SOUTH AFRICAN SUGAR INDUSTRY

AGRONOMISTS' ASSOCIATION

PROGRAMME FOR ANNUAL GENERAL MEETING 16 AUGUST 1978

9.00	Chairman's report.	
9.15	Soil Conservation with reference to alternative crops.	Rob Paxton S.A.S.A. Experiment Stn.
9.30	Coffee	Rob Lloyd Glendale Sugar Co.
10.00	Maize	Dr. John Mallett Summer Grain Centre D.A.T.S. Cedara
10.30	Tea	
11.00	Cotton	Martin Cornish-Bawden J.L. Clark & son D.A.T.S. Cedara
11.30	Pastures	Dr. Peter Edwards D.A.T.S. Cedara
12.00	Potatoes	Jon Rutherfoord D.A.T.S. Cedara
12.30	Lunch at Huletts Country Club	
2.15	Oil Seeds	Dr. Willem Snyman D.A.T.S. Pretoria
3.00	Bananas	Ron Wyatt Melville Sugar Co.
3.30	Horticultural Crops	Bill Going D.A.T.S. Cedara

THE PROSPECTS FOR SOYABEAN PRODUCTION

IN

SOUTH AFRICA

JUNE 1978

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Institute for Crops and Pastures

C O N T E N T S

INTRODUCTION

Attempts to encourage soyabean production in South Africa have met with limited success. Often such attempts have been made without sufficient consideration of the interests of the producer. Production propaganda based on "the increasing protein requirements of the world", or claims based on the "miracle" characteristics of soyabeans have little effect on the producer. Crop production patterns in South Africa are well established and producers have developed production teechniques adopted to local soil, climatic and labour conditions. The use of wide-row maize production techniques in lower-rainfall areas serve as a good example of such a system. To bring about a change in such a system, e.g. the introduction of a new crop, would require not only an equally remunerative alternative, but in addition a considerable "encouragement bonus" to compensate the producer for additional new-crop risk as well as for the higher level of managerial ability required for such a change-over.

SOYABEAN PRODUCTION IN THE UNITED STATES.

The success of soyabean production in the U S A is often held forth as an example of what could be done in South Africa. An examination of the situation in the United States indicates that such a comparison would not be valid.

Soyabeans are rivalled only by maize as the top cash crop in U S agriculture. Compared with other major crops such as maize, wheat, cotton and tobacco, soyabeans are much less enmeshed in complex farm programs which both support prices and restrict out=put of these commodities. Moreover soyabeans and their products move in international trade policies more freely than most other major agricultural commodities.

Extraordinary advances in maize-production technology have more than doubled yields since World-War II. Consequently the demand for U S maize has been fulfilled from a smaller and smaller acreage. Soyabeans have moved on to areas thus freed and onto areas released from oats, hay and pasture since World-War II. Low market prices for maize, together with government programs designed to reduce the output of feed grains made soyabeans attractive as a production alternative in the Midwest. In addition improved soyabean cultivars and production techniques continually expand the geographic limits of feasible production.

To the South, towards the Mississippi Delta, soyabeans have moved onto acreage previously used for cotton and onto newly developed cropland. To the North, towards the Lakes and Plains States, soya=beans have replaced some small grains and pasture acreage. Relatively low prices and governmental acreage-control programs for cotton and small grains also have stimulated soyabean production in these areas.

The interaction of the basic economic forces,

a relative attractiveness among production alternatives on U S farms;

b strong and growing demand for soyabeans and soyabean products, and

c adoption of cheaper and more efficient processing technology, provides the setting in which the soyabean miracle occurred. No acreage or marketing restrictions have even been imposed on soyabeans through either mandatory or voluntary programs.

In the absence of acreage and production control measures in South Africa crop production trends have tended "to follow the way of least resistance", resulting in the well established patterns of especially wheat and maize production.

A comparison of climatological characteristics of the most important soyabean producing areas in the U S A with potential producing areas in South Africa immediately indicates major differences. The major portion of the U S crop is grown at altitudes of less than 300 meter above sea level, whereas in South Africa production is limited to areas with an elevation above 1 000 meter, thus with considerably less favourable temperature and humidity regimes. Soyabeans require a moist warm climate for optimum development and local climatic conditions are often marginal in comparison with most other producing areas of the world.

MOISTURE REQUIREMENTS OF SOYABEANS AS RELATED TO PRODUCTION TECHNIQUE

The well-developed taproot and efficient secondary root system of the soyabean plant is capable of moisture uptake from considerable depths in the soil profile. Because of this fact soil moisture reserves at the end of the growing season would be at a considerably lower level on a soyabean field than would be the case with comparatively shallow-rooted crops such as maize. This fact would limit the application of the much advocated maize-soyabean rotation in drier areas. Due to all-the-year rainfall in the soyabean producing areas this problem does not crop up in the United States.

Because of a flowering period a good deal longer than in the case of maize (three to four weeks for soyabeans as compared with about 1 week for maize) the soyabean plant is better able to survive periods of infavourable moisture and humidity conditions during the flowering period. It should be kept in mind, however, that the post-flowering seed filling period is the most critical time in the life of the soyabean plant. Moisture stress over this period is especially serious and could result in a reduced number of seeds per pod and abortion of flowers and small pods. Adequate moisture during the seed filling period may completely overcome the effects of moisture stress during flowering.

In general, therefore, soyabeans cannot be regarded as all that much more drought resistant than maize.

POTENTIAL SOYABEAN PRODUCING AREAS IN SOUTH AFRICA

The extensive production techniques developed for maize in the lower-rainfall areas of South Africa are not suitable for soyabean production. Soil moisture conditions favourable to planting is very often experienced over a critically short period only. A good supply of soil moisture during the germination period is critically important in the case of the soyabean. The soyabean seed must reach a moisture content of 50 per cent before the germination process starts. A maize-seed, on the other hand, must absorb only 30 per cent of its weight in water before germination begins.

Maize is eminently suited to the high-speed planting techniques used under sub-optimum rainfall conditions. The maize seed can be planted fairly deep in order to utilize soil moisture in subsurface layers. Both high-speed as well as deep-planting techniques are unsuitable for soyabeans.

Wide-row, low plant population maize production techniques so well adapted to low rainfall conditions are obviously not suitable for soyabean production. There would appear to be little possibility for soyabean production in South Africa under dryland conditions in areas with a rainfall less than 650mm, unless intensive soil moisture conservation practices are followed on deep soils with a good moisture-holding capacity. Production would under these conditions vary considerably according to rainfall pattern.

In areas with a rainfall more than 650mm conditions are generally quite favourable to soyabean production. With the exception of higher altitude areas in the South Eastern Transvaal Highveld, temperatures are generally not a serious limiting factor to soyabean production in South Africa. Early planting of quicker maturing cultivars allow satisfactory yields to be obtained even in areas with somewhat low summer temperatures such as Bethal and Ermelo.

Because of favourable growing conditions in these higher-rainfall areas soyabeans would have to complete with well established crops such as maize, sunflower, grain sorghum and to a lesser extent dry beans. This competition would largely be on the basis of nett income per hectare.

A comparison of gross income obtainable from a number of cash crop alternatives in potential soyabean producing areas is presented in Table 1

/ INSERT TABLE I /

EASTERN FREE STATE

From the data presented it would appear that soyabeans could be an economically feasible alternative to dry-land wheat in the Eastern Free State (Bethlehem, Harrismith, Reitz, Warden) Because of the necessity for a moisture storage programme for wheat in these areas, double cropping of wheat and soyabeans would not be feasible Due to practical considerations, especially the critical time factor during harvest time, relatively small acreages of wheat would be replaced in this way. Increasing problems with weed control in wheat fields could justify inclusion of soyabeans in the cropping programme of the Eastern Free State. Climatologically soyabeans should not be a higher risk

TABLE 1 GROSS INCOME OBTAINABLE FROM SELECTED CASH CROPS IN COMPARISON WITH SOYABEANS

Crop	Yield range	Unit price*	Gross income
	t/ha	R/t	R/ha
Wheat - dryland	1		120
(Eastern Free State)	1,5	120	180
	2		240
Grain sorghum+	1,5		117
(South Eastern Transvaal)	3	75	225
	4		300
Maize	3		240
(South Eastern Transvaal)	4	80	320
	5		400
Sunflower+	1		140
(South Eastern Transvaal)	1,5	140	210
	2		280
Soyabeans	0,9		162
(South Eastern Transvaal)	1,5	180	270
(Eastern Free State)	1,7		306

* Taken as an average price for an average grade

+ Generally produced on heavy, clay soils less suitable for maize, but suitable for soyabeans crop in these areas than wheat. Both wheat planters and combines are suitable for soyabean production. The area planted to wheat in the Eastern Free State amounts to approximately 300 000 hectare.

SOUTH EASTERN TRANSVAAL (Bethal, Standerton, Middelburg, Bronkhorstspruit)

Although summer temperatures are somewhat low in some of these areas, soyabean production could definitely be regarded as a sound proposition in these areas. Economic competition of alternative cash crops would, however, have to be considered. Crops to be considered in this respect would be grain-sorghum, sunflower and maize. Considering the ease of production and high standards of production "know-how" developed after many years of maize production, it is doubtful whether soyabeans could be a serious competitor to maize in these areas. From the data presented in Table 1 it would appear that soyabeans does not offer the economic "bonus" to justify a change-over from maize to soyabeans. Soyabeans could, however, be considered on heavy clay soils less suited to maize production. Under these conditions soyabeans would have to compete with sunflower and grain sorghum. The increasing cost of nitrogen-fertilizer programmes for maize and grain sorghum should, be considered. Soyabeans not only do without nitrogenous fertilizer, but at the same time have a marked beneficial effect on the succeeding maize crop. These aspects place soyabeans in a more competitive position.

ADDITIONAL DRY-LAND AREAS

Soyabeans would do well in the higher-rainfall areas of Northern Natal and East Griqualand. Because of generally favourable climatic conditions maize yields in these areas are high and economic competition between soyabeans and maize would be a determining factor. The total area of suitable arable soils available is relatively small. Interest in soyabean production occurs periodically in parts of Northern Transvaal, especially Warmbad and Nylstroom districts. Successful production would, however, be dependant on intensive moisture conservation practices on deep soils. Production from these areas would, however, vary considerably depending on rainfall conditions.

Soyabeans would from time to time be grown in other areas. A stable production cannot, however, be envisaged from these situations.

SOYABEANS UNDER IRRIGATION

The production of soyabeans as summer crop under irrigation holds considerable promise in South Africa. A wheat-soyabean rotation under irrigation would bring about considerable practical and economic advantages to the producer. This rotation could be practised on very considerable areas. Some of the main advantages of such a cropping system would be as follows :

1 Double cropping achieves highly intensive utilization of expensive irrigation land.

2 A high degree of efficiency in utilization of equipment is achieved. The same planters and combine harvesters could be used for both wheat and soyabeans.

3 The soyabean crop would thrive on just the residual

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fertility of the generally well-fertilized wheat crop.

4 A minimum of weed-problems are envisaged under such an intensive production system. Herbicides are available for use in such system.

5 The production system is fully mechanized and an absolute minimum of labour is required. Bulk handling of both crops can be achieved quite easily.

From data presented in Table 2 it is evident that a wheat-soyabean rotation under irrigation presents attractive economic prospects. The production cost of such a system would be considerably less than that for either tobacco or cotton. The low labour requirement and

/ INSERT TABLE 2 /

ease of management of the wheat-soyabean rotation is an important point in favour of such a system. A minimum of pest- en disease-control measures are required.

