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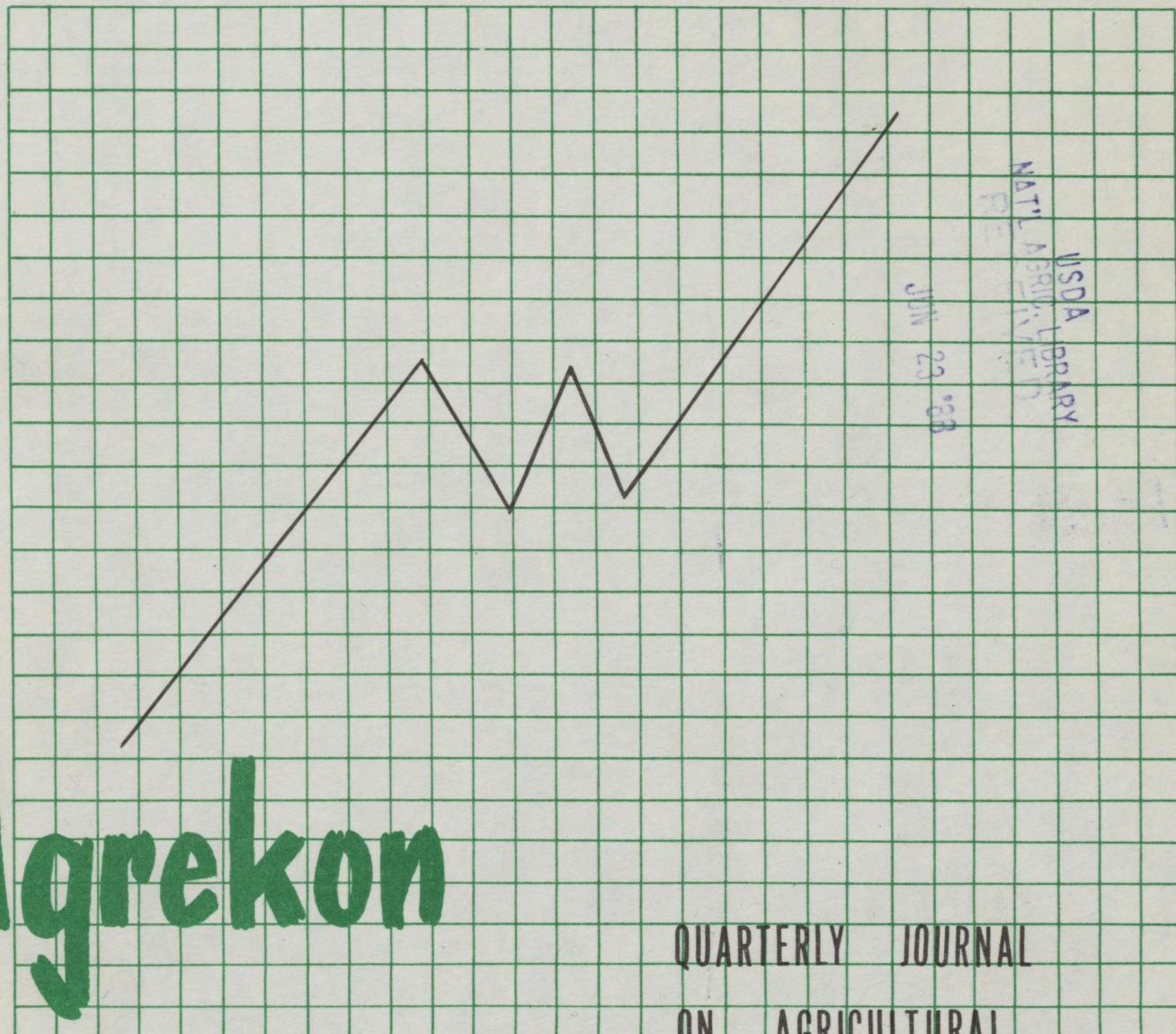
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THE IMPACT OF RISK AND UNCERTAINTY IN AGRICULTURE ON THE AGRICULTURAL INPUT INDUSTRY*

by C.F. le Clus

National Maize Producer's Organisation

and J.P.F. du Toit

University of Pretoria

Uncertainty about the future and the concomitant risks affect every individual and every enterprise every day. However, the ability to cope with risk and uncertainty is a prerequisite for survival and growth for any business enterprise.

For the purpose of this paper, no attempt will be made to define or describe risk and uncertainty in agriculture. Some risks and uncertainties will, however, be looked at more closely so that the suppliers of the inputs will be in a position to identify the risks involved more readily. Moreover, no attention will be paid to other risks which have to be discounted by suppliers since such risks are regarded as being beyond the scope of this paper. In fact, each of these justify several papers on their own.

For the suppliers of agricultural inputs, uncertainties and risks in agriculture manifest themselves in, among other things, varying yields, varying profits, a varying demand for inputs, a varying ability to pay and the destruction of supplies and production capacity due to technological obsolescence. In this paper, these aspects will be discussed first. Subsequently there will be a discussion of the consequences of these variations on the input industry in general. In conclusion a few input industries will be dealt with to demonstrate the impact of risk and uncertainty on the various types of input industries.

1. Agricultural risk and uncertainty as viewed by the input industries

As already stated, risk and uncertainty in agriculture for the suppliers of agricultural inputs lie in the varying demand for inputs, the farmer's ability to pay and the destruction of stocks and/or production capacity as a result of technological obsolescence. The magnitude of these factors and their long-term behaviour are therefore of particular interest to the suppliers of agricultural inputs.

