

A PRELIMINARY SURVEY OF RECENT FERTILIZER EXPERIMENTS FOR SUGARCANE.

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At the present time when the demand for the maximum amount of sugar from our industry is greater than ever, it is necessary to give renewed study to the various means of maintaining and increasing production. Among these means the use of fertilizers is of great importance, and since supplies are very limited for obvious reasons and are strictly rationed, a survey of fertilizer experiments and indicated fertilizer requirements of the sugarcane crop over recent years is of interest.

The period taken for review comprises the past ten seasons, which covers an important period of development in local sugar history, annual production of sugar having increased from 325,000 tons in 1931/32 to 595,000 in 1939/40.

The period selected also largely avoids the abnormal acreage yields and responses to fertilizers resulting from the very dry cycle of years from 1926 to 1931, over which the average annual rainfall was only 32.88 inches. The year 1933 was also abnormally dry, which evidently had its effect on fertilizer results, but thereafter there was no extremely dry year until 1941.

The same period has witnessed a spectacular and rapid change in the predominant cane varieties grown, the proportion of Uba cane in the total crop harvested having diminished from 95.8 per cent. in 1934 to 11.1 per cent. in 1942.

The experiments outlined are those carried out by the Experiment Station, either on our own land at Mount Edgecombe or

on various plantations and estates in co-operation with the owner or manager.

Since the Experiment Station is naturally limited to a definite area, 96 acres, not all of which is ideally suited for fertilizer experiment, it follows that a considerable proportion of the fertilizer experiments here have shown negative or doubtful results. Further, the Experiment Station has been a testing ground for alternative designs of field experiments, not all of which have proved well adapted for general use in this country.

In co-operative field experiments, on the other hand, the occupier usually offers a considerable area of land from which we can select a site we consider conveniently situated and most likely to give concordant and significant results because of the apparent uniformity of the soil and other conditions. Such land also has usually had normal agricultural treatment in the past and has not been already subjected to the vagaries of field experiments leading to possible very diverse residual effects. Consequently the co-operative experiments with fertilizers have, on the whole, led to a much larger proportion of positive and significant results. This is particularly the case where phosphatic fertilizer experiments are concerned, since phosphates can accumulate in the soil if not fully utilized by the crop, whereas nitrogen is apt to be lost to the soil if not soon utilized, and does not remain to affect further experiments.

NITROGEN EXPERIMENTS.—AVERAGES OF ALL RESULTS.

Plant cane crops.	Experiment Station.	Co-operative stations.	All stations.
Number of experiments ...	6	13	19
Cane yields in tons per acre—			
no nitrogen ...	42.28	47.12	45.59
with nitrogen ...	44.78	51.21	49.18
Sucrose yields in tons per acre—			
no nitrogen ...	6.72	7.46	7.23
with nitrogen ...	7.10	8.09	7.77
Sucrose per cent. cane—			
no nitrogen ...	15.89	15.84	15.85
with nitrogen ...	15.85	15.79	15.81
Ratoon crops.			
Number of experiments ...	11	26	37
Cane yields in tons per acre—			
no nitrogen ...	33.70	32.69	32.99
with nitrogen ...	38.23	37.67	37.84
Sucrose yields in tons per acre—			
no nitrogen ...	4.94	4.66	4.74
with nitrogen ...	5.59	5.38	5.44
Sucrose per cent. cane—			
no nitrogen ...	14.66	14.26	14.38
with nitrogen ...	14.62	14.28	14.38
All crops.			
Number of experiments ...	17	39	56
Cane yields in tons per acre—			
no nitrogen ...	36.73	37.50	37.26
with nitrogen ...	40.54	42.19	41.69
Sucrose yields in tons per acre—			
no nitrogen ...	5.57	5.59	5.59
with nitrogen ...	6.12	6.28	6.23
Sucrose per cent. cane—			
no nitrogen ...	15.16	14.92	14.99
with nitrogen ...	15.10	14.89	14.95

PHOSPHATE EXPERIMENTS—AVERAGES OF ALL RESULTS.