An attempt is made to determine the soyabean-production potential of the above situation, in Table 3

/ INSERT TABLE 3 /

A production of 116 000 metric tons of soyabeans could be regarded as a conservative figure. It is evident that attemps to stimulate soyabean production should be concentrated in these areas.

THE VALUE OF SOYABEANS IN A CROP ROTATION

The introduction of a maize-soyabean rotation is often suggested as a solution for the serious problem of maize diseases in South Africa. These claims are not supported yet with sufficient experimental evidence and practical experience under local conditions. No information is available e.g. on how often soyabeans would have to be grown on the same land before a worthwhile measure of disease control is attained under local conditions. The high cost and possible future shortages of nitrogenous fertilizers could necessitate the incorporation of soyabeans in the present largely maize monoculture cropping system. Such a practice would be largely restricted to higher rainfall areas, for reasons discussed earlier in the paper. Because of the dangers of eelworm infestation soyabean production on sandy soils should be avoided. It is doubtfull whether soyabeans would affect soil structure to any greater extent than any other tap-rooted crop such as sunflower.

THE MARKETING OF SOYABEANS IN SOUTH AFRICA

The lack of a stable and reasonable producer price for soyabeans in South Africa was for many years a very important limiting factor to increased soyabean production in South Africa. This situation has, however, now been set right through the provision of a one-channel marketing scheme <u>via</u> the Oilseeds Control Board. The Board

TABLE 2 GROSS INCOME OBTAINABLE FROM A SOYABEAN-WHEAT ROTATION COMPARED WITH ALTERNATIVES

Crop	Yield range	Unit price*	Gross income
	t/ha		R/ha
Irrigated wheat	3,5		420
(Groblersdal	4,5	120	540
	5,5		660
Irrigated maize	5,0		400
(Groblersdal)	8,5	80	680
	12,0		960
Irrigated cotton	2		860
(Groblersdal)	3	48c/kg	1 290
	4		1 720
Irrigated soyabeans	2,5		450
(Groblersdal)	3,0	180	540
	3,5		630
Wheat-soyabean rotation	3,5 + 5,0		870
	4,5 + 3,0		1 080
	5,5 + 3,5		1 290
Wheat-maize rotation**	3,5 + 5,0		820
	4,5 + 8,5		1 220

* Taken as an average price for an average grade

** This is not a very practical rotation, and it would be difficult and quite expensive to obtain the same high yields as in the case of maize as full-season summer crop.

NOTE : A wheat-cotton rotation is not practical because of the long growing-season requirement of cotton.

has to accept the responsibility to set a realistic producer price for soyabeans. A too high producer price would lead to limited market acceptability accompanied by a surplus situation.

TECHNICAL KNOWLEDGE AND PRODUCTION PRACTICES

As is evident from data presented in Tables 1 and 2 the profitability of soyabean production is to a large extent determined by yield per hectare. Efficient utilization of available "know-how" allows yields of up to 3 metric tons per hectare to be obtained under favourable dryland conditions. Average yields are still very low at present, due to a generally low level of efficiency in the production process. Attention should be given to the provision of short-season cultivars for use in low temperature, high altitude areas. Otherwise there are no serious shortcomings in knowledge on production technique.

CONCLUSIONS

Because of climatic adaptability and especially practical production factors, soyabean production in South Africa would largely be limited to areas with a rainfall above 650 mm, and irrigation areas with heavier soils. The most favourable production situation at present would be soyabean grown in rotation with wheat under irrigation. Production stimulation should be consentrated on this situation. Provided general standards of production are improved through efficient utilization of proposition in South Eastern Transvaal highveld (Bronkhorstspruit, Witbank, Middelburg, Bethal, Standerton) Northern Natal and the Eastern Free State (Bethlehem, Harrismith, Warden, Reitz). Because of practical considerations soyabeans would, in all these areas, make up a relatively small percentage of the total cropping programme, unless factors such as a shortage of nitrogenous fertilizer or very attractive producer prices comes forward.

Physical and biological factors dictate the geographic areas in which soyabeans can be grown. Economic relationships among prices and costs determine where soyabeans will be produced commercially. An encouragement price would in most cases be required to make producers change from traditional, well established crop production patterns, to a relatively new crop such as soyabeans. Such high producer prices would obviously make soyabeans a less atractive proposition to processors and other buyers. Price stability at acceptable levels is a prerequisite to the establishment of a successfull soyabean industry in South Africa.

TABLE 3 AREAS UNDER IRRIGATED WHEAT IN POTENTIAL SOYABEAN-PRODUCING AREAS

	Total area under wheat (1)	Area available for soyabeans (2)
	ha	ha
Vaalharts and Lower Orange River area	50 500	12 600
Orange Free State	14 600	3 000
Natal	900	900
Transvaal	137 600	100 000
Total potential soyabean area		116 500
Potential soyabean production (at yield of 1 metric ton/ha)		116 600

(1) From a survey by Economics and Markets, 1970/71

(2) Areas with light sandy soils, with a potential eelworm hazard, have been excluded, as well as areas with a too short growing season.

SOUTH AFRICAN SUGAR INDUSTRY

AGRONOMISTS' ASSOCIATION

SUITABILITY OF HORTICULTURAL CROPS (VEGETABLES) AS ALTERNATIVE CROPS TO SUGARCANE

Bill Going

Department of Agricultural Technical Services Cedara

In the early 1960's sugar quotas were cut back and one of the alternate crops suggested was coffee production in the sugar belt. This could have been a very lucrative industry in the long run, but as soon as sugar prices rose, the bulk of the sugar growers uprooted their coffee and the effort was negated.

Certain vegetables could fit well with sugar production such as cabbage production done in a cane fallow during the autumn to winter period. Some cane growers have grown up to 150 ha of cabbages in a single season in this way. The successful growers have specialised in this form of growing and have developed a successful marketing system over the years.

Tomato production is essentially a warm season crop, but in Pongola area is grown in the winter months, and in that area would be a complementary system to sugar production.

Both tomatoes and cabbages have a high demand rate amongst the population and could play an important part as alternate crops to sugar production. However, both these crops have a particularly high level of managerial ability with particular reference to frost and disease control. Cost of production for both crops is exceedingly high, and for this reason allow for no mistakes at all. In the case of cabbages the profit margin in relation to the cost input is not all that high, and loss of one crop through a heavy hail storm would necessitate two to three cabbage crops being grown to recoup the loss.

Outlets for vegetable crops are limited to the fresh market, as little scope exists in Natal for canning or quick-freezing, since factory facilities for this purpose are limited. It must also be remembered that the local Natal markets are easily flooded, and this past season has proved a good example of overstocking of markets when prices for cabbages fell to 50c a pocket (26 kg) as early as June 1978. Usually cabbage prices tend to fall to this level only from the end of August onwards, when supplies exceed demand.

Possibilities for setting up canning factories in areas like Weenen and Muden have been considered in recent years, but the uncertainty of growers' willingness to supply to the factories over a long period of time has been a serious obstacle to such implementation. Also, prices offered by canning factories are not exactly a stimulating incentive to growers, least of all when the cost of controlling pests and diseases is so high in Natal. The high rainfall and humidity conditions are conducive to disease incidence in every vegetable crop that any grower might consider.

Tunnel production of specialised intensive crops for supermarket contracts such as tomatoes, European cucumbers and crops of high specific value are also limited. Up to the present, the few growers involved in this practice of farming have done fairly well, as the supply of good quality produce has not exceeded demand and prices offered by the supermarkets have been relatively high. But this will not always be the case. The main reason being that the successful tunnel grower is now becoming a specialist with a greatly increased number of tunnels per grower. The individuals with up to two tunnels each, who have not made a success of the venture have put their tunnels up for sale, and it is the successful specialist going in for 20 or more tunnels who is buying them up. These increased production units are bound to have a strong effect on prices of goods supplied to the supermarkets.

For the cane grower who wishes to develop vegetable production, it is essential that he should start his enterprise on a small scale and first learn thoroughly how to grow an attractive quality product free from blemish caused by pests and diseases. When he has achieved this, he can consider the prospects of further development in accordance with his managerial ability. At present the biggest personal problem is the one of "keeping up with the Joneses". When contemplating a tomato crop or any other for that matter, the cane grower can only think in terms of an area figure with a nought or two added for "impression purposes".

Vegetable production requires the highest managerial ability of most forms of farming practise and for this reason, the grower must pay for his experience by first learning to grow the crop.

For the cane grower, it has been a bitter experience that their quotas should have been cut back. But by encroaching on a vegetable market already developed by specialised olericulturists they could very easily over-supply an already unstable market, and jeopardise the financial returns of those already in the vegetable industry as well as their own vegetable enterprise.

There is a part that certain cane growers can play in vegetable production, provided they accept the responsibility of proper irrigation facilities and devoting the necessary attention to all aspects of the growing of the crop. Some have already proved themselves an asset to the industry, and their contribution is of value to the community. But for cane growers to switch en mass to the alternate form of vegetable production would be a stumbling block to the industry.

W.D. GOING (Horticulturist)

BANANAS AS AN ALTERNATE CROP TO SUGARCANE

R. Wyatt
Melville Sugar Estates Ltd.

Although the banana is indeed a crop that can be produced profitably in selected areas along the Natal Coast, it is nevertheless a crop I hesitate to recommend as an alternate crop to sugar cane. My reasons for this are threefold :-

1). There is a very real danger of over-production occurring as soon as next year even without any further plantings,

2). The costs of establishment are high and,

3). The time lag between planting and reaping is too long for quick replacement by cane when the sugar market perks up again. To back up my first reason the following statistics illustrate my point :-

In 1976/77 the number of boxes supplied to the Sungold bananas ripening rooms in Pinetown amounted to 385 000. This increased last year to approximately 600 000 and the latest acerage returns indicate that this will increase to 900 000 in the next year or so. Remember that many growers do not supply the Co-Op but market their fruit through other channels.

With these thoughts in mind I would like to spend a few minutes outlining firstly the requirements of the banana from an agricultural point of view and secondly, very briefly, the economics of banana production.

As you know the banana is a herbaceous perennial with its true stem an underground tuberous rhizome from which the thick fleshy main roots develop as well as the leaves, flowers and suckers. As the leaves grow their leaf stalks elongate and remain tightly arranged above the corm and form the "trunk" or pseudostem of the plant. At a certain critical stage of development the bud region at the base of the pseudostem ceases to produce young leaves and starts developing an inflorescence. The developing flower stalk forces the inflorescence upwards until it becomes visible at the top of the pseudostem. Subsequent growth and the mass of the inflorescence results in the latter hanging in the characteristic upside-down position. After fruiting the aerial portions of the banana plant die down if they have not been cut down at harvest time and the plant propogates itself by producing suckers around the rhizome at the base of the plant.

In South Africa the Dwarf Cavendish is produced commercially on the majority of farms while the Williams, believed to be a mutant of Dwarf Cavendish from FIJI, has been introduced from Australia and is now being propagated on an increasing scale. The main reason for growing Williams and other promising mutants currently under test is that they do not have the one really undesirable characteristic known as, choke throat, whereby in winter and spring bunches are not thrown well clear of the throat of the plant.

The banana having originated in the humid tropics has high heat and moisture requirements, so in South Africa production is severely limited by climate as ideal conditions simply do not exist. Rainfall is generally inadequate but can be remedied by supplementary irrigation. More important is the fact that air temperatures in most areas tend to drop too low at night, especially in winter. Choice of site and aspect for bananas is therefore very important, taking into account these two factors as well as the next most important one, wind. Because of their large friable leaves bananas are extremely susceptable to wind and must be well protected from prevailing winds. Hail also causes enormous damage to bananas so they must

be grown...../2.

be grown in hail-free areas. Lastly, from the climatic point of view bananas are intolerant of frost, so low-lying frost-prone areas must be avoided.

