YIELD DATA FOR EXPERIMENTS, HARVESTED AT ILLOVO, 1958—1959

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Introduction

The plant cane stages of a considerable number of experiments have been harvested at Illovo in the past two years. This paper deals with the results of these experiments, pertinent information concerning them, and the translation of the responses to treatment into improved field practice. Thirteen experiments are summarized, each illustrating different interesting features which may benefit the Estate's subsequent development. It is possible that similar experiments have been carried out elsewhere in the sugar belt, and these data are presented to swell the fund of general information.

The paper is sub-divided into three sections:

(*a*) Nutritional Experiments.

(*b*) Variety Trials.

(*c*) Miscellaneous Experiments.

It should be noted that throughout the paper "significance" refers to statistical significance at the five per cent level and "high significance" to statistical significance at the one per cent level. In all discussions "tons sucrose per acre" is used to compare yields, although "tons cane per acre" is also given in the summaries of results.

PART I

NUTRITIONAL EXPERIMENTS

(i) 4×2×3 NPK Experiments

Three experiments of this type have been harvested. The designs are the same as those of the industry-wide "Regional Fertilizer Trials", and the results are therefore suitable for integration with those from similar climates and soil types. The experiments are intended to define the optimum levels of the three major nutrients for the conditions under which the trials are conducted.

EXPERIMENT No. 1

This experiment was carried out in the Dalton area, which is approximately 3,000 feet above sea level. The land had been under continuous cultivation for many years prior to the planting of sugarcane, the previous crop having been maize. Due to the sandy nature of the soil, variety Co.331 was selected for the experiment.

TABLE I

Planted: 26/9/56 **Harvested: 13/10/58**

TONS CANE PER ACRE

	P_1	P_2	K_1	K_2	K_3	*Average*
N_1	69.36	70.99	67.15	67.17	76.22	70.18
N_2	69.58	69.17	68.89	67.70	71.56	69.37
N_3	68.37	70.91	67.09	72.72	69.13	69.64
N_4	71.34	65.61	68.59	70.50	66.34	68.48
P_1	—	—	67.80	70.18	71.01	69.66
P_2	—	—	68.06	68.86	70.60	69.17
Average ...	69.66	69.17	67.93	69.52	70.80	—

TONS SUCROSE PER ACRE

	P_1	P_2	K_1	K_2	K_3	*Average*
N_1	8.72	8.26	8.18	8.86	8.45	8.49
N_2	9.19	9.60	9.16	9.09	9.95	9.40
N_3	8.69	9.99	9.03	9.42	9.57	9.34
N_4	9.58	8.82	8.97	9.61	9.03	9.20
P_1	—	—	8.94	9.11	9.09	9.05
P_2	—	—	8.73	9.38	9.40	9.17
Average ...	9.05	9.17	8.83	9.24	9.25	—

Treatments/Acre

N_1 ... ... 60 lbs. N in furrow.
N_2 ... ... 60 lbs. N in furrow, 60 lbs. N Top Dressing.
N_3 ... ... 60 lbs. N in furrow, 120 lbs. N Top Dressing.
N_4 ... ... 60 lbs. N in furrow, 180 lbs. N Top Dressing.

P_1 ... ... No Phosphate treatment.
P_2 ... ... 200 lbs. P_2O_5 in furrow.

K_1 ... ... No Potash treatment.
K_2 ... ... 100 lbs. K_2O Top Dressing.
K_3 ... ... 200 lbs. K_2O Top Dressing.

Analysis and Discussion

The only significant response obtained in this experiment was to nitrogen at the N_2, N_3 and N levels over the N_1 level.

The apparent responses to phosphate and potash treatments were not statistically significant. The response to nitrogen is shown more dramatically in the following summary:

TABLE II

Treatment	*Lbs. N per Acre*	*Lbs. Ammon. Sulphate/ Acre*	*Tons Suc. per Acre*	*Gross Value of Crop/Acre £*	*Increase/ Ac. over N_1 £*	*Additional Cost of Fert./Acre Over N_1*	*Profit/Acre due to Treatment £*
N_1	60	300	8.49	£123 12 1	—	—	—
N_2	120	600	9.40	£136 17 1	£13 5 0	£3 2 5	£10 2 7

EXPERIMENT No. 2

This experiment is at approximately the same altitude as Experiment No. 1, but the land had been under wattle for numerous years prior to sugarcane cultivation. The experiment is in the Wartburg area on a deep red lateritic soil, for which the variety N:Co.293 was deemed suitable.

TABLE III

Planted: 27/9/56 **Harvested: 29-31/10/58**

TONS CANE PER ACRE

	P_1	P_2	K_1	K_2	K_3	*Average*
N_1	85.07	86.56	82.74	90.44	83.70	85.82
NN_2	83.63	88.56	87.99	82.44	87.85	86.09
N_3	81.66	84.75	79.57	82.35	87.75	83.22
N_4	81.17	84.40	85.47	83.30	79.72	82.83
P_1	—	—	83.89	83.65	81.10	82.85
P_2	—	—	84.00	85.86	88.44	86.10
Average ...	81.18	86.10	83.94	84.76	84.77	—

TONS SUCROSE PER ACRE

	P_1	P_2	K_1	K_2	K_3	*Average*
N_1	13.18	13.52	12.56	14.47	13.02	13.35
N_2	13.27	14.10	14.29	13.28	13.50	13.69
N_3	13.09	13.81	13.33	13.30	13.73	13.45
N_4	12.92	13.86	13.80	12.89	11.96	12.89
P_1	—	—	13.62	13.29	12.44	13.11
P_2	—	—	13.37	13.68	13.67	13.57
Average ...	13.11	13.57	13.49	13.48	13.05	—

Treatments/Acre

N_1 ... ... 60 lbs. N in furrow.
N_2 ... ... 60 lbs. N in furrow, 60 lbs. N Top Dressing.
N_3 ... ... 60 lbs. N in furrow, 120 lbs. N Top Dressing.
N_4 ... ... 60 lbs. N in furrow, 180 lbs. N Top Dressing.