*Paper presented at the 18th conference of the Agricultural Economic Society of South Africa in April 1981 at Bloemfontein

1.1 Variations in agricultural yields

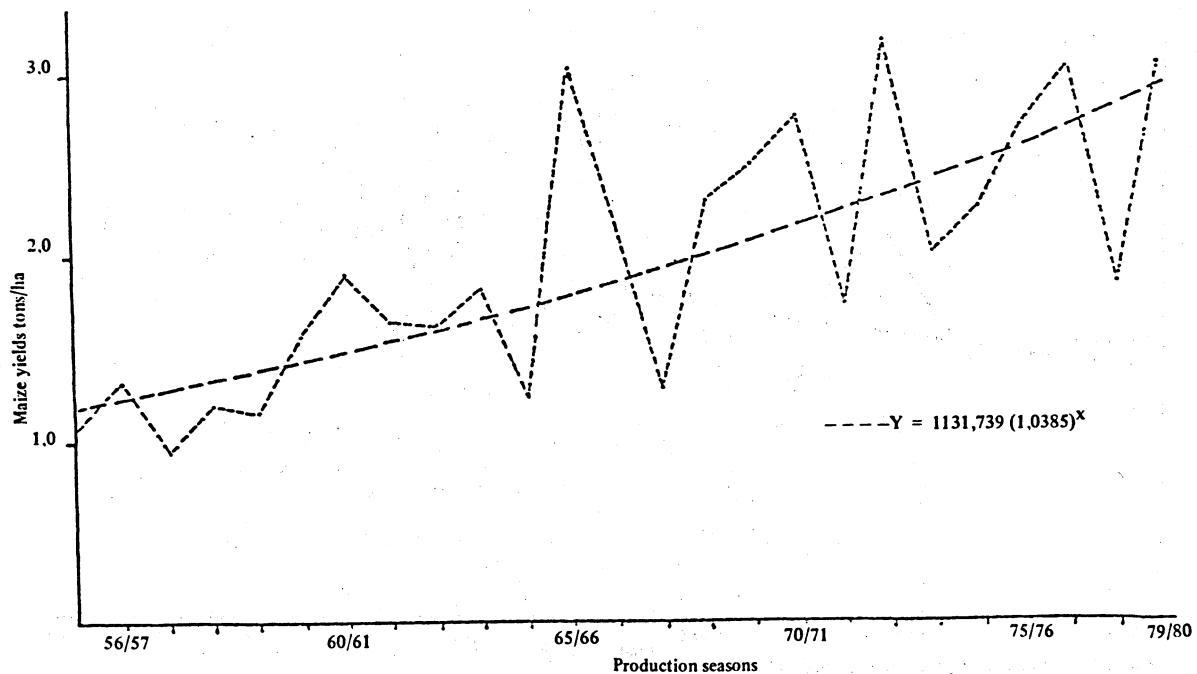
The per-hectare maize yields in the three major maize-producing areas over a period of 25 years and the theoretical growth curve (log-normal) for each region are shown in Figures 1 to 3. It is noteworthy that the deviations around this *growth curve* are considerably larger since the mid-sixties when compared with the deviations prior to the mid-sixties. It appears as if these deviations are on the increase.

The total area planted to maize during the same period is shown in Figure 4. This area increased from the late fifties up to the mid-sixties. The increase was probably due to improved mechanisation practices which made production possible on relatively marginal soils. From the mid-sixties to the early seventies there was a fluctuating decline in the total area planted - a phenomenon that can probably be attributed to the withdrawal of the most marginal soils from maize production. Since then the area planted has stabilised at around 4,5 million hectare. Albeit with large and apparently increasing fluctuations, yield per hectare continued to increase.

The relevant question now seems to be: will these fluctuations continue, or will they level off? In other words, are they inherent to the modern maize production structure or merely the result of coincidental and marked climatic variations? (For the purpose of this paper, only maize - as the major agricultural product - will be dealt with although the phenomenon applies, to a greater or lesser extent, to other important agricultural crops.)

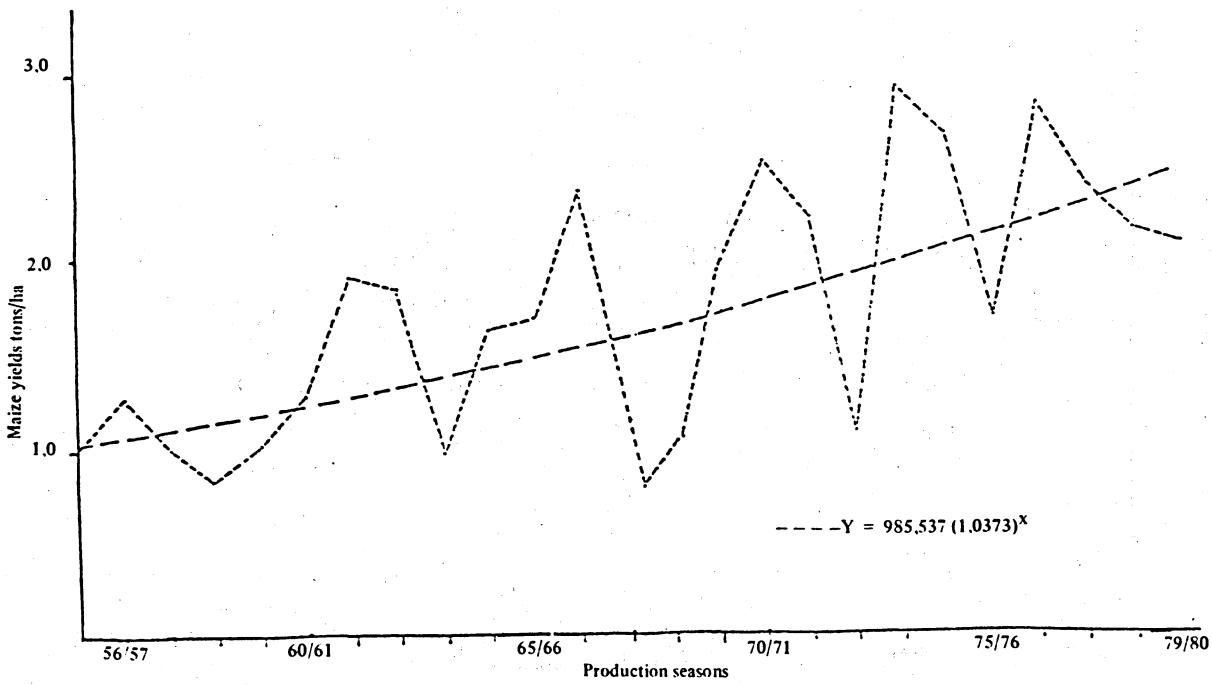
1.2 Expansion of agricultural production