Turning to soils, bananas may be cultivated in almost all types of soil provided that they are at least 100 cm deep, well aerated, and well drained. The chemical requirements of soils for bananas are not critical since most deficiencies can be corrected with fertilisers. For best results soil pH should be between 5,5 and 6,5. Lands that have previously been under most other crops should be fumigated before planting bananas.

The requirements of the banana plant in regard to plant nutrients are relatively high in comparison with those of other plants. Types of fertiliser used are not important with Urea, Supers or Double Supers and Muriate of Potash usually being recommended as there are no suitable mixtures currently available. Where necessary agricultural or domestic lime are usually applied before planting. Fertiliser applications vary according to soil and leaf analyses and timing is important. Current recommendations are for all the phosphate in the early spring with nitrogen split into four applications over the spring and summer months and potash into two applications in spring and late summer. Organics such as poultry manure can be used to supplement the fertiliser programme.

Timing of planting is critical but varies according to the type of planting material used. Time does not permit a discussion on this subject but most popular times vary from November to February. Spacing is also important and as a general guide 4,5 to 5,5 square metres per mat, consisting of one parent and only one follower may be considered as optimum. It is necessary to prune or desucker regularly throughout the summer months to keep the population down for maximum production of large high quality fruit.

As mentioned earlier the moisture requirements of bananas are high and in most areas rainfall is inadequate, so for optimum production, supplementary irrigation is required. A detailed research programme is being conducted by the C.S.F.R.I. to determine the exact water requirements and the most efficient system. Methods include overhead and low pressure under-tree sprinkler systems as well as drip irrigation.

There is still a great deal to discuss about the cultivation and agronomic practices called for in banana production but time limits me to but mention them. -- On a well run farm weed control is almost entirely by the use of chemicals, most popular being gramoxone, gramuron and gesapax. No mechanical cultivation can be done due to excessive root damage and light hoeing is practised to supplement the use of herbicides.

Other cultural practices important in banana cultivation include :-

i). Trimming of leaves and bunches to help combat certain leaf diseases and to promote light penetration and to prevent wind damage;

ii). Propping with wooden stakes to prevent plants toppling over.

iii). Bunch covers used in winter to prevent cold damage and hasten fruit ripening.

iv). Regular spraying with pesticides to control thrips, mites, borers and other insects. Application of bait for slug control is also necessary during summer.

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We are fortunate in South Africa in that diseases do not severely limit banana production in most areas. A close watch and certain prophylactic practices are nevertheless necessary, and diseases to watch for include certain leaf-spot diseases, cigar-end rot, bacterial pin-spot, Panama disease, bacterial wilt and collar-rot. Most important is probably collar-rot, a post-harvest pathological condition damaging the collar portion of a hand where it was cut from the bunch. To prevent collar-rot all hands should be dipped in a fungicide such as Benlate before packing.

The final activities on a banana farm involve the important procedures included in the harvesting operation. Here I could speak for a great length of time but I realise that to-day time simply does not permit. Suffice to say that although harvesting and packing are the last operations on the farm, they should be the first considered when laying out the farm and positioning and designing the pack-shed. From the pack-shed the banana cases are either collected by the marketing agent such as the Natal Banana Co-Op or delivered to central loading points for collection at set times during the week.

Now I must quickly discuss the economics of banana production. To avoid confusion I have ignored irrigation.

BANANA FARMING ECONOMICS.

The following can be regarded as an average sample unit under dryland conditions on a well managed farm on the Natal South Coast, during the season 1977/78. Establishment costs, amounting to R750 per ~~hectare~~ acre. are apportioned over a 10 year period, the average replanting cycle. or R1827/ha

COSTS :

i). Direct Costs

Labour	300	
Weedkiller, Insecticides, Tractor, Banana Shed, Fertiliser, General	300	
Establishment	~~35~~ 182	~~835~~ 783

ii). Indirect Costs : Related to :-

a). Labour :	Compound, Maintenance, Tools, Bad Debts	20	
b). Land :	Interest on bond, Insurance	42	
c). Income:	Stationery, Bank Charges, Telephone, Office Equipment, Travelling, Accounting Fees, Vehicle	118	180

TOTAL COSTS R~~835~~ 963

REVENUE :

Yield - 20 Tons/Ha.

	%	Price/Ton	Av.Price/Ton
First Grade	76	R105	
Assorted	15	80	R 97.50
Smalls	9	62.50	

TOTAL REVENUE 20 X 97.50 R1950

TOTAL COSTS ~~835~~ 963

∴ NETT PROFIT R 987/Hectare.

I must re-iterate that the figures given apply to an average field on the lower South Coast for last season, assuming that the bananas were marketed through the Natal Banana Co-Op and thus transported, ripened and marketed by them.

Mr. Chairman and Gentlemen I know how inadequately I have covered my subject - there is indeed a lot to farming bananas on a commercial scale. It is unfortunate that, being an uncontrolled industry, especially here in Natal where we are considered a production area, marketing of fruit can be chaotic at times with different farmers marketing their fruit through several different channels. Several efforts to rationalise this have and are being made but unless the Government closes the area the marketing of bananas will always remain uncertain. Mainly for this reason, in addition to the ones I mentioned at the beginning of this talk, I do not recommend the planting of bananas as an alternate crop to sugar cane.

DL = DRY LAND
I = IRRIGATION

POTENTIAL ALTERNATE CROPS FOR CANE BELT BIO-CLIMATIC GROUP I

CROP	SUITABILITY 0 - 5	POTENTIAL YIELD kg/ha	FEB. 1978 INCOME PER TONNE	SPECIAL REQUIREMENTS AND PRECAUTIONS
COTTON	4 SUMMER	1000 DL 2500 I SEED COTTON	R429	° Regular spraying programme must be adhered to. The major pests which can cause severe crop losses are, american bollworm, red bollworm, spiny bollworm, red spider, aphids and cotton stainers. ° Early boll loss due to poor insect control leads to excessive vegetative growth and subsequent managerial difficulties. ° Where humid conditions prevail the boll ripening period can be extended and a dessicant may be required. ° Casual labour should be available at picking time. ° Crop residues must be efficiently disposed of to advoid a build up of cotton pests.
GROUND-NUTS	4 SUMMER	SHELLED NUTS 1.200 D.L 2.500 I UNSHELLED 1500 DL 3200 I	R220	° Cultivars for the oil, confectionery and cocktail trade are suitable for the lighter soils. Heavy soils present a mechanical difficulty when lifting the crop and losses will occur. ° Seed should be inoculated on new ground but is not necessary for soils where groundnuts have been grown within the last five years. ° Seed must be treated with a non-mecuric fungicide to control seedling diseases. ° Leaf spot diseases (cercospora spp) are a problem in humid areas but are effectively controlled by a spraying programme. ° Pests do not present a serious problem.
LEGUMES LUCERNE	3 PERENNIAL	2.200 I Dry mass per cut 19t over 9 cuts per annum	R35	° Irrigation is required to obtain full potential. There is not a cold enough period to provide dormancy and the best quality lucerne is obtained in the colder months under coastal conditions. ° Under hot humid conditions rust can be a management problem. At this time defoliation can be serious. Cutting at the best possible time must be resorted to before rust can cause damage and the hay quality is still acceptable. ° Crop life under these conditions is shortened to about 4 years but in that time more cuts have been taken than in colder areas.
POTATOES	5 WINTER	35 000 I	R2 875.00 (R1.25 PKT)	° Vigerous spraying programme against late and early blight. ° Planting from April through June but not later than mid-June. ° Use certified seed and cold storage seed in required for the early plantings. ° Cultivars most suitable are Sack filler and BP 1 ° High populations of 160 000 to 180 000 stems per hectare because of the lower yield potential under Winter conditions.
RICE	4 SUMMER	3000 I UNHULLED	R200 - R260 ACCORDING TO GRADE	° Can be grown under overhead-irrigation ° During early vegetative growth stage water demands are not high but the irrigation frequency is shortend after panicle emergance when demands are critical. ° Planting and harvesting are similar to wheat. ° Generally disease and pests are not serious. ° Birds can be a problem and early maturing cultivars are important.

CROP	SUITABILITY 0 - 5	POTENTIAL YIELD Kg/ha	FEB. 1978 INCOME PER TONNE	SPECIAL REQUIREMENTS AND PRECAUTIONS
SOYABEAN	4 SUMMER	2 500 DL 4 000 I	R165.00	° Early December planting. ° Maize planters can be used. ° Seed must be inoculated. ° Non mecuric fungicidal seed dressing should be used. ° Disease and insects are not a problem but any insect infestation must be controlled as safeguard again disease occuring and being transmitted.
WHEAT	- WINTER	3.000 I	R116	° A useful rotation crop provided the previous crop can be harvested and preparations for the wheat crop are completed before the last week in April. ° Needs irrigation. ° Planting by May is important to (a) minimise the risk of rust and (b) the grain development to be well advanced before the onset of high temperatures.
CASSAVA	4 12 MONTHS	30.000 I 16.000	NOT KNOWN	° Crop for consideration bearing in mind it's industrial uses, feed for human and animal consumption and a high potential for alcohol. ° Increasing world attention to Cassava and an export market to the E.E.C. countries exists. ° High starch content of up to 32% ° 12 - 14 months crop depending on cultivars and irrigation availability. ° Not a difficult crop to cultivate but ground disturbance is considerable at lifting time.
HORTICULTURE				° Dealt with by other departments.

THE PROSPECTS FOR SOYABEAN PRODUCTION

IN

SOUTH AFRICA

JUNE 1978

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C O N T E N T S

INTRODUCTION

Attempts to encourage soyabean production in South Africa have met with limited success. Often such attempts have been made without sufficient consideration of the interests of the producer. Production propaganda based on "the increasing protein requirements of the world", or claims based on the "miracle" characteristics of soyabeans have little effect on the producer. Crop production patterns in South Africa are well established and producers have developed production teechniques adopted to local soil, climatic and labour conditions. The use of wide-row maize production techniques in lower-rainfall areas serve as a good example of such a system. To bring about a change in such a system, e.g. the introduction of a new crop, would require not only an equally remunerative alternative, but in addition a considerable "encouragement bonus" to compensate the producer for additional new-crop risk as well as for the higher level of managerial ability required for such a change-over.

SOYABEAN PRODUCTION IN THE UNITED STATES.

The success of soyabean production in the U S A is often held forth as an example of what could be done in South Africa. An examination of the situation in the United States indicates that such a comparison would not be valid.

Soyabeans are rivalled only by maize as the top cash crop in U S agriculture. Compared with other major crops such as maize, wheat, cotton and tobacco, soyabeans are much less enmeshed in complex farm programs which both support prices and restrict out=put of these commodities. Moreover soyabeans and their products move in international trade policies more freely than most other major agricultural commodities.

Extraordinary advances in maize-production technology have more than doubled yields since World-War II. Consequently the demand for U S maize has been fulfilled from a smaller and smaller acreage. Soyabeans have moved on to areas thus freed and onto areas released from oats, hay and pasture since World-War II. Low market prices for maize, together with government programs designed to reduce the output of feed grains made soyabeans attractive as a production alternative in the Midwest. In addition improved soyabean cultivars and production techniques continually expand the geographic limits of feasible production.

