SOUTH AFRICAN SUGAR INDUSTRY

AGRONOMISTS' ASSOCIATION

PROGRAMME FOR ANNUAL MEETING

THURSDAY, 12 OCTOBER, 1972.

9.00 a.m.	Chairman's Report
	General
9.20 a.m.	"Plastic Mulching" - Ric Millard
10.00 a.m.	Tea
10.30 a.m.	"Recommending fertilizer for a full crop cycle rather than for individual crops" - Ken Alexander and John Boyce.
11.10 a.m.	"A new approach to the development of mechanical harvesting in Natal" - George Bartlett.
11.50 a.m.	"Cane quality and the effects of delivery delays, extraneous matter, etc." - Elwyn Muller.
12.30 p.m.	Lunch.
2.00 p.m.	"Extension and the Estate Agronomist" - Dave Routledge and Edmund Browne.
2.40 p.m.	"Cane transport - a review of overseas practices" - Graeme Shuker.

SOUTH AFRICAN SUGAR INDUSTRY

AGRONOMISTS' ASSOCIATION

ANNUAL GENERAL MEETING, 1972

A PRELIMINARY LOOK AT PLASTIC AS A MULCH FOR SUGARCANE

by Ric Millard

Introduction

The planting season is generally considered to be from August to April in the northern cane growing areas and between October and March in the Natal Midlands. In spring it is desirable to plant as early as possible to take full advantage of the Summer growing period, but this is often impracticable because: a) spring is when the African labourers go to their homelands to plant their own crops, and b) spring is a peak demand period for other farm operations.

The earlier in spring or the later in autumn that a crop is planted, the more likely is poor germination because soil temperature has become limiting. To ensure better germination more seedcane can be used but this is costly and still does not guarantee a good strike. Replanting or "gapping up" a poorly germinated plant crop is expensive and usually ineffectual because the established cane shades out the newly planted cane.

Another problem associated with low soil temperatures is the poor ratooning ability of some varieties when cut during the winter. This adds to difficulties in planning the cutting programme.

As plastic mulches are used successfully in horticulture it was decided to test the effects of various types and colours of plastic film on soil temperature.

Trial 1 Mount Edgecombe Experiment Station

Procedure

Seven different treatments and a control were established on a Rydalvale soil. Thermocouples were placed at 4cm under the plastic film. Readings were taken hourly during the day and as frequently as possible during the evening and night for a period of one week from 5 - 10 September 1971.

Treatments P.E. = polyethylene

1) Thin black P.E. film.
2) Thin black P.E. film with painted silver surface down.
3) Clear thick P.E. film.
4) Control: no P.E.

5) Clear thick P.E. film with painted silver surface up.

6) Thick black P.E. film.

7) Thick black P.E. film with silver painted surface up.

8) Thick black P.E. film with silver painted surface down.

Results

The data are presented graphically in Fig. 1. Both the reflective treatments (silver surface up) lowered the day-time temperatures and increased the night-time temperatures.

The black P.E. did not increase day-time soil temperatures and, surprisingly, tended to lower them on some days. However, a night-time increase was apparent.

Cyperus spp. grew through the thin, but not through the thick P.E. film.

Having a silver painted surface down was intended to provide a "thermos flask" effect and, to a slight degree, this was successful.

Clear P.E. gave the largest day-time and night-time temperature increases. Cyperus spp. germinated within two days under clear P.E. and continued to grow vigorously for the duration of the trial.

Conclusions

The main conclusions reached were:

1) Clear P.E. raised the soil temperature and aided both germination and subsequent growth of Cyperus spp.

2) Cyperus spp. easily penetrated through thin but not through thick P.E.

Trial 2 Seven Oaks

Procedure

Four treatments with four replicates were tested on plant cane on 15 October, 1971.

The treatments were:-

A) Control: no plastic.

B) Clear P.E. 0,07 mm thick, 90cm wide on row.

C) Clear P.E. 0,07 mm thick, 90cm wide on interrow.

D) Black pineapple mulching film on interrow.

The plastic was laid by hand.

Comments

Difficulty was experienced in laying the plastic. The interrow plastic was subsequently removed and relaid after cultivation. After fixing the plastic into the furrow for the on-row treatment, a width of only ± 15cm remained exposed, but even this narrow strip hastened germination considerably. The P.E. used was too thick to allow the shoots to penetrate, consequently much of the benefit of the plastic was lost when it was slit to allow the plants through. After 3 months the on-row treatment looked greener and generally better grown, but this has not shown up in either stalk counts or height measurements.

Conclusions

1) The P.E. used on the row was too thick to allow shoot penetration.

2) A system of mechanical planting geared specifically to laying plastic mulch was needed for future trials.

Trial 3 Glasshouse, Mount Edgecombe

Four varieties of single-eyed setts were planted and covered with 0,035 mm clear P.E.. About 50% of the shoots of NCo 293 and NCo 376 succeeded in pushing through the P.E..

Four trays of the same four varieties were then planted and covered with 0,02 mm plastic. All the shoots of NCo 293 and 376 came through as did most of the shoots of N55/805 and N53/216.

Conclusions

According to the manufacturers of plastic film, it is difficult to extrude plastic much thinner than 0,02 mm. It was decided to use this thickness of film for future trials.

The Experiment Station Mechanization department had by this time developed a system by which the plastic could be mechanically applied. This involved a slightly raised seedbed, the mechanical covering of setts, rolling, and a very simple and effective mulch layer.

Trial 4 Mount Edgecombe Experiment farm

Procedure

Three treatments with six replications were tested on NCo 376 planted on 11 April '72 in a Phoenix soil. The treatments were:-

A) Control: No plastic.

B) 90cm wide 0,05 mm thick plastic film on the row.

C) " " " " " " " " interrow.

Note: (A mistake was made in the thickness of plastic used).

Two weeks after planting 5cm soil thermometers were placed in three replications of the treatments. The thermometers were placed under the plastic of treatments B and C, and in bare ground in treatment A.

On 10 May 20cm thermometers were placed alongside the 5cm thermometers. For a period of six weeks, day-time temperatures were recorded at 8-00, 10-00, 12-00, 14-00 and 16-00 hours from Monday to Friday. From then onwards readings were taken at 08-00 and 14-00 hours two or three times a week. Soil temperature data are presented in Figs. 2 and 3.

Discussion of Results

Differences between the on-row and interrow temperatures are immediately apparent. As the leaf area increases so the P.E. becomes shaded - but even after four months growth, with the crop completely canopied over the plastic, there is still a temperature difference of more than 1°C at 20cm depth. Optimum temperature for germination of the sett piece has been shown by many researchers to be in the vicinity of 34 - 38°C. Fig. 3 shows that at the 5cm level this optimum in treatment B is reached whenever soil temperature in treatment A rises above 26°C. Therefore, a favourable temperature for germination was created under conditions where germination might normally be inhibited.

When plastic is placed over the row, evaporation from the soil surface is prevented, the sett is less prone to drying out, and clay soils show less tendency to cap. Many different benefits from P.E. mulch have been proved but they would seem to derive mainly from improved temperature and moisture conservation. The extent to which mulch influences the development of plant populations is shown in Fig. 4.