The total area available for agricultural production continues to decrease as non-agricultural projects claim more land. Current technology does not hold out much hope of a significant expansion in total area of arable land. This means that future production increases will have to be vertical and this can only be obtained by either moving to the right along the slope of the multiple production function, or by moving to a higher production function through improved technology, or a combination of the two. These possibilities are presented in Figure 5. This graphic



Source: Abstract of Agricultural statistics 1981

FIG. 1 - Maize yields in tons per hectare in the Transvaal Highveld for the production seasons 1955/56 - 1979/80



Source: Abstract of Agricultural Statistics, 1981

FIG. 2 - Maize yields in tons/ha in the Northwestern Orange Free State for the production seasons 1955/56 - 1979/80

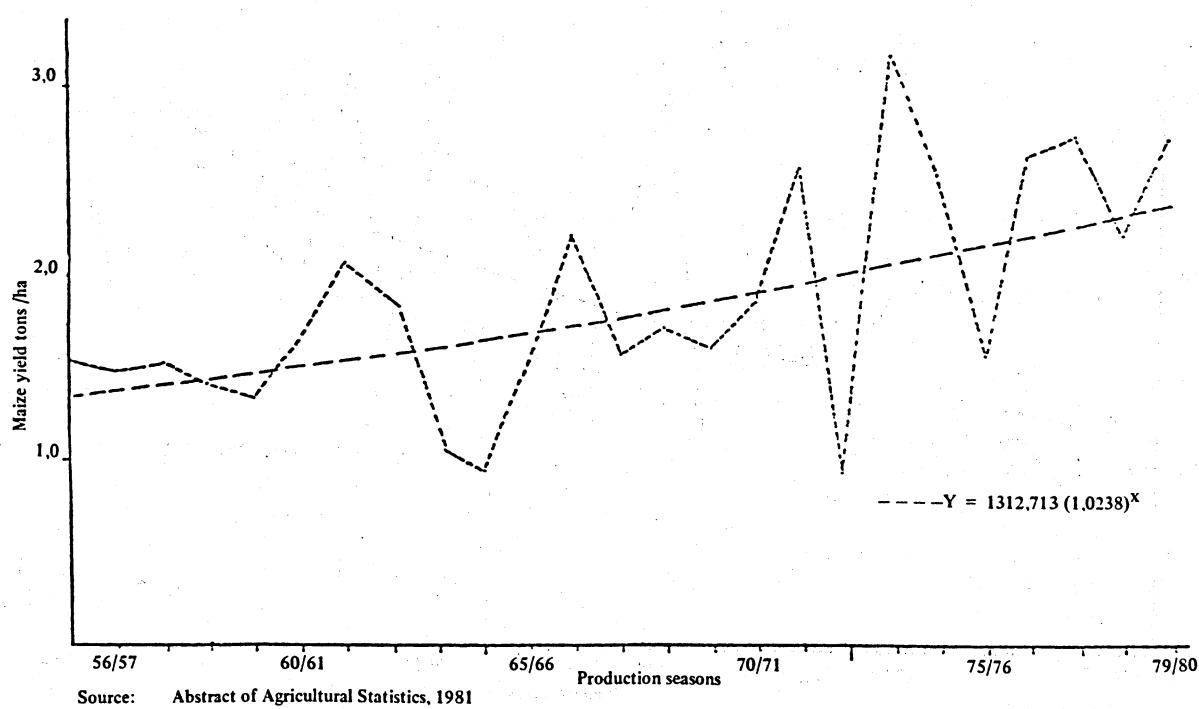


FIG. 3 - Maize yields in tons/ha in Western Transvaal for the production seasons 1955/56 - 1979/80