To the South, towards the Mississippi Delta, soyabeans have moved onto acreage previously used for cotton and onto newly developed cropland. To the North, towards the Lakes and Plains States, soya=beans have replaced some small grains and pasture acreage. Relatively low prices and governmental acreage-control programs for cotton and small grains also have stimulated soyabean production in these areas.

The interaction of the basic economic forces,

a relative attractiveness among production alternatives on U S farms;

b strong and growing demand for soyabeans and soyabean products, and

c adoption of cheaper and more efficient processing technology, provides the setting in which the soyabean miracle occurred. No acreage or marketing restrictions have even been imposed on soyabeans through either mandatory or voluntary programs.

In the absence of acreage and production control measures in South Africa crop production trends have tended "to follow the way of least resistance", resulting in the well established patterns of especially wheat and maize production.

A comparison of climatological characteristics of the most important soyabean producing areas in the U S A with potential producing areas in South Africa immediately indicates major differences. The major portion of the U S crop is grown at altitudes of less than 300 meter above sea level, whereas in South Africa production is limited to areas with an elevation above 1 000 meter, thus with considerably less favourable temperature and humidity regimes. Soyabeans require a moist warm climate for optimum development and local climatic conditions are often marginal in comparison with most other producing areas of the world.

MOISTURE REQUIREMENTS OF SOYABEANS AS RELATED TO PRODUCTION TECHNIQUE

The well-developed taproot and efficient secondary root system of the soyabean plant is capable of moisture uptake from considerable depths in the soil profile. Because of this fact soil moisture reserves at the end of the growing season would be at a considerably lower level on a soyabean field than would be the case with comparatively shallow-rooted crops such as maize. This fact would limit the application of the much advocated maize-soyabean rotation in drier areas. Due to all-the-year rainfall in the soyabean producing areas this problem does not crop up in the United States.

Because of a flowering period a good deal longer than in the case of maize (three to four weeks for soyabeans as compared with about 1 week for maize) the soyabean plant is better able to survive periods of infavourable moisture and humidity conditions during the flowering period. It should be kept in mind, however, that the post-flowering seed filling period is the most critical time in the life of the soyabean plant. Moisture stress over this period is especially serious and could result in a reduced number of seeds per pod and abortion of flowers and small pods. Adequate moisture during the seed filling period may completely overcome the effects of moisture stress during flowering.

In general, therefore, soyabeans cannot be regarded as all that much more drought resistant than maize.

POTENTIAL SOYABEAN PRODUCING AREAS IN SOUTH AFRICA

The extensive production techniques developed for maize in the lower-rainfall areas of South Africa are not suitable for soyabean production. Soil moisture conditions favourable to planting is very often experienced over a critically short period only. A good supply of soil moisture during the germination period is critically important in the case of the soyabean. The soyabean seed must reach a moisture content of 50 per cent before the germination process starts. A maize-seed, on the other hand, must absorb only 30 per cent of its weight in water before germination begins.

Maize is eminently suited to the high-speed planting techniques used under sub-optimum rainfall conditions. The maize seed can be planted fairly deep in order to utilize soil moisture in subsurface layers. Both high-speed as well as deep-planting techniques are unsuitable for soyabeans.

Wide-row, low plant population maize production techniques so well adapted to low rainfall conditions are obviously not suitable for soyabean production. There would appear to be little possibility for soyabean production in South Africa under dryland conditions in areas with a rainfall less than 650mm, unless intensive soil moisture conservation practices are followed on deep soils with a good moisture-holding capacity. Production would under these conditions vary considerably according to rainfall pattern.

In areas with a rainfall more than 650mm conditions are generally quite favourable to soyabean production. With the exception of higher altitude areas in the South Eastern Transvaal Highveld, temperatures are generally not a serious limiting factor to soyabean production in South Africa. Early planting of quicker maturing cultivars allow satisfactory yields to be obtained even in areas with somewhat low summer temperatures such as Bethal and Ermelo.

Because of favourable growing conditions in these higher-rainfall areas soyabeans would have to complete with well established crops such as maize, sunflower, grain sorghum and to a lesser extent dry beans. This competition would largely be on the basis of nett income per hectare.

A comparison of gross income obtainable from a number of cash crop alternatives in potential soyabean producing areas is presented in Table 1

/ INSERT TABLE I /

EASTERN FREE STATE

From the data presented it would appear that soyabeans could be an economically feasible alternative to dry-land wheat in the Eastern Free State (Bethlehem, Harrismith, Reitz, Warden) Because of the necessity for a moisture storage programme for wheat in these areas, double cropping of wheat and soyabeans would not be feasible Due to practical considerations, especially the critical time factor during harvest time, relatively small acreages of wheat would be replaced in this way. Increasing problems with weed control in wheat fields could justify inclusion of soyabeans in the cropping programme of the Eastern Free State. Climatologically soyabeans should not be a higher risk

TABLE 1 GROSS INCOME OBTAINABLE FROM SELECTED CASH CROPS IN COMPARISON WITH SOYABEANS

Crop	Yield range	Unit price*	Gross income
	t/ha	R/t	R/ha
Wheat - dryland	1		120
(Eastern Free State)	1,5	120	180
	2		240
Grain sorghum+	1,5		117
(South Eastern Transvaal)	3	75	225
	4		300
Maize	3		240
(South Eastern Transvaal)	4	80	320
	5		400
Sunflower+	1		140
(South Eastern Transvaal)	1,5	140	210
	2		280
Soyabeans	0,9		162
(South Eastern Transvaal)	1,5	180	270
(Eastern Free State)	1,7		306

* Taken as an average price for an average grade

\+ Generally produced on heavy, clay soils less suitable for maize, but suitable for soyabeans crop in these areas than wheat. Both wheat planters and combines are suitable for soyabean production. The area planted to wheat in the Eastern Free State amounts to approximately 300 000 hectare.

SOUTH EASTERN TRANSVAAL (Bethal, Standerton, Middelburg, Bronkhorstspruit)

Although summer temperatures are somewhat low in some of these areas, soyabean production could definitely be regarded as a sound proposition in these areas. Economic competition of alternative cash crops would, however, have to be considered. Crops to be considered in this respect would be grain-sorghum, sunflower and maize. Considering the ease of production and high standards of production "know-how" developed after many years of maize production, it is doubtful whether soyabeans could be a serious competitor to maize in these areas. From the data presented in Table 1 it would appear that soyabeans does not offer the economic "bonus" to justify a change-over from maize to soyabeans. Soyabeans could, however, be considered on heavy clay soils less suited to maize production. Under these conditions soyabeans would have to compete with sunflower and grain sorghum. The increasing cost of nitrogen-fertilizer programmes for maize and grain sorghum should, be considered. Soyabeans not only do without nitrogenous fertilizer, but at the same time have a marked beneficial effect on the succeeding maize crop. These aspects place soyabeans in a more competitive position.

ADDITIONAL DRY-LAND AREAS

Soyabeans would do well in the higher-rainfall areas of Northern Natal and East Griqualand. Because of generally favourable climatic conditions maize yields in these areas are high and economic competition between soyabeans and maize would be a determining factor. The total area of suitable arable soils available is relatively small. Interest in soyabean production occurs periodically in parts of Northern Transvaal, especially Warmbad and Nylstroom districts. Successful production would, however, be dependant on intensive moisture conservation practices on deep soils. Production from these areas would, however, vary considerably depending on rainfall conditions.

Soyabeans would from time to time be grown in other areas. A stable production cannot, however, be envisaged from these situations.

SOYABEANS UNDER IRRIGATION

The production of soyabeans as summer crop under irrigation holds considerable promise in South Africa. A wheat-soyabean rotation under irrigation would bring about considerable practical and economic advantages to the producer. This rotation could be practised on very considerable areas. Some of the main advantages of such a cropping system would be as follows :

1 Double cropping achieves highly intensive utilization of expensive irrigation land.

2 A high degree of efficiency in utilization of equipment is achieved. The same planters and combine harvesters could be used for both wheat and soyabeans.

3 The soyabean crop would thrive on just the residual

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fertility of the generally well-fertilized wheat crop.

4 A minimum of weed-problems are envisaged under such an intensive production system. Herbicides are available for use in such system.

5 The production system is fully mechanized and an absolute minimum of labour is required. Bulk handling of both crops can be achieved quite easily.

From data presented in Table 2 it is evident that a wheat-soyabean rotation under irrigation presents attractive economic prospects. The production cost of such a system would be considerably less than that for either tobacco or cotton. The low labour requirement and

/ INSERT TABLE 2 /

ease of management of the wheat-soyabean rotation is an important point in favour of such a system. A minimum of pest- en disease-control measures are required.

An attempt is made to determine the soyabean-production potential of the above situation, in Table 3

/ INSERT TABLE 3 /

A production of 116 000 metric tons of soyabeans could be regarded as a conservative figure. It is evident that attemps to stimulate soyabean production should be concentrated in these areas.

THE VALUE OF SOYABEANS IN A CROP ROTATION

The introduction of a maize-soyabean rotation is often suggested as a solution for the serious problem of maize diseases in South Africa. These claims are not supported yet with sufficient experimental evidence and practical experience under local conditions. No information is available e.g. on how often soyabeans would have to be grown on the same land before a worthwhile measure of disease control is attained under local conditions. The high cost and possible future shortages of nitrogenous fertilizers could necessitate the incorporation of soyabeans in the present largely maize monoculture cropping system. Such a practice would be largely restricted to higher rainfall areas, for reasons discussed earlier in the paper. Because of the dangers of eelworm infestation soyabean production on sandy soils should be avoided. It is doubtfull whether soyabeans would affect soil structure to any greater extent than any other tap-rooted crop such as sunflower.

THE MARKETING OF SOYABEANS IN SOUTH AFRICA

The lack of a stable and reasonable producer price for soyabeans in South Africa was for many years a very important limiting factor to increased soyabean production in South Africa. This situation has, however, now been set right through the provision of a one-channel marketing scheme <u>via</u> the Oilseeds Control Board. The Board

TABLE 2 GROSS INCOME OBTAINABLE FROM A SOYABEAN-WHEAT ROTATION COMPARED WITH ALTERNATIVES

Crop	Yield range	Unit price*	Gross income
	t/ha		R/ha
Irrigated wheat	3,5		420
(Groblersdal	4,5	120	540
	5,5		660
Irrigated maize	5,0		400
(Groblersdal)	8,5	80	680
	12,0		960
Irrigated cotton	2		860
(Groblersdal)	3	48c/kg	1 290
	4		1 720
Irrigated soyabeans	2,5		450
(Groblersdal)	3,0	180	540
	3,5		630
Wheat-soyabean rotation	3,5 + 5,0		870
	4,5 + 3,0		1 080
	5,5 + 3,5		1 290
Wheat-maize rotation**	3,5 + 5,0		820
	4,5 + 8,5		1 220

* Taken as an average price for an average grade

** This is not a very practical rotation, and it would be difficult and quite expensive to obtain the same high yields as in the case of maize as full-season summer crop.

NOTE : A wheat-cotton rotation is not practical because of the long growing-season requirement of cotton.

has to accept the responsibility to set a realistic producer price for soyabeans. A too high producer price would lead to limited market acceptability accompanied by a surplus situation.

TECHNICAL KNOWLEDGE AND PRODUCTION PRACTICES

As is evident from data presented in Tables 1 and 2 the profitability of soyabean production is to a large extent determined by yield per hectare. Efficient utilization of available "know-how" allows yields of up to 3 metric tons per hectare to be obtained under favourable dryland conditions. Average yields are still very low at present, due to a generally low level of efficiency in the production process. Attention should be given to the provision of short-season cultivars for use in low temperature, high altitude areas. Otherwise there are no serious shortcomings in knowledge on production technique.