Conclusions

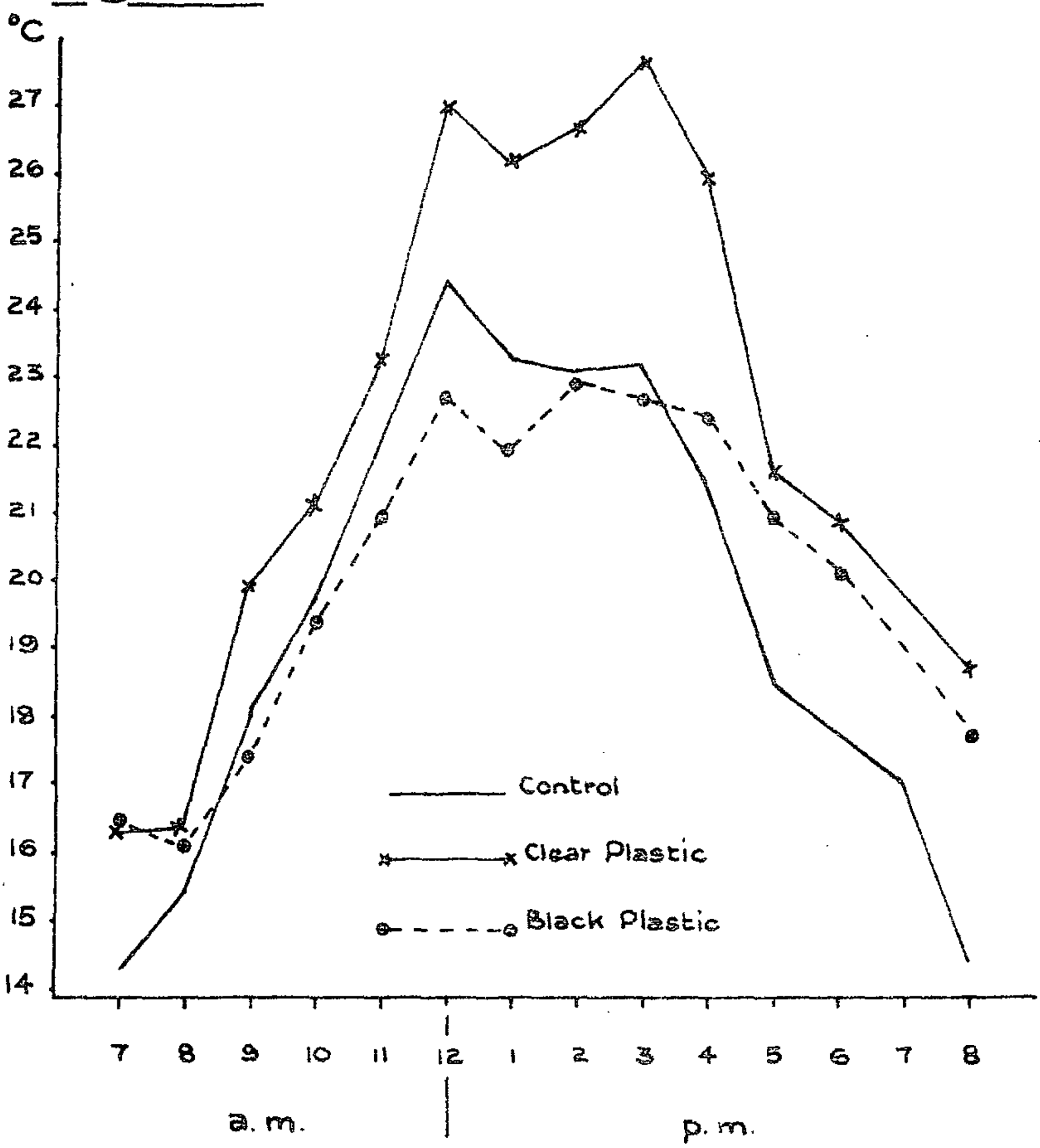
To date no harvest data are available and any assessment of the value of P.E. as a mulch must be made on its ability to speed up and increase germination percentage, to increase tillering and thereby control weed growth in the row.

The ability of plastic film to increase soil temperatures raises interesting theoretical possibilities. It has been shown (Glover) that the $\frac{8\text{ am} + 2\text{ pm}}{2}$ temperature (close to true daily mean) for the Midlands and the North Coast varies by about 3°C only at the 20cm level. This seemingly small difference is very important as it occurs in the colder months when soil temperatures are at the threshold level for effective growth (18 - 20°C). Fig. 5 illustrates this. From this figure it can also be seen that for each degree increase in temperature the growing season can be extended from 2-3 weeks. This could give scope for extending the planting season earlier into spring, or later into autumn with greater assurance of a good strike. Another factor in favour of plastic mulching is that the seedpiece can be sown at a shallow depth without fear of desiccation. Shallow planting has the twofold advantage of a quicker strike and a decreased likelihood of waterlogging on some soils.

Only when harvest data are available can the economics of this treatment be assessed for the different ecological zones of the sugar industry.

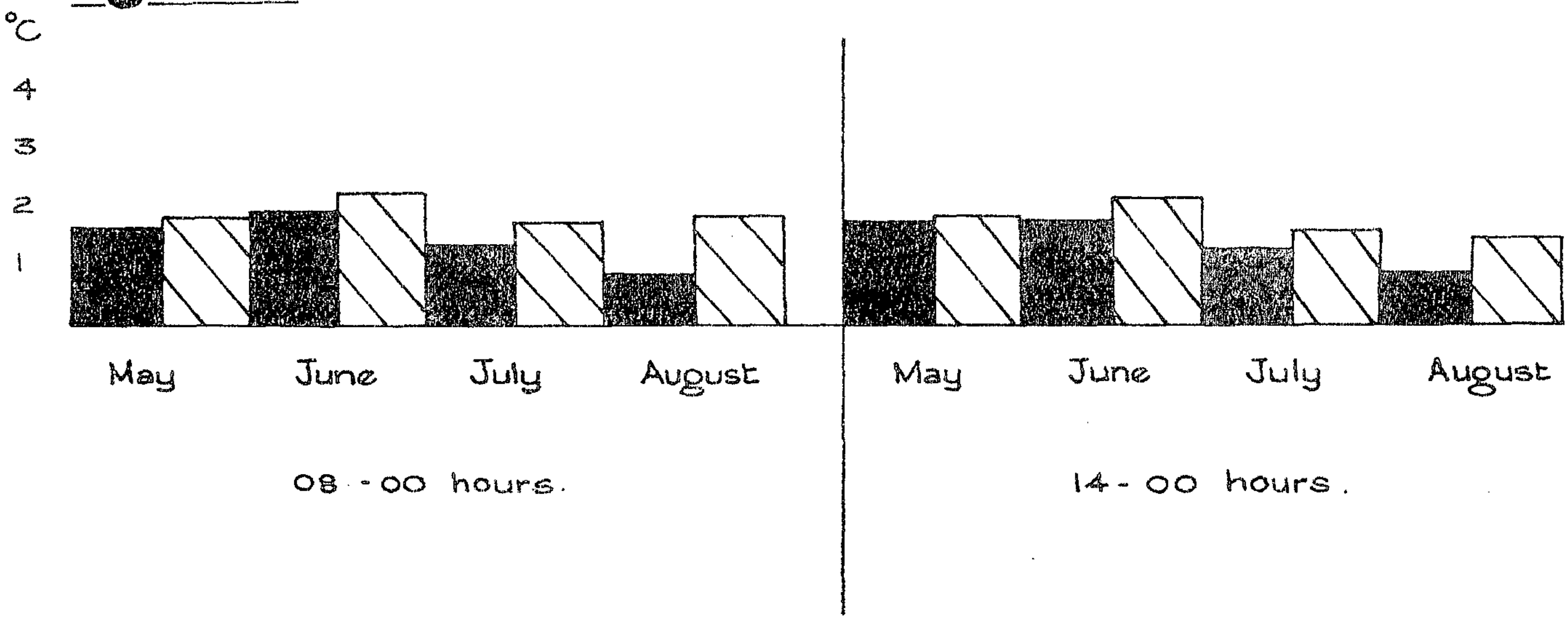
EWM/SN

Figure 1.