P_1 ... ... 100 lbs. P_2O_5 in furrow.
P_2 ... ... 200 lbs. P_2O_5 in furrow.

K_1 ... ... No Potash treatment.
K_2 ... ... 100 lbs. K_2O Top Dressing.
K_3 ... ... 200 lbs. K_2O Top Dressing.

Analysis and Discussion

This experiment showed no statistically significant treatment effects. It is perhaps unfortunate that a zero phosphate treatment was not included as there appears to be a beneficial trend with increasing phosphate nutrition. Visually apparent responses to high phosphate treatment have been observed on a neighbouring farm with similar soils. This might be expected due to the high sesqui-oxide content of these lateritic soil types.

The preceding wattles being a leguminous crop and the organic matter content of the soil being in the region of five per cent, the chances of nitrogen and potash responses in the plant stage were not enhanced.

EXPERIMENT No. 3

This experiment was conducted in the Powerscourt area, some 25 miles inland from Illovo at an altitude of approximately 2,500 ft. The area has been under continuous sugarcane production for many years. Variety N:Co.293 was planted on a Mist Belt T.M.S. soil.

TABLE IV

Planted: 1/11/56 **Harvested: 17/11/58**

TONS CANE PER ACRE

	P_1	P_2	K_1	K_2	K_3	*Average*
N_1	64.58	65.07	60.85	60.16	73.48	64.83
N_2	66.27	67.07	47.96	70.48	81.58	66.67
N_3	66.78	66.17	50.03	68.35	81.05	66.48
N_4	67.06	73.49	64.63	68.75	77.45	70.27
P_1	—	—	53.94	64.96	79.62	66.17
P_2	—	—	57.79	68.91	77.16	67.95
Average ...	66.17	67.95	55.86	66.93	78.39	—

TONS SUCROSE PER ACRE

	P_1	P_2	K_1	K_2	K_3	*Average*
N_1	8.87	9.41	8–71	8.29	10.42	9.14
N_2	9.57	9.61	6.94	9.99	11.84	9.59
N_3	8.09	9.13	7.01	8.71	10.12	8.61
N_4	9.10	9.48	8.86	9.68	9.33	9.29
P_1	—	—	7.58	8.52	10.63	8.91
P_2	—	—	8.18	9.81	10.23	9.41
Average ...	8.91	9.41	7.88	9.17	10.43	—

Treatments/Acre

N_1 ... ... 60 lbs. N in furrow.
N_2 ... ... 60 lbs. N in furrow, 60 lbs. N Top Dressing.
N_3 ... ... 60 lbs. N in furrow, 120 lbs. N Top Dressing.
N_4 ... ... 60 lbs. N in furrow, 180 lbs. N Top Dressing.

P_1 ... ... 100 lbs. P_2O_5 in furrow.
P_2 ... ... 200 lbs. P_2O_5 in furrow.

K_1 ... ... No Potash treatment.
K_2 ... ... 100 lbs. K_2O Top Dressing
K_3 ... ... 200 lbs. K_2O Top Dressing.

Analysis and Discussion

The data for both tons cane per acre and tons sucrose per acre show a highly significant linear response to potash treatment, and there remain the possibility of even greater responses at a higher level of treatment. The least significant difference at the five and one per cent levels were 0.72 and 1.00 tons sucrose per acre respectively. This experiment probably shows one of the most remarkable responses to potash since this element was realized to be a limiting nutritional factor in numerous areas on the sugar belt some ten years ago. The economics of the response are summarized in Table V.

TABLE V

Treatment	Lbs. K_2O per Acre	Lbs. Muriate of Potash/ Ac.	Tons Suc. per Acre	Gross Value of Crop/Acre	Increase in Value over K_1	Additional Cost of Fert. over K_1 £	Profit A/c due to Treatment
K_1	0	Nil	7.88	£114.725	—	—	—
K_2	100	166	9.17	£133.506	18.781	1.535	17.246
K_3	200	333	10.43	£151.850	37.125	3.071	34.054

It can be seen from this table that for an outlay of £3,071, a gross profit of £34.054 per acre can be realized.

Conclusions

From the above three $4\times2\times3$ NPK trials the following is inferred:

(*a*) On the sandy soils in the Dalton-Fawn Leas area plant crops should respond economically to 120 lbs. N and 100 lbs. K_2O per acre. Although no response to phosphate treatment was proved, it should be noted that this might be apparent in the subsequent ratoons, and it might therefore be advisable to apply some phosphate in the root zone when planting.

