SOUTH AFRICAN SUGAR INDUSTRY

AGRONOMISTS' ASSOCIATION

ANNUAL MEETING - THURSDAY 25 OCTOBER 1990

VENUE : Conference Room SASA Experiment Station, Mount Edgecombe

PROGRAMME

9.00 - 9.15	Chairman's report	
9.15 - 9.45	Are we using available technology effectively? A grower's point of view.	J Lonsdale
9.45 - 10.15	Are we using available technology effectively? An estate point of view.	P Braithwaite
10.15 - 10.45	The delay in the implementation of available technology - an extension point of view.	D Hellmann
10.45 - 11.15	TEA	
11.15 - 11.45	Thoughts on transplants	D Thomas
11.45 - 12.15	Cane burning - cost/benefit	(Dr) GD Thompson
12.15 - 12.45	Wetlands	Q Mann
12.45 - 2.00	LUNCH	
2.00 - 2.45	SSA Agronomy research	SSA Extension Services
2.45 - 3.30	SASA Agronomy research	SASA Agronomy Department

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Are we using available technology effectively? - a grower's point of view

J Lonsdale

Driving through the Industry it is apparent that there are large discrepancies in the application of available technical information. Some of the problems observed are listed:

1. Severe weed problems possibly caused by one or more of the following:

    a) Herbicide application starts too late in spring
    b) Post-emergent applications are late
    c) Standard of hand weeding is too low
    d) Insufficient labour to complete the weeding
    e) Weeding tasks are too low
    f) Patches of potentially dangerous weeds are ignored.

2. There appears to be large scale wastage of fertilizer:

    a) Fertilizer is applied to weedy fields
    b) Rates are higher than recommended by FAS
    c) Potash is applied when not recommended by FAS
    d) Application techniques result in striping with mechanical application and haphazard rates by hand.

3. Labour productivity varies widely.

4. Preventative maintenance of vehicles is often non existant.

In the past farmers who are not applying technology correctly have been left to their own devices because these are often the people who do not attend meetings, read letters etc. I have a strong conviction that, because such increases in profitability are possible in these situations and because nothing succeeds like success, there is tremendous potential for rewarding inroads to be made into these high cost problems.

With this in mind I would like to pose a few questions:

1) What is the magnitude of the above problem?
2) How does it impact on the industry as a whole?
3) Based on the above information, how much time could an Extension Officer spend on the problem?
4) Is there some way of reaching these people?
5) If there is and the profits of one or two people could be improved, would they not be highly motivated to improve further?
6) Could the above success not impact on their neighbours and later on the "good farmers"?
7) In the "New South Africa" is this aspect not going to be a priority?

J E LONSDALE

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The theoretical potential of changing varieties on Sezela Estate

by P G Braithwaite

1. The objective of this exercise is to compare what we had in the ground at April 1990 to the theoretical optimum as advised by the Experiment Station.

2. Calculations are based on advice from Dr Bamber of the Experiment Station. Table 1 gives an example of a typical Variety Evaluation Worksheet. Full calcualtions were carried out for each of the 10 Bioclimatic regions identified on Sezela.

3. Graph 1 compares the present situation to the theoretical optimum as determined from the worksheets.

   Table 2 shows the potential increase in terms of Rand and tons sucrose. This is only calculated for the farming operation and additional revenue would be realised in the factory and from by-products.

4. In reality it is unlikely that we could reach this potential due to practical considerations.

   4.1 Phasing in at maximum of 10% p.a.

   4.2 Unknowns which will affect the recommendations:-

   Eldana on N11
   Eldana on N16
   Factory performance
   By-products
   Cutting age.

   4.3 Disappointing results:-

   N12 to date
   Ratoonability
   Germination

   4.4 Large D.R.D. ⟶ large fields

   4.5 Availability of seed material.

   4.6 Poor water utilisation -

   4.6.1 current layouts designed to concentrate + remove water as quickly as possible.

   4.6.2 poor drainage.