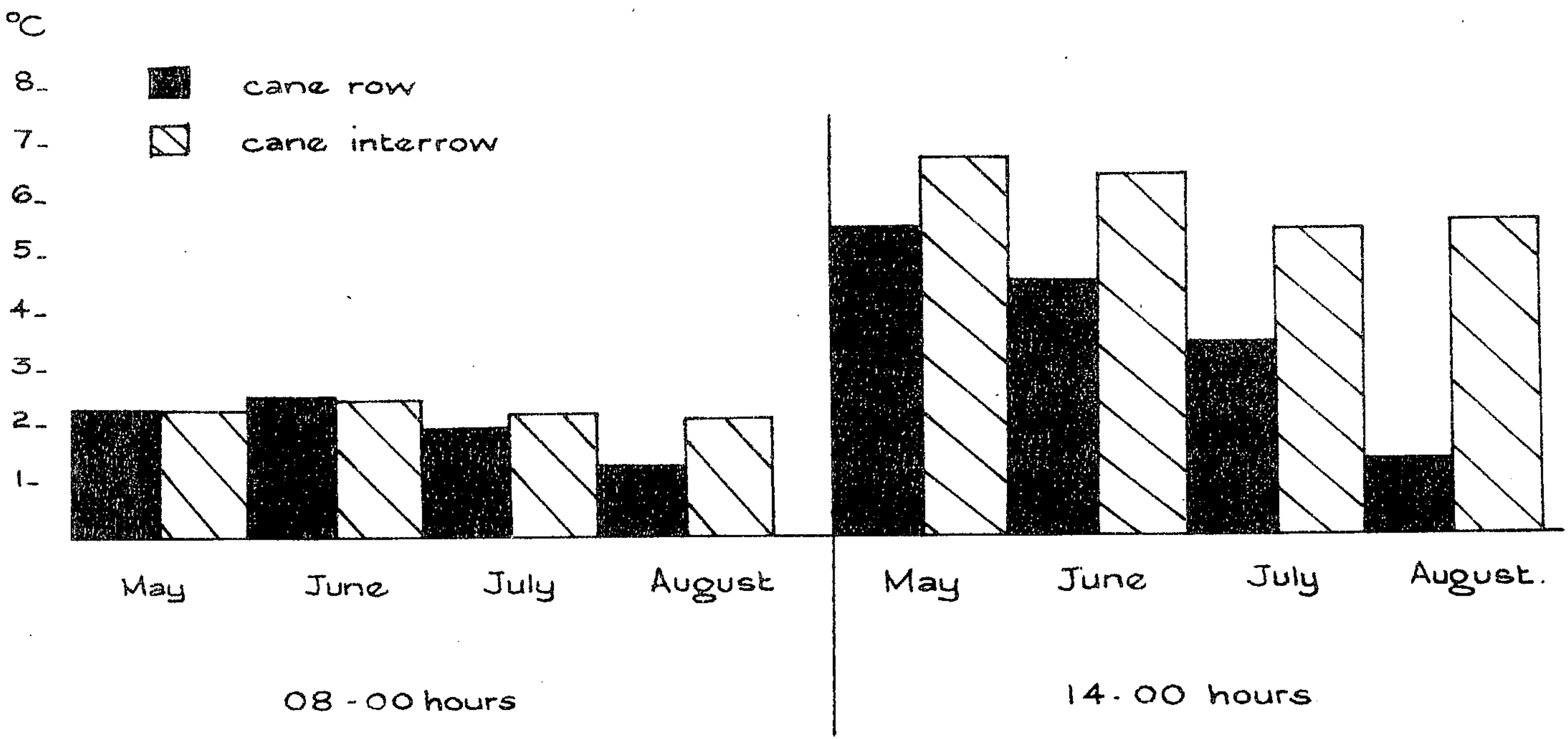
The mean hourly temperatures for one week, 5-11 Sept. 1971, recorded by thermocouples placed at 4cm depth, in a Rydalvale soil.

Figure 2.



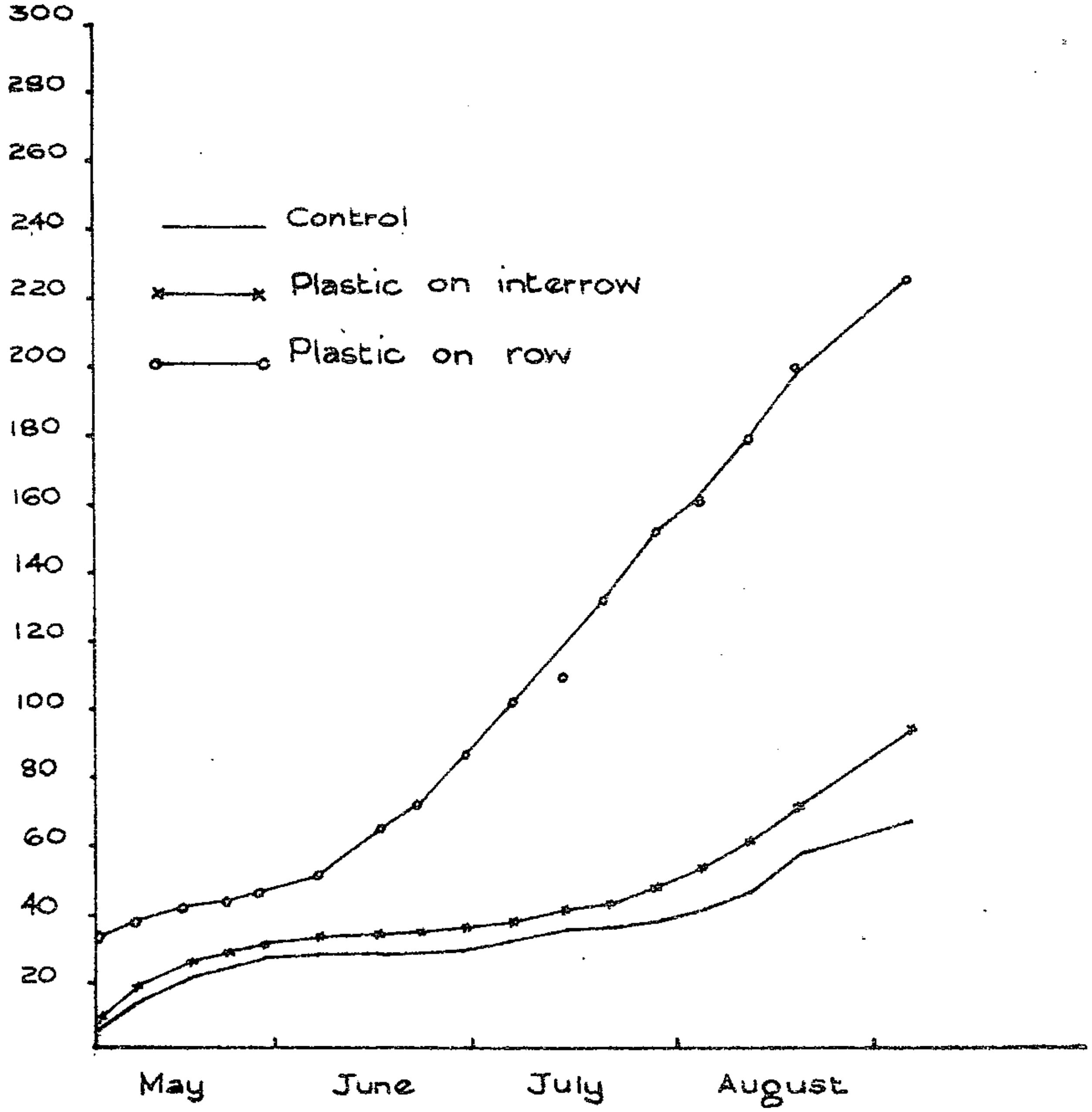
The mean monthly soil temperature increases due to treatment over control at 20 cm. depth, obtained by applying 90 cm. wide plastic on (a) cane row.
(b) cane interrow

Figure 3.



The mean monthly soil temperature increases due to treatment over control at 5 cm depth obtained by applying 90 cm. wide plastic on (a) cane row (b) cane interrow.

