THE FINANCIAL ASPECT OF SOME EXPERIMENTS HARVESTED DURING 1934 AND 1935

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PART I.

The yield in tons of sucrose per acre and its equivalent cash value is undoubtedly the final standard of comparison on which to base judgment as to the success or otherwise of cane cultural methods; and how to obtain the maximum yield of sucrose per acre in the minimum of time is the problem which is exercising the minds of all progressive members of the planting community to-day.

The questions are often asked:—

(1) Do the newly released varieties give a bigger cash return per acre than Uba?
(2) Does it pay to fertilize?
(3) What is the most economical amount to apply per acre?
(4) What is the most commercially valuable combination of fertilizer to use?

It would be a bold man who would endeavour to give a precise answer to all these questions, with our very varied soil conditions, on such meagre evidence as we have at hand on which to base our conclusions, and it will probably take many years of patient research and the accumulation of considerably more data than we have at present before definite conclusions can be drawn on these knotty problems.

Nevertheless, it is the writer's intention to submit in this paper some of the results obtained in comparing (1) the gross monetary value of the yields of the different cane varieties in different parts of the sugar belt, from information obtained from variety trials which include Uba as a standard of comparison; (2) the monetary returns from different fertilizer combinations, under different soil and moisture conditions as compared with controls which received no fertilizer at all.

It is hoped that such will serve as some indication and guide until more definite information is available on the subject.

It is possible that the figures quoted may be criticised as being higher than those which are likely to be obtained under ordinary field conditions, and this is, of course, quite possible; they are, however, the actual results obtained without any special differential treatment, other than the ordinary attention given to the main crop grown in that particular locality; and in any case it is the comparative results which we are reviewing rather than the actual yields, in other words, what improvement or otherwise has been obtained by the use of fertilizers, and what gain or loss per acre is shown by planting the released varieties in the place of Uba.

The values as stated constitute the gross return based on the yield of sucrose per acre under the Fahey Agreement Scale for the particular years mentioned and does not take into account costs of production, which are, for purposes of convenience, assumed to be equal in all cases for the different varieties and treatments.

It is proposed to deal first of all with the monetary values of the variety trials in the different districts, and these are shown by means of a table as follows:—

EXPERIMENT No. 1.—Lot 16 (E. S. Murphy), Umfolozi Flats. First Ratoons (variety trial), 18 months' old, cut August, 1934. Rich virgin alluvial clay soil—some irrigation, no fertilizer.

Variety.	Tons Cane per acre.	Total value of Sucrose per acre.	Monetary gain or loss over Uba.
P.O.J.2725 ..	86.43	£62 9 6	£43 3 3 gain.
Co.290	85.65	54 10 10	35 4 7 ,,
P.O.J.2878 ..	71.44	50 11 0	31 4 9 ,,
P.O.J.2727 ..	75.10	37 9 8	18 3 5 ,,
P.O.J.2714 ..	59.03	39 8 11	20 2 8 ,,
Ch.64/21 ..	50.05	14 0 0	5 6 3 loss.
Uba	43.16	19 6 3	—

Owing to low purity of CH64/21 and Uba, these canes were penalised severely under the Fahey Conference Agreement Scale. Some damage could be attributed to locusts, but in spite of this their sucrose returns should have been better, considering the time of the year at which the experiment was cut.

EXPERIMENT No. 1.—Second Ratoons, 14 months' old, cut 1935—no fertilizer.

Variety.	Tons Cane per acre.	Total value of Sucrose per acre.	Monetary gain or loss over Uba.
P.O.J.2725 ..	55.40	£37 16 8	£18 9 7 gain.
Co.290	59.57	37 11 1	18 4 0 ,,
P.O.J.2878 ..	43.12	28 19 2	9 12 1 ,,
P.O.J.2727 ..	43.31	26 5 0	6 17 11 ,,
P.O.J.2714 ..	21.39	14 3 2	5 3 11 loss.
Ch.64/21 ..	32.01	18 16 0	0 11 1 ,,
Uba	31.46	19 7 1	—

Combined value per acre of gain or loss for two crops (32 months' growth):—

Variety.	Total gain or loss per acre for two crops.
P.O.J.2725	£61 12 10 gain.
Co.290	53 8 7 ,,
P.O.J.2878	40 16 10 ,,
P.O.J.2727	25 1 4 ,,
P.O.J.2714	14 18 9 ,,
Ch.64/21	5 17 4 loss.
Uba	—

It is not possible to give the figures for the plant cane crop as this was cut to furnish planting material for the subsequent experiments planted, but the plant cane crop results of Experiment No. 2 on exactly similar soil gives an indication of the probable results.

EXPERIMENT No. 2.—Plant Cane crop, cut August, 1934, 19 months' old. Fertilizer used: 750lbs. Superphosphate, 250lbs. Ammonium Sulphate, and 50lbs. Potassium Chloride per acre.

Variety.	Tons Cane per acre.	Total value of Sucrose per acre.	Monetary gain or loss over Uba.
P.O.J.2725 ..	95.26	£67 16 9	£38 15 10 gain.
Co.290	90.43	56 12 5	27 11 6 ,,
P.O.J.2878 ..	78.74	56 12 5	27 11 6 ,,
P.O.J.2727 ..	70.40	39 2 4	20 1 5 ,,
P.O.J.2714 ..	54.63	36 16 4	7 15 5 ,,
Ch.64/21 ..	65.48	30 5 1	1 4 2 ,,
Uba	59.16	29 0 11	—

EXPERIMENT No. 2.—First Ratoons, 14 months' old, harvested 1935.