Plant cane crops.	Experiment Station.	Co-operative stations.	All stations.
Number of experiments ...	6	20	26
Cane yield in tons per acre—			
no phosphate ...	38.92	45.70	43.94
with phosphate...	39.35	49.97	47.21
Sucrose yields in tons per acre—			
no phosphate ...	6.11	7.10	6.84
with phosphate...	6.16	7.79	7.36
Sucrose per cent. cane—			
no phosphate ...	15.69	14.77	14.98
with phosphate...	15.66	14.82	15.00
Ratoon crops.			
Number of experiments ...	11	23	34
Cane yields in tons per acre—			
no phosphate ...	29.06	28.37	28.59
with phosphate...	29.20	31.85	31.00
Sucrose yields in tons per acre—			
no phosphate ...	4.27	4.02	4.10
with phosphate...	4.29	4.52	4.44
Sucrose per cent. cane—			
no phosphate ...	14.70	14.17	14.34
with phosphate...	14.68	14.18	14.34
All crops.			
Number of experiments ...	17	43	60
Cane yields in tons per acre—			
no phosphate ...	32.90	36.43	35.39
with phosphate...	33.15	40.28	38.17
Sucrose yields in tons per acre—			
no phosphate ...	4.99	5.29	5.20
with phosphate...	5.02	5.86	5.61
Sucrose per cent. cane—			
no phosphate ...	15.16	14.52	14.69
with phosphate...	15.14	14.55	14.70

SUMMARY OF RESPONSES TO NITROGEN IN FERTILIZER EXPERIMENTS OVER THE TEN YEARS 1933—1942.

Experiments done at the central station, Mount Edgecombe, are denoted by E., with the number, of the field in brackets.

Date harvested.	No.	Locality.	Type of soil.	Cane variety.	Age of crop in months.	Plant or ratoon.	Kind of fertilizer.	Dose (lbs. per acre).	Cane yields per acre.		Sucrose yields per acre.		Remarks.	
									Controls.	Fertilized plots.	Controls.	Fertilized plots.		
1933.														
October ...	1	E. (E.1) ...	Clay loam...	P.O.J.2725	22	Plant...	Sodium nitrate	120	27.02	26.59	5.02	4.92	Average sucrose content 17.75 per cent.	
							Sodium nitrate	200		26.37		4.83		
							Sodium nitrate	280		28.22		5.22		
November .	2	Empangeni ...	Heavy loam ...	Uba ...	16	2nd ratoon	Ammonium sulphate	200	20.82	20.54	3.13	3.12	No response over three crops.	
1934.														
July ...	3	E. (A.3) ...	Clay loam...	Uba ...	24	3rd ratoon	Whale meal ...	415	25.93	28.70	3.47	3.86	Whale meal and nitrate better than ammoniacals.	
							Sod. nit....	320		28.37		3.84		
							Am. sulph. ...	245		27.34		3.66		
							Urea ...	110		26.26		3.61		
							Cyanamide ...	265		25.99		3.51		
October ...	4	Umzinto ...	Gravelly granite	Uba ...	19	2nd ratoon	Am. sulph. ...	250	45.48	44.00	4.09	3.81	Mean of three crops.	
November .	5	Felixton ...	Alluvial silt ...	P.O.J.2725	22	Plant...	Am. sulph. ...	200	66.46	65.13	10.93	10.81	1st line without potash, 2nd line with.	
							Am. sulph. ...	200	65.70	64.86	10.81	10.84		
November .	6	Umhlali ...	Coarse sand ...	Co.281 ...	12	Plant...	Am. sulph. ...	160	26.51	26.50	4.09	4.14		