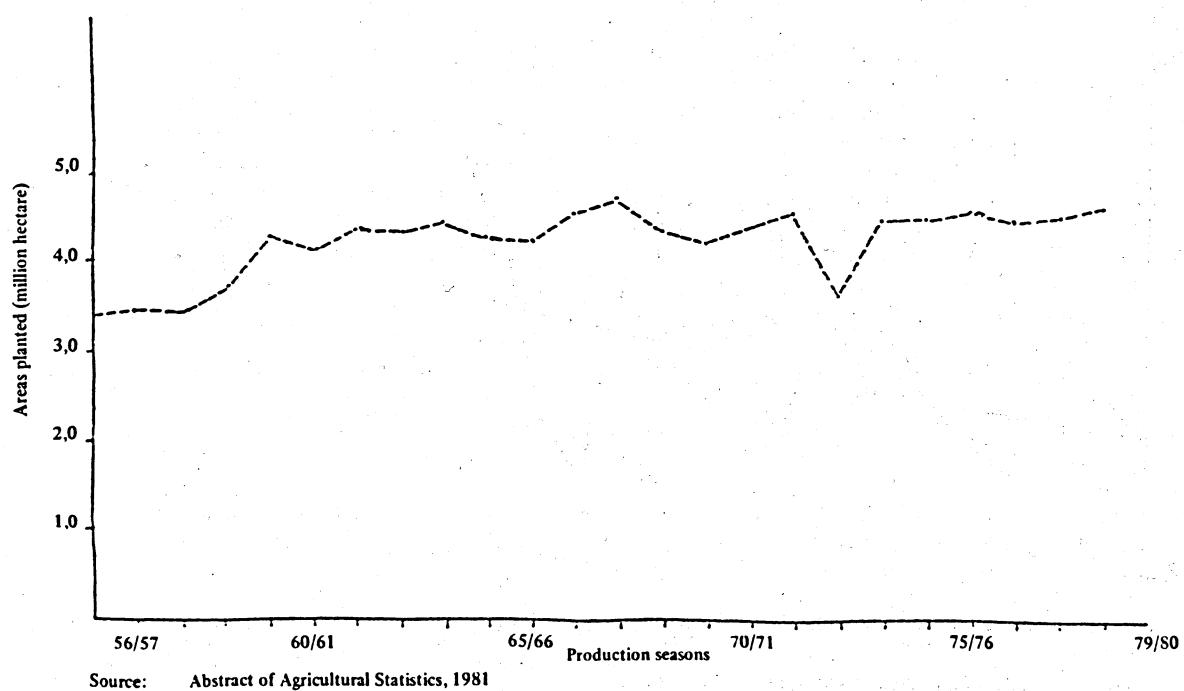


FIG. 4 - Total area planted to maize in the White areas of South Africa for the production seasons 1955/56 - 1979/80

presentation is naturally an oversimplification of a complex reality, particularly where a simple function is used to represent a multivariable one, but it is nevertheless useful to illustrate the expansion potential.

1.2.1 Expansion at constant technology

If production occurs rationally at point A on production function 1 while price ratio 1 prevails, then expansion with constant technology is only possible through a movement to the right along the slope of this production function, and then only if the price ratio improves. The effects of the Law of Diminishing Returns are such to justify this movement economically, the price ratio will have to improve continuously for every additional increase in the output. The more favourable the price ratio, the higher can the movement be along the slope of the function; more and more extra inputs are therefore required per unit of extra output and the investment per unit of output increases. There is an increasing probability of loss because the efficiency of any input depends on the quantity and quality of the other inputs with which it is combined.

A sudden change in the quality or quantity of one input (e.g. rainfall) will therefore have a more dramatic effect at this level compared with a situation where production takes place at a lower level.

1.2.2 The implementation of improved technology

Technology development enables the producer to move towards a higher production function, i.e. to function 2 in Figure 5. With the same price ratio, production can be increased even at a lower level of inputs. However, technological development frequently lies in the input itself and not always in the method of application, for example new hybrids, new herbicides, new stock remedies and new types of machinery or implements. Due to the interdependence of the inputs, a technological improvement in any one could lead to a completely new production structure. The same obviously applies if there should be a change in the price of any input. This fact causes specific changes in the structure of the demand for the various inputs.

It is known that changes in the prices and quality of other agricultural inputs remain a continuous risk for any supplier of a particular agricultural input. However, for the purpose of this paper, particular emphasis falls on the changes in the rate at which improved technology is applied in agriculture, that is the rate at which technology becomes antiquated.

In this regard the adage that the farmer, when the inflation rate is high, has to run faster just to maintain his position seems only too true. The real gross realisation of the maize producer over the past number of years is given in Table 1. (This period was chosen because the total area planted to maize remained fairly constant while the inflation rate increased rapidly.)

The sum of the deviations around the average gross real realisation amounted to only R200 000. This means that the total real income from maize did not increase significantly, despite an increase in the yield per ha over this period.

The change in profit for the average maize producer is therefore determined by the movement of price ratios as well as the extent to which he can succeed in moving to a higher production function by applying improved technology.

However, the above argument implies that producers are currently producing rationally - something which is not necessarily true. Profits can be increased by rationalising the inputs, even if all other factors remain constant. It can, however, be accepted with a fair degree of certainty, that technology will be applied more quickly in future as pressure for increased production mounts. Once again maize has been used as the example, although the same arguments would apply - to a greater or lesser extent - to all agricultural products.

1.3 Summary

Agricultural yields vary drastically from one year to the next, and it appears as if these variations will increase in future since the emphasis will fall on vertical expansion.

These variations will inevitably cause direct and equally dramatic fluctuations in the demand for agricultural inputs.

As explained earlier, the application of improved technology can play a vital role in the vertical expansion of agricultural production.

It is expected that the rate at which improved technology is accepted and used will increase in future. However, the implementation of new techniques and inputs can increase risk via factors beyond the farmer's control.

Due to the above-mentioned facts, there is considerable annual variations in farming profits. The farmer's cash-flow and therefore his ability to create an effective demand for inputs and to meet his debts, also vary from year to year.

As a result of the uncertainties and risk in agriculture, suppliers of inputs therefore find that -

- the demand for their inputs varies from year to year, and this trend could increase in future;
- technological changes could increase at a growing rate (partially due to risk and uncertainty); and
- there are considerable variations in farmer's ability to create an effective demand for inputs and to meet their liabilities.

2. The consequences of agricultural uncertainties and risk for the input industry

The fundamental problems associated with risks and uncertainties in agriculture as described above are -

- the abnormal large buffer stocks that input industries have to carry, and/or the

TABLE 1 - Changes in the real gross income of the maize farmer from the 1974/75 to the 1979/80 production season

| Production season | 1974/75 | 1975/76 | 1976/77 | 1977/78 | 1978/79 | 1979/80 |
|--|---------|---------|---------|---------|---------|---------|
| Total quantity delivered (million tons) | 8,221 | 6,655 | 8,922 | 9,259 | 7,608 | 9,971 |
| Total realisation (quantity x net producers price) (R million) | 509,7 | 432,6 | 656,7 | 740,3 | 761,0 | 1 158,8 |
| Consumer price index (Oct. 1975 = 100) | 114,9 | 126,9 | 141,2 | 159,9 | 180,5 | 209,4 |
| Real realisation (R million) | 443,6 | 340,9 | 465,1 | 462,0 | 421,6 | 553,4 |

above-average production capacity for which provision has to be made;

- that they have to provide more and more credit for agriculture;
- that they have to discount technological obsolescence;
- that their profits fluctuate, and are sometimes abnormally low;
- that they find it relatively difficult to find capital for new expansions; and
- that import replacements by local manufacture takes place at a very slow rate.