   4.7 Unhealthy balance of N12 to the other varieties.

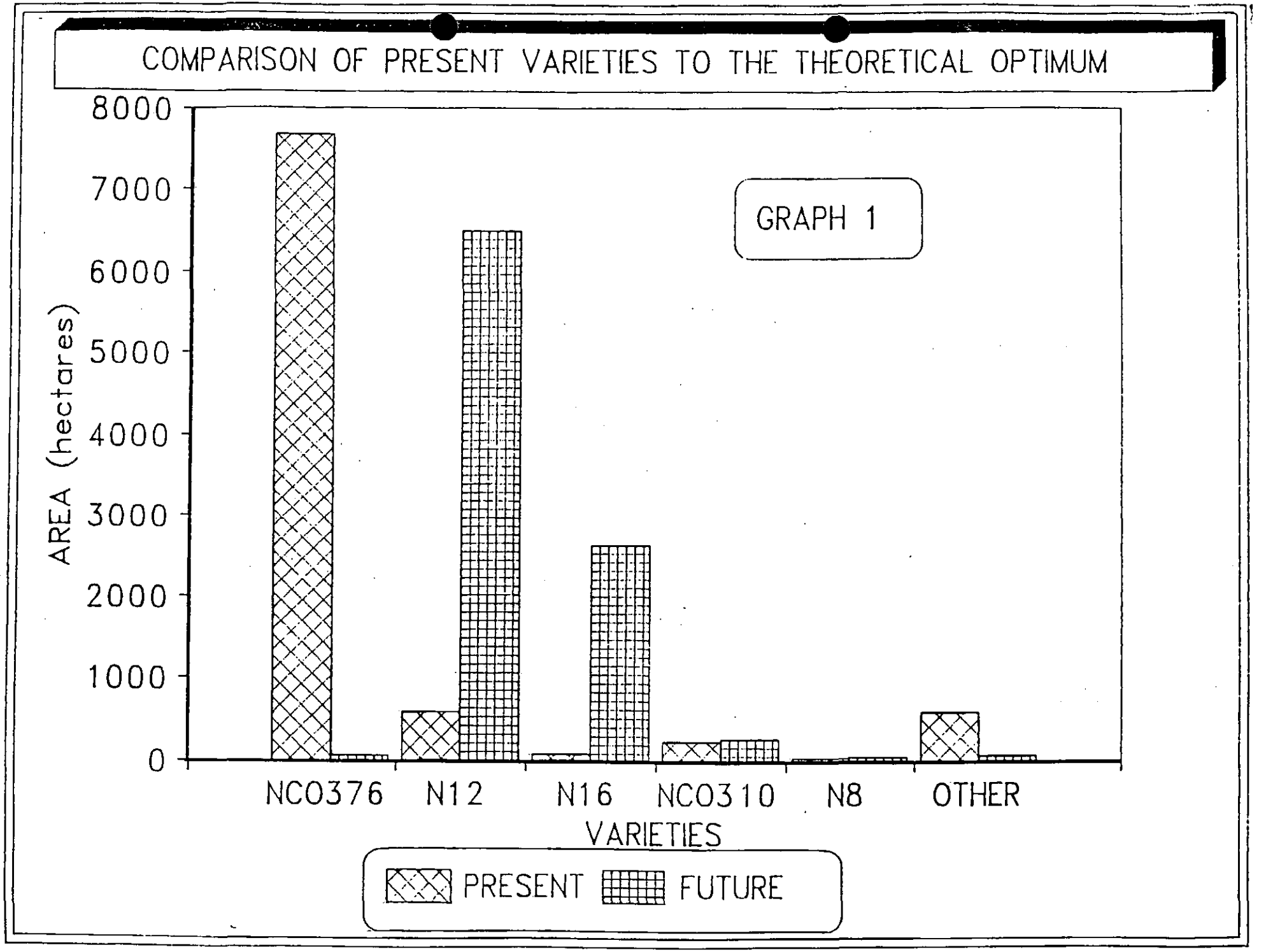
APPENDIX B

VARIETY EVALUATION WORKSHEET for CG SMITH, SEZELA

CLIMATE/SOIL CATEGORY : SHALLOW GRANITE

1 Approx. altitude	150	m	Expected Pest and disease levels		
2 Suggested plant and harvest cycle for NCo376.			7 Mosaic	high	
% area area cut per annum.	77	%	8 Smut	low	
% area replanted annually	15	% (Ratoons 5)	9 Eldana	medium	
Fallow period	3	months			
Resultant mean harvest age	15	months	10 Weeding cost per week	19	R/ha/ week
3 Mean sucrose % cane for NCo376	12.5	%	11 Sucrose price (A 1989)	376	R/ton suc.
			12 In field harvest costs	6.29	R/ton
4 Environmental yield potential(YP)	70	t cane /ha/ annum	13 Transhipment		
	8.8	t sucrose /ha/ annum	and Haulage costs	6.00	R/ton
5 Estimated drought frequency	8	years	Total harvest cost...	12.29	R/ton
			14 Plant - weeding cost	1953	R/ha
6 Management level	Average		15 Ratoon - weeding cost	488	R/ha
% potential realized	75	%			
Actual yield expected	53	t cane per annum			

A. List of relevant varieties approved by local Pest and disease committee.		1	NCo 376	NCo 310	N8	N12	N14	N16	N17	N18
B. Sucrose yield relative to NCo376 at given YP (%)		1	100	89	90	104	95	108	102	105
95% lower confidence limit (%)		1	100	89	90	102	90	105	97	98
Resultant gross return	(R/ha/annum)	1	2482	2208	2233	2581	2369	2687	2524	2606
		1								
C. Sucrose content as % of NCo376		1	100	112	90	105	100	106	107	105
Harvest and Transport cost	(R/ha/annum)	1	649	516	649	644	619	663	617	649
		1								
D. Mean time to canopy (weeks), Plant crop		1	19	17	19	21	16	16	23	16
Ratoons		1	16	14	17	16	13	13	14	14
Weeding cost	(R/ha/annum)	1	251	220	266	254	207	207	240	220
E. Expected number of ratoons		1	5	5	3	6	4	4	4	3
Fallow, plant and ratooning - weeding cost		1	668	659	795	632	720	732	726	814
		1								
F. Sucrose yield in severe drought (t/ha)		1	2.0	2.5	2.5	3.0	2.2	2.5	2.0	2.0
Loss of revenue in drought	(R/ha/annum)	1	270	198	202	227	239	272	278	290
		1								
G. Expected lodging at harvest (%)		1	4	4	4	4	4	4	4	4
Difference in harvest cost due to lodging assuming 50% extra for fully lodged cane and no additional cost for NCo376	(R/ha/annum)	1	0	0	0	0	0	0	0	0
		1								
H. Disease costs Roguing	(R/ha/annum)	1	40	40	0	0	0	0	0	0
Possible ratoons lost	No. ratoons	1	1	1	0	0	0	0	0	0
Extra replant costs	(R/ha/annum)	1	57	55	0	0	0	0	0	0
		1								
I. Change in harvest age to avoid eldana (months)		1	0	0	0	0	-1	-2	0	-1
Difference in plant and ratoon cost (R/ha/annum)		1	0	0	0	0	49	100	0	55
J. Relative value of variety	(R/ha/annum)	1	546	519	321	824	534	713	664	578
...Possible lower value	"	1	546	519	321	774	397	625	546	404
K. Difference wrt NCo376	"	1	0	-27	-225	278	-12	167	117	32
...Possible lower value	"	1	0	-27	-225	228	-149	79	0	-142


COMPARISON OF PRESENT VARIETIES TO THE THEORETICAL OPTIMUM
GRAPH 1
AREA (hectares)
8000
7000
6000
5000
4000
3000
2000
1000
0
NCO376
N12
N16
NCO310
N8
OTHER
VARIETIES
PRESENT
FUTURE

POTENTIAL INCREASE IN TERMS OF RAND AND TONS SUCROSE

Table 2

Description	Unit	N12	N16	N17	NCO310	NCO376	N8	TOTAL
Optimum area	ha	6 496	2 634	50	259	50	36	9 530
G A P	ha	5 899	2 571	50	-	-	-	8 520
Potential increase	Rand	1 311 944	363 960	7 900	-	-	-	1 683 804
Potential increase	t.s.	1 431	1 134	31	-	-	-	2 596

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THE DELAY IN THE IMPLEMENTATION OF AVAILABLE TECHNOLOGY - AN EXTENSION POINT OF VIEW

D.B. HELLMANN

INTRODUCTION

The title of this paper implies that available technology is not being implemented by cane growers as rapidly as it could be. The aim of this presentation is to establish whether or not this delay has any impact on yields, attempt to establish possible reasons for the delay and offer some solutions to the problem.

IS THERE A PROBLEM ?

Presented in Figure 1 are the t(cane)/ha yield distributions obtained during the 1989/90 season for 5 different homogeneous areas in the midlands area. Distribution A represents the area with the greatest yield potential, while distribution E represents the area of the lowest yield potential.

1. The following observations can be made from figure 1 :-
   - * The yield distributions for the 5 areas do not overlap as would be expected, with the yield boundaries of distribution A not being at a higher level than the boundaries of distribution E.
   - * The yield distribution for all 5 areas covers a wide range from less than 30 t(cane)/ha to 150 t(cane)/ha.
   - * Except for distribution B, which resembles a normal distribution curve, the remaining distributions are strongly biased towards the lower yields. In fact, 28 percent of the total sample (4351 hectares) yielded less than 60 t(cane)/ha.
2. It would appear that there is some factor limiting crop growth in the midlands. Whether this is due to technology not being implemented or whether there are management problems involved in the implementation of the technology is not clear.

ARE GROWERS ADEQUATELY TRAINED ?

It is necessary to establish whether or not cane farming is a business which requires that the grower should be adequately trained if he is to farm efficiently.

Page 2/..

Using a 1000 ton sucrose quota farm producing 8000 tons of cane annually as an example, the following facts can be established :-

* At an industrial average of 5 labourers/1000 tons of cane, a labour force of 40 would be required. The labour complement would comprise indunas, tractor drivers, workshop assistants and unskilled labour.

* At an A pool sucrose price of R510 per ton (assuming the transport rebate is included in the sucrose price), the gross income would be R510,000 per annum or R56,600 per month for a 9 month milling season.

* In addition to making decisions regarding labour and finance, the grower should also be in a position to evaluate yield data in order to implement sound agronomic practices.

It therefore appears that for a grower to operate efficiently, he should be competent in the fields of labour and financial management. It would be an advantage if he had a basic understanding of observational and sampling techniques as well as the interpretation of yield data.

It is felt that many growers have not been adequately trained in these three aspects of management.

MANAGEMENT

The late Mr Noel Calder (Field Manager, Tambankulu Sugar Estates) once said that "the difference between practice and theory is the level of management", i.e. if management were lacking in any aspect, then the less technology there is likely to be implemented on the farm.

Labour management

At present, participative management by labour on most farms is not being practised with the result that the grower spends most of his time in the role of supervisor and mechanic. The natural consequence of this is that there is insufficient time for the keeping of adequate records (labour, financial, mechanical and yield) and the assessing of these records. Ultimately the farm is managed from one crisis to the next.