							Whale meal ...	200		28.01		4.38		
November .	7	Empangeni ...	Heavy loam ...	Uba ...	23	2nd ratoon	Sod. nit....	320	25.04	26.25	2.94	3.18	No response at 1st or 2nd cuttings.	
							Am. sulph. ...	245		26.29		3.19		
1935.														
October ...	8	Umfolozi ...	Heavy alluvial .	P.O.J.2725	14	1st ratoon .	Am. sulph. ...	150	78.38	77.70	10.28	10.42	Mean of two crops.	
							Am. sulph. ...	300		71.86		9.77		
							Sod. nit....	200		76.58		10.04		
October ...	9	Umhlali ...	Coarse sand ...	Co.281 ...	11	1st ratoon .	Am. sulph. ...	160	25.40	23.94	3.64	3.50	Organic better than inorganic here.	
							Whale meal ...	200		27.00		3.87		
							Am. sulph. ...	200	28.57	28.01	4.11	4.13		
October ...	10	Empangeni ...	Heavy loam ...	Uba ...	24	3rd ratoon	Am. sulph. ...	200	28.57	28.01	4.11	4.13		
1936.														
November .	11	E. (A.3) ...	Clay loam...	Co.281 ...	14	Plant...	Diss. Perugano	520	26.81	31.79	4.41	5.18	Organic nitrogen distinctly better than inorganic in this case.	
							Raw Perugano	245		29.20		4.73		
							Whale meal 1	286		29.86		4.89		
							Whale meal 11	484		29.26		4.75		
							Sod. nit....	194		27.73		4.59		
1937.														
November .	12	Umhlali ...	Coarse sand ...	Co.281 ...	12	3rd ratoon	Am. sulph. ...	200	18.09	22.09	2.95	3.59		
							Whale meal ...	400		21.56		3.51		
							Sod. nit....	250		22.13		3.62		
1938.														
June... ..	13	E. (A.1) ...	Stiff clay ...	Co.290 ...	22	3rd ratoon	Am. sulph. ...	300 (P)	23.63	25.83	3.30	3.51	(P) signifies all applied at time of planting; (TD) all top-dressed; ($\frac{2}{3}$ TD) one-third only at time of planting.	
							Am. sulph. ...	300 (TD)		25.17		3.41		
							Am. sulph. ...	300 ($\frac{2}{3}$ TD)		26.13		3.62		
							Am. sulph. ...	600		24.84		3.31		
							Am. sulph. ...	150	48.74	50.76	7.54	7.93		1st line without, 2nd line with 80lbs. chloride of potash.
September .	14	E. (E.1) ...	Heavy loam ...	Co.281 ...	23	Plant...	Am. sulph. ...	150	50.70	48.54	7.90	7.56		
September .	15	E. (E.1) ...	Heavy loam ...	Co.290 ...	23	Plant...	Am. sulph. ...	300	51.06	54.71	7.82	8.25	No significant difference between different forms of N.	
							Sod. nit....	400		54.00		8.12		One-half top-dressed, rest at time of planting.
							Whale meal ...	600		53.56		8.11		
							Nitro-chalk ...	300		55.84		8.49		
October ...	16	Umzinto ...	Sandy loam ...	Co.281 ...	21	Plant...	Am. sulph. ...	250	26.62	28.63	4.80	5.20	As above.	
							Sod. nit....	350		27.31		4.98		
							Whale meal ...	500		29.24		5.34		
							Nitro-chalk ...	350		28.41		5.20		
December .	17	Umfolozi ...	Heavy alluvial .	P.O.J.2725	12	4th ratoon .	Am. sulph. ...	400	32.54	35.79	5.30	5.64	Each result mean of 24 replications.	
							Am. sulph. ...	800		36.84		5.84		