Variety.	Tons Cane per acre.	Total value of Sucrose per acre.	Monetary gain or loss over Uba.
P.O.J.2725 ..	47.36	£34 8 7	£15 19 11 gain.
Co.290	49.16	33 7 5	14 18 9 ,,
P.O.J.2878 ..	37.66	25 17 7	7 8 11 ,,
P.O.J.2727 ..	42.72	27 7 0	8 18 4 ,,
P.O.J.2714 ..	25.33	16 14 8	1 14 0 loss.
Ch.64/21 ..	34.99	21 3 10	2 15 2 gain.
Uba	30.07	18 8 8	—

Combined value for two crops (33 months' growing period) over Uba):—

Variety.	Total gain or loss per acre for two crops.
P.O.J. 2725	£54 15 9 gain.
Co.290	42 10 3 ,,
P.O.J.2878	35 0 5 ,,
P.O.J.2727	28 19 9 ,,
P.O.J.2714	6 1 5 ,,
Ch.64/21	3 19 4 ,,
Uba..	—

EXPERIMENT No. 7A.—Umfolozi. Variety trial, irrigated. Cut July, 1935. (Soil conditions, etc., similar to Nos. 1 and 2.) No fertilizer applied.

Variety.	Tons Cane per acre.	Total value of Sucrose per acre.	Monetary gain or loss over Uba.
P.O.J.2725 ..	80.30	£54 8 6	£28 12 9 gain.
Co.290	74.70	46 16 10	21 1 1 ,,
Co.281	69.98	42 12 3	16 16 6 ,,
P.O.J.2878 ..	63.95	42 6 9	16 11 0 ,,
Uba..	48.74	25 15 9	—

EXPERIMENT No. 7B.—Plant Cane, 19 months' old, cut July, 1935. Conditions as for 7A (above), but has had no irrigation.

Variety.	Tons Cane per acre.	Total value of Sucrose per acre.	Monetary gain or loss over Uba.
P.O.J.2725 ..	74.18	£50 0 3	£23 5 2 gain.
Co.290	69.39	42 11 4	15 16 3 ,,
Co.281	70.77	43 16 2	17 1 1 ,,
P.O.J.2878 ..	62.66	41 12 10	14 17 9 ,,
Uba	49.70	26 15 1	—

EXPERIMENT No. 8.—Plant Cane, 19th months' old, cut July, 1935. Dark clay soil—no irrigation and no fertilizer.

Variety.	Tons Cane per acre.	Total value of Sucrose per acre.	Monetary gain or loss over Uba.
P.O.J.2725 ..	64.44	£45 19 4	£19 16 3 gain.
Co.290	66.89	42 13 2	16 10 1 ,,
Co.281	74.41	48 6 3	22 5 3 ,,
P.O.J.2878 ..	51.18	33 10 3	7 7 2 ,,
Uba..	46.65	26 3 1	—

This completes the information to date of the behaviour of the released varieties on the Umfolozi flats. Comment is superfluous, for in all cases they have proved far superior to Uba, with the exception of CH64/21, with which Uba can be said to compare favourably. The ratooning properties of P.O.J.2725 and the Co. canes appears to be very satisfactory up to the present, but P.O.J.2714 gives poor results after the plant cane crop.

The next locality to be dealt with is the Umhlatuzi flats at Felixton, though by no means the best portion of these, the soil being somewhat sandy in spots and rather variable. No irrigation was applied, and the fertilizer applied to all varieties was at the rate of 750lbs. Superphosphate, 250lbs. Ammonium Sulphate, and 50lbs. Potassium Chloride per acre.

In this particular case the purity and sucrose of the Uba and CH64/21 plots was so poor that it fell well below rejection point in most cases.

Therefore in order to present any comparison at all the writer submits the actual sucrose figures (without penalty or bonus) for all varieties, otherwise the returns for the two above mentioned varieties would have been very much lower (somewhere in the vicinity of £15 per acre instead of £29 10s. 10d. and £26 19s. 5d. as shown).

EXPERIMENT "A".—Variety Trial at Sir J. L. Hulett and Sons, Felixton. Plant Cane, 23 months' old, cut in November, 1934.

Variety.	Tons Cane per acre.	Sucrose % Cane.	Tons Sucrose per acre.	Total value of Sucrose per acre.	Monetary gain or loss over Uba.
P.O.J.2725	74.99	14.90	11.17	£61 2 2	£34 2 9 gain.
Co.290	71.29	13.41	9.56	52 6 0	25 2 8 ,,
P.O.J.2878	67.50	14.65	9.89	54 2 1	27 2 8 ,,
P.O.J.2727	57.75	11.56	6.68	36 10 11	9 11 6 ,,
P.O.J.2714	48.74	13.65	6.65	36 7 7	9 8 2 ,,
Ch.64/21	56.11	9.63	5.40	29 10 10	2 11 5 ,,
Uba	49 32	9.99	4.93	26 19 5	—

The monetary returns compare favourably with the Umfolozi flats. The varieties also maintained much the same order of superiority.

VARIETY TRIAL at Mr. G. P. Ladlau's Estate, Umhlali. Plant Cane, 21½ months' old, harvested August, 1935. Grey sandy loam soil.

Variety.	Tons Cane per acre.	Total value of Sucrose per acre.	Monetary gain or loss over Uba.
Co.290	49.35	£35 18 1	£12 6 5 gain.
Co.281	41.61	31 6 1	7 14 5 ,,
Uba	33.46	23 11 8	—
P.O.J.2725	20.16	15 17 2	7 14 6 loss.

A clear indication of the unsuitability of P.O.J.2725 on this particular type of soil which is apparently better suited to the Co. varieties.

This also illustrates how a variety can give overwhelmingly superior results to Uba under certain conditions in one district, and yet show quite a substantial loss under different conditions in other districts.