2.1 Buffer stocks and/or capacity

Market share is important to any producer since buyers, on the whole, are fairly conservative and often prefer to stick to the known product. It is therefore easier to lose one's share of the market than to increase it. If a producer cannot meet the demand for his product, it offers his competitors an opportunity to increase their market share. The rational producer will therefore always try to carry sufficient buffer stocks or have the production capacity at his command - to meet varying demands for his product and thereby to increase his share of the market.

It is therefore obvious that the bigger the variations in the demand, the bigger must be the buffer stocks and extra production capacity. However, both stocks and production capacity are expensive and cannot be replenished at short notice. The importer has to place his orders in advance and pay for them, whether he sells his stock or not. The production capacity of the local manufacturer is determined not only by his machinery and labour, but also by the stock of raw materials. Raw materials too, must be purchased and paid for well in advance, whether they are processed or not.

The bigger the variations in the demand for the manufacturer's product, the more necessary it becomes for him to invest capital in stocks and production capacity which leads to higher production costs. This reduces his profit margin, leaving him with less cash for expansions. The agricultural input industry finds itself in a most unenviable position in this respect.

2.2 Credit

Suppliers of agricultural inputs who sell direct instead of through co-operatives, often find that

they have to grant considerable credit facilities to farmers in years when agricultural conditions are poor. This means that both their working capital and their expansion capital are reduced accordingly, and few suppliers are financially strong enough to afford this.

The demand for this type of credit from farmers usually occurs in years when crop prospects are comparatively poor, which implies that suppliers must make above-normal provision for writing off bad debts. Commercial banks, co-operatives and other financial institutions usually hold the mortgage bonds on the agricultural lands and most suppliers prefer to write off bad debts rather than spoil their image by taking legal action against farmers. This type of credit to farmers has an adverse effect on their profits and also restricts their ability to acquire expansion capital.

2.3 Technological obsolescence

Technological obsolescence occurs when the demand for an input falls away because technological development replaces its productivity in the production process with other inputs and/or production methods. The classic example in this regard is the replacement of the draught animal by the tractor. This provided new technology and new inputs that could complete the work faster, better and more economically. The machines that manufactured bridles and harnesses soon became useless - as did the unsold supplies of the finished product.

There are numerous such examples of technological obsolescence. The cost of technological obsolescence lies in both the destruction of supplies and production capacity and in the supplier's loss of market share and turnover. The dilemma of the input is, *inter alia*, that risk and uncertainty in agriculture demand that bigger investments must be made in both supplies and production capacity. However, this investment is most vulnerable to technological obsolescence while the latter is in turn increased by risk and uncertainty in agriculture.

2.4 Low profits

Because the suppliers of inputs must invest in relatively large stocks and production capacity and simultaneously provide risky credit to agriculture, their total cost structure increases.

The suppliers' ability to pass the higher costs on to agriculture depends on the elasticity of the demand for the various inputs. There is strong competition in most input categories and this reduces the chances for passing on the costs, with the result that suppliers operate on relatively low profit margins.

2.5 Expansion capital

As is the case with the farmer, the supplier of inputs - under conditions of double-figure inflation - finds it increasingly difficult to maintain his financial position. It is therefore important for the supplier to expand. However, expansion requires considerable capital which must be obtained either through loans or by issuing additional shares.

In both cases the profitability of the investment, the growth potential and the risk profile are thoroughly investigated before shares are bought or loans granted. The less favourable these factors are, the more difficult the input supplier will find it to acquire funds and will increasingly have to rely on his own funds for this purpose.

Many suppliers of agriculture inputs therefore find it difficult to obtain optimum amounts of expansion capital, and if they do acquire the capital, it is often at a considerable premium. This situation applies particularly when money is relatively scarce, which makes it difficult for the input industries to share in the benefits of economic revival.

2.6 Local manufacture versus imports

When compared with developed countries, the South African market for agricultural inputs is small. This results in a comparatively high investment in overheads relative to throughput. For this reason the fixed cost component of the end product is often very high and the local manufacturer finds it difficult to compete with the imported product. The Atlantis diesel-engine project clearly illustrates this problem. Apart from the tremendous amount of capital required for this project, the locally manufactured engines are expected to cost up to twice as much as the imported ones.

The input industry's problems which arise from the uncertainties and risk in agriculture increase the local producer's cost structure and make it even more difficult for him to compete with the imported product. It also reduces his chances of exporting his product in an attempt to reduce his fixed costs per unit output.

The local importer of agricultural inputs, on the other hand, is faced with the problem that South African agricultural conditions differ from those in overseas countries for which the inputs were designed. The imported inputs are therefore often less suitable than those developed for local conditions and manufactured locally. The purchase prices for importers depend largely on the rate of inflation in the export countries and also on the manipulation of international cartels. The local

importer's order is usually such a small percentage of the overseas supplier's turnover that the importer has little or no bargaining power concerning prices and other conditions of sale. Should overseas suppliers decline to cease deliveries to a local importer, the latter is immediately faced with serious problems. This remains a very real problem in the present political climate.

The ideal for the input industry is local manufacture rather than reliance on imports, but the potential in this regard is further restricted by risk and uncertainty in agriculture.

2.7 Summary

The risk and uncertainty problems with which the agricultural inputs industry has to cope have led to a situation where only a few manufacturers remain who cater solely for agriculture. However, it is only logical that the greater a manufacturer's exposure is to agriculture, the larger is his exposure to the risks and uncertainties in agriculture. The majority of such manufacturers have therefore merged with other groups in the non-agricultural sector, or diversified themselves into the manufacture of non-agricultural products. In the course of this process the number of independent manufacturers in the agricultural input industry was drastically reduced and economic concentration was a natural outflow.