(*b*) On the heavier Mist Belt soils in the Wartburg area, following wattles, the only response likely in the plant stage would be to an application of as much as 200 lbs. P_2O_5 per acre in the furrow.

(*c*) At Powerscourt, the experimental evidence confirms the earlier foliar diagnosis which led to high potash fertilization. This has no doubt contributed largely to the following field results in the area for Co.331 only:

Yield per acre, plant cane, 1955: 12.43 tons cane.

Yield per acre, plant cane, 1958: 46.89 tons cane.

(ii) Other Nutritional Experiments

Apart from the standard NPK trials, various experiments have been conducted to compare available organic and inorganic fertilizer materials. Three such experiments have been harvested.

EXPERIMENT No. 4

This experiment was designed primarily to compare the relative merits of filter cake and superphosphate, but also included treatments with a commercial brand of organic fertilizer supplemented with inorganics, and kraal manure.

TABLE VI

Planted: 18/12/56 **Harvested: 25/9/58**

4 Treatments × 6 Replications

N:Co.293 ON A MIST BELT T.M.S. SOIL

Treatment No.	Furrow Treatment per Acre	Top Dressing per Acre
1	10 tons Filter Cake 200 lbs. Ammon. Nitrate 200 lbs. Muriate of Potash	200 lbs. Ammon. Nitrate 200 lbs. Muriate of Potash
2	800 lbs. Superphosphate 200 lbs. Ammon. Nitrate 200 lbs. Muriate of Potash	200 lbs. Ammon. Nitrate 200 lbs. Muriate of Potash
3	600 lbs. Organic Fertilizer 600 lbs. Rock Phosphate 180 lbs. Muriate of Potash 120 lbs. Ammon. Sulphate	Nil
4	20 Tons Kraal Manure 300 lbs. Superphosphate	200 lbs. Ammon. Nitrate

HARVEST DATA

Treatment No.	Tons Cane per Acre	Sucrose per cent Cane	Tons Sucrose per Acre	Purity	Fibre per cent Cane
1	70.07	15.51	10.86	91.6	10.66
2	66.34	15.83	10.51	92.7	10.95
3	54.87	16.03	8.80	94.4	11.73
4	67.21	15.54	10.43	91.7	10.89

Analysis and Discussion

There was no significant difference between treatments 1, 2 and 4, but all three were better than treatment 3 at the five and one per cent levels. The yields from the filter cake treatment were higher than those from the superphosphate treatments in five out of six replications, and the average difference only just fails to meet the requirement for significance at the five per cent level. Unless a considerable response due to the residual effects of filter cake develops in the ratoon stages, it is doubtful that this treatment would be economically better than superphosphate when haulage costs are also considered.

The highly variable composition of kraal manure, even from a single source, particularly in terms of moisture content, is such that the results with this material cannot be given general interpretation. Only cheaply available material from a source reasonably close to the field would be likely to compare economically with the inorganic fertilizer treatment.

The limiting factor in the commercially recommended organic manure was probably potash, as these high altitude soils have shown linear responses to much higher potash applications.

The general conclusions are that inorganic fertilizer shows the most economic response in the plant crop under these conditions, but that higher yields may be obtained using either filter cake or kraal manure.

EXPERIMENT No. 5

This experiment constitutes a natural supplement to the preceding experiment, different phosphate carriers being compared in a replicated trial. Each phosphate treatment was based on the cost of 1,000 lbs. of superphosphate per acre as a standard, exclusive of haulage and application costs.

TABLE VII

Planted: 18/11/57 **Harvested: 12/10/59**

6 Treatments × 6 Replications

N:Co.293 ON A MIST BELT T.M.S. SOIL

Treatment per Acre	*Tons Cane per Acre*	*Tons Sucrose per Acre*
No phosphate	52.12	7.80
1,000 lbs. Superphosphate	60.58	8.89
954 lbs. Raw Rock phosphate	60.71	9.08
690 lbs. Superphosphate, 2,000 lbs. Lime	61.91	9.14
905 lbs. Basic Slag	61.99	9.20
5 Tons Filter Cake	63.18	9.39

All Plots received:

100 lbs. Ammon. Nitrate
and 200 lbs. Muriate of Potash in the furrow/Acre.
and 200 lbs. Ammon. Nitrate
and 200 lbs. Muriate of Potash Top Dressing/Acre.

Analysis and Discussion

All forms of phosphate gave a highly significant response over the "No Phosphate" treatment, but no significant differences could be measured between the various phosphate treatments. It is interesting to note that although the original pH of the soil was in the region of 4.6, no significant response was gained from the application of 2,000 lbs. of finely ground agricultural limestone per acre. Since the experimental site was about 30 miles from the source of filter cake at the mill, the filter cake was priced at approximately £1 per ton delivered in the field.

Here again, unless considerably different residual effects are shown in the ratoon cycles, any of the above forms of phosphate nutrition would serve equally well under these specific conditions.

EXPERIMENT No. 6

As the potential of molasses as a fertilizer is important to the miller-cum-planter, an experiment was designed to study five levels of treatment with this relatively cheap form of potash nutrition.