Summary of Responses to Nitrogen in Fertilizer Experiments over the Ten Years 1933—1942 (continued).

Date harvested.	No.	Locality.	Type of soil.	Cane variety.	Age of crop in months.	Plant or ratoon.	Kind of fertilizer.	Dose (lbs. per acre).	Cane yields per acre.		Sucrose yields per acre.		Remarks.
									Controls.	Fertilized plots.	Controls.	Fertilized plots.	
1939.													
July ...	18	E. (A.2) ...	Heavy loam ...	Co.281 ...	20	4th ratoon	Am. sulph. ...	240	36.16	40.27	5.49	6.12	Profit of £2/7/11 per acre.
September .	19	Chakas Kraal...	Coarse sand ...	Co.281 and 301	19	Plant... ..	Am. sulph. ...	400 (TD)	39.30	46.95	6.50	7.72	Maximum profit £8/11/11 per acre from 800lbs.
							Am. sulph. ...	400 (½ TD)		44.40		7.36	
							Am. sulph. ...	800 (TD)		52.65		8.57	
							Am. sulph. ...	800 (½ TD)		52.93		8.76	
							Am. sulph. ...	1200		52.58		8.62	
September .	20	Braemar ...	Fine loam... ..	Co.281 and 301	22	Plant... ..	Am. sulph. ...	120	38.43	41.29	6.26	6.71	1st line no potash, 2nd line with potash, N top-dressed. 3rd line N applied at time of planting.
							Am. sulph. ...	120	38.19	42.08	6.24	6.85	
							Am. sulph. ...	120		38.97		6.38	
October ...	21	Illovo ...	Heavy alluvial..	Co.290 and 301	21	Plant... ..	Am. sulph. ...	200	73.26	71.07	11.06	10.83	400lbs. most profitable, £5/4/1 per acre.
							Am. sulph. ...	400 (TD)		78.54		11.76	
							Am. sulph. ...	400 (¾ TD)		77.94		11.81	
							Am. sulph. ...	800		79.25		12.11	
October ...	22	Verulam ...	Heavy loam ...	Co.281 and 301	22	Plant... ..	Am. sulph. ...	200	50.14	52.69	8.61	9.03	As before, 400lbs. most profitable, £10/12/4 per acre.
							Am. sulph. ...	400 (TD)		54.77		9.22	
							Am. sulph. ...	400 (¾ TD)		52.24		8.83	
							Am. sulph. ...	800		52.13		8.89	
October ...	23	Upper Tongaat.	Loam (T.M.S.) .	Co.290 and 301	21	Plant... ..	Am. sulph. ...	200	45.98	48.64	7.22	7.54	400lbs. again most profitable, £3/3/10 per acre.
							Am. sulph. ...	400 (TD)		51.55		7.73	
							Am. sulph. ...	400 (¾ TD)		47.63		7.38	
							Am. sulph. ...	800		48.83		7.49	
December .	24	Umfoloji ...	Heavy alluvial .	P.O. J.2725, Co.281, 290 and 301	20	Plant... ..	Am. sulph. ...	300	67.90	68.32	9.06	9.07	Each result mean of 32 tests.
1940.													
June... ..	25	E. (E.1) ...	Heavy loam ...	Co.281 ...	21	1st ratoon .	Am. sulph. ...	150	33.95	34.94	4.95	5.06	1st line without, 2nd line with 80lbs. KCl per acre.