CONCLUSIONS

Because of climatic adaptability and especially practical production factors, soyabean production in South Africa would largely be limited to areas with a rainfall above 650 mm, and irrigation areas with heavier soils. The most favourable production situation at present would be soyabean grown in rotation with wheat under irrigation. Production stimulation should be consentrated on this situation. Provided general standards of production are improved through efficient utilization of proposition in South Eastern Transvaal highveld (Bronkhorstspruit, Witbank, Middelburg, Bethal, Standerton) Northern Natal and the Eastern Free State (Bethlehem, Harrismith, Warden, Reitz). Because of practical considerations soyabeans would, in all these areas, make up a relatively small percentage of the total cropping programme, unless factors such as a shortage of nitrogenous fertilizer or very attractive producer prices comes forward.

Physical and biological factors dictate the geographic areas in which soyabeans <u>can</u> be grown. Economic relationships among prices and costs determine where soyabeans <u>will</u> be produced commercially. An encouragement price would in most cases be required to make producers change from traditional, well established crop production patterns, to a relatively new crop such as soyabeans. Such high producer prices would obviously make soyabeans a less atractive proposition to processors and other buyers. Price stability at acceptable levels is a prerequisite to the establishment of a successfull soyabean industry in South Africa.

TABLE 3 AREAS UNDER IRRIGATED WHEAT IN POTENTIAL SOYABEAN-PRODUCING AREAS

	Total area under wheat (1)	Area available for soyabeans (2)
	ha	ha
Vaalharts and Lower Orange River area	50 500	12 600
Orange Free State	14 600	3 000
Natal	900	900
Transvaal	137 600	100 000
Total potential soyabean area		116 500
Potential soyabean production (at yield of 1 metric ton/ha)		116 600

(1) From a survey by Economics and Markets, 1970/71

(2) Areas with light sandy soils, with a potential eelworm hazard, have been excluded, as well as areas with a too short growing season.

POTATO PRODUCTION
IN THE SUGAR CANE GROWING AREAS OF NATAL

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GENERAL GROWTH CHARACTERISTICS AND CLIMATIC REQUIREMENTS

The potato (*Solanum tuberosum* L.) is a crop well suited to moderate climates. Day temperature and day length conditions for optimum growth are 20°C and 12 - 14 hours respectively. However, the crop can tolerate short periods at temperatures as high as 30 - 35°C without severe reduction in yield, provided soil moisture is plentiful. The crop requires a regular and fairly plentiful supply of water during the tuber bulking period. The crop's growth period which varies from 12 - 18 weeks, is dependent on cultivar and climatic conditions. The crop matures more quickly in the short days of winter than the long days of summer. Tuber bulking commences about three weeks after emergence and continues until about 80 per cent leaf die-back has occured.

LAND PREPARATION

A well-prepared seed bed, free of undecompased organic matter, is essential for uniform and rapid emergence. Trash on old cane lands should therefore either be worked in well before planting (to allow for adequate decomposition of organic matter), or burned off before ploughing. Steep lands are not recommended for potato production because of the high degree of soil exposure during the season.

CHOICE OF CULTIVAR

The choice of cultivar depends on the time of planting (climate) and the purpose for which the crop is grown *viz.* table market or processing industry. See Table 1.

2/.....

Table 1: CULTIVAR EVALUATION

CULTIVAR	SEASON			PURPOSE		YIELD * POTENTIAL				DISEASE RESISTANCE		DROUGHT RESISTANCE	KEEPING QUALITY
	Summer	Autumn	Winter	Table	Processing (Chips & Canning)	Dryland t/ha	Dryland pkts/acre	Irrig. t/ha	Irrig. pkts/acre	Blight	Virus		
BP 1	1	2	2	1	2	30	810	35	905	2	2	2	2
SACKFILLER	2	1	1	2	2	40	1 080	45	1215	1	2	1	2
CEDARA	2	1	1	1	2	30	810	32	864	1	2	1	2
KOOS SMIT	1	2	2	1	1	25	675	30	810	3	2	3	3
VAN DER PLANK	1	2	3	1	-	25	675	30	810	2	1	2	1
BAKU	1	-	-	1	1	25	675	30	810	2	2	2	2
R100	1	-	-	1	1	23	671	28	756	3	2	2	2
PIMPERNEL	1	2	2	3	1	30	810	35	945	1	1	3	1

* A 15-20% drop in yield can be expected from Autumn and Winter crops

RATING 1 = EXCELLENT; 2 = ACCEPTABLE; 3 = POOR

The cultivar Cedara, Koos Smit, Baku and R100 need not be considered for the 1978/79 season because of limited seed stocks. BP1 which makes up over 80% of production in Natal is readily available from most Natal seed potato associations. Sackfiller, Pimpernel and Vanderplank are also available.

SEED REQUIREMENTS

Seed quality. One of the most important requirements in potato production is good quality, government-certified seed which is inherently free of virus diseases and certain tuber diseases. Well sprouted seed is an important prerequisite for rapid and even emergence after planting.

Seed quantity (population). The optimum stem population for potatoes is about 160 000 stems/ha which can be obtained by placing 30 - 150g seed 25 cm apart in the row with rows 90 cm apart.

3/.....

This population requires about 4t/ha of 30 - 150g seed. The smaller the seed size, the lower the mass of seed required to obtain the optimum stem population.

PLANTING

Time of planting. There are four generally accepted times of planting.

A mid July planting for a spring crop is common on farms which are not quite frost-free. This early planting produces a crop which can be lifted in early December when market prices are generally above average.

A late August to early October planting for a summer crop is common on most farms in the midlands where severe winter frosts make earlier plantings advisable. This crop is ready for lifting during January to February, but can safely be stored in the soil for about six weeks, provided soil temperatures are not excessive ($> 25^{o}C$)

A January planting for an autumn crop is grown in areas where late summer rains are common or irrigation is available. This crop can be stored in the soil through the winter months if necessary.

A May planting for a winter crop is practical in the frost-free areas of Natal. The yield potential of the winter crop is considerably lower than summer crops, but higher market prices in September and October make potato production in the "out-of-season months" well worthwhile.

Planting Method

The recommended planting method is to open furrows about 25 cm deep and to place seed tubers at the base of the furrow above banded fertilizer which is applied from bins attached to the furrow opener. After furrows have been covered, the seed tubers should lie 5 - 8 cm (2 - 3 inches) below the levelled soil surface.

4/.....

FERTILIZATION

Fertilization should, where possible, be based on a chemical soil analysis. A common fertilizer rate, however, is 1 600 kg/ha 2:3:4 (24) + Zn banded in the row at planting and 85 kg/ha nitrogen applied as a side dressing when the crop is about 30 cm high, which should coincide with the ridging of the crop. Light liming (1 - 2 t/ha) is only recommended in cases where Ca and Mg levels in the soil are very low. Heavy liming increases the risk of tuber scab infection. On sandy soils which have been cropped with sugar cane for more than two seasons, a trace element foliar spray containing Mo and B is strongly recommended.

WEED CONTROL AND CULTIVATION

Chemical weed control should consist of a pre-plant Eptam application for the control of watergrass and pre-emergence surface application of a hormonal type weedicide like 2-4D or M.C.P.A. for the control of emerging broadleaf weed seedlings. If chemical weed control is practiced, mechanical cultivation can be limited to one ridging only. Besides controlling weeds it is necessary to ridge (earth up) the potato crop to ensure that developing tubers are not exposed to direct sunlight, which causes tuber greening and skin scorching.

INSECT AND DISEASE CONTROL

Cutworm. As soon as the crop starts to emerge, cutworm should be controlled by baiting with some suitable insecticide mixed with moist maize meal or bran.

Eelworm. Eelworm infestation in old cane lands which are to be planted to potatoes poses a serious problem to growers because potatoes are particularly susceptible to eelworm infestation. Not only is yield reduced but infected tubers are downgraded on the market. A rigorous fumigation programme will be necessary where eelworm infestation is suspected.

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Blight. A regular spray programme consisting of weekly applications of one of the many registered fungicides (e.g. Dithane M45 or Ridomil) is essential for the control of Late Blight (Phytophthora infestans) and Early Blight (Alterneria solani). Blight is one of the major factors limiting tuber yields in Natal.

IRRIGATION

The potato is a relatively shallow rooting crop with the majority of roots occuring in the top 45 cm of soil. Serious yield reductions occur when the crop suffers moisture stress during the tuber bulking period. In all the potato growing areas of Natal, supplementary irrigation would be economically worthwhile. However, reasonably good yields can be obtained under dryland conditions in areas where rainfall is well distributed over the growing season.

HARVESTING

Tuber yield is directly related to the duration of the leaf canopy, because tuber bulking continues through the growing season until about 80% leaf die-back. If market prices make premature lifting worthwhile, the crop can be defoliated chemically or mechanically. Thereafter, tubers should be left in the ground for about ten days to allow their skins to become firm before lifting.

During the lifting, carting and sorting process, care should be taken to prevent excessive bruising and cutting of tubers which may result in down-grading on the market and facilitates secondary disease infection. After lifting, tubers should not be left exposed to direct sunlight on the soil surface for excessively long periods (over two hours). Excessive exposure leads to tuber scorching and greening.

ECONOMICS OF POTATO PRODUCTION

See Table 2.

TABLE 2

AN INCOME AND COST BUDGET FOR TABLE POTATOES IN THE NATAL MIDLANDS
ON A SANDY LOAM SOIL AND UNDER NORMAL CLIMATIC CONDITIONS (RAINFALL 900mm) - 1977/78 PRODUCTION YEAR

VARIABLE COSTS PER HECTARE

(A) OPERATIONAL COSTS

OPERATION	NO. OF REPS. A	TRACTOR AND IMPLEMENT COSTS: HOURS/HA/ OPERATION B	COSTS PER HOUR: TRACTORS C (cents)	COSTS PER HOUR: IMPLEMENTS D (cents)	COSTS PER HA A x B (C+D) = E (R)	LABOUR COSTS: HOURS/HA/ OPERATION F	COSTS/HR G (cents)	COSTS PER HA A x F x G = H (R)	TOTAL OPERATION COSTS E + H (R)
a) Disc - 46kw tractor + 1,6 m off-set disc	1	1,30	177,80	25,0	2,64	1,30	45,0	0,59	3,23
b) Plough - 46kw tractor + 3 furrow mouldboard	1	2,33	177,80	19,2	4,59	2,33	45,0	1,05	5,64
c) Disc - 46kw tractor + 1,6 m off-set disc	1	1,30	177,80	25,0	2,64	1,30	45,0	0,59	3,23
d) Furrow opening + fert. - 46kw tractor + 2 row ridger	1	1,52	177,80	13,9	2,91	3,04	37,5	1,14	4,05
e) Plant (by hand) - Casual labour	1	x	x	x	x	35,00	20,0	7,00	7,00
f) Closing furrows - 46kw tractor + ridger	1	1,52	177,80	13,9	2,91	1,52	45,0	0,68	3,59
g) Spray weedicides - 35kw tractor + boom type sprayer	1	0,76	133,20	59,2	1,46	1,52	37,5	0,57	2,03
h) Ridging + top dressing - 46kw tractor + ridge	1	1,52	177,80	13,9	2,91	3,04	37,5	1,14	4,05
i) Spray fungicides - 35kw tractor + boom type sprayer	10	0,76	133,20	59,2	14,60	3,04	37,5	11,40	26,00
j) Lifting - 35kw tractor + potato digger	1	6,25	133,20	39,5	10,79	3,04	37,5	1,14	11,93
casual labour	1	x	x	x	x	90,00	20,0	18,00	18,00
k) Bagging, tying up and stacking pockets - casual labour	1	x	x	x	x	110,00	20,0	22,00	22,00
l) Transport contract - 100 km at 15c/ton/km 27 t	x	x	x	x	x	x	x	x	405,00
TOTAL									515,75