TABLE VIII

Planted: 21/11/56 **Harvested: 30/7/58**

5 Levels of Treatment × 6 Replications

N:Co.310 ON A DOLERITE

Treatment	*Tons Cane per Acre*	*Tons Sucrose per Acre*
No molasses	74.89	12.22
500 gallons of molasses/acre	73.51	12.03
1,000 gallons of molasses/acre...	82.97	13.25
1,500 gallons of molasses/acre...	83.93	12.96
2,000 gallons of molasses/acre...	84.59	13.52

All plots received 500 lbs. Superphosphate in the furrow and a top dressing of 300 lbs. Ammonium Nitrate per acre.

Analysis and Discussion

The data for tons cane per acre show a significant linear response to molasses as demonstrated by the sharp rise between the first two levels and the last three. The corresponding results for tons sucrose per acre fall just short of significance. This experiment confirms the findings at Tongaat reported by Cleasby[1], and the response from 1,000 gallons of molasses per acre more than warrants the treatment.

PART II

VARIETY TRIALS

With the continuous release of new varieties from the Experiment Station, it has been imperative to compare the new releases with established varieties under varying climatic conditions and on different soil types. Four replicated variety trials have so far been harvested.

EXPERIMENT No. 7

This experiment was carried out on a coastal Dolerite soil at Illovo. In the early stages of growth it suffered a severe set-back due to drought.

TABLE IX

Planted: 21/11/56 **Harvested: 3/7/58**

7 Varieties × 4 Replications

Variety	*Tons Cane per Acre*	*Tons Sucrose per Acre*
N:Co.339	72.02	10.69
N:Co.376	81.15	9.90
N:Co.310	68.48	9.73
N:Co.293	73.46	9.03
N:Co.292	62.10	8.73
N:Co.382	68.42	8.68
N:Co.334	39.71	5.37

Analysis and Discussion

All other varieties were significantly better than N:Co.334. Unfortunately, the least significant difference between variety means with this limited number of replications was such that no other significant differences could be proved.

EXPERIMENT No. 8

This variety trial was conducted on the problematical Dwyka soil type, also at the coast at Umkomaas.

TABLE X

Planted: 20/11/56 **Harvested: 25/7/58**

7 Varieties × 5 Replications

Variety	*Tons Cane per Acre*	*Tons Sucrose per Acre*
N:Co.376	63.78	10.82
N:Co.382	69.33	10.58
N:Co.339	54.95	8.80
N:Co.310	49.75	8.48
N:Co.293	51.15	8.01
N:Co.292	48.97	7.89
N:Co.334	42.64	7.44

Analysis and Discussion

Varieties N:Co.376 and 382 were significantly better than all other varieties and highly significantly better than all but N:Co.339. It is interesting to note that, except for N:Co.382, the varieties have maintained essentially the same sequence as in Experiment No. 7. On coastal soils, therefore, N:Co.376 appears to be a natural choice, with varieties N:Co.339 and N:Co.382 as likely substitutes.

EXPERIMENT No. 9

This experiment was planted at high altitude on a Mist Belt T.M.S. soil.