VARIETY TRIAL at Waldene Estates, Chakas Kraal.— Plant Cane, 22 months' old, harvested September, 1935. A poorly drained wet, grey sandy loam which has never grown good Uba, selected to ascertain whether any variety could be established to yield profitable crops.

Variety.	Tons Cane per acre.	Total value of Sucrose per acre.	Monetary gain or loss over Uba.
Co.290	28.04	£20 8 2	£13 6 7 gain.
Co.281	24.43	16 19 3	9 17 8 ,,
Uba	10.59	7 1 7	—
P.O.J.2725	10.05	6 18 10	0 2 9 loss.

It will be appreciated that in a variety trial the time of harvesting must be controlled by the maturity of the greatest number of varieties and not by the optimum of any one single variety.

The writer would like to draw the attention of those who are interested in the point, to the age of the Co.290 in the various experiments quoted, which averages about 22 months. The experiments cover a wide range of conditions, but in no case was any sign of over-ripening or red rot noticed; this does not necessarily mean that 22 months is the optimum age at which to harvest this variety, but it does indicate that no harm has accrued through not harvesting earlier.

VARIETY TRIAL at Mr. E. J. Smith's Estate, Umzinto. Plant Cane, 20 months' old, harvested in September, 1934. The soil, which is on a steep hillside, is stony and appears to be difficult to work. Conditions at the time of planting were rather dry and the germination of all varieties except Uba and Co.281 was poor. Considerable damage was done by locusts, and the comparatively low sucrose content at the time of harvesting was probably due to this cause.

Variety.	Tons Cane per acre.	Total value of Sucrose per acre.	Monetary gain or loss over Uba.
Co.281	48.11	£35 11 2	£17 11 2 gain.
P.O.J.2878	38.24	28 10 0	10 10 0 ,,
Co.290	32.49	22 13 0	4 13 0 ,,
P.O.J.2725	30.50	22 4 3	4 4 3 ,,
Uba	32.85	18 0 0	—
Ch.64/21	33.32	17 10 1	0 9 11 loss.
P.O.J.2727	27.36	16 12 7	1 7 5 ,,

EXPERIMENT STATION, Mount Edgecombe, Field D1. Plant Cane, 24 months' old, cut 1932. The soil is a clay loam with some sandy patches.

Variety.	Tons Cane per acre.	Total value of Sucrose per acre.	Monetary gain or loss over Uba.
Co.281	35.70	£26 8 0	£6 8 0 gain.
Co.290	37.67	25 3 7	5 3 7 ,,
P.O.J.2725	32.66	25 15 2	5 15 2 ,,
P.O.J.2878	25.41	18 10 7	1 9 5 loss.
P.O.J.2727	26.96	19 1 3	0 18 9 ,,
Uba	30.12	20 0 0	—
Ch.64/21	30.82	21 4 7	1 4 7 gain.
P.O.J.2714	25.10	18 3 8	1 16 4 loss.

Field D1, Variety Trial.—First Ratoons, 24 months' old, cut September, 1934.

Variety.	Tons Cane per acre.	Total value of Sucrose per acre.	Monetary gain or loss over Uba.
Co.281	40.27	£33 19 5	£7 9 11 gain.
P.O.J.2725	31.46	26 10 7	0 1 1 ,,
Co.290	36.97	28 10 0	2 0 6 ,,
P.O.J.2878	28.89	24 4 8	2 4 10 loss.
P.O.J.2727	28.35	21 6 8	5 2 10 ,,
P.O.J.2714	22.51	18 15 3	7 14 3 ,,
Uba	33.34	26 9 6	—
Ch.64/21	36.57	29 8 7	2 19 1 gain.

Combined value per acre of gain or loss for two crops:—

Variety.	Total gain or loss per acre for two crops.
Co.281	£13 17 11 gain.
Co.290	7 4 1 ,,
P.O.J.2725	5 15 3 ,,
P.O.J.2878	3 14 3 loss.
P.O.J.2727	6 1 7 ,,
P.O.J.2714	9 10 7 ,,
Ch.64/21	4 3 8 gain.
Uba	—

EXPERIMENT STATION, Field E, Variety Trial.—Plant Cane, 14 months' old, cut November, 1934. A dark clay loam soil.

Variety.	Tons Cane per acre.	Total value of Sucrose per acre.	Monetary gain or loss over Uba.
Co.281	34.40	£30 16 0	£7 9 11 gain.
Co.290	39.83	35 2 5	11 16 4 ,,
Co.301	39.70	34 2 9	10 16 8 ,,
Uba	27.73	23 6 1	—

VARIETY TRIAL, Mr. Goble's, Upper Tongaat.—Plant Cane, 22 months' old, cut September, 1935. Gray sandy loam, uniform, well drained, free working.

Variety.	Tons Cane per acre.	Total value of Sucrose per acre.	Monetary gain or loss over Uba.
Co.281 (cut for plant cane)		—	—
Co.290	36.60	£25 14 10	£10 14 2 gain.
P.O.J.2725	23.53	18 3 2	3 2 6 ,,
Uba	22.22	15 0 8	—

This experiment was not complete as the Co.281 was cut at 12 months old for planting material. The indications are, however, that the Co. varieties will be superior under these conditions to either P.O.J.'s or Uba.

SUMMARY.

From the information presented above it would appear that on rich alluvial silts and clays with or without irrigation P.O.J.2725 is the most commercially valuable variety to grow. Under these conditions its ratooning properties appear to be quite satisfactory and its sucrose content superior to any of the other varieties. As alternatives Co.281, Co.290 and P.O.J.2878 in that order of merit, the two former yielding satisfactory tonnages of slightly lower sucrose content, and the last named a somewhat lower tonnage but good sucrose.