Financial management

An aspect of financial management which has an effect on the implementation of Technology is that many growers loose site of the actual magnitude of certain of their expenditures. The 1988/89 cost of production survey carried out by the S.A. Cane Growers Association indicates that some of the major expenses for a 8000 ton cane farm would be :

Item	Cost per ton	Total cost	Approximate monthly cost
Fertilizer	4.88	39040	-
Chemicals	1.70	13600	-
Labour/rations	10.19	81520	6793
Fuel/lubrication/maintenance	6.37	50960	4247

As the fertilizer and chemical costs are usually incurred as lump sums as opposed to the monthly expenditure for the other items, too much attention is given to these costs of production. As growers tend to relate crop growth directly with fertilizer rates, there is a tendency to be prepared to over apply fertilizer. On the other hand, herbicide application is seen as an area of cost savings; many of the weed problems observed in the industry are no doubt related to efforts being made to reduce herbicide costs. The labour and mechanization costs are where considerable savings could be made, but this point is missed by many growers as the monthly expenses are seen as minor compared to the fertilizer and herbicide costs.

THE ROLE OF ADVISERS

Agriculture advisers are the main instruments by which technology is transferred from its source to the grower.
Many growers find it difficult to accept the advice given by advisers as they see advisers as not being practical and not having to be responsible for the advice they give. In most cases growers turn to their colleagues for advice as they then feel that they are dealing with people who are exposed to the same risks as themselves. It is at this stage that a lack of understanding of observational and sampling techniques leads to invalid conclusions being made on occasions.
Examples of these invalid conclusions are :-

a) Lime improves crop growth when in fact what the grower is observing is a response to the increased nitrogen mineralization that takes place once lime is applied.

b) Gypsum is credited with yield responses when in fact the response is due to the phosphate in the phosphogypsum.

c) Scattered tops affect the efficacy of herbicides when in fact the incorrect herbicide was applied or spraying took place at the incorrect time.

d) Rate of germination plays an important role in the selection of varieties.

e) Yields are seen as being directly related to fertilizer rates; diseases, particularly mosaic and RSD, and stress periods are not seen as major contributors to yield and population loss.

POSSIBLE SOLUTIONS

1. At present there is no system available to establish whether or not the yield responses/cost benefits obtained from trial results are being obtained under commercial conditions. The industrial Field Record System (FRS) should overcome this problem provided the data is assessed in a valid manner. These records are seen as the major extension tool to be used in the process of having agronomic technology implemented effectively.

2. A better understanding of crop growth in relation to climatic factors, particularly under dryland conditions, would assist advisers in assessing crop growth and the advice that is given. In this regard, the crop modelling work being carried out by Dr. Geoff Bamber will be of great benefit.

Page 4/..

3. It is felt that the changing economics and labour situation in the country will result in growers forming productivity groups, if they have not already done so, to solve their own problems with possibly some input coming from the extension officer.

4. Approaches should be made to agricultural education institutions to discuss the possibility of introducing a course in assessing agriculture data, sampling techniques and how to avoid drawing invalid conclusions from simple observations.

5. The same institutions could also give guidelines on how to assess the credibility of the various types of advisers that are active in agriculture!

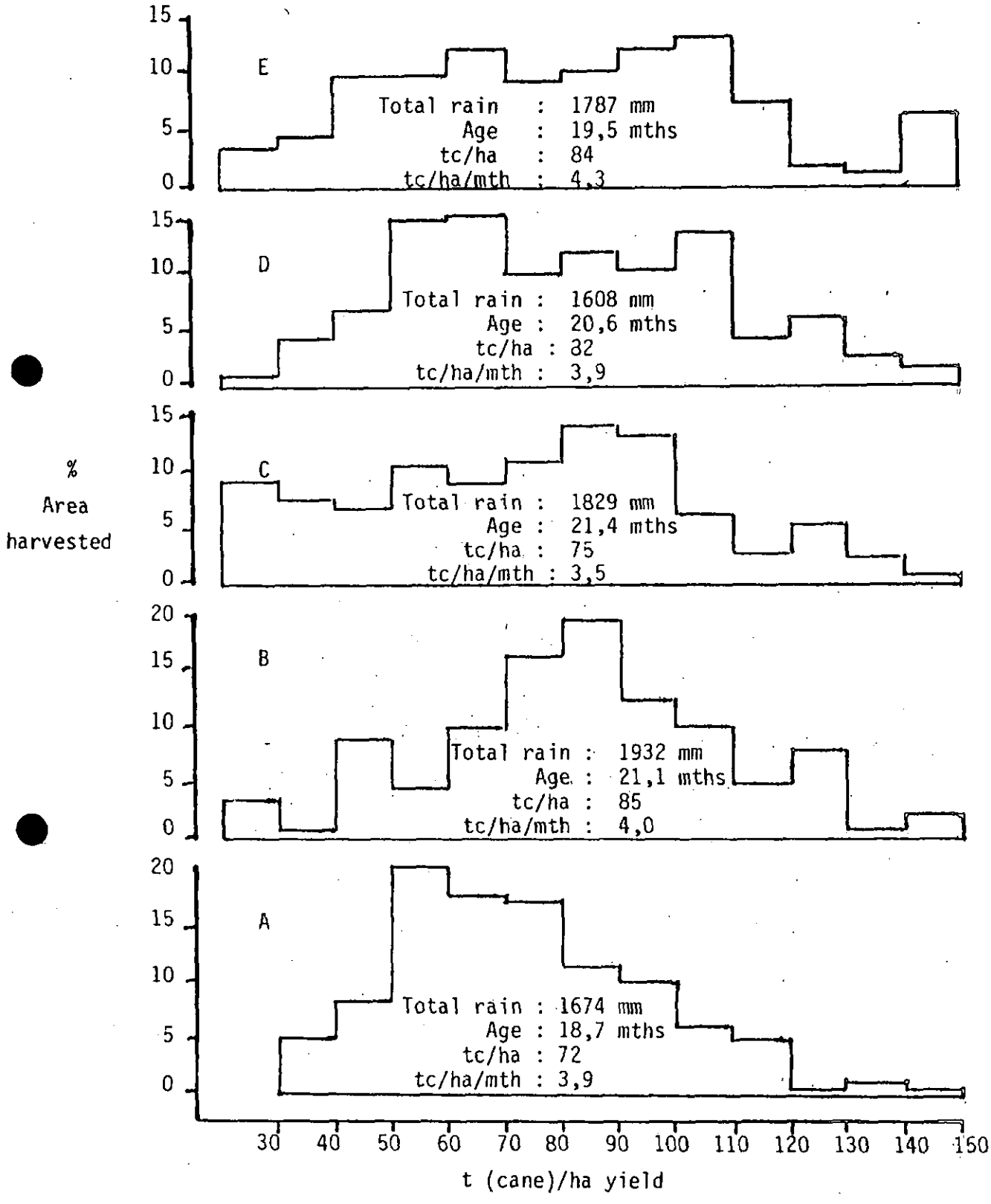

Figure 1 : 1989/90 t(cane) ha yield distribution for 5 homogeneous areas in the midlands.

Information Sheet No. 21 : Transplants

Transplants offer an alternative way of planting with some distinct advantages, particularly for the production of healthy true-to-type seed material in nurseries. Modern techniques of transplanting have only been recently applied to sugarcane. Procedures are therefore relatively new, and some are not yet fully proven.