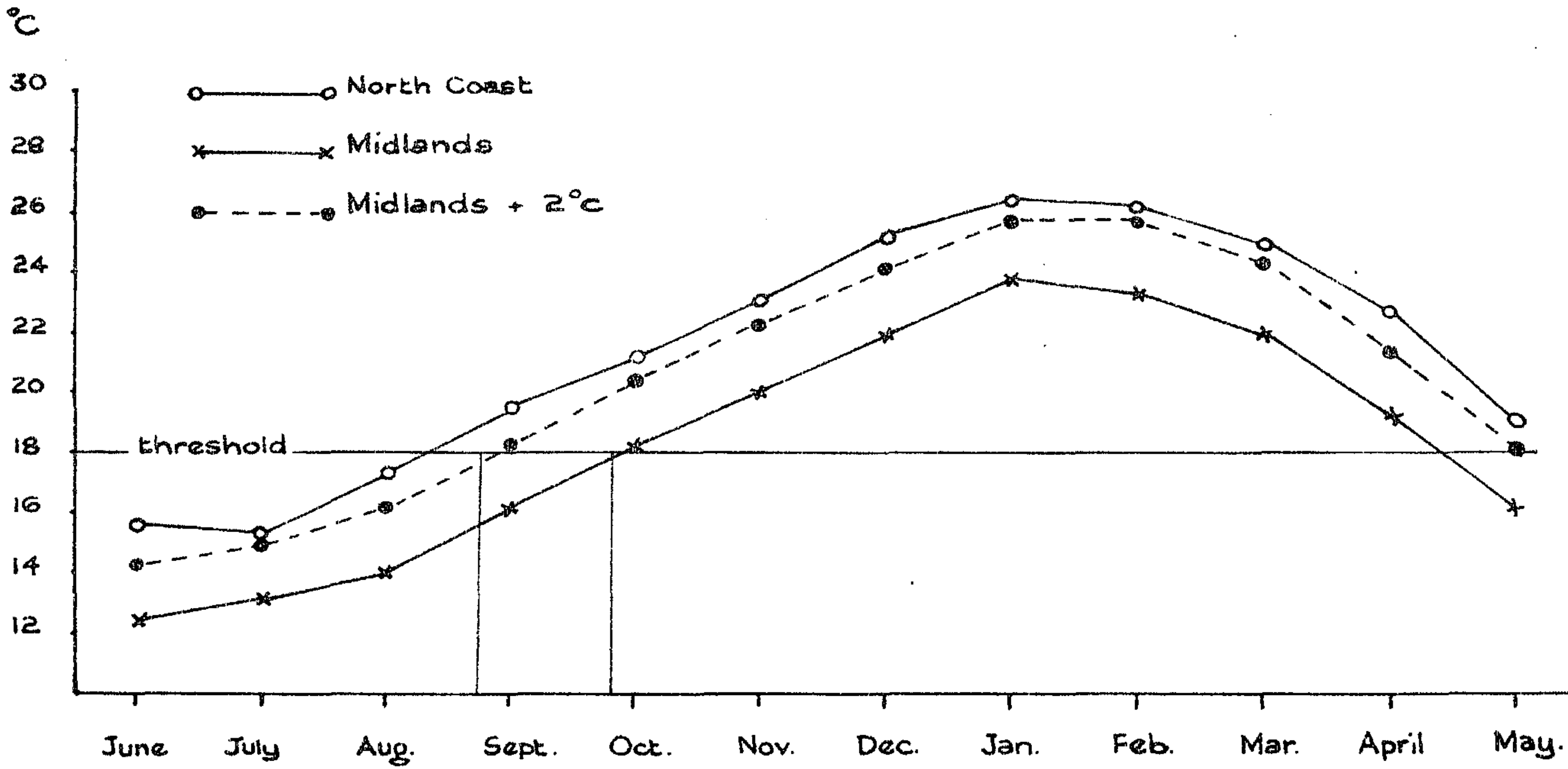
Figure 4.



P. M. 2/72/P

Plant Population, 10^3/ha.

Figure 5.



Monthly mean (8a.m. + 2pm/2) soil temperatures at 20cm. depth in °C.

<u>SOUTH AFRICAN SUGAR INDUSTRY</u>

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<u>ANNUAL GENERAL MEETING 1972.</u>

<u>SOME THOUGHTS ON FERTILIZER RECOMMENDATIONS FOR FULL CROP CYCLES</u>

by Ken Alexander.

The suggestion has been made that we should investigate the possibility of making fertilizer recommendations for the plant crop plus three or four ratoons, based on the results of analyzing a single soil sample. This means that a grower would sample his fields only once every eight years or so, unless some unexpected problem arose in the interim. It would be a far more desirable situation if we could encourage virtually every grower to submit a soil sample from every field every eight years, instead of having only one third of the growers submitting samples after almost every harvest. Naturally, if fertilizer dressings for perhaps five or more crops are to be based on only one sample, that sample <u>must</u> be a good one. The grower should ensure that a large number of cores is taken at random in order to get a really representative sample from the field involved. If possible, he should personally supervise the sampling. The usual precautions should be taken to prevent sample contamination and to avoid filter-cake dumps, anthills, etc. The sample ticket would need to be filled in very carefully and it might even be printed in some distinctive colour in order to draw attention to the fact that "full-cycle recommendations" are required.

From the point of view of drawing up recommendations there is no real problem. Any phosphate dressing for the furrow would be recommended in the usual way. Suppose a soil which is low in available phosphorus is known to have high phosphorus-fixing properties and tends to be low in potassium. A dressing of a mixture like 4-1-6 would be recommended on all ratoons. In a similar situation, but where phosphorus-fixation is limited, the dressings on the first and second ratoons could be mixture 1-0-1, with 4-1-6 being brought in for the third and subsequent ratoons. In this way the grower would be able to plan ahead. He could get his fertilizer supplies ordered, delivered and stored, ready for application at the right time. There would be no need for him to send off a soil sample urgently, wait for the recommendations, send off a frantic fertilizer order, wait for its delivery, only to find, on reflection, that he is applying essentially the same dressing as was recommended for his previous crop.

We all know that soil mineral levels are not static. Changes occur up or down the scale through the years. However, these changes are not dramatic. The annual differences are small. After an eight- or ten-year period, trends can be picked up, and their effects incorporated in the next recommendation cycle.

Any grower wishing to carry on with the present system would be entirely free to send in samples after every harvest. Anyone having had full-cycle recommendations, but who was not satisfied with the growth pattern of any field could immediately send in soil and/or leaf samples to check on the nutrient situation.

All in all, it appears that there are more points in favour of the proposed scheme than there are against it. I look forward to the comments of our agronomists and cane-growers.

KEF/FG.

DESCRIPTION OF A FARM IN THE NORTH COAST AREA

1.	SIZE:	130 ha
2.	MEAN PEAK:	8 150 tons
3.	TOPOGRAPHY:	Rolling with some steep slopes
4.	SOILS:	T.M.S. (Cartref)
5.	MEAN RAINFALL:	1100
6.	IRRIGATION:	Nil
7.	PERCENTAGE TRASHED:	90%
8.	VARIETIES:	NCo 376........75% N55/805........15% N50 211.........5% NCo 310.........5%
9.	CUTTING CYCLE:	17 months

10. SPECIFIC PROBLEMS:

a) Erodable soils with shallow profiles make conservation very necessary.

b) Local areas require drainage.

c) Steep slopes make access difficult.

d) Ubabe and watergrass are a real problem.

e) Aluminium toxicities occur on some fields.

MANAGEMENT PLANNING WORKSHOP 1973.

Objectives and Targets

Is your familiar routine the best that is available for your farm? Why not find out, by setting targets and then preparing an operations programme to see how your existing routine measures up? Here are some of the targets/decisions which might be established for a cane farming enterprise.

OBJECTIVE:

MAXIMUM PROFIT PER HECTARE

TARGETS/DECISIONS

Replant rate ....10..........%

Area to be cut each year ....%

Varieties: for valley bottoms, hill slopes, hill tops, other.

Seedcane production: to (a) purchase 'seed' from ....