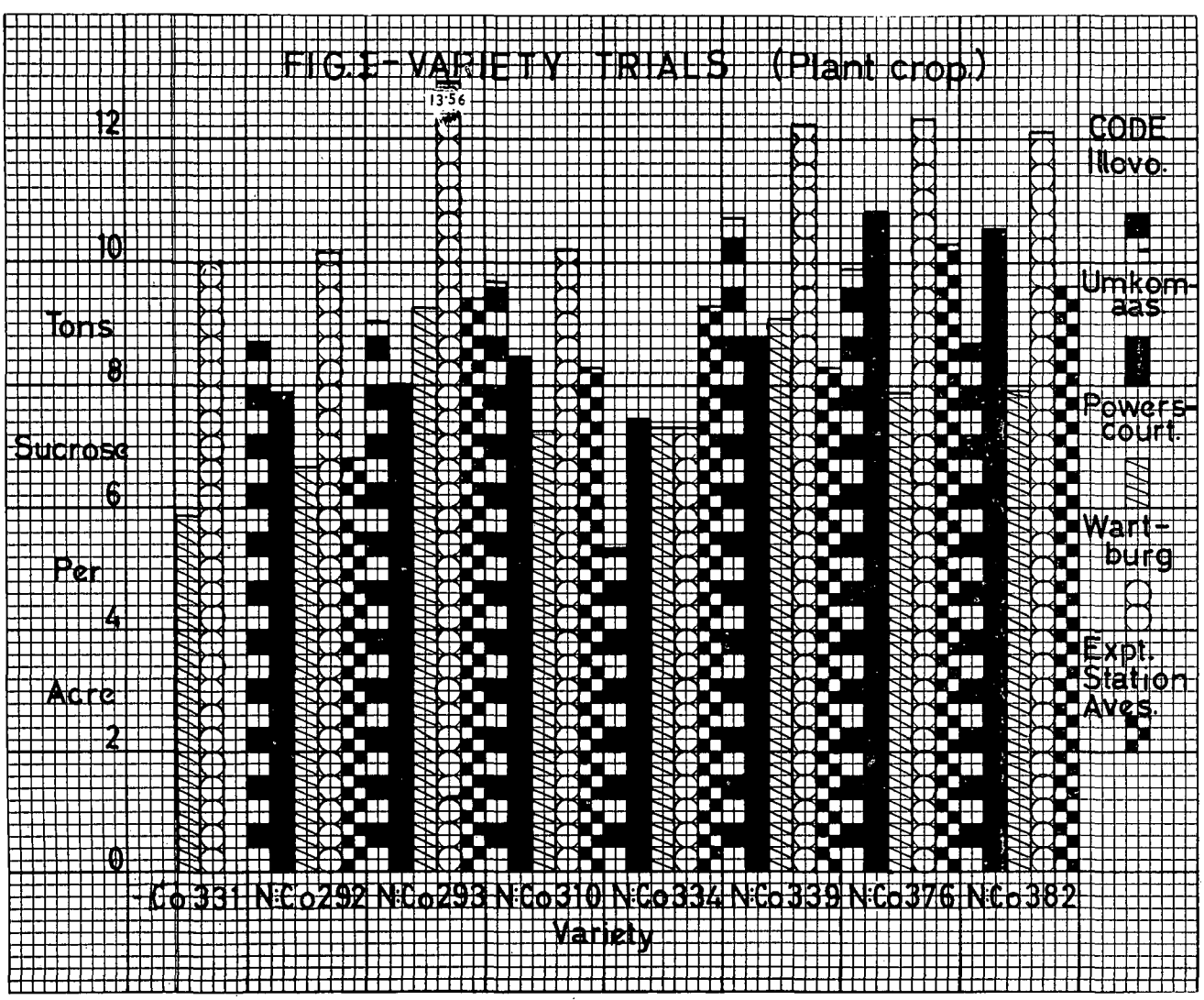
TABLE XI

Planted: 15/11/57 **Harvested: 28/9/59**

8 Varieties × 5 Replications

Variety	*Tons Cane per Acre*	*Tons Sucrose per Acre*
N:Co.293	64.19	9.24
N:Co.339	63.10	9.07
N:Co.376	53.35	7.90
N:Co.334	46.78	7.37
N:Co.310	44.63	7.33
N:Co.382	51.13	6.94
N:Co.292	47.14	6.66
Co.331	42.17	5.89

The least significant difference between variety means was 0.81 tons sucrose per acre at the five per cent level, and 1.09 tons sucrose per acre at the one per cent level.



Analysis and Discussion

From the previous table it can be seen that there was a highly significant difference in yield between varieties N:Co.339 and N:Co.293 on the one hand, and all other varieties in the experiment on the other. It is unfortunate that N:Co.339 is susceptible to, although tolerant of mosaic disease, as this variety would obviously constitute an excellent counterpart to N:Co.293, which, if cut and trashed during winter, tends to ratoon very badly. N:Co.376 again ranked high in the yield rating, thus confirming previous observations that it is one of the most versatile varieties grown in Natal at present. N:Co.382 was significantly better than Co.331 and may well constitute a welcome substitute for the latter with its low sucrose content on poor sandy soils at high altitude.

EXPERIMENT No. 10

This trial was planted on Mr. W. Meyer's farm on a Mist Belt T.M.S. soil in the Wartburg area.

TABLE XII

Planted: 27/9/56 **Harvested: 29/10/58**

8 Varieties × 5 Replications

Variety	*Tons Cane per Acre*	*Tons Sucrose per Acre*
N:Co.293	80.64	13.56
N:Co.376	78.73	12.30
N:Co.339	80.19	12.24
N:Co.382	82.88	12.17
N:Co.310	57.78	10.20
N:Co.292	69.33	10.16
Co.331	67.11	10.00
N:Co.334	44.38	7.29

Analysis and Discussion

Whilst the first four varieties were all highly significantly better than N:Co.334, only N:Co.293 was significantly better than N:Co.310, N:Co.292 and Co.331.

The results of the variety trials are summarized in the histogram on page 5 (Fig. 1), where the yields of the different varieties in the experiments described are compared with some Experiment Station averages.

PART III

MISCELLANEOUS EXPERIMENTS

EXPERIMENT No. 11

Plant Population Experiment

This experiment was designed to study the effects of varying row widths and levels of fertilization. For convenience the standard Estate row width (3ft. 6 ins.) was halved and doubled, and these three row widths were compounded factorially with three essentially balanced levels of fertilization.

TABLE XIII

Planted: 16/11/57 **Harvested: 5/10/59**

N:Co.293 ON A MIST BELT T.M.S.

4 Replications

Treatments:

Fertilization	*Lbs./Ac. Furrow*			*Lbs./Ac., Top-Dress*			*Lbs./Ac., Total*		
	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O
F1	33	80	60	33	—	60	66	80	120
F2	66	160	120	66	—	120	132	160	240
F3	99	240	240	99	—	240	198	240	480

ROW	*WIDTH*	*ROWS PER PLOT*
R_1	1 ft. 9 ins.	16
R_2	3 ft. 6 ins.	8
R_3	7 ft. 0 ins.	4

TONS CANE PER ACRE

Row Width	R_1	R_2	R_3	*Average*
Fertilization				
F_1	55.57	52.84	47.03	51.81
F_2	58.13	58.08	45.86	54.02
F_3	68.28	61.73	55.89	61.97
Average...	60.66	57.55	49.59	55.93

TONS SUCROSE PER ACRE

Row Width	R_1	R_2	R_3	*Average*
Fertilization				
F_1	8.24	8.04	7.10	7.79
F_2	8.63	8.63	6.98	8.08
F_3	10.22	9.38	8.39	9.33
Average...	9.03	8.68	7.49	8.40

Analysis and Discussion

The main effects of both fertilizer and row width were very highly significant, but there was no evidence of interaction between the two variables. Thus under the conditions of the experiment it appears that the narrowest row and the highest fertilization gave the greatest yield but that the response to fertilization itself was not a function of the row width or alternatively the plant population.