							Am. sulph. ...	150	34.51	32.81	5.10	4.82	
June... ..	26	E. (E.1) ...	Heavy loam ...	Co.290 ...	21	1st ratoon .	Am. sulph. ...	300	38.93	47.49	5.87	7.06	Am. sulph. most profitable—£3/12/2 per acre.
							Sod. nit....	400		46.54		6.71	
							Whale meal ...	600		45.72		6.82	
							Nitro-chalk ...	350		46.52		6.97	
July... ..	27	E. (E.2) ...	Clay loam... ..	Co.281 and 301	20	Plant... ..	Am. sulph. ...	250	49.38	52.90	7.62	8.15	Complete Wagner experiment.
							Am. sulph. ...	500		53.50		8.21	
August ...	28	Compensation...	Clay loam... ..	Co.281 and 301	19	Plant... ..	Am. sulph. ...	250	44.16	49.55	6.96	7.80	Nett gain per acre £2/19/8.
September .	29	Umfoloji...	Heavy alluvial .	P.O. J.2725	20	3rd and 5th ratoons	Am. sulph. ...	400	56.86	65.00	7.73	8.80	400lbs. showed a profit of £1/15/7 per acre.
							Am. sulph. ...	800		67.71		9.12	
November..	30	Illovo ...	Heavy alluvial .	Co.290 and 301	13	1st ratoon .	Am. sulph. ...	200	23.68	28.75	3.26	3.96	Only 200lbs. showed profit at present prices—£2/5/- per acre.
							Am. sulph. ...	400		28.18		3.87	
							Am. sulph. ...	800		30.44		4.20	
December .	31	Umfoloji ...	Heavy alluvial .	4 varieties .	12	1st ratoon .	Am. sulph. ...	600	40.97	41.66	5.70	5.73	Each result mean of 32 tests.
December .	32	Braemar ...	Fine loam... ..	Co.281 and 301	17	1st ratoon .	Am. sulph. ...	120	23.79	26.93	3.55	4.00	240lbs. most profitable, £3/19/3 per acre.
							Am. sulph. ...	120	23.20	27.18	3.46	4.03	
							Am. sulph. ...	240		30.26		4.49	
July... ..	33	E. (D.2) ...	Heavy loam ...	Co.281 and 301	20	1st ratoon .	Am. sulph. ...	200	35.01	35.64	5.11	5.22	No profit at present prices.
							Am. sulph. ...	400		39.47		5.69	
							Am. sulph. ...	600		39.21		5.49	
							Am. sulph. ...	800		43.71		6.12	
							Am. sulph. ...	1000		37.30		5.25	
July... ..	34	Chakas Kraal...	Coarse sand ...	Co.281 and 301	22	1st ratoon .	Am. sulph. ...	200	28.47	33.44	4.52	5.34	800lbs. again slightly best yield, but 600lbs. most profitable—£4/15/9 per acre.
							Am. sulph. ...	400		34.43		5.47	
							Am. sulph. ...	600		39.29		6.22	
							Am. sulph. ...	800		39.19		6.24	
							Am. sulph. ...	1000		37.48		5.78	

Summary of Responses to Nitrogen in Fertilizer Experiments over the Ten Years 1933—1942 (continued).