(b) grow seedcane - nursery area

- nursery location

(c) use commercial cane

Farm layout: to secure an I.D.P. and plan a layout

to locate and maintain roads on crests where feasible

to use and maintain grassed waterways

to seek the E.O.'s advice on terrace spacing and design

to drain wet areas

to purchase a blade terracer

Land preparation: to use a catch crop to eliminate volunteers

to plough (mould board) in May/June

to harrow twice (tine harrow) in July/September

to dig out volunteers

to plough and ridge in October/November

to use esisting equipment

to confine costs to: Ploughing R9.00/ha
Harrowing R3.00/ha
Ridging R5.00/ha

Planting: to plant in spring

to space rows at 1,20 metres

to draw furrows 20 cm deep

to use setts and to dip these

to treat furrows with dieldrin

to cover with 6 cm soil

to use labour only - and confine planting costs to R25.00/ha

Fertilizing: to use F.A.S. advice

to secure whole cycle advice

to use leaf samples to check on each crop

to use filtercake in the furrow

to topdress mechanically using a broadcast type fertilizer distributor

to topdress 2 weeks after cutting

to purchase an approved fertilizer distributor

Weed control: to use herbicides in conjunction with mechanical and hoe weeding

to seek the E.O.'s advice on weed control

to control weeds while they are still small

to secure better weeding hoes

to purchase 3 knapsack sprayers

to order herbicides well in advance of needs

to confine weed control costs to R40.00/ha in plant cane

to trash

Irrigation:

to provide supplementary irrigation for x ha

to use a profit and loss account for irrigation control

to secure the necessary data on T.A.M.'s, infiltration rates and application rates

to seek advice through the E.O. on the suitability of design of the existing scheme

to secure whatever replacement/additional equipment is required

to confine irrigation costs to Y /ha

Harvesting:

to dry off by stopping irrigation 1 month before harvest

to trash cane cut between September and the end of the season

to burn, at one time, no more than 2 days delivery needs

to move cut cane to the loading zone without delay

to cut and stack as separate tasks

to replace one side loader

to use long handled cane knives to cut burnt cane

to sterilise knives between fields

MANAGEMENT PLANNING WORKSHOP - NORTH COAST

FIELD BY FIELD CUTTING AND REPLANTING PROGRAMME

(Based on an 8 month milling season - 200 milling days)

Targets: (1) % area cut each season ..66.....   (2) % area replanted each season ..10... (15ha)

Field	Area (ha)	Variety	Present crop	Age at 1st May	Est. yield per ha at harvest	Est. total yield at harvest	Fields to be ploughed out	Order of harvest	Estimated number of cutting days	Month of harvest	Age at harvest (months)
1	8	376	2 R	17	110	880		4	4		
2	6	211	4 R	9	60	360	✓	10	2		
3	10	376	Plant	17	120	1200		3	5		
4	10	376	3 R	13	100	1000		7	4		
5	6	376	4 R	15	80	480		6	2		
6	10	805	1 R	16	110	1100		5	4		
7	8	376	6 R	20	70	560	✓	1	2		
8	6	310	2 R	18	90	540		2	2		
9	10	376	3 R	12	90	900		8	4		
10	12	376	1 R	10	100	1200		9	5		
	86					8220			34 WEEKS		

Delivery rate: ....

OPERATIONS PROGRAMME

	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APRIL
Cutting	7 8	3	1	6	5 4 4	4 9	10	2	{FIELD & AREA}			
Estimated yield									{TONS CANE}			
ROUGH - OUT												
PLANTING												
FERTILIZING												
PRE EMERGE												

POST EMERGE												
DRAIN CLEANING												
CLEARING BREAKS & VERGE SPRAYING												

REQUIREMENTS

OPERATIONS	FIELD	AREA	MATERIALS	TRACTORS & DRIVERS	Working Days per month	TRACTOR hours (8hr = 1dy)	Labourers	Working Days per month	Labour Days

SOUTH AFRICAN SUGAR INDUSTRY

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FERTILIZER RECOMMENDATIONS FOR WHOLE CROP CYCLES

by John Boyce

Introduction

In the 1971/72 Annual Report of the Experiment Station it is stated that a record number of 27 295 samples were analysed by the Fertilizer Advisory Service Laboratories. This total was made up as shown in Table 1.

Table 1

Number of samples analysed by F.A.S. Laboratories (1971/72)

Source	Soil Samples	Leaf Samples	Totals
Growers	10 585	2 258	12 843
Experiment Station	4 497	7 047	11 544
Miscellaneous	-	-	2 908
Totals	15 082	9 305	27 295

The real question is whether or not the results of these analyses are being fully utilized? In other words, could the same purpose be served by a much smaller number of "effective samples"? If so, the available F.A.S. facilities could be of greater benefit to the industry, and the need for future expansion could be postponed.

Table 1 shows that both Growers and the Experiment Station demands should be examined. However, only one method of economising without detrimental results will be considered here. The prospect of making fertilizer recommendations for whole crop cycles on the basis of single soil samples taken prior to planting warrants careful consideration.

ADVANTAGES

A proposal that recommendations should be made for whole crop cycles was presented by Mr. Tim Bishop at the Annual Meeting of the Agronomists' Association on the 26th September, 1967. The case in favour of this approach may be summarised as follows:

i) The number of samples to be taken by the grower will be reduced and therefore, more attention will be given to the quality of the sample.

ii) The potassium content of soils in the industry has been shown to be relatively stable and the phosphorus level does not decline rapidly.

iii) Recommendations based on repeated samples will not, in fact, differ appreciably from recommendations based solely on the pre-planting soil analysis.

iv) Sampling variability from crop to crop produces errors in current recommendations; and the sum of these errors will not differ much from the sum of errors incurred by recommending fertilizer for whole crop cycles on the basis of a single pre-plant soil sample.

v) Leaf analysis is apparently more reliable than soil analysis for identifying fertilizer deficiencies; leaf analysis will provide an adequate monitoring system during the crop cycle.

vi) Growers will be able to order fertilizer for ratoons without having to wait for the results of soil analysis.

DISADVANTAGES

Assuming that the current system involves soil sampling of 2nd, 4th, 6th, 8th, etc. ratoons following pre-plant sampling, the case against recommendations for whole cycles may be summarised as follows:

i) The conditions governing the validity of leaf analysis are much more critical than for soil analysis; in other words, the quality of the sample is more critical for leaf analysis than for soil analysis.

ii) Having identified a deficiency by means of leaf analysis, action must be delayed until the next crop.

iii) The duration of the validity of the pre-plant soil analysis is not unlimited, so that leaf analysis is essential to supplement the soil analysis.

iv) In the case of fields requiring lime, the pre-plant soil analysis results arrive too late; soil analysis of a recent ratoon would be desirable in this instance.

v) Because of soil variability and the hazards of soil sampling, the pre-plant soil analysis results may not be reliable; limited sampling of ratoons would overcome this problem by providing more data.

DISCUSSION AND CONCLUSION

Under ideal conditions of optimum supervision, the case for making fertilizer recommendations for whole crop cycles is strong, but it depends heavily upon the need to introduce reliable leaf sampling methods.

There is certainly considerable scope for reducing the frequency of soil sampling. For example, it is probably quite safe to rely on the pre-plant soil analysis results for recommendations for the plant crop and three ratoons. After three ratoons, a further soil sample would provide some insurance against errors, and leaf sampling would then become less critical.

It is concluded that fertilizer recommendations could well be made for the plant crop and three ratoons, but not necessarily for the whole crop cycle. The frequency of soil sampling could therefore be reduced without the need to rely heavily on leaf analysis results. This conclusion constitutes a compromise between the two situations under consideration.

K

(Pre-plant 103) $\frac{K_0}{106}$, $\frac{K_1}{150}$, $\frac{K_2}{162}$ after R3. (FTSL.)

P (Inanda)

		R1	R2
	Control	7.0	5
	B.C.	20	18
	Banded	13	6
	Deep	6	6
	In furrow	9	9

Grasses
Time factor
Difficulty in physical sampling in ratoons.

Some Thoughts on Mechanical Cane Harvesting in Natal for the Agricultural Research Worker and Design Engineer.

by GEORGE S. BARTLETT

It is generally accepted that the successful mechanisation of any agricultural crop has only been achieved through the co-operative efforts of the Agriculturalist and the Engineer. General speaking, the overiding considerations can be stated as:-

a) A crop must be grown which provides the farmer with an adequate return on his investment in land, husbandry and machinery,

b) an acceptable form of crop culture must be practised which allows the Engineer to design a mechanical system which performs the operations required at economically and practically acceptable levels.