This economic concentration and the reduction in total exposure of the agricultural input industry to agriculture, naturally hold specific implications for agriculture and agriculture should be fully conversant with these implications and take them into account. In principle it holds the advantage for agriculture that more and more sophisticated inputs are developed and manufactured for local conditions without any danger of foreign boycotts and manipulation.

There is however, the danger that local power groups could start manipulating the entire agricultural input industry.

3. Impact of agricultural risk and uncertainty on specific input industries

Theoretically, the demand for capital goods destined for use in the production process is derived from the demand for the output of this production process. It is also known that the demand for capital goods shows greater fluctuations than the demand for outputs. The effect of the variations in the demand for outputs on the demand for capital goods will vary according to the term nature or life-time of the capital goods. The demand for long-term capital will, for example, vary more than the demand for short-term capital.

The demand for agricultural inputs in South Africa over the short and medium terms is determined not so much by the demand for agricultural outputs, but rather by conditions in agriculture. The general demand for short-term inputs depends largely on the short-term conditions

in agriculture. For example, the demand for seed, fertilizer, fuel, herbicides, etc., depends on how favourable climatic factors are for planting at that stage. The demand for these inputs is therefore a function of the area planted rather than the financial position of the agricultural sector. Changes in the consumption of nitrogen, phosphorus and potassium over the past 10 years are shown in Figure 6. (Phosphorus consumption remained surprisingly steady, as phosphorus is in many respects regarded as a medium-term input.)

The demand for medium-term inputs (e.g. machinery) is essentially a function of the financial position of agricultural producers, something which shows considerable annual fluctuation. Tractor sales in South Africa since 1973 and the number of tractors imported annually are shown in Figure 7. The particularly large variations in the demand for tractors and the stocking problem that this causes the tractor suppliers are clearly reflected.

It can therefore generally be expected that the risk and uncertainty in agriculture will have a greater impact on suppliers of medium-term inputs than on suppliers of short-term inputs. However, technological obsolescence is more rapid in short-term than in medium-term inputs. It must, however, be realised that uncertainty and risk in agriculture will affect the various input industries in different ways. A closer look will now be taken at some changes that took place in the major input industries.

3.1 Fertilizer industry

In the fertilizer industry one should distinguish between the manufacturers and the processors of raw materials. The former demands tremendous investments which have for some time been made by large groups such as AECI, FOSKOR, SASOL, etc., particularly where the manufacture of nitrogen is concerned.

The blending and packing of fertilizer demand relatively less capital and in 1961, 15 companies were involved in this activity. After a spite of mergers and take-overs only a few remained, namely Fedmis (now a subsidiary of the Sentrachem group), Triomf (which has strong connections with AECI) and Omnia, which is relatively small when compared with the two former groups.

3.2 Farm machinery

There was also a trend towards mergers in this sector, and virtually all the large groups are either a local branch of overseas parent groups, or form a part of larger local industrial groups. For example, Ford, John Deere, International Harvester, Deutz, etc., are local branches of international groups which sell not only farm machinery, but also motorcars, lorries, LDV's, etc., locally. Malcomess became part of the Malbak group while Massey-Ferguson was taken over by Federale Volksbeleggings. Vetsak is owned by

agricultural co-operatives and also manufactures a wide range of other agricultural inputs.

Most of the farm machinery (on a value basis) are imported because it would require too much capital to manufacture these machines locally, because the market is too small, because too many different models are demanded and because the annual demand fluctuates too much. Independent local manufacture is on a very small scale.

3.3 Dips and sprays

Although most of the raw materials for this purpose are still imported at present, imports are rapidly being replaced by locally manufactured products. The large groups, such as Sentrachem, play an important role in this regard. The formulation of the raw materials is mainly done by seven groups, with a more or less equal share of the market. All seven are either members of larger groups with interests outside the agricultural sector or they represent local branches of overseas parent companies. Formulators of dips and sprays are Agricura and Form Chem (both Sentrachem), African Explosives, AECI, Shell Chemicals (international), Fisons/Booths (international), Datons (VETSAK) and Bayer (international).

3.4 Stockfeeds

There are presently about 120 registered stockfeed companies which vary from small bonemeal manufacturers to a few large manufacturers of balanced stockfeeds. However, the industry is dominated by a few large groups namely, Epol (Premier Milling), Tiger Oats, Nola Industries (Federale Volksbeleggings), Tongaat and a few co-operatives such as Sentraalwes, OTK, Bokomo and Delmas.

3.5 Financing

Agricultural financing is undertaken mainly by the commercial banks and other financial institutions as well as the Land Bank (either direct or via the co-operatives). Both the commercial banks and the co-operatives provide mainly short-term financing, while the Land Bank and the other financial institutions provide medium and long-term financing.

The share of the total outstanding agricultural debts held by these four groups changed as follows over a decade:

| | 1970-12-31 | 1980-12-31 | % |
|------------------------------|------------|------------|---|
| Land Bank (direct) | 20,0 | 18,6 | |
| Co-operatives | 8,2 | 21,7 | |
| Commercial banks | 20,4 | 21,9 | |
| Other financial institutions | 20,7 | 16,2 | |
| Joint portion of total | 69,3 | 77,0 | |

Although the above-mentioned four groups jointly increased their share in agricultural