General recommendations for running a transplant nursery

Local conditions have a big influence on how nurseries are managed. These recommendations must be taken as a guide only.

Cutters

Either a manually operated guillotine or a twin blade circular saw cutter can be used to prepare setts. Blades must be sterilized regularly with Jeyes fluid at 10% concentration. The recommended sett size at present is 20-25 mm. Freshly cut setts must be planted immediately.

Source of setts and hot water treatment (HWT)

HWT for 2h at 50°C eliminates RSD from one-budded setts but unfortunately has serious adverse effects on the germination of many varieties, including N12, N17, N19 and N21. The following alternative practices are recommended so that acceptable germination can be achieved together with the required control of diseases.

For first stage nurseries, the one-budded setts should be obtained from a nursery that was established with setts that had been treated for 2h at 50°C and grown in land that had been free from all sugarcane growth for at least one year. The plot of 'mother seedcane' should have been carefully managed to avoid risk of infection by diseases, particularly RSD, and the initial seedcane used should itself have been of nursery standard. For second stage nurseries, the one-budded setts should be obtained from first-stage nurseries.

In areas where smut is endemic, the one-budded setts for both first and second stage nurseries should be heat treated for 30 minutes to 50°C in order to eliminate any latent smut before transplanting into the trays: this has little adverse effect on the germination of most varieties and may even have beneficial effects on germination. Alternatively, whole stalks can be treated before being cut into setts.

Heat treating the one-budded setts or the stalks from which they are cut for 2h at 50°C is of course acceptable for the control of both RSD and smut provided the producer is satisfied with germination. Better germination may be obtained if the stalks are heat treated first and then allowed to 'pregerminate' in humid conditions with a temperature of around 28°C before being cut into one-budded setts. Setts not HWT should be pregerminated in similar hot humid conditions for a few days. The germinated setts can then be selected out to plant the trays.

All setts should be dipped in fungicide (Benlate or Panoctine).

Quantity of seed material required

The quantity required to produce sufficient transplants for planting 1 ha depends on many variable factors, but one to two tons will suffice for most situations.

Planting media

Composted bagasse has proved to be the best medium used locally, as it has good physical and chemical properties. Other media can be used provided they are light and well drained.

SOUTH AFRICAN SUGAR ASSOCIATION EXPERIMENT STATION
Private Bag X02 Mount Edgecombe 4300 Natal South Africa
Telephone (031) 593205 Telex 6 23020 SA
Telegrams SASEX Mount Edgecombe
Fax (031) 595406

Trays

Model 98 is recommended, but thick setts will not fit in properly. Model 72 can be used for thick setts. Before use, polystyrene trays must be dipped in a chemical root pruning solution and must be thoroughly washed and dipped after each time used. The best time to wash the trays is immediately after the plugs have been removed..

Planting into trays

Setts should be covered with around 10 mm of medium. If weeds are occurring in the medium, Lasso + atrazine at 5 l and 2 l/ha can be sprayed onto the damp medium immediately after planting.

Fertigation

The sett acts as a nutritional buffer in the early growth stages; but with the high leaching conditions in the trays, the plants eventually require nutrients. To avoid possible micronutrient deficiencies, it is a good idea to supplement the macronutrients with a general trace element mixture in the feeding programme.

Trimming

One trimming during the growing period can be beneficial. It slows down the stronger plants and allows the weaker ones to catch up and makes for more uniformity. A day or two before transplanting, a light trimming facilitates the handling of the plants. The degree of trimming depends on the moisture conditions in the field and the transit time. If harsh conditions are expected more severe trimming should be practised; local experience is the best guideline. Cutting tools must be dipped regularly in Jeyes fluid.

Time required

Under favourable conditions plants will be ready to transplant into the field from 60 days in summer to over 120 days in winter. Good management and adequate nutrients will ensure the development of a firm root plug. It seems advisable to wait until the fleshy white shoot roots appear before transplanting; this is easily observed by examining a root plug periodically.

Raising your own transplants

Growers can raise their own transplants relatively cheaply. During the hot months (January to March) when no special germination facilities are required, off-season labour may be used. Transplants established in trays during January can be planted out into the field in March. The trays must be replanted immediately and the plants kept in the trays until spring planting. The nursery site must be sheltered from wind but must be in full sunlight. The trays must be raised at least 300 mm off the ground to allow light underneath, and thus prevent roots growing through the drain hole in the bottom of the tray cells.

Water soluble fertilizer containing both macro and micronutrients can be applied with a water can. Follow the directions given on the fertilizer package for application rates.

Planting and spacing in the field

Transplants must be kept **moist** at all times, e.g. both in transit and during planting. They must be planted deep: right to the lower leaves to ensure that when tillering takes place it comes from below soil level. Transplants must never be placed directly on fertilizer. They must be watered/irrigated or planted immediately after a good rain. With regard to spacing, as few as 8 000 plants/ha can produce adequate yields; however, probably no more than 14 000/ha should be considered. The spacing is a compromise between yield costs and the provision of enough canopy in the early growth stages to control weeds.

Weeding

Transplants are sensitive to herbicide damage, and the chemical must be directed onto the interrow only. If a pre-emergent herbicide is to be applied, then Lasso + atrazine should be used. However, if some young weeds are present at planting, gramoxone can be added to the pre-emergent herbicide, provided the transplants are planted deep and the leaves have been well trimmed with little leaf area exposed. For a post-emergent herbicide, sencor + diuron can be applied, but only when tillering has occurred on all the plants.

For further information contact your local extension officer.

October 1990

GDT/LO
24 October 1990

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AGRONOMISTS' ASSOCIATION

Burning v Trashing

* Burning the standing crop can involve decision making over a wide range of issues. Some of these are:

Crop yield	Eldana
Crop quality	Wind
Crop deterioration	Powerlines
Payloads	Conservation
Trashworm	Arson
Ratoon chlorosis	Mill extraction
Weed control	Factory recovery
Harvesting costs	Milling rate
Ploughout	Length of season

* In the 1988/89 season the situation was:

South Coast	:	60% burnt
North Coast	:	55% burnt
Zululand	:	77% burnt

The proportion burnt throughout the industry has increased from 64% in 1975/76 to 74% in 1988/89.

* 47 crops from 9 trials have shown a response to trashing which averaged:

7 tons cane/ha
0,9 tons sucrose/ha
0,8 tons ers/ha

* 14 crops from 4 trials showed that most of the response to trashing could be achieved by scattered tops after a very cold burn.

* on coastal sands there has not been a response to trashing, due largely to the prevalence of ratoon chlorosis.

* cane quality is not affected materially. Comparisons of burnt cane and clean trashed cane are:

	No of crops	Burnt	Trashed
Suc % cane	52	14,6	14,5
Juice purity	36	91,0	90,3

* Four days after harvesting, burnt cane contained 96% of original units of recoverable sugar, trashed cane 89%. After 21 days the figures were 47% and 62%. In another experiment

after 21 days, cane that was burnt and left standing contained only 42% of the original units of recoverable sugar, cane burnt and cut immediately contained 61%.