There are many examples of the successful partnership of the agricultural research worker and the engineer. One example close to home is the breeding of the monocotyledon beet seed to enable engineers to successfully mechanise the growing of sugar beet. It is well known that the Australian and Louisianan cane farmer has to follow a definate pattern of field husbandry in order to create a work situation where harvesting machines can operate at optimum efficiency. The history books of Agricultural research and its resultant successes, are full of similar examples.

If one accepts this, and then examines cane agriculture in Natal with the view to mechanising both the growing and the harvesting of the cane at economically and agriculturally acceptable levels, one is forced to consider whether the ultimate answer might not lie in a radical approach to the whole question of sugar cane agriculture.

Since radicalism is often looked upon with cynicism by the layman, one would hesitate to propound one's radical views to the public at large. However, to be invited by so imminent a research scientist as Dr. Gerald Thompson, to put one's views to the members of the South African Sugar Industry's Agronomists' Association, is a different matter. It is here where original thinking is done, and where, given the time, the tools and the brains, what is considered impossible today, might prove to be possible tomorrow. It is here where one can hold a "brain-storming" session in the hope that out of it will come the germ of an idea, from which the solution to a major industrial problem will emerge.

What follows are ideas only; ideas which are based on some years of study and practical experience in the field of mechanical cane harvesting, many of which are not original, but rather have emerged from the experience and efforts of others.

Sugar cane is successfully harvested by machines in a number of countries. Most successful are Australia and Louisiana. Both these countries harvest a more or less 12 month crop, and the cane is generally grown on flat terrain. It is about here that the similarities end. While Australia originally started working on whole stick cane cutters, based initially on the Louisiana design, events in the engineering field overtook these, and today the industry is practically 98% committed to the chop-load, or short cane, harvester-combine. Louisiana on the other hand, primarily because of the practical problems of getting standing green cane to burn, and also because it was much earlier committed to mechanical harvesting than was Australia, is today practically 100% committed to the "soldier" or whole stick cane cutter, coupled with the push-piling, slewing grab loader.

Besides these two countries are many others throughout the world, which are using a great variaty of machines and systems in an attempt to harvest their respective cane crops. It can be said, however, that given the flat or gently rolling terrain of Louisiana or Queensland, and given the careful field planning and husbandry which is standard practice today in these areas, the existing machines will work successfully anywhere in the world.

Today, Louisiana and Queensland machines are spreading to many other countries as rising costs and labour shortages, based on rising standards of living and human aspirations, exert their pressures. Unfortunately, this expansion into mechanical harvesting, which should have as one of its benefits, lower harvesting costs, is being plagued by inflation, and the cost of machines is spiralling at an alarming rate. In order to offset the high cost of the machine, manufacturers and users are striving for higher and higher output, which can only be achieved by either firstly building a machine with a higher rate of harvesting, and/or secondly by improving the machines "field efficiency", i.e. its time efficiency in the field.

As South Africans sit on the sidelines and view these developments, they might pause to wonder what affect these will have on local practice in the future. Quite often the first reaction is to argue that the world-wide trend towards large high-capacity machines is not for South Africa, and that the answer to our problems lies in a small, simple, farmer-owned machine capable of cutting on average about 50 tons of cane per day. Ideally, this is correct, but in practice, the builder of a cane cutting machine usually finds that because of the nature of cane as we now know it, the inherent strength and power required to do even the most basic operations are such, that before long, the cutting device is mounted on a tractor of some 40 to 50 horse-power. The problems of having to handle lodged cane, of having to remove the cane top, of having to convey and place the cut cane in the cane bin or on the ground in a manner which allows for easy and economic handling thereafter, are such, that inevitably greater horse-power is required. As the machine develops, so the demand for increased capacity to offset increased machine costs exerts itself, until eventually a machine emerges which is powerful enough to handle cane, yet efficient enough to cut cane fast enough to justify the cost.

While the foregoing summarises what has happened in practically all harvester development today, this does not necessarily mean that it is impossible for someone to invent a successful small, simple cane cutting machine. It is a fact, however, that such a machine, which can be used on a wide scale, has just not emerged from all the development work being done anywhere in the world to date.

The second major consideration is that of "field efficiency", which is basically the ratio of the effective machine operating time to the total time spent in the field. In other words, what effect does downtime, due to operational difficulties and field conditions, have on the effective utilization of the machine system? This is a very important consideration when operating high cost machinery, so much so that lost time due to turning at the field headlands alone, has led to cane-growers in Florida planning cane fields a half a mile long. This is really a basic principle taught to any first year student of agricultural mechanisation, but one which, due to the lack of any real high cost field mechanisation, has yet to be appreciated to the full in the South African Sugar Industry.

It is in this context that one must view the possibility of the mechanisation of cane harvesting in Natal. Let it be repeated, that, given the flat or rolling terrain and the field lay-out and conditions of Louisiana and Queensland, there would appear to be no real reason why existing production made machines cannot be used successfully in South Africa.

It is at this point, however, that one encounters Natal's basic problem, namely, that of steep and broken terrain. It is this problem which leads many to state, probably correctly, that the existing production made mechanical harvesters are not suitable for Natal. The steep and rolling topography of Natal's coastal cane belt has resulted in the construction of cane extraction roads and contoured conservation structures, all of which add to the problem of operating large harvesting equipment on steep slopes. The retention of the trash blanket as another conservation and weed control measure, adds still further problems when considering the case of existing harvesters. In fact, it can be accepted that a basic principle of good farming of cane on steep slopes, is to expose the soil to the elements for as short a period as possible. This applies as much to the period of ratooning immediately after cutting, as it does to the plough-out and re-planting period.

Summarising, therefore, it can be said that because of the hilly nature of Natal's coastal areas, cane is grown in rows, along the contour in panels, which are separated either by conservation structures or cane extraction roads which, because of the steepness of the terrain, are often not negotiable by vehicles moving onto them from the adjacent panels. Compounding this problem is the need to conserve trash, which when left on the ground in a blanket makes traction difficult for vehicles, especially when operating on the contour on slopes.

3/ ....

With these facts in mind, one wonders what the future holds in Natal for mechanical systems which, in spite of their high capital cost, and because of their high output per unit of time, and high field efficiencies, are proving to be highly successful and economic elsewhere. If answered quickly, the reply is generally - no future, and it is at this point where the "brain-storming" sessions must start.

Inevitably, many ideas come forward, such as winches and cables, sleds, conveyer-belts, aerial cableways, chutes, hovercrafts and helicopters. In Hawaii, where in some areas conditions are similar to parts of Natal, cane-growers have resorted to push-pilers, V-cutters, "cane buggies" and drag-line loaders. Such operations would soon deplete Natal of much of its already too shallow top-soil, besides probably also bringing most mills to a stand-still because of the resultant soil and dirt problems.

These and many other ideas have been presented from time to time, and there is little doubt that many more must be recorded, investigated and discarded or used, before our particular problem is to be solved. Might I therefore, as an Agricultural Engineer, and as a practical cane-farmer, be permitted to put forward yet a few more to this body of scientists, in the hope that they might act as a catalyst to still more original thinking about a problem, which time has yet to prove, will be of major consequences to the Natal cane belt.

Firstly, might I say that because of,

a) our steep terrain and the danger of soil erosion, and

b) our less than ideal climate, and

c) the high cost of planting and post harvest operations in ratoon crops on steep terrain, and

d) because a study of actual field operating costs show that some 60% of these costs are directly related to the area of cane-lands worked rather than to the tonnage of cane harvested,

I would like to recommend that we endeavour to grow a vigourous cane crop, and keep it growing for as long as the rate of growth per unit of time is maintained at a predetermined economic optimum level. That is, grow a good stand of cane, and keep it growing for as long as is economically desirable.

Secondly, because contour farming on steep slopes results in roads and contour drains which obstruct the efficient movement of machinery, might I be so bold as to suggest that our lands be returned to their natural state, namely to rolling hillsides. That is, dulldoze out all existing cane extraction roads and conservation structures, and attempt to establish a continuous rolling form to our hillsides.