Calculated data based on the length and weight of stalks selected at random for the sucrose samples, indicated that the variation in stalk length was widest at the 7 ft. row spacing, whilst the population increase due to decreasing row width was considerably more than that due to increasing fertilization.

The positive relationship between level of nutrition and plant population in maize, which stimulated the interest in an experiment of this kind was not shown for sugarcane. The response here may be presumed to be due to those treatments giving the earliest, most complete canopy of active green leaf

to absorb radiant energy, and that decreasing row widths and increasing nutrition contribute separately to this end.

EXPERIMENT No. 12

Age of Harvest Experiment

This experiment was originally designed as a weeding trial but the planned size of breaks between replications was insufficient to permit the necessary cultivation techniques, and hence it was converted into an age of harvest trial.

TABLE XIV

Planted: 2/11/56 **Harvested: At 4 monthly intervals from 9/7/58**

Age of Harvest × 3 Varieties × 2 Replications

MIST BELT T.M.S. SOIL

Variety	*Age (Months)*	*Tons Cane/Acre*	*Sucrose % Cane*	*Tons Sucrose/ Acre*	*Fibre % Cane*	*Purity*
Co.331	20	66.0	10.40	6.86	10.26	80.1
	24	58.2	12.47	7.26	16.15	90.7
	28	56.9	11.13	6.35	12.75	88.7
	32	62.7	12.49	7.85	13.13	91.5
	36	48.2	13.38	6.45	13.75	91.6
N:Co.293	20	83.5	13.20	11.04	8.17	86.4
	24	79.0	13.36	10.55	12.68	92.2
	28	82.8	13.10	10.84	10.13	90.8
	32	66.6	14.97	9.96	11.06	94.3
	36	53.1	11.78	6.28	12.04	85.8
N:Co.339	20	92.6	11.77	10.90	9.26	82.5
	24	86.9	13.42	11.68	11.08	91.0
	28	66.3	14.36	9.53	10.78	92.4
	32	55.8	14.65	8.09	11.56	94.4
	36	42.4	14.40	6.08	12.33	90.9

Discussion

These data have not been alaysed statistically, and are presented simply to show the trends which can have considerable economic importance. Whilst Co.331 only appears to deteriorate markedly after 32 months, the other two varieties show a fairly steady decline in yield with age. It was originally intended to continue this experiment through to 48 months of age, but at 40 months the cane had lodged so badly that there was little more than a layer of entangled dead sticks about two feet thick. The experiment was therefore abandoned.

EXPERIMENT No. 13

Methods of Weed Control

This experiment was laid down to determine the effects of different forms of weed control on three varieties of cane.

TABLE XV

Planted: 5/11/56 **Harvested: 8/10/58**

3 Varieties × 3 Types of Weed Control × 5 Replications

Treatment	*DESCRIPTION*	
1	Weedicide only	16 pts. M.C.P.A./Acre on 5/11/56. 20 lbs. T.C.A./Acre on 30/11/56. 10 lbs. Dalapon/Acre on 5/2/57.
2	No weedicide	Plots kept continuously clean by hand weeding.
3	Weedicide and Weeding	15 lbs. T.C.A./Acre on 30/11/56. 5 lbs. Dalapon/Acre on 5/2/57.

TONS CANE PER ACRE

Variety	*TREATMENT*			*Average*
	1	2	3	
Co.331	62.47	60.60	61.04	61.44
N:Co.293	70.80	82.73	73.16	75.57
N:Co.339	75.21	81.07	69.61	75.29
Average...	69.49	74.80	68.00	—

TONS SUCROSE PER ACRE

Variety	*TREATMENT*			*Average*
	1	2	3	
Co.331	8.29	8.39	8.53	8.40
N:Co.293	9.86	11.04	9.70	10.20
N:Co.339	11.20	11.56	10.09	10.95
Average...	9.78	10.33	9.44	—

All plots were cultivated from March, 1957, onwards.

Analysis and Discussion

The heavy post-emergent weedicide applications were necessary to attempt control of a vigorous flush of cyperus spp. These treatments had little apparent effect on Co.331, but N:Co.293 and particularly N:Co.339 showed general stunting and many peculiarities in growth during the early stage of development. The yields for varieties N:Co.293 and N:Co.339 were highly significantly better than that for Co.331. There was also a significant interaction, indicated by the depression in yield from hand cultivation in Co.331 and an increase due to the same treatment in the other two varieties. Unfortunately, from the nature of the experiment, it is not possible to state whether the greater yield was a result of a beneficial effect from hand cultivation, or the depressed yields due to the harmful effects of weedicide.

Acknowledgements

The authors wish to thank the S.A.S.A. Experiment Station staff for conducting the sucrose analyses and the subsequent statistical analyses of the majority of these experiments, and for the interest they have shown in our research programme.

REFERENCE

[1] Cleasby, T. G., (1959): Use of Molasses on the Land. Proc. S.A. Sugar Tech. Assoc., 33, 95.