(B) MATERIAL AND OTHER COSTS

			R c
SEED	3,5t Seed potatoes at R6,50/30 kg		758,33
FERTILIZER	1 600 kg 2:3:2 (22) + 1% Zn at R118,35/ton	189,36	
	400 kg Ammonium Sulphate at R90,80	36,32	225,68
WEEDICIDES	4,5 l Eptam Super at R226,75/25 l		40,82
FUNGICIDES	2,5 kg Dithane M45 (x10) : 25 kg at R62,37/ 25 kg	62,37	
	1,25 Ridomil (x1) at R124,74/25 kg	6,24	68,61
POCKETS	1 800 x 15 kg at R0,10 each		180,00
CROP INSURANCES	8% of crop valued at R100/m.t.		240,00
AGENTS FEES	5% of gross proceeds : 1 800 pkts. at R1,45		130,50
MARKET DUES	5% of gross proceeds		130,50
LEVIES	Potato Board on 1 800 pockets at 2c/15 kg		36,00

(B)	TOTAL MATERIAL AND OTHER COSTS	R1 810,44
(A)	TOTAL OPERATIONAL COSTS	515,75
	TOTAL VARIABLE COSTS	R2 326,19

GROSS INCOME PER HECTARE

		R c
POTATOES	1 800 x 15 kg pockets at R1,60 per pocket	2 880,00
	200 x 15 kg reject pockets given to laboures at R0,30/15 kg	60,00
	TOTAL	R2 940,00

GROSS MARGIN

	R c
GROSS INCOME	2 940,00
VARIABLE COSTS	2 326,19
GROSS MARGIN	613,81

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FOOT NOTES

1. Fertilizer application based on crop removal on soil test norms of 25 ppm P and 150 ppm K. With fertile soil, application could be reduced cosiderably.

2. Only fuel and repair costs are taken into account.

3. Drivers at R0,45/hour, assistants at R0,30/hour and casual labour at R0,20/hour.

4. Transport costs may vary considerably depending on distance from market or if own transport is used.

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NATAL REGION

JANUARY 1978

Cultivated pastures on the coast and coastal hinterland of Natal

P.J. Edwards, Natal Region, Dept. A.T.S.

The climate of the moist coast and coastal hinterland of Natal (Bioclimates 1 and 2 of Phillips, 1973) is well suited to the growing of improved tropical pastures for animal production. Precipitation and temperatures are generally adequate (except in the dry river valleys) for these species and the lack of frost allows for a long productive season which can be extended to twelve months by the use of irrigation on supplementary annual temperate pastures during winter.

During previous cycles, economically less favourable to sugar, trials with pasture species have been conducted in bioclimates 1 and 2 which provide a fair basis for predicting pasture potential in these areas. In bioclimate 2, the coastal hinterland, we have the example of a number of very successful dairy and beef farmers on which to base our recommendations.

In this talk I will touch on those aspects of intensive pasture farming and their companion livestock enterprises which may be of greatest interest to you. I hope I am not too far off the target.

Pasture Species adapted to the coast belt

There are host of tropical grass species which are well adapted to the coastal areas of Natal. Probably the most important of these are kikuyu (Pennisetum crandestinum) the Cynodons (star grass and coast x2) and nylgrass (Acroceras macrum). Amoungst the others are Setaria, Cenchrus, Digitaria, Paspalum (dilatatum, notatun and vaginatum - saline conditions), Haemathria, Chloris gayana, Bracharia, Panicum and Pennisetum purpureum (Napier fodder). I will concentrate on kikuyu, Cynodon and nylgrass which should prove to be the most valuable in the grazing situation. These three are ranking (stoloniferous and/or rhyzomatous) types well suited to grazing and providing the good ground cover so necessary on steeper areas,

Kikuyu, which can be established from either roots or seed, provides a high quality grazing but has a high soil fertility requirement and production may thus sometimes dissapoint on sands. It is well suited to dairy, beef and sheep. Even with adequate moisture its production is very low in winter but is has a fair foggage value. Depending on the selection this species may or may not produce seed.

The Cynodons, stargrass and Coast x2, are generally established from roots, and are well suited to the area. They are probably the highest yielding species, have a somewhat lower soil fertility requirement than kikuyu but are also less nutritions. They are best suited to beef and sheep and also show practically no winter growth. Their foggage value is low but selected types do not set viable seed.

Hylgrass, about which relatively little is known in these areas, could prove to be very useful mainly because of its high quality as foggage and thus its ability to fill the winter gap. It is planted from roots at present, (seed production is being investigated) and is slow to establish, consequently weeds present problems to this grass in the early stages of establishment. Selected rust resistant lines should be used. It will not produce in winter and volunteer seedlings are unlikely to be a problem. It is well suited for dairy, beef and sheep.

These three species should produce from 10 - 15 tons DM/ha under good management. As none of them produce significant amounts of herbage in winter it is necessary to plug this gap either with foggage, or with <u>annual temperate grasses</u> under irrigation. Two species which will perform well in the hinterland and reasonably on the coast are oats and ryegrass. Irrigation is necessary for these species, they are annuals and their productive season will be short on the coast. They have a very high feed value.

Most tropical <u>legumes</u> and lucerne (<u>Medicago sativa</u>) are suited to these areas. Both <u>Desmodium</u> spp (green and silverleaf), <u>Macroptilium</u> (Sinatro), <u>Glycine</u>, <u>Stylosanthes</u> (Stylo) and sometimes <u>Lotononus</u> are well adapted to the area. Under good conditions they can yield 5 - 6 tons DM/ha and have the advantages of high quality ($<$ temperate legumes) nitrogen fixation ($<$ temperate legumes) and acid tolerance. Their main production is in the late season which is useful for foggage but they require lax utilization which means a relatively low grazing capacity and a high level of management in mixtures. They are better adapted to the beef situation than to dairy or sheep. Lucerne also has a high management requirement under grazing and a very high lime requirement, further, it does not mix very well with creeping grasses. The use of legumes in a mixture will a result in a drop in total yield but a saving in nitrogen fertilizer when compared with grass alone.

Fertilizer requirements

The fertilizer recommendations for pastures in Natal are, except for N, based on soil analyses. Much more calibration is necessary in the coastal areas, however, current recommendations approximate the following for good to average yield levels:

N = 300 kg/ha
P = 15-20 ppm (0,05 NH_2SO_4) for grass 30 ppm for legumes
K = 120 ppm

Lime depending on species requirement
(Lucerne very high requirement)

Fodder flow and animal requirements

Production of most pasture species shows a distinct seasonal trend which in the case of tropical grasses reaches a peak in mid-summer and almost ceases in winter. This seldom matches the animals requirements without considerable planning and manipulation. The nutrient requirements of different animal enterprises also vary, for instance a dairy herd producing for the fresh milk market has an almost constant year round requirement; while a spring calving beef weaner operation has a relatively low winter requirement; sheep in which autumn lambing is favoured have a high winter spring requirement. Thus the beef enterprises tend to approximate the tropical grass production curve better than other enterprises. For those enterprises with a high winter requirement, temperate species and/or hay, silage or foggage are required.

In the coastal hinterland when irrigation is available a combination of kikuyu and Italian ryegrass is very nearly able to match the roughage requirements of a dairy herd (c.v. Horton). However, in many other situations the solution is not so simple. Cane tops can provide a useful high fibre supplement when miled and mixed with molasses, however, I understand that their supply is limited in autumn. In planning an intensive livestock enterprise on pastures a satisfactory feed budget is vital to the success of the enterprise.

The type of animal and management

Available feed, management expertese, and markets and prevailing climatic conditions, disease problems and economic trends all play a role in determining the optimum livestock enterprise and best type of animal within the enterprise.

We have dealt with the problems of feed budgeting while breed adoptability is hardly my field, although I am given to understand from our sheep experts that the Dorper is perhaps the best adapted fat lamb breed. Markets and transport to them are critical in fresh milk production but less of a problem in other enterprises.

The control of disease and parasites on intensive pastures in such moist and humid climates requires a high level of management - particularly in the case of sheep. The management requirement in pasture and animal husbandry is highest for milk production, next highest for sheep and least for growing out steers. I doubt is any of these operations can be economically successful without a fair input of management expertese.

The sort of grazing capacities which could be expected from good pastures in these areas are as follows:

Dairy = 2 - 3 cows/ha for 8 - 9 months; Beef cows and calves = 5 - 6 cow + calf/ha for 9 months
Long yearling steers = 10 long yearling/ha for 9 months
Sheep = 25 - 40 sheep/ha " 9 "

Irrigation can increase these rates and will help to cater for some of the winter feed problems.

Economics

I am not an economist but anticipating some queries on this aspect I consulted our economists who has provided the following information from the results of group studies.

1. Pasture costs

These costs are annual maintenance variable costs plus prorated establishment costs i.e. they exclude interest on land, livestock, fencing and watering.

Hay pasture (c.13 ton DM/ha) R320/ha or R24/ton
Grazed pasture - tropical (c.13t) R270/ha or R22/ton
or R110/dairy cow
Grazed pasture - Italian ryegrass (c.8, 5t) R226 or R28/ton
or R110/dairy cow

2. Gross margins on animal enterprises per animal unit in herd.

Dairy R200-250/cow or R300 - 380/ha summer pasture
Beef cow + calf R30 or R115/ha " "
Beef growing out R50 or R380/ha " "
Fat lamb R60 - 70 per AU = R10/sheep or R190 - 310/ha summer pasture

To conclude, I have no doubt that the coastal hinterland (where rainfall exceeds 850 mm) is better suited to intensive pastures and animal production than are the coastal areas. The south coast is probably better than the north coast and irrigation will make things a whole lot easier.

Phillips, J., 1973. The agricultural and related development of the Tugela Basin and its influent surrounds. A study in sub-tropical Africa. Natal Town & Reg. Plan. Comm., Pietermaritzburg.

AN INTRODUCTION TO MAIZE PRODUCTION

J.B. MALLETT
SUMMER GRAIN CENTRE

Maize (*Zea mays*) is a widely adapted coarse annual grass that needs to be replanted each year. The crop originated in the Americas and has become so domesticated that it could not survive without man's assistance.

CLIMATIC REQUIREMENTS

Maize cannot tolerate frost and as such is invariably grown in summer, requiring a frost free period of at least 150 - 160 days for the hybrids currently available in the Republic. The crop is not very drought tolerant and under low rainfall conditions low plant populations have to be resorted to in order to ensure any return.

The life cycle of the maize plant can be divided into three distinct phases, each with its own special climatic requirements. The first is the vegetative phase which extends from planting to flowering. Limited periods of moisture stress early on do not seem to seriously effect yields, although stress after 40 days will definitely cause yield reductions. The vegetative phase can vary from 70 - 90 days depending upon variety and prevailing temperatures. The same hybrid will flower sooner under hot than cool conditions. The second, or reproductive phase, is extremely sensitive to moisture stress. This period extends from 8 to 14 days overlapping slightly with the end of the vegetative phase and the beginning of the next phase. Any moisture stress during this phase will seriously decrease yields. Extremely high temperatures can cause pollen problems but these are rare in South Africa. The third, or grain filling stage, follows flowering and the length of this phase can vary from 55 - 70 days. This variation is mainly due to variety although temperature can also play a role but not to the same degree as in the vegetative phase. If high yields are to be obtained, it is important that temperatures (radiant energy) be high and moisture supplies plentiful during grain filling.