Under slightly drier conditions and on soils of a somewhat lighter and more open texture the superiority of P.O.J.2725 is not so marked, better commercial crops usually being obtained from Co.290, which continues to yield good tonnages with improved sucrose, followed closely by P.O.J.2725 and Co.281. Where conditions are still drier, Co.281 usually takes the lead, followed by Co.290 and then the P.O.J. varieties. On sandy soils of poor fertility the P.O.J. canes are usually disappointing.

In the case of soils which appear to suffer poor drainage but are not actually waterlogged and where Uba was unsatisfactory it seems possible to establish Co.290 and Co.281 and obtain quite fair returns.

It is premature as yet to state what position the newly released variety, Co.301, will occupy in the above arrangement, but trials including this variety have been laid down and will no doubt in time yield valuable information in this respect.

Under practically all conditions at least one of the released varieties will produce better commercial crops than Uba. The final choice of the variety for any particular locality rests with the observation of the planter concerned, and to some extent on the experience of his neighbours.

PART II.

FERTILIZER TRIALS.

In examining the information available on the effects of fertilizer treatments it is at once apparent that nothing like as significant results are shown by the use of fertilizers as was the case between varieties of cane. This is rather an interesting point for it shows, that up to the present stage of investigation, more commercially profitable results are to be obtained by a careful selection of the most suitable variety of cane for a given soil, than by the application of complicated and expensive mixtures of fertilizers which may or may not give a commercial return.

The writer does not at all intend to imply that the use of fertilizers is not a sound commercial practice for as will be seen from the following examples, in some cases they show handsome returns, especially from phosphates, but that it is of primary importance to select the correct variety first, and then endeavour to improve the yields by the judicious use of the fertilizer combination which has proved to be the most commercially valuable on that type of soil in a normal season.

In the experiments about to be quoted, the variety used, unless otherwise stated, was Uba; this is explained by the fact that many of them were laid down several years ago, before information from the variety trials including some of the most promising varieties was available.

The more recent fertilizer experiments are in most cases laid down with the variety which has proved to be most suitable for the local conditions.

It is not intended to discuss in this paper the fertilizer trials conducted at Umfolozi—as these

have already been dealt with in another paper at this Conference. It is sufficient to say the results obtained there, appear to have given negative results, and no gains have been recorded from any of the fertilizer combinations used.

It must be borne in mind, however, that all these experiments were carried out on virgin lands, and it is possible better responses would be obtained on old cane fields.

EXPERIMENT "D."—Messrs. J. L. Hulett and Sons, Umhlatuzi. Fertilizer requirements test. Carried out on alluvial flats of a silty nature. **P O.J.2725,** 23 months' old plant cane, cut November, 1934.

Treatments.	Tons Cane per acre.	Total value per acre.	Gross gain or loss over controls.	Cost of Fertilizer.	Nett gain or loss over controls.
Controls—no fertilizer	60.91	£56 4 9	—	—	—
200lbs. ammonium sulphate, 75lbs. potassium chloride—no superphosphate	63.99	57 2 3	£0 17 6	£1 6 3	£0 8 9 loss.
750lbs. superphosphate, 75lbs. potassium chloride—no nitrogen	65.70	59 2 8	2 17 11	1 13 7	1 4 4 gain.
750lbs. superphosphate, 200lbs. ammonium sulphate—no potash	65.13	59 2 8	2 17 11	2 1 4	0 16 7 gain.
750lbs. superphosphate, 200lbs. ammonium sulphate—75lbs. potassium chloride	64.86	59 6 0	3 1 3	2 10 7	0 10 8 gain.
750lbs. superphosphate only	66.46	59 18 0	3 13 3	1 4 4	2 8 11 gain.

Unlike the Umfolozi results we find here some profit from the use of superphosphate applied at the rate of 750 lbs. per acre, but no further gains are noticed by the addition of nitrogen or potash; they have only increased the cost per acre of the fertilizer and cut down the profit considerably, whilst the application of nitrogen and potash alone without superphosphate resulted in a loss. It must be noted here that unlike Umfolozi this was not virgin soil but had previously grown crops of cane for some years.

EXPERIMENT "C".—Umhlatuzi. Filter press cake and superphosphate and treacle. P O.J.2725, 23 months' old plant cane, cut November, 1934.

Treatments.	Tons Cane per acre.	Total value per acre.	Gross gain or loss over controls.	Cost of Fertilizer.	Nett gain or loss over controls.
Controls—no fertilizer	47.01	£44 18 4	—	—	—
10 tons filter cake, 5 tons molasses	60.06	53 11 2	£8 12 10	£3 5 0	£5 7 10 gain.
500lbs. super, 10 tons filter press cake	54.89	50 17 7	5 19 3	3 6 3	2 13 0 gain.
10 tons filter cake	55.70	50 11 0	5 12 8	2 10 0	3 2 8 gain.
500lbs. super only	50.58	48 2 11	3 4 7	0 16 3	2 8 4 gain.
5 tons molasses only	50.69	47 15 3	2 16 11	0 15 0	2 1 11 gain.
500lbs. super, 5 tons molasses	49.26	46 3 6	1 5 2	1 11 3	0 6 1 loss.

The soil on which this experiment was conducted was not of the usual rich silty nature found on the flats, but was comparatively poor and sandy.

It is evident from the results obtained that filter press cake at the rate of 10 tons per acre gave significant gains over the controls. This improvement was not increased by the addition of superphosphate to the plots already treated with filter press cake, but there were further increases by the addition of 5 tons of molasses per acre.

The plots which received no filter press cake gave no significant gain over controls with the exception of superphosphate which shows a fair return, which bears out the results of Experiment D from which super showed profits, and nitrogen and potash did not.