Mr. du Toit (in the Chair) congratulated the authors and the Illovo Sugar Estates for carrying out the experiments described in the paper. The Company followed the example of many Hawaiian companies where agronomic research formed part of their policy and they did not rely only on the results from an Experiment Station. As far as the experiments described in the paper were concerned he thought it unfortunate that in some of them there were no zero treatments for nitrogen and phosphate for this made it rather difficult to interpret the results. In the case of potash where there was a zero treatment we found that two experiments showed no significant response while one showed an enormous response. He assured the planters present that in all three cases either from foliar diagnosis or from soil analysis one would know that a response was likely or not. In the two Powerscourt experiments one would have expected an enormous response. He noted that in the experiments in the Dalton area 100 lbs. of K_2O was recommended to give best results. The results were not significant but the slightly higher yield per acre might seem to be just economical, but from the economic aspect one should not go by increased tons of cane or tons of sucrose per acre alone and increases in yield should not be judged solely by comparison against fertiliser costs. Other factors should be taken into consideration. Thus in the experiment at Dalton where cost of transport was very considerable, he doubted if the small increase shown would justify the application of 100 lbs. of K_2O. He thought that the work done by Messrs. Halse and Thompson on fertiliser and spacing would be followed up by experimental work by others. In the exceptional case of Powerscourt with poor nutrient conditions they had found of course that fertiliser could give enormous responses and closer spacing might give additional response although at the same expense for seed cane. Referring to the results of molasses treatments, the higher levels of application seemed to have given a significant response as compared with the lower levels but when it came to tons of sucrose per acre the authors said that the response just failed to reach significance. Was that due to a depression of sucrose per cent cane by the application of molasses?

Mr. Thompson said that he agreed with Mr. du Toit's remarks about the non-inclusion of zero levels of nitrogen in the Regional Fertiliser Trials and considered it a great pity that we did not have these treatments. As far as responses to nutrients other than nitrogen at Wartburg and Dalton were concerned it should be pointed out that these might well develop in the ratoon stages. It was true that potash responses were not significant at either Wartburg or Dalton but it might be pointed out that in those two areas cane had been planted for the first time, the previous crops being in the one instance, maize and in the other, wattle. At Powerscourt it was cane after cane and cane had been grown for 50 years, so it was not surprising that responses to potash were obtained there. In regard to the economics of the responses to treatments at Dalton he had worked strictly to tons of sucrose per acre and not to tons of cane per acre. This was the criterion which was their accepted yardstick to judge results by. There had been many discussions about whether or not the sucrose data of small plot experiments could be strictly accepted but that was the present policy. The average sucrose per cent cane figures for the molasses treatments were: zero treatment, 16.32; 500 gallons per acre, 16.41; 1,000 gallons, 15.90; 1,500 gallons, 15.51; and for 2,000 gallons, 16.12.

Dr. Cleasby considered that in the Powerscourt experiments, a most interesting result was that of Experiment V. There was a tendency in the industry to swing away from superphosphate and to use rock phosphate instead and also to use increasing quantities of lime. The experiment shewed that superphosphate was equivalent to rock phosphate and that applications of lime had not produced a significant response even though the soil pH was of the order of 4.8. There seemed to be little response to phosphate in the nutritional experiments reported and he asked for further information on the level of phosphate in the soil.

Mr. Thompson said the levels applied at Wartburg and Powerscourt were made on the basis of the Experiment Station recommendations and it was therefore decided to use the two treatments, 100 and 200 lbs. P_2O_5 per acre, and no zero treatment.

Mr. Pearson pointed out that in the comparison between superphosphates and other phosphates and the filter cake treatment it should be remembered that filter cake does carry a certain amount of nitrogen. He wondered if this was instrumental in raising the yield from filter cake. Most trials were carried out during a high rainfall period, 1958-59. In a paper produced by himself regarding spacing it appeared that water available was most important. With narrow spacing more water was required.

Mr. Thompson said that he had deliberately tried to mask the effect of nitrogen in filter cake in the

experiment shown in Table VII by putting on 300 lbs. ammonium nitrate per acre on all treatments. He thought that this met the requirements of a plant crop on a soil of that type so that he could only hope that they did not have the effect of nitrogen in filter cake there. As far as rainfall in this area was concerned, the population and fertiliser trial was in the same area as the regional fertiliser trial, which was in the previous cycle. The yields for N:Co.293 in 1958 were actually higher under maximum fertilisation than he got in the experiment with 3 ft. 6 in. rows in 1959 so that he thought 1958-59 was not an optimum rainfall cycle. The area was in the mist belt where the rainfall was good and the soil very deep. He had never seen any sign of drought there.

Dr. McMartin thought that as far as the row spacing was concerned the factor really affecting the yield was not necessarily so much the amount of cane planted as the number of stalks that the field could support. That was limited by factors such as fertility and moisture, particularly at the time when these factors were limiting, such as during winter. If the winter check was followed by good growing conditions in spring one had a big flush of bull shoots and the position righted itself again. He thought that the correct amount of cane to plant, was the minimum amount that would give the maximum leaf development at an early age over the field, and closing in of rows to absorb the radiant energy.