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CULTURAL REQUIREMENTS

Soil

Under ideal soil conditions, maize roots can easily penetrate to depths of 1,5 m. Deep well drained soils are therefore the most suitable, although the crop will do well on a variety of soils. Very good yields are obtainable for example on sandy soils with clay layers that prevent excessibley deep drainage but allow enough rooting volume to avoid waterlogging. Shallow soils tend to be droughty and should be avoided. In the Republic maize is produced predominantly on Hutton and Avalon soils.

Tillage

Being an annual crop, maize needs to be replanted each year. A clean, even but not necessarily very fine seedbed is required and the best results are obtained if the crop is kept entirely weed free for the entire season or at least until it canopies.

The modern trend is towards reduced tillage and this move is being actively encouraged by conservationists. However, reduced tillage can sometimes cause an increase in weed and insect problems so that caution will need to be exercised before recommendations are made. If specific soils display compaction problems then deep tillage at regular intervals will be required.

Fertilizer Requirements

These can only be established from the results of soil analyses. Cedara offers a sophisticated computerised fertilizer advisory service to growers and it is recommended that prospective maize growers make use of this service. N requirements are based upon yield target, for example, if the target is 4 000 kg grain per hectare, then 35 kg N are recommended, while if a yield of 7 000 kg is being aimed at 140 kg N will need to be applied. Split N applications are recommended where possibilities of loss due to leaching are suspected.

3/.....

Time of Planting

Maize does not yield well if the grain filling period coincides with cool short-day conditions. In the recognised maize producing areas of the Republic, planting date is decided by prevailing soil moisture conditions during October and November with the earliest possible date being selected. Yields normally decrease quite drastically with delayed planting after November 15.

Plant Population

Populations of 45 000 plants per ha (910 mm x 240 mm) are considered optimum where moisture conditions are favourable. Most of the Natal Midlands would be suitable for this stand but as conditions become drier so populations must be reduced.

Selection of Hybrids

No general recommendations can be made as hybrids are normally adapted to specific areas. In the wetter parts of Natal such as Kraanskop, Richmond and Highflats, the Rhodesian hybrid SR52 has performed well but being a very long season type, its more general use is limited. The Pioneer hybrids have also proved particularly well adapted to Natal conditions. Of the hybrids presently available in the Republic the whites generally outyield the yellows.

PRODUCTION COSTS

Mr Gerald Ortmann of the Division of Production Economics at Cedara provided the following 78/79 maize production cost projection for a sandy soil in the Dalton area.

	GRAIN YIELD LEVELS (KG/HA)			
	4 000	5 000	6 000	7 000
	R c	R c	R c	R c
OPERATION VARIABLE COSTS (Fuel, machinery, repairs, lab. etc.)	85,60	97,36	109,11	120,86
MATERIAL & OTHER VARIABLE COSTS (Lime, fert., seed, chemicals, etc.)	146,94	163,79	189,69	216,46
TOTAL VARIABLE COSTS	232,54	261,15	298,80	337,32
INCOME PER 1 000 KG GRAIN	GROSS MARGIN PER HECTARE			
Possible prices due to price fixing, quality etc. (R80	R 87	R139	R181	R223
(R85	R107	R164	R211	R258
(R90	R127	R189	R241	R293
(R95	R147	R214	R271	R328

The yields mentioned vary from average to good and the higher level should be attainable anywhere in the Natal Coastal Hinterland or Natal Mist Belt if sound production methods are adopted. Production costs will vary from site to site within these two subregions but differences will seldom be significant.

PESTS

Weeds

The maize farmer is fortunate in that herbicide technology has reached the stage where all important weeds in the recognised maize production areas of the Republic can be successfully and adequately controlled. Many farmers achieve excellent control of weeds using overall herbicide applications. Should chemical measures not be completely successful due to unfavourable weather or other causes it may be necessary to carry out one or two light mechanical cultivations.

If band herbicide application is practiced then mechanical measures will need to be very much more thorough.

Insects

Here again chemicals are available to effectively control all of the important insect pests occuring in the maize producing areas of the Republic. Cutworm and stalkborer control measures must be accepted as routine if maize is to be produced successfully.

Diseases

Helminthosporium turcicum (Blight) is probably the most serious maize disease in the Republic and is endemic in Natal. Fortunately many hybrids are resistant to blight and only these should be selected. Boil smut and tassel and cob smut can also cause problems and here again care should be exercised in selecting resistant hybrids.

Maize streak virus which is transmitted by the leaf hopper can cause serious crop losses if the disease becomes established when the plants are very young. Although maize breeding programmes exist where resistant types are being sought no commercially viable streak resistant hybrids are presently available. The winter cereals and many of our indigenous grasses act as hosts to the virus and leaf hopper so that in frost free areas or areas where winter cereals are grown, maize streak virus can cause serious problems. Maize streak cannot be transmitted to sugar cane but the specific cane streak virus can affect maize, albeit mildly. Carbofuran has recently been registered for the control of maize streak virus. This is a soil applied systemic insecticide which kills the leaf hoppers.

Generally speaking all leaf diseases can be expected to be more serious where maize is grown in hot humid areas. The leaf rusts which are almost completely absent in the normal maize areas of the Republic can also be expected to cause problems under hot humid conditions.

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Cob rots that usually only manifest themselves at the time of harvest are encouraged by humid conditions after maturity and are very prevalent in parts of Natal during some seasons. The presence of infected grain will lower the grade of the crop and result in the grower receiving a lower price per tonne.

PROSPECTS FOR MAIZE PRODUCTION IN NATAL SUGAR AREAS

The topography of the humid to sub-humid Coastal Lowlands subregion of Natal immediately presents problems to the prospective maize producer. Being an annual clean cultivated row crop, maize would have to be excluded from all slopes above 15%. This would rule out approximately 72% of the south coast and over 42% of the remainder. The remaining flatter areas are normally the cane farmers' better lands and he would no doubt prefer to keep these under cane. Maize therefore appears to have little hope of becoming an important crop in these subregions. Besides the problems associated with topography, disease probably presents an even greater hazard. It is doubtful whether any of the hybrids presently available in the Republic are really suited to the Coastel Lowlands and leaf diseases and cob rots are likely to cause such serious problems that growers would soon become discouraged. Maize could be grown as a winter crop in this area but yields would be low and the economics of the venture is unattractive. A limited market for out of season green mealie production certainly exists.

The flatter areas of the Coastal Hinterland and the frost free areas of the Mist Belt where cane is presently being produced offer good prospects for maize production. Many farmers in these areas are already producing maize very successfully and yields of the order of 7 t/ha are certainly possible. Leaf diseases may present a limited problem and cob rots will possibly cause lower grades from time to time but the potential for consistantly high yields exists. There is no doubt that maize is an economically viable alternative to cane in these areas provided reasonably flat land is available.

SOUTH AFRICAN SUGAR INDUSTRY

AGRONOMISTS' ASSOCIATION

COFFEE - AN ALTERNATE CROP TO SUGARCANE

ROB LLOYD : GLENDALE SUGAR CO.

1. Q Does coffee grow in Natal?

   A Yes, providing certain basic requirements of soil, aspect, and rainfall are fulfilled.

2. Q Is it profitable?

   A Yes, providing cultural practices are implemented timeously viz. pruning, weed control, pest and disease control measures.

3. Q Is it advisable to establish coffee?

   A (i) It is a long term venture carrying a high potential return allied to a high risk factor.

   (ii) It is a crop that requires capitalization in terms of loss of production during the establishment period in addition to the processing machinery.

   (iii) It is a crop that requires highly attentive management.

4. Q Is coffee compatible with sugarcane?

   A Yes. With minor exceptions where you can grow sugarcane, coffee will also grow. Peak labour demand is during winter/spring when labour supply should be plentiful.

5. Q Is there a demand for coffee?

   A Yes. The country is not self-sufficient and imports exceed production by ..1500.... tons. annually

6. Q Where and how can I market my crop?

   A Coffee Growers Association of S.A. which has its headquarters and hulling/grading equipment at Kearsney.

HISTORICAL

Between World War I and World War II both coffee and tea were grown on the Natal North Coast. Disease, in the form of Leaf Rust (probably assisted by pest problems) resulted in heavy crop losses and the ultimate demise of coffee.

In the early 1960's interest was revived (coincidental with low sugar prices?) and many sugar farmers including three large estates established coffee plantations. By the mid-1970's virtually all but the larger plantations had reverted to sugarcane production owing to the low yields and poor prices.

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During mid 1976, Brazil, the World's largest coffee producing country, was hit by a devasting frost causing the price to leap from R700/ton to R3000/ton, once again resulting in a revival in interest.

SOIL AND CLIMATIC REQUIREMENTS

1. Ideal soil conditions for coffee are a deep well structured, free draining soil of pH 5,0 - 5,5.

2. The importance of aspect cannot be over-emphasized. A north easterly/westerly aspect is essential to avoid crop losses caused by wind removal of flower spike or "pin-head" crop. Wind breaks of Grevillea Robusta are advisable.

3. Valley areas prone to frost should be avoided.

4. Rainfall requirements are ideally in the 1000 - 1125 mm range but with good distribution a lower rainfall could suffice. Supplementary irrigation may benefit crop production particularly when carrying a big crop through a dry period.

CULTURAL PRACTICES

1. Establishment

Seed from proven cultivars is propagated in prepared nursery beds or plastic sleeves. Seedlings are ready for transplanting to the field after twelve months in the nursery.

Plant spacings may vary considerably but most favoured planting is at 2,7 m x 2,7 m (9' x 9') or 3,3 m x 1,8 m (11' x 6')

Plant Populations:	at 2,7 m x 2,7 m	=	1330 plants/ha	(540/ac)
	at 3,3 m x 1,8 m	=	1630 " "	(660/ac)

Trees will commence limited cropping from the third year in the field and full maturity is attained in the fifth year.

Seedlings may be "capped" in the nursery in order to induce two or more stems for an eventual multi-stemmed tree.

Recommended cultivars: SL34, SL28, SL14, K7.

2. Field operations

2.1 Pruning: Must be carried out every year.

Systems:
- (a) Single Stem
- (b) Multi-Stem
- (c) Capped Multi-stem

Flower development requires light.

Advantages: (a) To permit air and light entry into the tree for maximum crop production.
(b) To create an unfavourable micro-climate for pests and diseases.
(c) To facilitate effective spray coverage for pest and disease prevention.
(d) To regulate biennial bearing.

Recycling: Should be considered after three years of cropping.

2.2 <u>Weed Control</u>
(a) Chemical
(b) Hand weeding with Cheel hoes

2.3 <u>Mulch</u>: Alternate row mulching should be practised where possible using either cane trash or Napier Grass.

Advantages resulting in increased yields are as follows:

(a) Moisture conservation during winter
(b) Weed control during summer
(c) Improved soil structure and nutrition levels
(d) Reduced erosion.

2.4 <u>Pest & Disease Control</u>: ~~Three~~ Four insect pests and one fungal disease have the greatest influence over crop losses.

2.4.1. <u>LEAF RUST</u> (<u>Hemilea vastatrix</u>). A fungus disease causing defoliation of the tree.

Control: 4-5 fungicide sprays at 4 weekly intervals commencing early December.