From this it would appear that on alluvial soils which have grown cane for some years the addition of superphosphate is of definite benefit, and on the poorer types it would be more advantageous to use filter press cake and treacle.

EXPERIMENT No. 11G.—At Wilton Park Estate, Empangeni. Quantitative Superphosphate Trial. Cut as 29 months' old plant cane, July, 1932. Reddish loam soils of good fertility.

Treatments.	Tons Cane per acre.	Total value per acre.	Gross gain or loss over controls.	Cost of Fertilizer.	Nett gain or loss over controls.
Controls—no fertilizer	17.83	£9 8 6	—	—	—
200lbs. ammonium sulphate and 100lbs. potassium chloride—no superphosphate	18.57	10 2 5	£0 13 11	£2 2 4	£1 8 5 loss.
200lbs. ammonium sulphate, 100lbs. potassium chloride, 250lbs. superphosphate	22.07	12 3 0	2 14 6	2 12 11	0 1 7 gain.
200lbs. ammonium sulphate, 100lbs. potassium chloride, 500lbs. superphosphate	25.20	14 6 6	4 18 0	3 3 6	1 14 5 gain.
200lbs. ammonium sulphate, 100lbs. potassium chloride, 750lbs. superphosphate	26.28	14 11 1	5 2 7	3 14 1	1 8 6 gain.
200lbs. ammonium sulphate, 100lbs. potassium chloride, 1,000lbs. superphosphate	25.29	14 3 6	4 15 0	4 2 9	0 12 3 gain.

Significant difference between treatments = £1 12s. 1d.

The addition of nitrogen and potash in this trial shows no significant gain over controls and commercially represents a loss. The addition of 250lbs. of superphosphate shows great improvement whilst a greater commercial yield is obtained from series 500 and 750 lbs. superphosphate per acre. No further response is shown from dressings heavier than this, in the plant cane crop. In the first ratoon crop of this experiment, however, it will be noted that again satisfactory increases are obtained from the 500 lbs., 750 lbs., and also from the 1,000 lbs. dressings, whilst the lighter dressing of 250 lbs. is somewhat lower and the nitrogen and potash series again gives no appreciable response.

EXPERIMENT No. 11G.—First Ratoon Crop, 28 months' old, cut November, 1934.

Treatments.	Tons Cane per acre.	Total value per acre.	Gain or loss over controls.	Nett gain or loss over two crops.
Controls—no fertilizer	24.13	£15 9 8	—	—
200lbs. ammonium sulphate, 100lbs. potassium chloride—no superphosphate	24.96	15 15 1	£0 5 5	£1 3 0 loss.
250lbs. superphosphate, 200lbs. ammonium sulphate, 100lbs. potassium chloride	29.00	17 18 10	2 9 2	2 10 9 gain.
500lbs. superphosphate, 200lbs. ammonium sulphate, 100lbs. potassium chloride	30.02	18 16 4	3 6 8	5 1 2 gain.
750lbs. superphosphate, 200lbs. ammonium sulphate, 100lbs. potassium chloride	31.40	19 8 5	3 18 9	5 7 3 gain.
1,000lbs. superphosphate, 200lbs. ammonium sulphate, 100lbs. potassium chloride	31.21	19 4 0	3 14 4	4 6 7 gain.

From this it will be seen that the economic limit for superphosphate appears to lie between 500-1,000 lbs. per acre on this particular type of soil, although this cannot be accepted as final for climatic conditions exercise a considerable influence on the results obtained, and better responses may be obtained from heavier dressings during more favourable seasons.

EXPERIMENT 11D.—Qualitative Potash Trial, at Wilton Park Estate, Empangeni. On chocolate loam soil of good depth and fertility. (1928-1935.)

This experiment yielded four crops, and the total gain over controls is given in the following table:—

Treatments.	Tons Cane per acre.	Total value per acre.	Gross gain or loss over controls.	Cost of Fertilizer.	Nett gain or loss over controls.
Controls—no fertilizer	117.72	£75 6 1	—	—	—
200lbs. rock phosphate, 200lbs. superphosphate	133.39	89 12 8	£14 6 7	£0 15 6	£13 11 1 gain.
Phosphate as above, plus 200lbs. ammonium sulphate	127.03	86 2 5	10 16 4	2 9 0	8 7 4 gain.
Phosphate as above, plus 200lbs. ammonium sulphate, 60lbs. potassium sulphate	132.64	88 8 10	13 2 9	2 17 3	10 5 6 gain.
Phosphate as above, plus 200lbs. ammonium sulphate, 120lbs. potassium sulphate	125.01	83 18 0	8 11 11	3 5 6	5 6 5 gain.
Phosphate as above, plus 200lbs. ammonium sulphate, 50lbs. potassium chloride	131.35	88 8 4	13 2 3	2 15 4	10 6 11 gain.
Phosphate as above, plus 200lbs. ammonium sulphate, 100lbs. potassium chloride	126.31	85 14 4	10 8 3	3 1 8	7 6 7 gain.

The values in the last column represent the value of the increased yield obtained through the use of the different fertilizer combinations shown. There was only one application made and that at time of planting early in 1928.

It is clear that even if we ignore the cost of the fertilizer, the biggest gains are shown from the use of phosphates alone, and this gain is accentuated when we take the prices of the fertilizers into consideration. There is some indication that the lighter dressings of potash gave better returns than the heavier dressings, whilst the combination of phosphates and nitrogen without any potash shows a smaller gain than when potash in moderate quantities is added.

There is no evidence to show that the form in which the potash was applied had any material effect.

EXPERIMENT No. 11E, Empangeni.—Qualitative Nitrogen Trial. Ammonium Sulphate *vs.* Nitrate on red loam soil of good fertility and depth which had grown no previous crops. **Plant Cane** crop, 24 months' old, cut 1930.