Date harvested.	No.	Locality.	Type of soil.	Cane variety.	Age of crop in months.	Plant or ratoon.	Kind of fertilizer.	Dose (lbs. per acre).	Cane yields per acre.		Sucrose yields per acre.		Remarks.
									Controls.	Fertilized plots.	Controls.	Fertilized plots.	
1941.													
August	35	E. (G.4)	Clay loam...	Co.281 and 331	21	Plant...	Am. sulph. ... 200	49.00	7.58	No controls, no significant differences between different quantities.			
							Am. sulph. ... 400	49.19	7.65				
							Am. sulph. ... 600	49.97	7.67				
August	36	Verulam	Heavy loam	Co.281 and 301	22	1st ratoon	Am. sulph. ... 200	35.91	38.00	5.69	6.08	No profit at present prices.	
							Am. sulph. ... 400	39.23	6.16				
							Am. sulph. ... 800	40.21	6.14				
August	37	Upper Tongaat	Loam (T.M.S.)	Co.290 and 301	23	1st ratoon	Am. sulph. ... 200	29.51	35.94	4.60	5.63	800lbs. most profitable, £7/1/5 per acre; 200lbs. next best, £6/3/6 per acre.	
							Am. sulph. ... 400	33.88	5.27				
							Am. sulph. ... 800	43.04	6.74				
December	38	Illovo	Heavy alluvial	Co.290 and 301	13	2nd ratoon	Am. sulph. ... 200	32.96	38.01	4.39	5.06	200lbs. most profitable, £2/2/9 per acre; 400lbs., £1/4/2; 800lbs., a loss of 16/5.	
							Am. sulph. ... 400	38.94	5.18				
							Am. sulph. ... 800	40.54	5.39				
December	39	Umfoloji	Heavy alluvial	P.O.J.2725	15	6th ratoon	Am. sulph. ... 400	37.52	43.62	6.43	7.46	400lbs. most profitable, £2/15/7 per acre.	
							Am. sulph. ... 800	46.32	7.76				
1942.													
July	40	E. (E.1)	Heavy loam	Co.290	25	2nd ratoon	Am. sulph. ... 200	39.21	42.34	5.60	6.12	1st 2 lines without, 2nd 2 lines with, super 350lbs. per acre.	
							Am. sulph. ... 400	45.74	6.72				
							Am. sulph. ... 200	36.02	42.58	5.12	6.18	400lbs. without super most profitable, £3/8/- per acre.	
July	41	Umzumbi	Light sand	Co.290 and 301	24	1st ratoon	Am. sulph. ... 250	15.52	19.71	2.11	2.68	250lbs. most profitable, £1/5/11 per acre. 500lbs. £1/1/- gain, 750lbs. £1/8/3 loss.	
							Am. sulph. ... 500	22.14	3.02				
							Am. sulph. ... 750	22.04	3.00				
August	42	E. (E.2)	Clay loam	Co.281 and 301	24	1st ratoon	Am. sulph. ... 200	42.70	45.56	6.61	6.90	Complete Wagner experiment.	
							Am. sulph. ... 400	47.35	7.23				
August	43	Ifafa	Granitic loam	Co.281 and 301	24	1st ratoon	Am. sulph. ... 200	29.35	28.64	4.34	4.23	Two equal applications.	
August	44	Compensation	Heavy loam	Co.281 and 301	23	1st ratoon	Am. sulph. ... 250	35.95	39.54	5.65	6.22	£1/5/11 per acre profit.	
August	45	Braemar	Fine loam	Co.281 and 301	19	2nd ratoon	Am. sulph. ... 120	33.38	39.42	5.45	6.44	1st line without, 2nd and 3rd with potash, 60lbs. KCl per acre. 240lbs. per acre of am. sulph. most profitable—£9/16/4 per acre.	
							Am. sulph. ... 120	33.15	40.22	5.42	6.56		
							Am. sulph. ... 240	43.99	7.18				
November	46	Illovo	Heavy alluvial	Co.290 and 301	12	3rd ratoon	Am. sulph. ... 200	38.14	45.32	4.51	5.36	200lbs. per acre most profitable, £3/11/4 per acre, 400lbs. £2/6/2, 600lbs. nil.	
							Am. sulph. ... 400	46.14	5.46				
							Am. sulph. ... 600	48.09	5.69				
November	47	Eshowe	Sandy loam	Co.290 and 301	13	2nd ratoon	Am. sulph. ... 200	27.28	29.94	3.45	3.79	Slight gain from 200lbs. (5/9 per acre), loss from 400lbs.	
							Am. sulph. ... 400	30.04	3.80				
December	48	Umfoloji	Heavy alluvial	P.O.J.2725	12	7th ratoon	Am. sulph. ... 400	29.89	35.86	4.48	5.14	No profit at present prices.	
							Am. sulph. ... 800	38.74	5.51				
December	49	Umfoloji	Heavy alluvial	P.O.J.2725	22	Plant	Am. sulph. ... 400	76.01	75.53	10.74	10.84		
							Govt. guano ... 800	74.98	10.54				
December	50	E. (P.2)	Stony clay loam	Co.290	—	2nd to 6th ratoons	Am. sulph. ... 320	24.65	29.01	3.74	4.42	Mean of results from five successive ratoon crops.	
							Sod. nit. ... 420	29.79	4.52				
							Nitro-chalk ... 320	29.86	4.56				
							Whale meal ... 650	29.39	4.45				

