideal. But decision-making can be improved by using available information and by effective financial planning and analysis.

The term 'risk management' means different things to different businesses, but in agriculture it involves identifying events that could have adverse financial consequences and then taking actions to prevent and/or minimize the damage caused by these events. Due to the very nature of agriculture and the limited number of insurance contracts available to producers, the importance of price risk management instruments is so much greater. The consequences of taking business and financial risks in agriculture heighten the need for producers to develop risk managing skills. It is especially important to formulate comprehensive strategies for dealing with the multiple sources of risk. Understanding the concepts and measures of variability and correlation is also important. Risk management considers both the asset and the liability structure of farm businesses, and accounts for the sources of risk and methods of managing risk in production, marketing and financing. High-performance producers compare the costs and returns for various risk management alternatives in developing their strategies.

In the following two chapters, two more price risk management strategies that are traded on SAFEX are discussed in detail: futures contracts and options on futures contracts. These contracts are traded on a daily basis. In the following chapters, the characteristics of these risk management strategies are identified, and hedging as an alternative marketing strategy is illustrated.