* Some reports from around the industry on cutter output (% increase, burn v trash) are:

12 month old straight cane	:	no difference
large south coast estate	:	+ 2%
north coast growers	:	+ 10%
Zululand grower	:	+ 23%
north coast estate (1)	:	+ 33%
(2)	:	+ 42%
Umfolozi growers	:	+ 80%

* Transport payloads (% increase, burn v trash) from around the industry:

stacked cane in chains	: no difference
Zululand grower (Hilos)	: + 3%
north coast estate, stacked cane	: + 11%
large south coast estate	: + 14%
Umfolozi growers	: + 14%
south coast estate	: + 17%
north coast estate, loose cane	: + 22%

* Experiment Station estimates of costs for controlling weeds are as follows:

	Cost, R/ha		
	Low	**High**	**Mean**
Burn, windrow tops	274	330	302
Burn, tops scattered	344	441	392
Trash blanket	100	229	164

* an SMRI investigation showed that for every 1% of trash in cane, the crushing rate was reduced by 2,2 - 3,0%. e.g. if trash % cane were reduced from 6% to 5%, the season could be reduced from 40 weeks to 38,7 weeks.

* furthermore, 1% trash in cane may <u>reduce</u> extraction by 0,44%, juice purity by 0,33%. Also, 1% trash in cane may <u>increase</u> clear juice colour by 3,6% and clear juice turbidity by 4,2%.

* in Hawaii the composition of smoke from a cane fire has been determined as follows:

less than 0,1% particulate matter (soot)
less than 1,0% carbon monoxide
less than 0,1% hydrocarbons
no sulphur dioxide

Mainly water vapour and carbon dioxide.

* iron chlorosis in cane growing on alkaline soils may be

exaggerated by a trash layer, but an iron spray remedies the problem effectively:

Control	:	8,0 t suc/ha
3,4 kg $FeSO_4$/ha	:	9,1 t suc/ha
3,4 kg $FeCl_3$/ha	:	9,9 t suc/ha

* artificial defoliation of cane stools to simulate the effects of trashworm caused an average yield reduction of 10%.

* a trash blanket per se does not appear to favour eldana:

	No of fields	eldana/100 stalks
previous crop burnt	4568	12,3
previous crop trashed	6365	10,9

(crops 12,8 to 17,2 months old).

SOUTH AFRICAN SUGAR INDUSTRY

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WETLANDS IN THE CANE AREA

by: Q.V. Mann

INTRODUCTION:

* The term "Wetlands" hardly needs defining: they are easy to recognise and their boundaries are fairly distinct. But even at this level there is confusion because of the gradation between open water and seasonal wet patches on the landscape.

* Environmentalists tell us wetlands are far more valuable to the whole ecosystem than any profits which farmers could squeeze out of them. Hence, environmentalists and farmers perceive different functions and values for wetland and the public probably does not know for which purpose they should really be used. This is the real nub of the dilemma and the reason why confusion reigns.

* What makes wetlands so valuable? i.e. what are their real functions?

1. Their ability to slow down flood waters, this increases the gathering time and lowers the high water mark.

2. Having reduced water speeds, some of the sediment load must be deposited, so wetlands and alluvial plains are there to accumulate sediment and clean the flood waters.

3. Wetlands regulate stream flow and enhance winter or dry season flow due to their sponge effect.

4. Wetlands have the ability to absorb or break down both organic and some inorganic pollutants e.g. anaerobic denitrification of excreta.
(These four functions should keep our rivers clean and greatly increase the life of our major storage dams and bridges.)

5. Wetlands provide a very important wild life habitat - essential to the survival of many plant and animal species.

6. Wetlands also have aesthetic values- most are a very attractive part of our scenery.

* Why are wetlands wet? Either due to ground water rising towards the surface or due to surface water flowing onto and over them (see Figure I) or frequently a combination of both. This is another reason for confusion and mismanagement because drainage works are frequently designed to drain out seepage water from the profile without thought or care for the surface runoff.

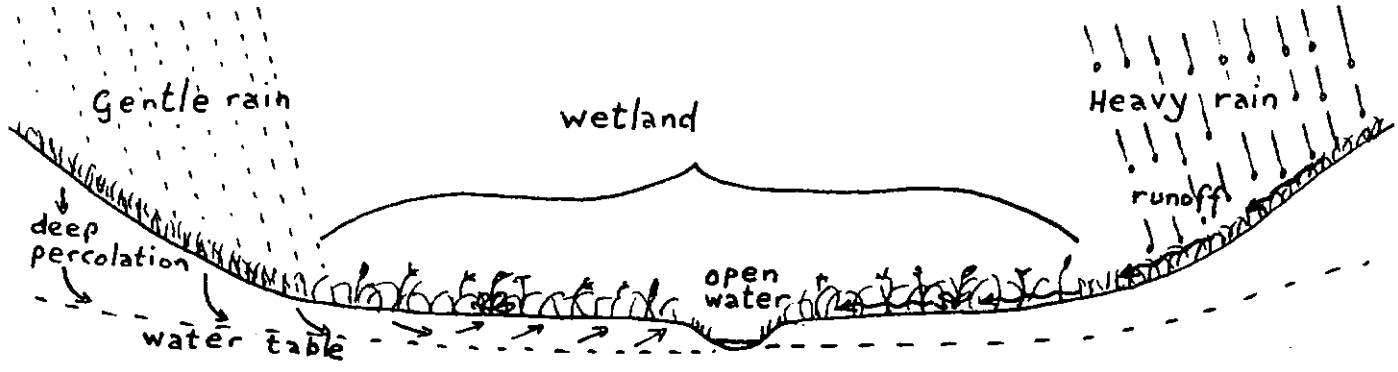


FIGURE I - WHY WETLANDS ARE WET!

CATEGORIES OF WETLAND:

In an attempt to clear up some of the confusion and for all sectors of the Sugar Industry to try and reach consensus on how to manage our important wetland, the following eight categories of wetland are described and discussed.

1. WETLAND IN THE NATURAL STATE: (any wetland under natural hydromorphic vegetation.)

   Here the whole catchment contributes to both the volume of water and its purity. The whole catchment and its management contributes to the stability of the wetland. Most of these few remaining wetlands should remain undisturbed and undeveloped simply because they are now so rare. That means "hands off" to agriculture, commercial forestry, industry, urban development and road or railway communication.

2. DEAD OR COMPLETELY ERODED WETLAND: (dry gullies eroded down to bed rock.)

   Management practices in the entire catchment were often responsible for its degradation. Over grazing, bad burning, ploughing non arable soils, etc. are a few of the practices which led to their destruction. The Universities teach that these wetlands are gone for ever, but it is possible for them to be very slowly resurrected and rehabilitated. Fortunately sugar farmers have very few areas that are so badly eroded.

3. PARTLY DEGRADED OR ERODED WETLAND: (the Sugar Industry abounds with land in this category.)

   Some of these areas may once have been under cane cultivation although this should never have been so. They, however, can no longer support commercial crop production and are usually abandoned as waste land with little management or capital injection. This category of wetland should be stabilised in almost every instance. While gullies can hardly ever be restored to their former shape, once they are stabilised and revegetated, they can again take on many of the functions of wetland.

   Grassed waterways are not truly within the definition of wetland even though they are regularly inundated with water. Having developed the cropland on the hillsides, grassed waterways take on the function of

what the entire upper catchment formally did, and for this reason they perform many of the same functions as wetland. They should therefore be considered along with the wetland. This campaign to upgrade streamlines and waterways would involve only a small proportion of existing cane land. It should be regarded as a normal, on-going cost of cane production because it is as a result of cane production that the gullies exist. However, there is a big change in attitude needed amongst many growers.

Drained wetland is the next category, but for convenience this will be subdivided into open drains (what Henry Aucock called "Mac Donga tartan drainage pattern.") and covered or pipe drained wetland.