SUMMARY OF RESPONSES TO SUPERPHOSPHATE IN FERTILIZER EXPERIMENTS OVER THE TEN YEARS 1933—1942.

Experiments done at the central station, Mount Edgecombe, are denoted by E., with the number of the field in brackets.

Quantities of superphosphate shown in brackets denote applications to the previous crop, so that any responses indicated are residual effects.

Year.	No.	Locality.	Type of soil.	Cane variety.	Plant or ratoon.	Lbs. of super per acre.	Cane yields per acre.		Sucrose yields per acre.		Remarks.
							Controls.	Fertilized plots.	Controls.	Fertilized plots.	
1933	1	E. (A.1)...	Stiff clay	Co.290	Plant...	600	27.23	27.71	4.109	4.118	
	2	Empangeni ...	Red loam	Uba	2nd ratoon	(500)	29.48	35.44	4.451	5.210	(Average three cuttings.)
									3.632	5.449	
									4.773	3.884	
1934	3	E. (E.1)...	Heavy loam...	P.O.J.2725	Plant...	800	26.37	21.60	4.735	3.132	200lbs. each of superphosphate and raw rock phosphate applied to plant cane crop only.
	4	Empangeni ...	Red loam	Uba	2nd ratoon	(400)	17.76	20.82	2.735	3.132	
					Plant...	400	—	—	5.89	7.04	
					1st ratoon	(400)	—	—	3.19	3.70	
								11.81	13.87	Total three cuttings.	
1934	5	E. (D.2)...	Heavy loam...	Uba	3rd ratoon	(500)	22.70	28.83	3.05	3.93	
									2.94	3.78	(Average four cuttings.)
	6	Chakas Kraal ...	Coarse sand...	Uba	Plant...	600	28.25	29.12	3.76	3.89	
	7	Chakas Kraal ...	Coarse sand...	Uba	Plant...	600	32.49	35.39	4.05	4.31	
	8	Umzinto ...	Gravelly granite...	Uba	2nd ratoon	(500)	33.84	41.58	3.91	4.78	
					Plant...	—	33.31	42.99	—	—	
					1st ratoon	—	45.24	51.86	6.57	7.40	
	9	Felixton ...	Alluvial silt...	P.O.J.2725	Plant...	500	47.01	50.57	8.21	8.79	
	10	Felixton ...	Alluvial silt...	—	Plant...	750	60.91	66.46	10.28	10.93	
	11	Empangeni ...	Red loam	Uba	1st ratoon	750	24.13	31.40	2.83	3.55	Residual.
	12	Umhlali...	Sandy	Co.281	Plant...	640	19.09	25.35	2.89	3.93	
	13	Empangeni ...	Red loam	Uba	2nd ratoon	(500)	22.45	25.04	2.79	2.94	All residual.
							49.08	59.02	6.64	7.73	
						18.51	21.52	2.24	2.58		
1935	14	E. (E.1)...	Heavy loam...	P.O.J.2725	1st ratoon	(800)	30.95	26.51	4.82	4.10	
	15	Umhlali...	Sandy	Co.281	1st ratoon	(640)	19.37	24.12	2.77	3.44	Residual.
	16	Umfolozi ...	Heavy alluvial	P.O.J.2725	Plant and 1st ratoon	600	153.01	155.39	20.09	20.75	Both crops combined.
	17	Empangeni ...	Red loam	Uba	3rd ratoon	(400)	26.03	28.57	3.78	4.11	£10/9/2 per acre profit over four crops.
1936	18	Chakas Kraal ...	Coarse sand...	Uba	Plant...	300 to 1200	24.47	27.98	3.96	4.45	600 best of 300—1200.
	19	E. (D.2)...	Heavy loam...	Uba	4th ratoon	(500)	21.39	26.84	2.80	3.46	
							132.91	167.12	18.37	23.18	Total of five crops.
	20	Darnall...	Gravelly loam	Co.281	Plant...	720	26.91	35.14	4.42	5.96	720lbs. most profitable.
						240		31.52		5.31	
						480		33.11		5.59	
						960		34.13		5.77	
						480	27.27	26.81	4.40	4.41	
						320	19.54	17.18	3.23	2.80	
	21	E. (A.3)...	Stiff clay	Co.281	Plant...	480	17.03	18.60	2.78	3.04	
	1937	22	E. (P.3)...	Heavy loam	Co.290	3rd ratoon	480	17.03	18.60	2.78	3.04
23		Umhlali...	Sandy	Co.281	3rd ratoon	480	17.03	18.60	2.78	3.04	
1938	24	E. (A.1)...	Stiff clay	Co.290	3rd ratoon	300	23.60	23.63	3.22	3.30	
	25	E. (E.1)...	Heavy loam	Co.281	Plant	700	48.79	48.74	7.66	7.54	
1939	26	E. (E.1)...	Heavy loam	Co.290	Plant	700	48.90	51.06	7.44	7.82	
	27	Umzinto ...	Sandy loam...	Co.281	Plant	600	22.91	26.62	4.18	4.80	
	28	E. (P.3)...	Heavy loam	Co.290	4th ratoon	320	24.71	22.53	3.85	3.52	
1939	29	E. (D.1)...	Heavy loam	Four varieties...	Plant	300	41.27	43.34	6.30	6.75	Profit per acre £1/17/9.
						600		47.51		7.38	Profit per acre £4/15/1.
						900		48.33		7.47	Profit per acre £4/13/10.
						1200		45.91		7.22	Profit per acre £2/15/9.
						1500		50.62		7.80	Profit per acre £5/7/7.
	30	Braemar ...	Dwyka loam	Co.281 and 290	Plant	600	38.17	38.43	6.18	6.26	
	31	Illovo ...	Heavy alluvial	Co.290 and 301	Plant	800	68.09	73.26	10.25	11.06	Profit per acre £2/18/8.
	32	Verulam ...	Heavy loam	Co.281 and 301	Plant...	800	39.30	50.14	6.66	8.61	Profit per acre £9/2/3.
	33	Upper Tongaat ...	Sandy loam...	Co.290 and 301	Plant...	800	42.84	45.98	6.54	7.22	Profit per acre £2/4/7.