The three crops reaped to date are shown separately in this instance, to illustrate an apparent improvement in the nitrogen series in the third cutting.

Treatments.	Tons Cane per acre.	Total value per acre.	Gross gain or loss over controls.	Cost of Fertilizer.	Nett gain or loss over controls.
Controls—no fertilizer	49.08	£32 19 6	—	—	—
500lbs. superphosphate	59.02	38 7 9	£5 8 3	£1 0 0	£4 8 3 gain.
Superphosphate as above, plus 245lbs. ammonium sulphate	60.21	37 7 11	4 8 5	3 1 1	1 7 4 gain.
Superphosphate as above, plus 320lbs. sodium nitrate	61.35	38 13 9	5 14 3	3 8 0	2 6 3 gain.

The improvement due to the use of superphosphate (16 %) is obvious and confirms the results obtained in Experiments 11D and 11G, which were conducted in the same district on similar soil.

The **First Ratoon** crop, 24 months' old, cut 1932, which suffered severely from drought, gave the following results:—

Treatment.	Tons Cane per acre.	Total value per acre.	Gross gain or loss over controls.
Controls—no fertilizer	18.51	£10 7 0	—
500lbs. superphosphate	21.52	11 18 5	£1 11 5 gain.
Superphosphate as above, plus 245lbs. ammonium sulphate	21.53	11 14 9	1 7 9 gain.
Superphosphate as above, plus 320lbs. sodium nitrate	20.82	11 3 8	0 16 8 gain.

The yields are all very much lower, but superphosphate still shows 15 % improvement over controls. Neither of the nitrogen series show any gain over this.

The **Second Ratoon** crop, harvested at 24 months' old in 1934, gave the following figures:—

Treatment.	Tons Cane per acre.	Total value per acre.	Gross gain or loss over controls.
Controls—no fertilizer	22.45	£15 5 3	—
500lbs. superphosphate	25.04	16 1 8	£0 16 5 gain.
Superphosphate as above, plus 245lbs. ammonium sulphate	26.29	17 9 0	2 3 9 gain.
Superphosphate as above, plus 320lbs. sodium nitrate	26.25	17 7 11	2 2 8 gain.

The total gain per acre over controls for three crops (six years) is:—

Controls	—
Superphosphate only	£6 16 1
Superphosphate and ammonium sulphate	4 18 10
Superphosphate and sodium nitrate	5 5 7

It will be noticed that on the second ratoon crop there appears to be a significant gain for the phosphate and nitrogen series over superphosphate alone; this is a somewhat remarkable effect, considering the fact that the nitrogen was applied six years previously. It will be interesting to see whether this belated gain is continued in the next harvesting. Apart from this, however, the superphosphate series again shows the biggest profit over the three crops already harvested; apparently virgin soil of this description only responds to phosphatic fertilizers, and previous experiments on this soil indicate that superphosphate or basic slag are the best forms in which to apply this phosphate. (Messrs. Dodds and Fowlie, S.A. Sugar Tech. Proceedings, March, 1931, p. 4).

There is some evidence of gains obtained through the use of nitrogenous fertilizers at Empangeni reported in the same paper. The final results show a gain after three crops of £7 per acre in the case of Ammonium Sulphate and Rock Phosphate, and £5/10/0 per acre for Blood Meal and Rock Phosphate when compared with Rock Phosphate alone. In this paper it is also stated: "It is certainly remarkable that at the second ratoon cutting there should still be a marked benefit from the fertilizer applied six years previously, after two heavy crops have, each with considerable increase due to fertilizer, already been attained."

This completes the information available of this particular type of soil (rich chocolate loam) in the Empangeni district, and the next type to be dealt with is the light reddish loam soils at Umhlali.

The first experiment deals with concentrated fertilizers as compared with bulk fertilizers, and the results are as follows:—

EXPERIMENT No. 2.—Mr. G. P. Ladlau's Estate, Umhlali. Co.281, Plant Cane, cut at 12 months' old, November, 1934.

Treatments.	Tons Cane per acre.	Total value per acre.	Gross gain or loss over controls.	Cost of Fertilizer.	Nett gain or loss over controls.
Controls—no fertilizer	19.33	£16 2 9	—	—	—
300lbs. concentrated cane fertilizer	22.52	18 19 8	£2 16 11	£3 1 6	£0 4 7 loss.
Bulk fertilizer: 640 lbs. superphosphate, 120lbs. ammonium sulphate, 80lbs. potassium chloride	22.06	18 13 1	2 10 4	2 1 0	0 9 4 gain.
400lbs. concentrated cane fertilizer	22.15	18 9 10	2 7 1	4 2 0	1 14 11 loss.
Bulk fertilizer: 840lbs. superphosphate, 160lbs. ammonium sulphate, 120lbs. potassium chloride	24.94	21 0 3	4 17 6	2 15 9	2 1 9 gain.

The **First Ratoon** crop, also harvested at 12 months' old in October, 1935, gave the following results:—

Treatment.	Tons Cane per acre.	Total value per acre.	Gross gain or loss over controls.
Controls—no fertilizer	15.80	£10 5 11	—
300lbs. concentrated cane fertilizer	19.50	12 18 4	£2 12 5 gain.
Bulk fertilizer, equivalent to 300lbs. concentrated cane fertilizer	19.15	12 17 5	2 11 6 gain.
400lbs. concentrated cane fertilizer	19.52	13 8 6	3 2 7 gain.
Bulk fertilizer, equivalent to 400lbs. concentrated cane fertilizer	20.95	13 16 9	3 10 10 gain.