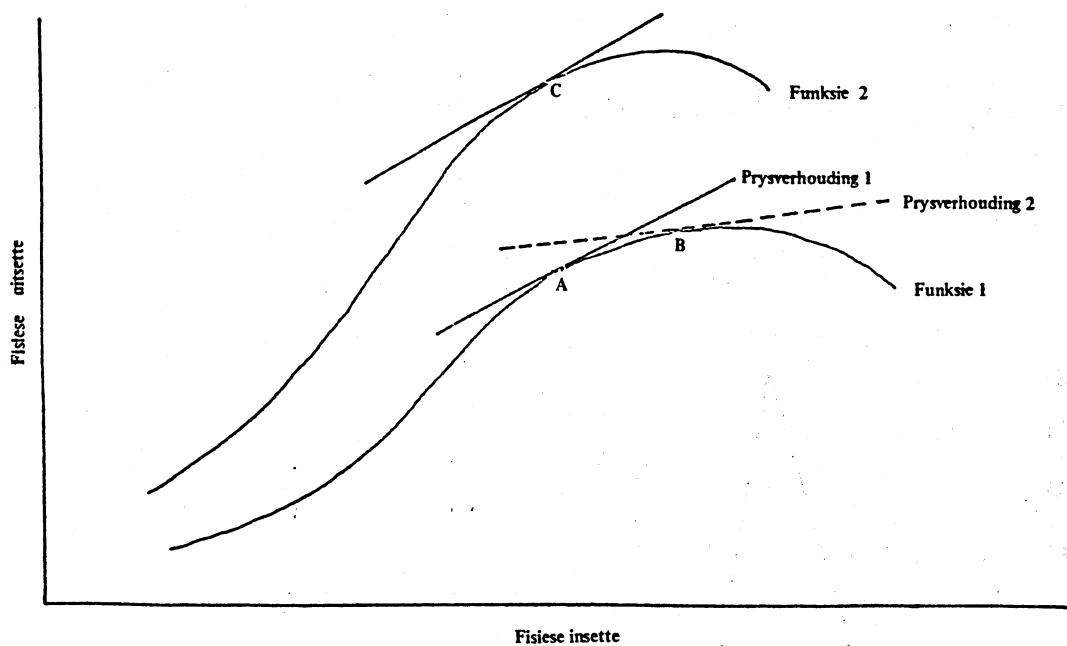
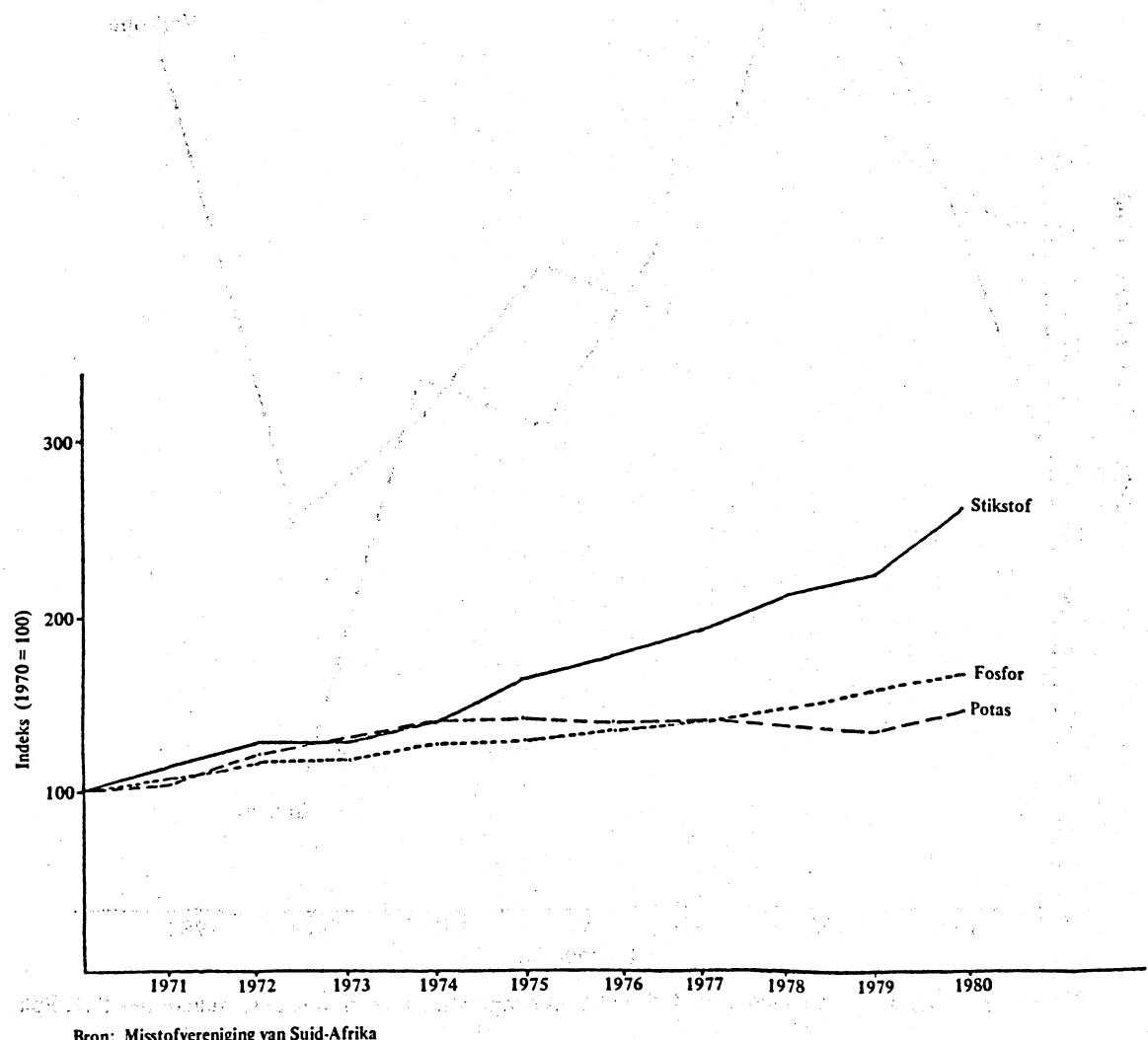
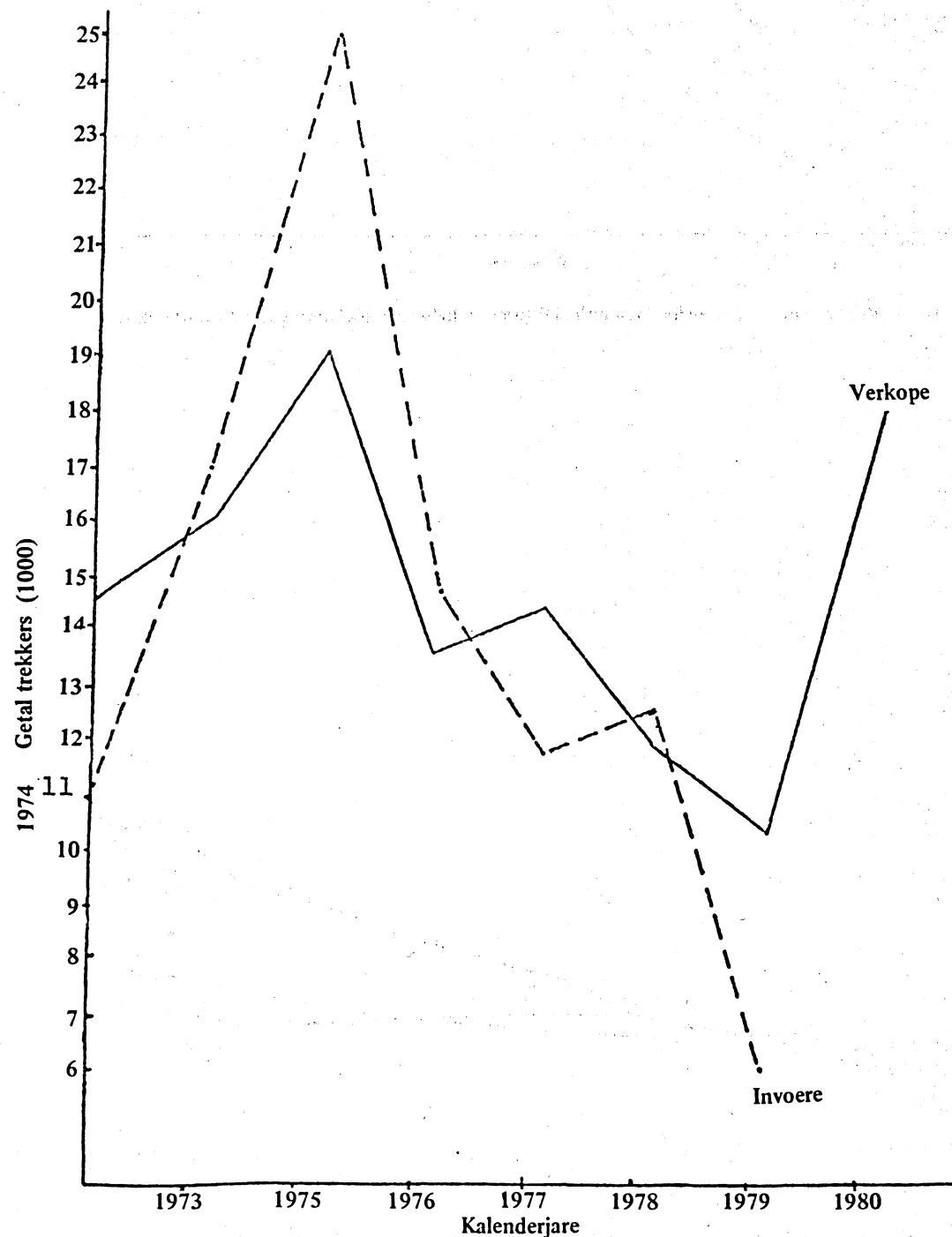