4. WETLAND WITH OPEN DRAINS: (Mac Donga tartan pattern.)

Here the land between the drains has been brought into cane production even though mechanization is difficult or impossible. The water table is lowered but the wetland still yields a fairly constant and reliable flow of clean seepage water. In terms of runoff and flooding, however, open drains spell disaster! Turbulence, erosive velocities, waterfalls into the drains, not only carries the sediment from the hillsides above (which should have been deposited in the wetland) but it also erodes the banks of the drains thus increasing the sediment load. Gathering times are reduced, peak floods are higher, rainfall is less effective, therefore, there is a reduced dry season or winter flow. It is this category of wetland in the Sugar Industry, the management of which is most severely criticized and where there is the greatest conflict of interests between the farmers and the environmentalists.

5. WETLAND WITH COVERED OR PIPE DRAINS: (Perforated pipes, clay tile drains, French drains, pole drains and Roman drains all fit this category.)

Here crop production is possible from the entire drained area and mechanization should not be unduly impeded. The water table is lowered but even this may not necessarily be harmful, for wetland with covered drains has more storage capacity for rain water (i.e. a greater sponge effect) than does a saturated profile (see Figure II).

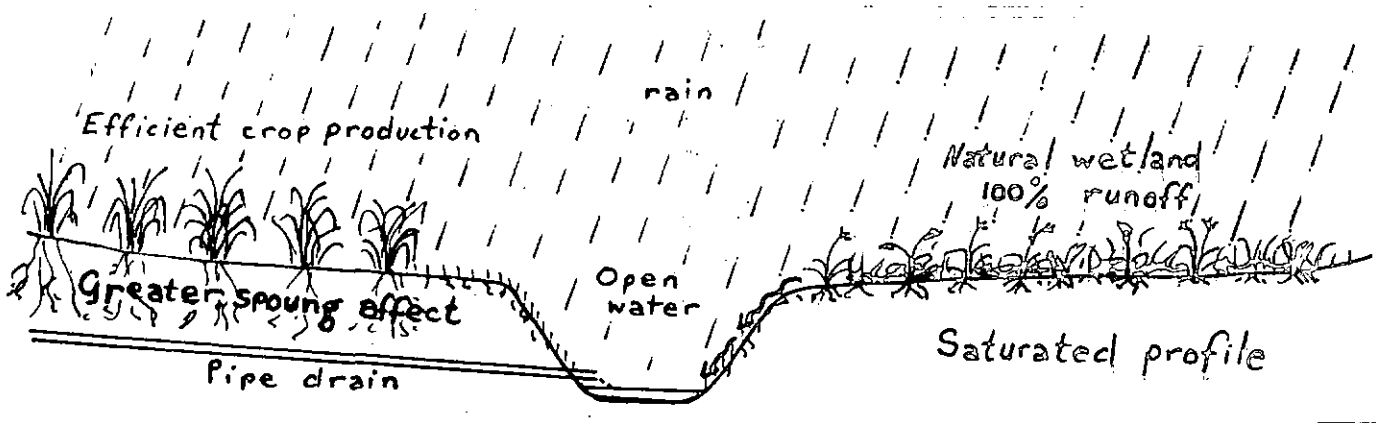


FIGURE II - COMPARATIVE EFFECT OF RUNOFF ON DRAINED AND NON DRAINED LAND.

The yield of water from a covered drainage system is very reliable and pure. In times of runoff or flooding there should not be excessive erosion, provided that the outlet pipes are properly protected. Most crops, including cane, grown on well drained land will not be as good at filtering and purifying surface water as the natural vlei vegetation. Therefore, while not fulfilling all the functions of natural wetland, well planned, covered drainage systems are not seen as altogether harmful. Where crop production has to be maximised one solution would be to convert all open drainage systems to covered systems.

6. WETLAND INVADED BY WEEDS: (most harmful are the shrubby alien weeds like Chromilaena, American bramble, Bugweed, Wattle, etc.)

Weeds reduce basal vegetative cover and this reduces the capacity of the wetland to retain water. They often invade wetland in the first place because excessive deposits of sediment destroy the natural wetland vegetation (poor management of upland cropping areas) so there must be an on-going active campaign to keep out alien weeds and to encourage natural wetland species. Again, there is a need for changed attitudes as weeds are often only recognised where they compete with crops and directly reduce production.

7. FLOODED OR DROWNED WETLAND: (all farm dams as well as major water storage works are part of this category.)

Full dams have 100% runoff every time it rains! Full dams therefore do not greatly slow down runoff water. They do deposit sediment but in doing so, are self destructive. They do not filter or clean water nearly as effectively as natural wetlands. However, all open water was formerly rare in South Africa. Shallow water in particular farm dams, provide an aquatic habitat which support an extremely diverse population of plants, insects, fish, amphibians, birds and mammals. Most dams therefore increase the diversity of the habitat and improve the situation while only some of them destroy essential areas necessary for the survival of some species (e.g. winter grazing grounds). All inland open water is regarded as part of the overall wetland as is their immediate periphery. It is regarded as essential to have a wide belt of natural wetland vegetation in the bottom land above all catchment dams to filter the flood water before it enters the dam. The entire spillway and the area immediately below the wall should also stay as wetland vegetation rather than as cropland. Where such land is cropped it is considered to be in the farmer's own interest for him to encourage re-establishment of wetland vegetation. It is also considered desirable that all farm dams built on perennial streams should be provided with a trickle flow spillway, which is below the level of the main spillway. This will keep the main spillway drier and greatly improve the flood attenuation function.

8. DEPLETED OR REDUCED WETLAND: (this is due to thirsty crops.)

In a catchment where the crop has a higher consumptive use of water than the original vegetation, the wetland shrinks and less hydromorphic species colonise what was once wetland. Cane uses more water than natural veld, and trees use even more, so cane farming has reduced the flow in many streams and timber has sometimes dried them up completely.

Such loss of wetland is regarded as inevitable and would only be condemned by those who would like mankind to return to the stone age but this is the reason why permits are necessary for tree planting and why the authorities do not allow more than 75% of any large catchment to be planted to trees.

CONCLUSIONS:

WHAT IS THE IMPORTANT WETLAND?

* If the cane growing community can be informed about the real value of wetland and come to understand the wider function than just its potential for crop production, then it is considered that they will be in the best position to decide which wetland remains under crop production and which should be withdrawn.

* There is a great need to do more than is currently being done to stabilise and rehabilitate eroded wetlands and to clear them of invader weeds. However, it is considered that this need not mean the withdrawal of a vast area of cane land.

* Measurements taken during several catchment case studies done recently by extension staff at the Experiment Station, revealed that grassed waterways occupied between 0,5% and 2.5% of the catchment area. Essential wetland and riverine vegetation ranged between 5% to 20% depending upon the situation and cane land that had invaded the real wetland was usually below 3% of the catchment area.

* Open drains need to be filled in or converted to covered systems where-ever possible.

* It is strongly believed that the 80/20 principle will apply to the management of wetland. This means we will get 80% of the response from the first 20% of effort that we put into wetlands. Hopefully, by increasing the width of our wetlands by only 20 metres we could get 80% of their full function.

* If, after doing what we can to improve the situation, society demands that we do even more, then maybe society will pay a subsidy for withdrawing more cane land from production.

* Lastly, if cane growers do what they can and we monitor progress carefully, we will be in a good position to advise society on what further steps will be necessary to have- "our coastline framed in blue rather than brown"!