The gains over controls shown may at first glance appear to be somewhat small, but it must be borne in mind that the crop is in each case only 12 months old and the combined value of the two crops (that is for a two-year growth period) gives a better comparison. These are as follows:—

Treatments.	Tons Cane per acre.	Total value per acre.	Gross gain or loss over controls.	Cost of Fertilizer.	Nett gain or loss over controls.
Controls—no fertilizer	35.15	£26 8 8	—	—	—
300lbs. concentrated cane fertilizer	42.02	31 18 0	£5 9 4	£3 1 6	£2 7 10 gain.
Bulk fertilizer, equivalent to 300lbs. concentrated cane fertilizer	41.21	31 10 6	5 1 10	2 1 0	3 0 10 gain.
400lbs. concentrated cane fertilizer	41.67	31 18 4	5 9 8	4 2 0	1 7 8 gain.
Bulk fertilizer, equivalent to 400lbs. concentrated cane fertilizer	45.89	34 17 0	8 8 4	2 15 9	5 12 7 gain.

The most satisfactory gain has been obtained from the use of bulk fertilizers and in this case the heavier dressing gives the better results; a response to all fertilizer treatments is also indicated.

EXPERIMENT No. 3, Umhlali.—Co.281, Plant Cane, harvested at 12 months' old, November, 1934.

Treatments.	Tons Cane per acre.	Total value per acre.	Gross gain or loss over controls.	Cost of Fertilizer.	Nett gain or loss over controls.
Controls—no fertilizer	19.09	£15 15 1	—	—	—
600lbs. superphosphate only	25.35	21 10 0	£5 14 11	£1 0 10	£4 14 1 gain.
Superphosphate as above, plus 80lbs. potassium chloride	26.51	22 7 6	6 12 5	1 10 9	5 1 8 gain.
Superphosphate as above, plus 80lbs. potassium chloride and 160lbs. ammonium sulphate	26.50	22 12 11	6 17 10	2 4 4	4 13 6 gain.
Superphosphate as above, plus potash as above and 200lbs. whale guano	28.01	23 19 2	8 4 1	2 11 9	5 12 4 gain.

And as **First Ratoons,** harvested at twelve months' old in October, 1935:—

Treatment.	Tons Cane per acre.	Total value per acre.	Nett gain or loss over controls.
Controls—no fertilizer	19.37	£12 14 8	—
Superphosphate only	24.12	15 16 3	3 1 7 gain.
Superphosphate and potash	25.40	16 14 10	4 0 2 gain.
Superphosphate, potash, and ammonium sulphate	23.94	16 1 10	3 7 2 gain.
Superphosphate, potash, and whale guano	27.00	17 15 10	5 1 2 gain.

The combined profits for two crops (two-year growing period) are as follows:—

	Nett combined gain per acre (2 crops) over controls.
Controls—no fertilizer	—
600lbs. superphosphate	£7 15 8 gain.
600lbs. superphosphate and 80lbs. potassium chloride	9 1 10 gain.
600lbs. superphosphate, plus 80lbs. potassium chloride, plus 160lbs. ammonium sulphate	8 0 8 gain.
600lbs. superphosphate, plus 80lbs. potassium chloride, plus 200lbs. whale guano	10 13 6 gain.

It would appear that on this type of soil, already described as of a red coarse sandy nature, there is definite response to all forms of fertilizer, and although in this instance the response to inorganic forms of nitrogen (e.g. ammonium sulphate) is doubtful (more definite cases on this type of soil have been noticed). The use of organic forms of nitrogen (e.g., whale guano) is indicated as being profitable and in conjunction with fairly heavy dressings of phosphates and moderate dressings of potash should prove sound commercial practice.

FERTILIZER REQUIREMENTS TRIAL ON UBA, at Mr. E. J. Smith's Estate, Umzinto.—A deep, black loam soil, situated in a valley where moisture conditions are favourable, and no previous crops grown.

Plant Cane crop, harvested at 21 months' old in September, 1930:—

Treatments.	Tons Cane per acre.	Total value per acre.	Gross gain or loss over controls.	Cost of Fertilizer.	Nett gain or loss over controls.
Controls—no fertilizer	33.31	£21 10 1	—	—	—
500lbs. superphosphate	42.99	27 15 3	£6 5 2	£1 0 0	£5 5 2 gain.
225lbs. superphosphate, 225lbs. bonemeal	44.16	28 10 1	7 0 0	1 7 11	5 12 1 gain.
500lbs. superphosphate, 75lbs. potassium chloride	42.12	27 4 4	5 14 3	1 10 6	4 3 9 gain.
500lbs. superphosphate, 250lbs. sulphate of ammonia	42.47	27 8 3	5 18 2	3 2 0	2 16 2 gain.

First Ratoon crop, cut November, 1932, at 26 months' old:—

Treatment.	Tons Cane per acre.	Total value per acre.	Gross gain or loss over controls.
Controls—no fertilizer	45.24	£29 2 2	—
500lbs. superphosphate	51.86	33 0 9	£3 18 6 gain.
225lbs. superphosphate, 225lbs. bonemeal	50.53	31 6 6	2 4 4 gain.
500lbs. superphosphate, 75lbs. potassium chloride	50.83	32 3 2	3 1 0 gain.
500lbs. superphosphate, 250lbs. ammonium sulphate	48.77	31 1 0	1 18 10 gain.

Second Ratoon crop, cut in October, 1934, at 23 months' old:—

Treatment.	Tons Cane per acre.	Total value per acre.	Gross gain or loss over controls.
Controls—no fertilizer	33.84	£21 7 10	—
500lbs. superphosphate	41.58	26 3 0	£4 15 2 gain.
225lbs. superphosphate, 225lbs. bonemeal	40.01	24 10 2	3 2 4 gain.
500lbs. superphosphate, 75lbs. potassium chloride	39.38	24 11 3	3 3 5 gain.
600lbs. superphosphate, 250lbs. ammonium sulphate	40.76	24 8 0	3 0 2 gain.