Thirdly, might I suggest that because of,

a) our more or less standard practice of planting cane in rows spaced at approximately 1.4 metres, and,

b) because our present method of row planting and cultivation results in a ridge and furrow pattern on the soil surface, and,

c) because this pattern necessitates, contour farming in order to combat soil erosion, and,

d) because this pattern results in a rough surface making the movement of equipment and vehicles difficult, and

e) because contour farming in rows results in a low "field efficiency" of machines, and,

f) because of the yield and quick canopy advantages resulting from "on the square" planting at high stool density as recorded by J.P. Boyce, and,

g) because the lodging of cane has now been accepted by the major harvester developers as a common field condition with which harvesters must cope, and,

h) because harvester development is approaching a stage where "multi-row" machines, and "mat harvesting" machines are envisaged in the near future, if not already in the prototype stage,

our agricultural research workers give consideration to,

4/ ....

a) the breeding of suitable cane varieties, if these are not already available, which will be suitably adaptable to "on the square" planting rather than the conventional row crop form of farming.

b) the development of planting and weed control techniques which will comply with the "on the square" method of cane growing, and which will leave the soil "flat" after planting so as to enable a cane cutting machine to cut cane at any angle in the field as the topography or "field efficiency" dictates,

c) the development of ratoon crop management techniques which take advantage of the quick canopy of close growing cane, and aided by herbicides, which will eliminate the need for animal or machine drawn earth engaging implements, and hand weeding.

d) liaising with suitably qualified cane harvesting and handling equipment developers to ensure that the necessary co-operation and inter-change of ideas and know-how be achieved in order that a joint effort be made to solve this common and inter-related problem.

As was stated earlier, the opportunity has been taken to put forward some rather radical proposals as to how cane could possibly be grown in order to allow suitably designed machines to operate freely and efficiently on steep slopes. I envisage green cane, chopper-harvester machines running across, and straight up and down slopes where necessary, cutting cane as one would mow a field of hay.

The cane I envisage will have a thin stalk, possibly of a short length, but growing at a close stool spacing with high population levels, which will provide an adequate protection against soil erosion, and a quick canopy to conserve moisture and prevent weed growth. I envisage a whole new range of soil working tools being developed to handle a "width" of field as opposed to "rows" as the Australian and Louisianan farmer must now do in order to achieve efficient machine operation. Basically, the proposal is to move away from "row cropping", and towards "mat cropping" sugar cane. I also envisage a completely new approach to field lay-out and cane extraction road systems which will allow for the efficient movement of both harvesting and cane haulage equipment.

The South African Sugar Industry is just commencing its adventure into cane mechanisation. If experience elsewhere throughout the world is anything to go by, this is going to be a great adventure, so great that no idea, no matter how trivial, or how radical, can be judged and disproved of without first passing it through all the normal scientific steps of analysis.

SOUTH AFRICAN SUGAR INDUSTRY
AGRONOMISTS' ASSOCIATION

ANNUAL GENERAL MEETING, 1972

NOTES ON CANE QUALITY

by E.L. Muller, Huletts Sugar Limited

1. Introduction

The introduction of direct cane testing, coupled with the possibility of a new cane payment system based on the E.R.S. concept, has aroused interest and concern with regard to cane quality. At Darnall Mill, a Quality Control Department was formed at the beginning of the 1971/72 season to fulfil the following functions:-

a) Recording of, and recommendation for reduction in the delays between burning/cutting and milling of Miller-cum-planter cane.

b) Investigating and recommending on ways to improve cane quality through better trashing and topping.

c) Accumulation of field data through maturity testing and advising on programmed harvesting.

d) Assessment of the financial benefits derived through milling a better quality cane.

The prime objective therefore is to maximize the quantity of crystallizable sucrose contained in the cane delivered to the mill, or in other words, to minimize the cane-to-sugar ratio.

2. Time Lapse between Harvesting and Milling

In recent years, the subject of cane deterioration has been brought to the forefront by the Australian sugar industry through the introduction of chopper harvesters. Their claims of an 18 hour delay between harvesting and milling caused a certain degree of surprise in South Africa. Unfortunately, no comparison could be made with South African conditions because no figures were available in this country.

It was for this reason that we started a survey at Darnall to establish:-

a) What the actual delay was.

b) Where the delay was caused, i.e. in the fields, at the zones, or in the mill yard.

c) Whether anything could be done to minimize the delay.

d) How much money were we losing.

2.1 Method Used

By means of ticketing and weighing each bundle of M-C-P cane, we have been able to calculate the weighted average delays between each of the cane handling operations, i.e. burning, cutting, bundling, zone delivery, mill delivery and crushing.

Each field within an estate is treated as a separate entity, so that individual field averages, as well as the overall estate average, is available.

2.2 Results

The average delays for the 1971/72 season are shown in Table 1, 2 and 3. Table 1 gives the results of the mechanized estates, (i.e. Funkey Bell loaders) and Table 2 deals with Coleraine Estate where hand cutting and loading is practised. These results refer to trashed cane only. Table 3 shows the average delays for the burnt cane.

2.3 Discussion

Referring to Table 1, it is obvious that the majority of the overall delay, 70%, is caused in the field. The exception here is Tugela Estate which was only incorporated into the survey quite late in the season. Its influence on the overall average for all estates is therefore proportional to its small tonnage.

The fact that the mechanical loaders are operating 1,60 days behind the cane cutters leaves room for improvement. This alone is responsible for 43% of the overall delay. Unfortunately, these machines cannot operate too close to the cane cutters but it certainly is possible for them to be half a day behind. In fact, this season one of our estates is doing better than half a days delay between cutting and bundling on some fields.

The infield transport is operating one day behind the loaders and is responsible for a further 27% of the overall delay. The results of Sinkwazi Estate (0,65 day) prove that this delay can also be reduced substantially.

Referring to Table 2, it can be seen that the delay in the field is somewhat reduced when hand cutting and loading is used. The reason of course, is that the cane is cut and bundled on the same day. However, the in-field transport is rather far behind (1,79 days).

The whole problem centres around the fact that we over handle our cane. It is picked up and put down six times before it is actually crushed. Furthermore, a good deal of cut cane and bundled cane is carried over every day. It is the size of this carry-over or stock which determines the average delay.

Table 3 shows that an additional delay of one day is introduced when burning. This again, can be improved upon.

2.4 The 1972/73 Season

Certain improvements to the survey were introduced this season. All processing of data is now done by computer and a broader picture of the operational delays is given in the resulting print-out. Apart from giving weighted average delays, we now get a histogram which shows the spread or distribution of the results about the mean. It gives a clear indication of the size of the carry-over stocks in the field or zone.

Table 4 is a copy of an actual computer print-out which illustrates the importance of the histogram.

3. Extraneous Matter

During the 1971/72 season a total of 882 cane samples were analysed at Darnall Mill to determine the percentage trash and tops. The results are shown below.

CONDITION RATING	NO. OF SAMPLES	AVE. % TRASH	AVE. % TOPS	TOTAL % EXTRANEOUS MATTER
Bad	787	6,79	4,95	11,74
Marginal	85	4,36	1,69	6,05
Acceptable	9	3,80	0,49	4,29
Good	1	3,60	0	3,60
TOTALS AND AVE.	882	6,52	4,58	11,10

Analysis of the two worst samples gave the following results:-

	% Trash	% Tops	TOTAL
a)	9,1	27,3	36,4
b)	32,7	4,1	36,8

Although the average extraneous matter is 11,10%, this figure is not truly representative of all the cane crushed at Darnall. However, if one assumes 8% as being nearer to the truth, then Darnall last season must have crushed 96 000 tons of trash and tops. This is equivalent to 3 extra weeks of milling. Also, as the rate of crushing is proportional to fibre throughput, clean cane would mean that Darnall could crush about 13% faster.

However, we all know that the present cane payment system provides no incentive for a grower to supply clean cane. At

Darnall we hope to introduce an extraneous matter control scheme which will, at least, serve to breed a competitive spirit amongst our estate managers. A further step would be the introduction of a penalty/bonus system for our M-C-P cane.