S O U T H A F R I C A N S U G A R I N D U S T R Y

A G R O N O M I S T S' A S S O C I A T I O N

SWAZILAND SUGAR ASSOCIATION EXTENSION SERVICES
AGRONOMY RESEARCH PROGRAMME

by A.G. King & P.C. Henry

INTRODUCTION

The Swaziland Sugar Association Extension Services is a small research and Extension organization which was established in 1984 to service the sugar industry in Swaziland. It is independently financed by the sugar industry and all activities are directed by an Extension Committee while matters of a research and technical nature are dealt with by a Technical Sub Committee. These committees are made up of representatives from both the large estates and the smaller private growers and as such ensure that the best interests of the industry are considered.

A close working relationship has been maintained with the SASA Experiment Station and an annual fee is paid for the provision of services and sugarcane varieties.

THE AGRONOMY RESEARCH PROGRAMME

Extension Services employs a Research Agronomist who is responsible for approximately 20 - 30 field trials which are established in commercial fields throughout the industry. The trials have been established to investigate various aspects of sugarcane production including variety performance, crop nutrition, chemical ripening, soil amelioration and other matters as required.

1. VARIETIES

The objective of the variety programme is to compare the performance of recently released varieties with established industry standards over a range of soils types and times of harvest.

Trials are established on each of the four major soil types in the early and late season harvest periods so that at any one time there are about 8 variety trials in progress. Each trial runs for a plant crop and three ratoons. In the absence of new varieties the trials are continued for as long as possible so that ratooning ability can be assessed.

The variety trials are chemically ripened whenever possible in order to assess the response of the varieties to standard ripening treatments.

2. CHEMICAL RIPENING/FLOWER CONTROL

Trials are carried out to determine the optimum use of registered products for ripening and/or flower control.

*** Rates of Ethrel on early harvested NCo376 in the combination treatment.**

Previous results have shown that the rate of Ethrel can be reduced when used in the combination treatment with Fusilade.Two trials were established to confirm this finding.

*** Rates of Fusilade on early harvested N19.**

Previous results have shown that significant cane yield reductions occurred in this variety when the high (0,6l/ha) rate of Fusilade was applied. Trials were established to determine the optimum rate of Fusilade on N19 when applied alone or in combination with Ethrel.

*** Flower control and/or ripening of late harvested N14.**

Previous results have shown that although significant flower control could be achieved with Ethrel, there were no associated yield increases in cane harvested between early and mid October. It is felt that yield responses could occur in cane harvested in November and trials were established to examine this possibility. In addition very low rates of Fusilade were included as a flower control treatment.

3. NUTRITION

Nitrogen

Most of the work to determine optimum Nitrogen rates for the various soil types has been concluded in previous N/K trials.

*** Nitrogen rates on older ratoons.**

Two of the original N/K trials have been continued to determine the need for extra Nitrogen in older ratoons on the 'R' set soils (Shortlands/Hutton) and to observe the effects of season on optimum Nitrogen requirement.

*** Nitrogen rates on shallow 'S' Set soils.**

One N/K trial has been continued to confirm Nitrogen recommendations on a shallow 'S' set soil (Mayo). Previous results have been variable and there have been indications that N recommendations could be increased. (currently 120 kg N/ha)

*** Nitrogen rates * varieties.**

One variety trial has been converted to assess the response of varieties to different rates of Nitrogen. A previous result indicated that there were differential responses and that N17 apparently required higher rates than NCO376 or N14.

Phosphorous

It has been noted that an increasing number of commercial soil samples are exhibiting moderate to high P fixing characteristics. In addition low leaf P values are being observed where soil P levels are apparently adequate.

*** Phosphate * residual effects on a 'R' set soil (Shortlands/Hutton).**

A trial was established on a moderately P fixing 'R' set soil to observe the effects of different rates of phosphorous together with different placement of fertilizer. Low leaf P values have been associated with relatively high soil P values and the trial is continuing to investigate these results.

*** Reliability of the Truog extraction method on Swaziland soils**

Work at Mt. Edgecombe has revealed that the Truog extraction procedure to determine Phosphorus requirement can substantially overestimate plant available P on alkaline alluvial soils. Many Swaziland soils are alkaline in nature and a project (Lab/pot), is planned with the University of Swaziland to assess the importance of this finding for Swaziland soils.

Potassium

The highest priority is being given to work to improve K fertilizer recommendations on Swaziland soils. The following aspects are being investigated.

*** N/K Trials.**

Three N/K trials are being continued to deplete Potassium levels so that threshold values for the 'R' and 'S' set soils can be confirmed.

*** Soil K threshold on sandy soils.**

Previous trials have shown that the soil K threshold value can be reduced to below 112 ppm on certain sandy soils probably because of the presence of K reserves at depth.

* **Soil K threshold on heavy vertic clay soils.**

There are indications that soil K threshold can be increased to above the new FAS recommendations on heavy vertic clay soils with high K fixing properties. These results were largely from winter harvested cane and seasonal effects require investigation.

* ***leaf K threshold values.***

Trials are being conducted to confirm the new reduced leaf K threshold values proposed by Mt. Edgecombe for winter harvested cane.

In addition foliar solutions of K are being applied in an effort to raise leaf K levels during the spring period so that it can be determined if the 'dip' in leaf K levels is having an impact on yields.

SOIL AMELIORATION

* **Vertical Mulching**

Vertical mulching trials have been established on two heavy soils with poor physical properties ('K' and 'V' Sets, Rensburg/ Arcadia) .Top soil, and filtercake have been used as ameliorants and results were initially promising but have been relatively shortlined.

* **Furrow erosion and infiltration under surface irrigation.**

A co-operative project with the Institute of Soils and Water in Israel is planned to investigate the following:

- To study the effect of soil properties and water quality on erosion, sediment concentration and infiltration in furrow irrigation under various slopes and discharge rates.
- To investigate the effects of soil amendments such as phosphogypsum, polymers and mulching on furrow erosion and infiltration.
- To study the structure and hydraulic properties of depositional crusts formed under various conditions.

* **Agroforestry for sustained production on duplex soils and reclamation of degraded soils.**

Investigative trials are planned to determine if these techniques have application under local conditions.

HERBICIDES

* **Dual/Falcon vs. Harness for control of Sorghum verticilliflorum.**

  A trial was established to test the efficiency of various pre-emergence herbicides on Sorghum verticilliflorum. Results are only just to hand but indicate that Harness was more effective than Dual/ Falcon.

FUTURE RESEARCH

* Irrigation.

  The absence of any research on irrigation in the Extension Services work programme is considered to be a major limitation. The following subjects require investigation :

  * Irrigation with drier regimes (viz.Zimbabwe). The long term effects of this practice on different varieties, on pest and disease levels and on ratooning ability need assessment.

  * Interactions between irrigation, chemical ripening and crop nutrition (especially K) should also be assessed.

AGK/PCH
12.10.90

SOUTH AFRICAN SUGAR INDUSTRY

AGRONOMIST ASSOCIATION

SASEX AGRONOMY RESEARCH

1. RESEARCH PROGRAMMES

1.1 Nutrition

1.1.1 Potassium

In conjunction with Chemistry and Soils Department to test the response to K where high soil values have been associated with low leaf K values in summer harvested cane and to continue one trial to test K responses where K fixation may be a problem. To assess the need for earlier applications of fertiliser (N + K) to winter cut cane which is to be harvested at a young age.

1.1.2 Phosphogypsum

To test the value of phosphogypsum as a soil amendment in co-operation with the Chemistry and Soils Department and the Soil Science Department of the University of Natal.

To test the value of phosphogypsum in the minimum tillage system for amelioration of aluminium toxicity in conjunction with Chemistry and Soils Department.

To test the response to surface applications of phosphogypsum in ratoons.

1.1.3 Phosphorus

To test in conjunction with the Chemistry and Soils Department the response to applied phosphorus in high P fixing soils outside the Midlands and in soils of the Mfolozi flood plain.