FIG. 5 - Vereenvoudigde voorstelling van uitbreidingsmoontlikhede in toekomstige landbouproduksie



Bron: Misstofvereniging van Suid-Afrika

FIG. 6 - Indekse van die totale verbruik van stikstof, fosfor en potas in die Suid-Afrikaanse landbou (1970-1980)



Bronne: Kortbegrip van Landboustatistiek 1981 en persoonlike mededeling deur Malcomess S.A. Bpk.

FIG. 7 - Totale getal trekkers ingevoer en verkoop vir die kalenderjare 1973 - 1980

financing, the importance of co-operatives increased very rapidly with regard to furnishing short-term credit to agriculture. Commercial banks, however, are still reluctant to overexpose themselves to agriculture, due to the nature and extent of the risks and uncertainties in the industry. The same applies to the other financial institutions. There is therefore a bigger onus on the Land Bank to finance agriculture both directly (mainly long-term mortgages) and through the co-operatives.

4. Conclusion

Uncertainty and the concomitant risks create specific problems for the agricultural input industry. The input industry experiences considerable variations in the demand for its inputs (particularly with regard to medium-term inputs) due to the tremendous variations in agricultural production. There are also indications that this phenomenon could increase with the vertical expansion in agricultural production.

The rate at which technological improvements are implemented in agriculture is expected to increase, partially due to the risks in agriculture and partially due to the natural process of vertical expansion. This increases the danger of

technological obsolescence of supplies and production capacity.

Because of the risk and uncertainty in agriculture, the private financing sector is reluctant to invest in agriculture and the input industry often finds it necessary - particularly in poor years - to supply considerable credit to agriculture, thereby increasing the risk of bad debts.

The input now finds that its investment in stocks and production capacity must be comparatively large, that its cost structure is relatively high, that its profit margins are relatively small and that it has a high risk profile, all of which make it difficult to obtain expansion capital. In addition, the total agricultural market is relatively small and the input industry finds it difficult to make full use of the benefits of local manufacturers.

The ultimate result is a large-scale movement towards economic concentration in the input industry as well as mergers with larger groups whose activities are mainly centred in the non-agricultural sector. These developments are common to all the main branches of the agricultural input industry.