There are a couple of points which must be borne in mind in respect of extraneous matter:-

a) Generally speaking, our Estates cane is well trashed and topped, but it does not arrive at the mill in a "clean" condition. This is largely due to our system of mechanical loading and it seems as though extraneous matter and mechanization go hand in hand.

b) Direct cost to the Estates. In this regard, we must be aware of the possibility of an unreasonable escalation of harvesting costs in consequence of the implementation of an extraneous matter control scheme. When one considers the relative economics of extraneous matter, field versus factory, a balanced viewpoint must be maintained in the administration of a control scheme.

4. Financial Consequences of Deteriorated Cane

Last season. Darnall crushed 1 195 673 tons of cane at an average E.R.S. % cane of 11,06. If one assumes the overall delay to be 4 days between harvesting and milling and that the rate of loss of E.R.S. is 2,5% per day, then the actual loss of recoverable sugar over the 4 days amounts to 15 500 tons (at a Natal Ratio of 105,5). At R80 a ton, this is worth R1 240 000. If the delay could be halved to 2 days, then the extra revenue would amount to R620 000.

5. Conclusion

In conclusion, I would like to say that deteriorated and dirty cane produces serious manufacturing difficulties to the miller as well as considerable financial loss to both miller and grower. It is a problem which must be appreciated by all, and co-operation must be sought from both sides of the industry to combat it.

TABLE 1 - 1971/72 SEASON - DELAYS ON MECHANISED ESTATES.

	PROSPECT ESTATE	SINKWAZI ESTATE	OCEAN VIEW ESTATE	TUGELA ESTATE	AVERAGE	% OF CUT-CRUSH DELAY
Delay between cutting and bundling	1,45	1,78	1,89	0,61	1,60	42,90
Delay between bundling and zone delivery	1,18	0,65	1,98	0,87	1,02	27,35
TOTAL DELAY IN THE FIELD	2,63	2,43	3,87	1,48	2,62	70,25
Delay at the zone	0,98	0,86	0,96	0,93	0,93	24,93
Delay at the Mill	0,17	0,17	0,29	0,28	0,18	4,82
Overall Delay - Cut to Crush (Days)	3,78	3,46	5,12	2,69	3,73	100,00

TABLE 2 - 1971/72 SEASON - DELAYS ON HAND CUT AND LOAD ESTATE.

	COLERAINE ESTATE	% OF CUT-CRUSH DELAY
Delay between cutting and zone delivery	1,79	60,68
Delay at the zone	0,86	29,15
Delay at the Mill	0,30	10,17
OVERALL DELAY - CUT TO CRUSH (DAYS)	2,95	100,00

TABLE 3 - DELAYS OF BURNT CANE FOR ALL ESTATES - 1971/72 SEASON

	PROSPECT	SINKWAZI	OCEAN VIEW	TUGELA	COLERAINE	AVERAGE
Delay between Burning and Cutting	0,85	0,67	0,54	1,13	1,57	1,12
Delay between Cutting and Milling	3,70	3,66	5,44	2,69	3,01	3,62
OVERALL DELAY - CUT TO CRUSH	4,55	4,33	5,98	3,82	4,58	4,74

QUALITY CONTROL DEPT. - TIME ANALYSIS OF CANE HANDLING. ESTATE 1212 - OCEAN VIEW 29/08/72

FIELD 500 - POND VARIETY 376 ZONES: 572 TONS: 1019.00 METHOD 63

HARVESTED AND CRUSHED BETWEEN 12/06/72 AND 07/07/72. RAINFALL DURING PERIOD: 32.2% BURNT

M E A N   D E L A Y S (24 HOUR DAYS)

	BURN	CUT	BUNDLE	ZONE DEL	MILL DEL	CRUSH	DELAYS MARKED * AS % OF CUT-TO-CRUSH
BURN		0.26*	1,50	3,24	4,57	4,76	5,89
CUT	0,11		1,02*	3,18	4,43	4,52	22,59
BUNDLE	1,46	0,95		2,16*	3,41	3,50	47,92
ZONE DEL	1,63	1,58	1,44		1,25*	1,34	27,70
MILL DEL	1,44	1,43	1,45	0,84		0,09*	2,10
CRUSH	1,68	1,55	1,40	0,86	0,31		

S T A N D A R D   D E V I A T I O N S

HISTOGRAM OF DELAYS (%)

DURATION OF DELAY	BURN / CUT	CUT / BUNDLE	BUNDLE / ZONE DEL	ZONE DEL / MILL DEL	MILL DEL / CRUSH	OVERALL CUT/CRUSH
0,0 - 0,49	98,80	25,18	11,11	20,74	92,96	
0,5 - 0,99		41,85	10,00	19,25	3,33	0,37
1,0 - 1,49	1,19	13,33	14,07	27,40		0,37
1,5 - 1,99		10,37	15,92	11,85	3,70	0,74
2,0 - 2,49		2,59	17,40	11,11		
2,5 - 2,99		0,37	4,07	5,92		11,11
3,0 - 3,49			7,03	2,22		20,74
3,5 - 3,99		2,59	6,29	0,74		14,81
4,0 - 4,49		3,70	4,81	0,74		8,88
4,5 - 4,99			3,70			9,62
5,0 - 5,49			4,81			6,66
5,5 - 5,99			0,37			1,85
6,0 - 6,49			0,37			7,40
6,5 - 6,99						6,66
7,0 - 7,49						8,51
7,5 - 7,99						2,22
8,0 - 8,49						
8,5 - 8,99						
9,0 - 9,49						
9,5 - 9,99						
10,0+						

SOUTH AFRICAN SUGAR INDUSTRY

AGRONOMISTS' ASSOCIATION

ANNUAL GENERAL MEETING, 1972

EXTENSION AND THE ESTATE AGRONOMIST

by Edmund Browne and Dave Routledge

1. The Extension Officer and the Estate Agronomist have similar backgrounds consisting of formal training in Agriculture.

The Extension Officer has some training and experience in dealing with people.

The Estate Agronomist has more experience and practice in dealing with experimental technology work.

The Extension Officer has a wide experience of general farming situations.

The Estate Agronomist has a particular knowledge of his estate situation.

2. The Extension Officer is consultant, teacher, leader, sometimes servant, often regarded as a nuisance. He works in the field of cane farm management and agricultural technology. The Experiment Station expects him to organise all its communication and trouble shooting with all sugar growers, including miller-cum-planters.

The Estate Agronomist is responsible for the inclusion of pertinent modern technology in his company's agricultural policy, and for trouble-shooting in the field. He is agricultural consultant and adviser to his management, and must control a number of agronomic trials on his company's land to test agricultural policy recommendations under his own conditions.

3. Common ground to both Estate Agronomist and Extension Officer lies in their need to be "up to date" on cane growing technology, their influence on the private cane growing community (although the Estate Agronomist's influence is somewhat indirect), and their influence on estate management (where the Extension Officer's influence may be indirect). Both are striving for an improved agricultural situation.

4. The greatest difference between their respective tasks is that the Estate Agronomist is expected to take an active and critical interest in his Company's particular field management policy, while the Extension Officer is only involved in any management situation into which he is invited, and views this situation very objectively.

Therefore their attitudes and approaches to their tasks are very different.

5. Both Estate Agronomist and Extension Officer need to be "up to date" on cane growing technology, so each must have something to offer the other from his experience in his particular job.

The Extension Officer will find it difficult to be a channel of information between the research worker and the Estate Agronomist who has a very specific requirement from research for his special circumstance, and who is equally able to interpret the situation. However, the Estate Agronomist should not neglect to use the Extension Officer's wider experience and field of observation and closer contact with the research worker.

The Extension Officer should on his part gain as much as he can from the Estate Agronomist's close contact with practical field management.

It goes without saying that each should respect the others function of being "technological communicator" for his employer.

6. Because he is able to control the situation an Estate Agronomist will use herbicides and fertilizers with greater precision than the Extension Officer can recommend. Unless each understands what the other is doing, and why, this situation could lead to misunderstanding, criticism, and loss of credibility to both Estate and Experiment Station.

To sum up. In spite of a seeming lack of common purpose, there is very good reason for Extension Officer and Estate Agronomist to set up and maintain continuous communication.

GDT/PMO