2.4.2 <u>ANTESTIA</u> (<u>Antestiopsis Lineaticollis</u>). An insect bug that destroys flower bud, and inflicts widespread damage to vegetation and berry.

Control: 1-2 insects/tree may reduce crop by 50-70%.

(a) Natural enemies ie parasitic wasp
(b) Cultural - pruning
(c) Chemical - insecticide.

2.4.3 <u>GREY SNOUT BEETLE</u> (<u>Ellimenistes lassicollis</u>) A weevil-type insect. It is a voracious feeder devouring leaf and stem of young suckers, flower spike and most stages of berry development.

Control:

(a) Cultural - pruning and weeding
(b) Chemical (tolerant to most insecticides)

Control by controlling weeds - dies in open sunlight. - insecticides - no effect.

SOUTH AFRICAN SUGAR INDUSTRY

AGRONOMISTS' ASSOCIATION

SUGARCANE, ALTERNATIVE CROPS AND SOIL EROSION

We know that erosion is a function of the erosivity (of the rain) and the erodibility (of the soil). The erodibility of the soil will depend to a large degree on the management of that soil, that is the land management and the crop management. The difference in erosion caused by different management of the same soil is very much greater than the difference in erosion of different soils given the same management.

We know also that the effect of raindrop splash in the process of erosion is of particular significance. The raindrop is a complete erosive factor within itself, and little or no erosion occurs when the soil surface is protected by ample crop cover.

The areas selected for the growing of sugarcane in Natal were chosen for reasons of climate and rainfall. There is a great variation in soil type and slope, but even on the poorest soils and steepest slopes sustained economic yields can be obtained, though it is the better soils that can withstand the many and large variations in the climatic conditions under which cane is grown.

The nature of the cane crop itself allows production on some soils and slopes which would not otherwise be classified as suitable for cropping, or would need very special treatment to avoid severe erosion, and it must be appreciated that this places a severe limitation on the extent of the area on which crops other than sugar cane can be grown.

Attempts have been made for many years to quantify in a numerical form the erosion effects of cropping practices and thus allow erosion to be predicted for given circumstances and our Department of Agricultural Technical Services are at present engaged in attempting to produce a soil loss simulation model, or estimator, for Southern Africa. Many of you are familiar with the Universal Soil Loss Equation, the essence of which is to isolate each variable and reduce its effects to a number so that when these numbers are multiplied together the answer is the amount of soil loss. I want to use the equation only to illustrate all the factors which together contribute to soil erosion.

2/....

The equation is presented in the form

$$A = R \times K \times L \times S \times C \times P$$

where A is the soil loss in tons/hectare

R is the rainfall erosivity index

K is the soil erodibility factor

L is the length factor

S is the slope factor

C is the crop management factor

and P is the conservation practice factor.

The basic equation is A = R x K, factors which are largely beyond control, as is S. The other subsidiary factors L, C and P we can alter by different forms of land and crop management. L, length of slope, can be altered by mechanical protection works, and the effective length of slope becomes the distance between terraces. C, crop management, is the most complicated because there are an infinite number of ways of managing the growing of crops, each having an effect on the erosion potential of the soil in which they are being grown. P, the conservation practice factor, will take into consideration contour ploughing, planting and tillage, and of course now minimum tillage.

If we look at the L factor, which is the length of slope between terraces on terraced land, the surface interval between these is calculated in the sugar industry by using a formula which takes into account the nature of the crop, the cover it provides and the fact that it is ploughed out on average once only in ten years. For a 10% slope on an erodible soil under a system of trash management, the surface interval for a cane crop using this formula would be 45 metres.

If an annual row crop was planted under similar conditions, and using the formula for annual cropping, the surface interval between terraces would have to be reduced to as little as 11 metres to prevent the velocity of surface run-off reaching a level when serious erosion would occur. The maximum slope accepted for annual cropping is 15%, and approximately 45% of our cane lands in Natal are on slopes exceeding this figure.

It is accepted that mechanical structures alone cannot prevent erosion from occurring, and that the management of the crop between these terraces will contribute more to achieving a stable situation. The C (crop management) factor takes into account, amongst other things, the nature of the seed bed, the amount of cover achieved by the crop and the length of time for which maximum cover is maintained. It will also take into account the management of the crop residues. Here one can appreciate the comparison between sugarcane and another crop for example cotton. Sugarcane is planted in a fairly deep furrow in a comparatively rough seedbed. Complete canopy is achieved after four to five months, and this cover is maintained usually with a thick trash blanket for a further 13 months before harvesting and trashing again.

The seedbed required for cotton has to be of a fine tilth to obtain accurate depth of planting, cover is poor in the early stages of growth, and even in a mature crop only reaches about half that of sugarcane, and of course lasts for a much shorter period. There are also no appreciable crop residues.

Groundnuts, potatoes and cow peas all require good seedbed preparation, and produce relatively little cover, although a good crop of soyabeans will achieve almost as good a canopy as cane but for a much shorter period.

The P (conservation) factor in the equation will alter according to the practices applied between the terraces. These include contour cultivation, ridging and basin listing, all of which could be applied equally to both cane and other crops.

In using these factors from the Universal Soil Loss Equation, it can be seen that the growing of annual row crops in many areas at present under cane presents the potential for a high level of soil erosion. Many of our soils on steeper slopes have a high erodibility index and this, in combination with storms of high intensity, increases this danger significantly. Particular care will have to be exercised in selecting land for alternative crops to sugarcane. It is assumed that the objective in planting crops other than cane would be to supplement income lost through a reduction in sugarcane output. It would appear therefore that well drained valley bottom soils provide the best opportunity for this. The planting of annual crops on poor soils which would result in unprofitable yields, while encouraging severe erosion, is a situation to be avoided at all costs.

RHP/CAB
11.8.78

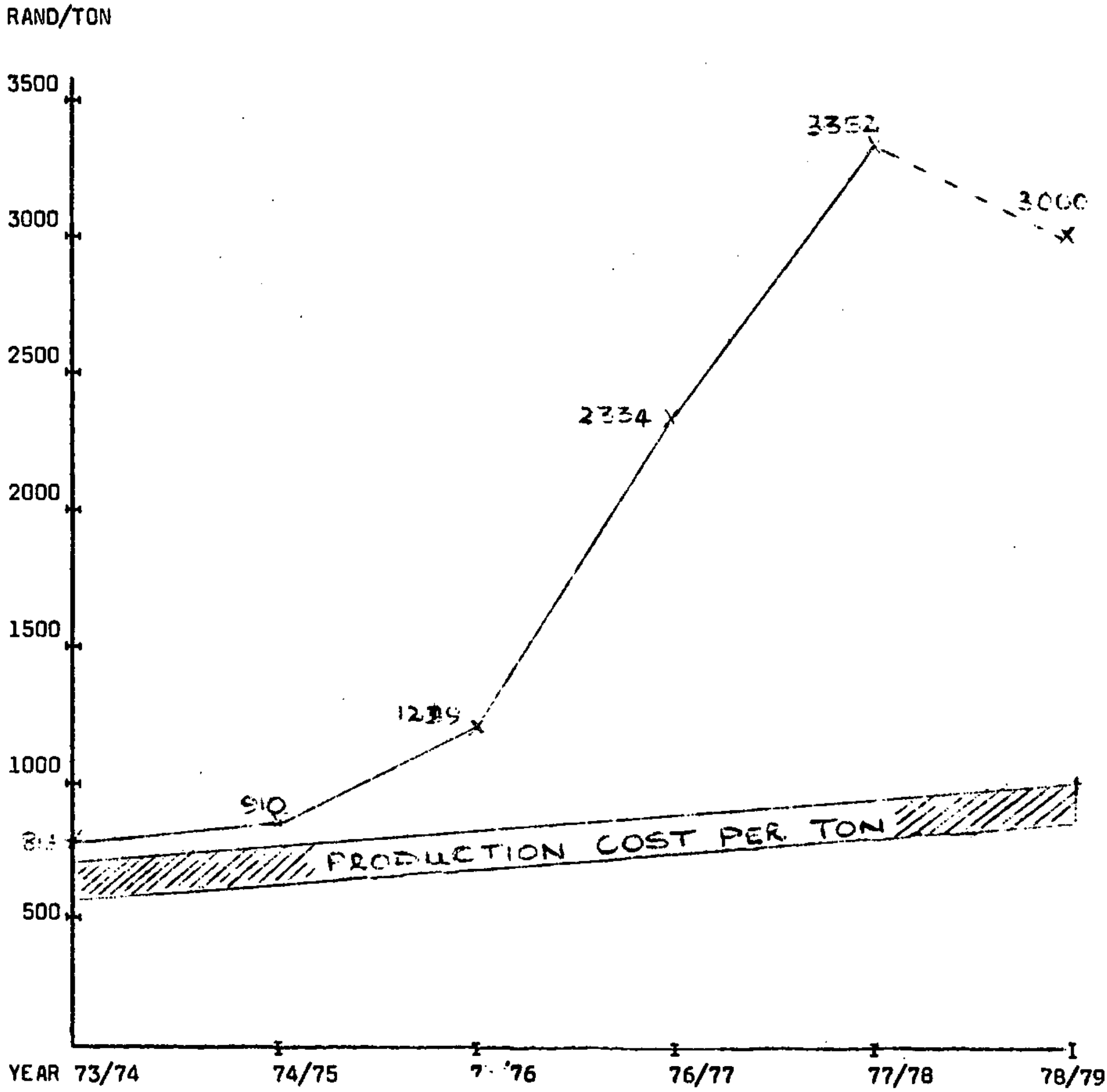
STATISTICS

1. Coffee production from the Natal/Zululand areas amounts to some 300 tons annually. This does not, however, include production from the Eastern Transvaal which is marketed through a separate organization.

2. Annual consumption varies between 1500 - 2000 tons. It it were to be assumed that the total production from S.A. Growers amounted to 500 tons, it can be seen that self-sufficiency is in deficit by 1000 - 1500 tons.

3. Fig I represents gross return per ton clean coffee:-

FIG I



4. Production costs from an integrated coffee cum sugarcane operation tend to become confused. The following figures are an attempt at isolating direct coffee costs and consequently tend towards an inflated level.

In the 1977/78 season, one grower produced his crop at R920 per ton. This fugure included tractor costs, depreciation, capital and operating costs.

Yield levels are obviously critical to profitability. At current prices, it can be calculated that 1/3 ton/ha is the break-even point assuming fixed production costs at R1000/ha.

2.4.4 LEAF MINER (leucoptera Meyricki). A moth larva that feeds on leaf tissue reducing photosynthesis and leading to defoliation.

Control: - same as Antestia.

(a) Natural enemies - parasitic wasps. Red Mite

(b) Chemical - insecticide.

Effective chemical control of pests and diseases can only be achieved by accurately placed, well-timed sprays.

Chemical sprays are normally applied by either tractor-mounted, high-volume mistblow sprayers or motorized knapsacks.

Insecticide applications can be incorporated into routine phrophylactic fungicide treatments.

2.5 Fertilization: Should be determined by soil and leaf analysis.

An average recommendation might be as follows :

150 kg N/ha	-	split application
40 kg P/ha	-	single application
80 kg K/ha	-	single application

- Apply after flower production - otherwise it will only increase vegetative parts.

FACTORY

The degree of sophistication of equipment and buildings will depend largely on the size of the operation. Pulping station requirements will consist of a pulper with one or more discs, a pre-grader, fermenting tanks, and a washing channel. An area in the immediate vicinity of the coffee factory is necessary for drying tables.