The age at which the rows close in was another factor affecting the distance one should space the plants. In Java it was found that when they replaced some of the older varieties with P.O.J.2878, which was a plant with upright leaves, they could plant closer. He though Dr. Dodds would remember some of the older experiments at Umfolozi where it was found that one could profitably reduce the row width of Co.281, but not with some of the other varieties.

Mr. Wilson said he wished to express gratitude to Illovo Sugar Estates, Ltd., for allowing the authors to record these experiments for our benefit. It was not often that management allowed these things to be published. His particular interest was in the plant population experiment which he thought pointed out possibilities of following out the recommendations of the chairman of the South African Sugar Association's opening address. He intended following up this question of spacing as he was not convinced that moisture at the rate of 35" per annum on an average was insufficient to supply a much greater plant population than was considered normal at the moment. He asked a question following the very last sentence of the paper on page 147, which stated it was doubtful if the result was due to "a beneficial effect from hand cultivation, or the depressed yields due to the harmful effects of weedicide". His own experience with weedicides had been confined to maize and although weedicides have always been quite effective they were uneconomic at the price in relation to the wages of labour. There was always a benefit from cultivation *per se* as distinct from weeding. This raised the point that in any intensive form of production it may be an advantage to ensure that conditions were such that one could cultivate. It might be necessary to get rid of trash in order to do so under certain circumstances.

Mr. Thompson replied that the nature of the experiment did not permit of a detailed analysis to be made of possible bad effect of weedicide, but from observation he would say that for the most part the poorer yields were due to the harmful effect of the chemicals applied. The weeded cane gained something from cultivation. With regard to cultivation, was it not true that there were higher yields from narrow row widths under irrigation? This would lead one to the conclusion that available moisture could be the deciding factor in the selection of the best row width for dry land conditions.

Mr. Pearson stated that when he had an experiment on 1'6" spacing it was always obvious that some other factor was coming into the picture. Where he had used this 1' 6" spacing of rows only one hand weeding was done. In the narrow planting it was noticeable that there was less hardening of the crust of the soil after the application of water.

Dr. Dodds asked if the authors had any plans for continuing to the ratoon stage especially with regard to varieties. He was interested to see that liming of the soil had no beneficial effect. This was done in the early days of the Experiment Station on acid soils in Canelands and Eshowe where it was found by adding lime even to a pH of 7.0 (neutralisation), no increase in yield resulted. He would like to know if anybody present had found any increase in yield from liming.

Mr. du Toit said that Dr. Dodds had raised an interesting point. That was liming. Liming had increased enormously in the sugar industry during the last year and the Experiment Station had at the moment a bulletin in preparation on that subject. The experiments which Dr. Dodds referred to were old experiments carried out on quite acid soils which gave no positive results and it was also interesting to note that the authors had limed a very acid soil. We were finding that our soils were getting progressively more acid, and that was perhaps very largely a result of the increased quantity of nitrogen now being used, with by far the worst offender, ammonium sulphate. We should know how far we could allow the soil to get more acid before we would get into real trouble, because although sugar cane undoubtedly would stand a very wide range of pH we could get to a position where the soil would be

too acid for cane to grow normally. We have had indications in experiments that too low a pH would lead to very slow growth. The position that we have taken up is that we need further liming experiments at this very moment and the Experiment Station is going to carry out such tests on a fairly large scale. If again we find no response, then we would have to continue for a while longer. He did not believe that we could apply lime with no research, but at the same time it was felt that as we had not had any lime experiments for a long time, in the interim, until further tests were made, we must at least ensure that our soils do not get more acid. This could be done by applying small quantities of lime to those soils which are already acid, so as to stabilize the pH. Lime may be necessary in certain circumstances. Another important factor may be the calcium content of the soil. In other words the Bulletin being prepared would advise that during the interim period, until we have had more data, applications of smallish quantities of lime to acid soils should be made so as to guard against our soils becoming more acid with the application of nitrogen.

Dr. McMartin said that recent plant physiological research had shewn that between the pH range of 4 and 9 no major agricultural crop was affected by pH per se, unless the intake of plant foods was affected. It was not mentioned in the paper, but it occurred to him when on the subject of acidity caused by sulphate of ammonia, to mention the feeling in some quarters that urea should take the place of sulphate of ammonia. He had heard that in some countries they were getting disappointing results from urea, and wondered if in Natal there was any data here to confirm or dispute that?

Mr. du Toit said that in an experiment carried out at the Experiment Station there appeared to be some loss of nitrogen even when ammonium sulphate was being used.

Mr. Main asked if the Experiment Station could throw more light on the subject. He thought quite a lot might depend on the current methods of application, and urea might be most susceptible if applied during dry conditions.

Mr. Steward, about planting 1′ 9″ rows, asked how the cane could be weeded and cultivated when it reached the ratoon crops, which would become a solid mass of interwoven cane?

Mr. Thompson replied to questions on the application of various phosphate forms and said that they were not repeating the phosphate treatments in the ratoons. They were putting on adequate nitrogen and potash and attempting to measure the residual effects of the phosphate treatments so that records could be kept of the performance without further phosphate treatment. The amount of lime used in the experiment was limited to 2,000 lbs. per acre, although a higher treatment might have been preferable, simply to keep the total cost of the treatment down to the equivalent of 1,000 lbs. of superphosphate at the standard price.