A final consideration of the total monetary gain for the three crops over the controls shows the following results:—

	£ s. d.
Controls	—
500lbs. superphosphate	13 18 10
225lbs. superphosphate, 225lbs. bonemeal	10 18 9
500lbs. superphosphate, 75lbs. potassium chloride	10 8 2
500lbs. superphosphate, 250lbs. ammonium sulphate	7 15 2

More reliable conclusions can usually be drawn from a review of the results of a fertilizer experiment over three or more crops covering a period of several years, than could be done from results of a single crop, for it is possible that certain unfavourable climatic conditions may affect the responses obtained from certain fertilizers for a particular crop, and in this manner it sometimes occurs that the yield of two individual crops from the same experiment may give contradictory results in different seasons.

Over a period of years, however, this tendency is to a great extent reduced.

From the experiment now being discussed, the results over three crops show superphosphate alone, again to be the most profitable fertilizer, and the series to which ammonium sulphate has been added show the lowest gain.

The response to fertilizer on this type of soil is marked, and the residual effect of superphosphate after six years is also clearly illustrated.

It might be mentioned here that another indication of the residual effects of phosphates is to be found in an experiment conducted at the Experiment Station, the third ratoon results of which are as follows:—

EXPERIMENT D3.—Qualitative Phosphate Trial. Cut as **Third Ratoons** in June, 1934:—

Treatment.	Tons Cane per acre.	Gross return per acre.	Nett gain over controls.
Controls—no fertilizer	22.70	£16 13 9	—
500lbs. superphosphate	28.83	21 10 0	£4 16 3
300lbs. rock phosphate	26.97	19 4 0	2 10 3
410lbs. bone dust	26.59	19 9 6	2 15 9
470lbs. basic slag	26.68	19 16 1	3 2 4
320lbs. Rhenania phosphate	27.54	19 17 2	3 3 5
375lbs. of equal parts of superphosphate and rock phosphate	27.17	19 11 8	2 17 11

After eight years, as will be seen, there are still profitable increases for all forms of phosphatic fertilizers, but particularly for superphosphate.

The total financial gain over controls for four crops in this experiment was as follows: —

Controls	—	
500lbs. superphosphate	£21 15 10	gain.
300lbs. rock phosphate	10 17 8	,,
410lbs. bone dust	14 12 10	,,
470lbs. basic slag	13 2 1	,,
320lbs. Rhenania phosphate	15 13 9	,,
375lbs. of equal parts of superphosphate and rock phosphate	7 11 1	,,

Time and space will not permit the inclusion of any further detailed fertilizer experiments, on other types of soil. It may be possible at some future date to continue this subject and at the same time include any subsequent crops harvested from the experiments already dealt with.

SUMMARY.

The results of various fertilizer experiments are tabulated, showing the monetary response to different ingredients, for each successive crop and as a total for all crops harvested to date, for each experiment. A short description of the type of soil on which each experiment is conducted is given.

In all cases (with the exception of the Umfolozi alluvial flats soils, where no gains from any fertilizer were obtained) definite response to phosphatic fertilizer is shown, especially in the case of superphosphate. Dressings of 500 lbs. and over per acre, appear to give better results than the smaller dressings.

No very great response can be shown from the application of potash and inorganic nitrogen, the latter in some cases appearing to depress slightly the yield of cane.

Organic forms of nitrogen appear to give better results than the inorganic forms, especially on the red sandy soils. Beneficial results are shown from the residual effects of phosphatic fertilizers even six to eight years after application.

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Acknowledgements and thanks are due to the various planters, on whose estates these experiments were conducted, for their co-operation and assistance at all times, and to the chemical staffs of the various mills who carried out the numerous sucrose tests which were necessary in order to obtain the information on which this paper is based.

Experiment Station,
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The CHAIRMAN: I am sure Mr. Colepeper's paper has filled a very definite function in impressing upon those who have had the privilege of listening to it, the financial side of the different varieties, and impressing, furthermore, the fact of how much extra profit it is possible to make if we are careful and judicious in selecting the right cane for the right locality.

There is a point which sticks out rather prominently in three of these experiments, which rather calls for comment and further explanation, and that is the way in which experiment Nos. 1 and 2 on lot 16 has dropped its yield from the first ratoon to the second ratoon in each case. We notice that the second ratoon in each case is four to five months younger, but that would hardly be thought to be responsible for such a drop in yield. Further, Experiment No. 11E, also shows a tremendous drop in yield on the second crop harvested. Perhaps someone can enlarge on that aspect.

Mr. COLEPEPER: In the case of the Umfolozi experiment. not only was the cane younger, but I think the first crop—that would be the plant cane crop, and the first ratoon crop, Experiment 1—received more irrigation. The irrigation was very much delayed in the second crop, and that has quite possibly had something to do with the results obtained. In the case of 11 (e) it suffered very severely from drought.

Mr. FOWLIE: I would like to supplement what Mr. Colepeper has said about Experiments 1 and 2, at Umfolozi. Experiment No. 1 as I explained before that was not a plant cane crop. When it was young it was cut—in February, to be exact—and at 18 months when it had had the greater part of two growing seasons, then the whole of another one, bringing it to August, when it was cut; whereas Experiment No. 2 was planted in December. It had had practically the whole of two growing seasons and was cut in August. The next crop was cut in the following November, so that it really had 14 months. It only had one growing season and a couple of months and well into the end of the season; and therefore in a sense you are comparing what we would usually call a two-year crop.

The CHAIRMAN: If there is no further discussion on this paper, we will record our thanks to Mr. Colepeper for giving us this most interesting paper.