To test the response to broadcast and deep applications of phosphorus in soils with low subsoil P levels.

1.1.4 Nitrogen

To complete two trials to test levels of N for old ratoons and split N applications on Longlands and Cartref soils.

To continue two trials to test the value of late N applications in the Midlands on soils prone to leaching and waterlogging/denitri-fication. To assess the need for earlier applications of fertiliser (N + K) to winter cut cane which is to be harvested at a young age.

To assess responses in N14 and NCo376 to nitrogen at Pongola.

To assess responses to nitrogen in sandy granite derived soils in the Eastern Transvaal

1.1.2 **Lime**

To test the effect of lime application in the minimum tillage system for aluminium amelioration.

To test the value of deep lime placement.

To compare surface applied gypsum with incorporated lime for aluminium amelioration in ratoons.

1.2 **Trashing**

Continue with the long term BT1 trial on the Arcadia soil form at Mount Edgecombe.

1.3 **Soil Amendments**

In conjunction with the Chemistry and Soils Department to test sewage sludge as a source of nutrients and as a soil amendment.

1.4 **Seedcane**

To establish field trials to test ways of improving seedcane performance.

1.5 **Trickle Irrigation**

To continue the trickle irrigation trial at Shakaskraal.

1.6 **Compaction and ripping**

To summarise available information on compaction and the effects of ripping.

To determine the effects of interrow ripping/cultivating on yields of ratoon cane.

1.7 **Nematicides**

1.7.1 **Screening**

To screen any new products.

1.7.2 **Nematicides**

Nematicides on heavier soils

To test the effects of nematicides applied to plant cane grown in a Shortlands form soil in the Eastern Transvaal.

1.8 **Ripeners and Growth Regulators**

1.8.1 To test the response of varieties to ripeners.

1.8.2 To update all variety x ripener data.

1.8.3 To continue screening promising new products or systems for their ripening or growth promoting activity.

1.8.4 To test the response to ripeners with respect to topping height, rates, drying off and the optimum time interval between spraying and harvesting.

1.8.5 To add to the understanding of the ripening process by studying the effects that ripeners have on partitioning of dry matter and sugars in the stalk.

1.8.6 To assess the response to ripeners in rainfed areas.

1.9 **Varieties**

1.9.1 ***Released variety trials***

To maintain and establish at the appropriate times variety trials which will include new varieties in the bulking stage at the following environment sites:

Northern irrigated - Pongola sub-station - loamy clay

Coastal - Mtunzini Field Station and FB Hopwood - clay loam

Coastal - Umdloti, Hillhead, Natal Estates - sand

Coastal - Mount Edgecombe, Ottawa, Natal Estates - clay loam

Coastal Hinterland - Paddock, Umzimkulu Sugar Company - sandy - sandy loam

Mistbelt - Harburg, R Rencken - clay loam

Coastal - Shakaskraal - shallow soils

Northern alluvium (WT) - Uloa, Monzi, - an alluvium soil with a water-table

Northern Zululand - Recent Sands.

Additional sites will be considered.

1.9.2 **Estate variety trials (Yield only trials)**

To co-operate with growers in conducting variety experiments on different soil forms.

Additional trials to be considered:
Umfolozi - Alluvium - spring/autumn plant, Umfolozi - KwaZulu areas.

1.9.3 **Variety x Nitrogen/Potassium**

Continue with the variety x nitrogen experiment at Dalton.

To test levels of potassium on four varieties.

1.9.4 **Hilling up x variety**

To complete one trial to investigate whether hilling up in ratoon cane at Pongola will delay lodging.

1.9.5 **Age at cutting x variety**

Compare variety performance when cut at different ages - Mtunzini, Ottawa and other sites.

1.9.6 **Variety x ripener**

Measure interactions between varieties and ripeners in the northern region variety trials and at Paddock.

1.9.7 **Variety x White grub**

To assess the susceptibility of varieties to white grub in the midlands.

1.9.8 **Variety x weed competition**

To evaluate the tolerance of some released varieties to week competition.

1.9.9 **Variety x transplants**

To compare the performance of varieties planted as transplants.

1.9.10 **Prepare information sheets on released varieties.**

10.1 Herbicides and weeds

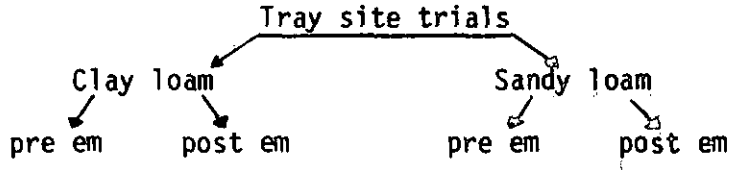
10.1.1 Efficacy of new products

Continue evaluating promising new products and mixtures for pre- and post-emergence efficacy Under irrigated and dryland conditions.

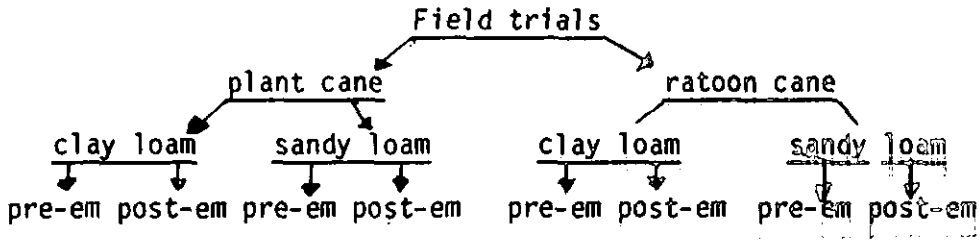
10.1.2 Phytotoxicity of new products and mixtures for registration.

Products and mixtures which show promise in efficacy trials will be tested for phytotoxicity at Shakaskraal and Pongola as follows:

Phase I



Phase II



10.1.3 Phytotoxicity x variety

To test the sensitivity of new varieties to herbicide damage in field experiments at Pongola and CFS.

10.1.4 Phytotoxicity x transplants

To test the sensitivity of transplants to herbicides.

10.1.5 Application techniques

To test methods for improving the application herbicides.

10.1.6 Weed identification booklet

To gather information and material for publication of a booklet to assist in the identification of all growth states.

1.10.7 **Problem weeds**

To investigate the control of Cynodon dactylon with different herbicides on sandy soil.

1.10.8 **Variety x weed competition**

To determine which varieties are more prone to yield reduction caused by Cynodon dactylon (to be propagated vegetatively).

1.10.9 ***Cane eradication***

To test herbicides for cane eradication and improved methods of cane eradication (NBL).

1.11 **Agricultural Economics and Systems analysis**

To become familiar with the economics of sugarcane production systems.

1.11.1 **Crop growth model**

To develop a physiologically based model of crop growth and to incorporate this into a model of whole farm production systems with a view to optimizing the choice of varieties and the harvest schedule within the constraints of milling season and the climate.

1.11.2 **Growth analysis**

To analyse the growth and water use of NCo376 and N12 over 16 months starting at different timeson a rainfed coastal farm.

1.11.3 To determine water use and growth during the early stages of development of different varieties in different water regimes using the lysimeters at Pongola.

1.11.4 **Economics of varieties**

To assess the economic value of agronomic characteristics of commercial varieties and to produce a computer method of assisting growers to make the best choice of variety.

1.11.5 **Economics of topping**

To develop a model of the distribution of components of cane quality in the stalk to assist growers with selection of topping height.

To research the economics of the plant/replant cycle.