Summary of Responses to Superphosphate in Fertilizer Experiments over the Ten Years 1933—1942 (continued).

Year.	No.	Locality.	Type of soil.	Cane variety.	Plant or ratoon.	Lbs. of super per acre.	Cane yields per acre.		Sucrose yields per acre.		Remarks.
							Controls.	Fertilized plots.	Controls.	Fertilized plots.	
1940	34	E. (E.1)...	Heavy loam	Co.290	1st ratoon	700	39.14	38.93	5.70	5.87	
	35	E. (E.2)...	Heavy loam	Co.290 and 301	Plant...	500	52.63	51.23	8.08	7.91	
	36	Umzumbi	Light sand	Co.290 and 301	Plant...	500	16.30	20.30	2.29	2.85	
	37	Ifafa	Granitic loam	Co.281 and 301	Plant...	500	43.10	46.70	6.54	7.09	
	38	Hibberdene	Sandy loam...	Co.281 and 301	Plant...	500	30.13	40.34	4.60	6.16	
	39	Verulam	Heavy loam...	Co.281 and 301	Plant...	800	39.30	50.14	6.66	8.61	
	40	Eshowe...	Sandy loam...	Co.290 and 301	Plant...	500	59.58	60.50	8.94	9.07	
	41	Compensation	Sandy loam...	Co.281 and 301	Plant...	500	45.04	48.68	7.09	7.67	Profit £2/1/11 per acre.
	42	Gingindhlovu	Heavy loam...	Co.281 and 301	Plant...	500	51.91	53.22	8.05	8.18	Not significant.
	43	Illovo	Heavy alluvial	Co.290 and 301	1st ratoon	400	22.64	23.68	3.14	3.26	
1941	44	Braemar	Dwyka loam	Co.281 and 301	1st ratoon	600	20.81	23.79	3.10	3.55	
	45	Kulu	Light sand	Co.290	2nd ratoon	400	27.95 31.27	28.99 33.44	4.22 4.76	4.37 5.07	Loss per acre 4/3. Profit per acre 19/4. Mean of three crops.
1942	46	E. (D.1)	Heavy loam	Four varieties	1st ratoon	600	27.75	29.54	4.06	4.34	Not significant.
	47	Verulam	Heavy loam	Co.281 and 301	1st ratoon	400	31.35	35.91	5.01	5.69	Profit per acre £2/2/9.
	48	Upper Tongaat	Sandy loam...	Co.290 and 301	1st ratoon	400	25.93	29.57	4.04	4.60	Profit per acre £2/0/6.
	49	Illovo	Heavy alluvial	Co.290 and 301	2nd ratoon	400	34.11	32.96	4.54	4.39	
	50	E. (E.1)...	Heavy loam	Co.290	2nd ratoon	350	39.21	36.02	5.60	5.12	
1942	51	Umzumbi	Light sand	Co.290 and 301	1st ratoon	200	19.23	20.48	2.62	2.79	Not significant or profitable.
	52	E. (E.2)...	Heavy loam	Co.281 and 301	1st ratoon	500	43.85	46.55	6.70	7.13	
	53	Ifafa	Granitic loam	Co.281 and 301	1st ratoon	200	29.80	34.26	4.38	5.03	Profit per acre £1/15/1.
	54	Compensation	Sandy loam	Co.281 and 301	1st ratoon	200	37.59	37.90	5.91	5.96	
	55	Braemar	Dwyka loam	Co.281 and 301	2nd ratoon	600	30.72	33.38	5.02	5.45	Profit per acre £1/11/0.
	56	E. (P.2)...	Heavy loam	Co.290	7th ratoon	320	26.81	24.65	4.07	3.74	Mean of five ratoon crops.
	57	Illovo	Heavy alluvial	Co.290 and 301	3rd ratoon	400	40.42	38.14	4.78	4.51	
	58	Eshowe...	Sandy loam	Co.290 and 301	2nd ratoon	200	25.77	30.32	3.26	3.84	Profit per acre £3/6/6.
	59	Umfolozi	Heavy alluvial	P.O.J.2725	Plant...	(800)	75.73	79.60	10.84	11.13	

The recent results from the nitrogen experiments confirm the conclusions set forth by the writer last year, namely, that a response to nitrogenous fertilizer may be expected from practically all light soils, and from heavy soils that have not been subjected to severe drought soon after the application of the fertilizer. No application of nitrogenous fertilizer is usually necessary to the plant cane crop if the soil was green manured with a leguminous crop shortly before planting. Inorganic fertilizer such as ammonium sulphate should be applied to plant cane, if not green manured, as a top-dressing after the cane has become established, although in light soils there is something to be said for a small application at time of planting, which promotes early root development.

Inorganic nitrogenous fertilizers are at present almost unprocurable, but results show that even at present prices of about £1 per unit of nitrogen, it pays to use this kind of fertilizer if possible, provided that the increased yield therefrom is not less than 0.6 tons of sucrose, say 4½ tons of cane per acre from an application of 80 lbs. of nitrogen per acre, equivalent to 400 lbs. per acre of ammonium sulphate or 500 lbs. of sodium nitrate. These quantities in most cases promote the greatest increase in yield, but under present circumstances somewhat smaller applications may be more profitable.

It can be seen that, on the whole, the application of nitrogenous fertilizer has been profitable, both at the Experiment Station and at the co-operative field stations, though in the case of phosphatic fertilizer there has not been nearly so high a proportion of favourable responses at the Experiment Station as at co-operative stations, for reasons already suggested.

It is evident that in this country the sucrose content of the cane in the great majority of cases is not appreciably affected by the application of fertilizer. In other countries having less favourable conditions than ours for maturing the cane, it is frequently found that nitrogenous fertilizer diminishes the sucrose content of the cane by delaying maturity. The same thing is noticeable here, in certain cases where the cane is harvested after only one season's growth after relatively heavy applications of nitrogenous fertilizer.

It may be noted that the average yields of ratoon crops and sucrose concentrations are much lower than of plant cane crops in our returns. This is not necessarily due to any considerable diminution in rate of growth of ratoons, but is due in part to many ratoon experiments being cut after only one season's growth instead of the full two seasons usually allotted to the plant cane crop.

In the case of the phosphatic fertilizer experiment ratoon results, it should be clearly understood that the increased yields from the phosphate treated plots in many cases is due to residual effect only of the fertilizer given to the plant cane crop, no further phosphatic fertilizer having been applied. A remarkable case of residual effect may be seen in phosphate experiment No. 21, where significant residual results from superphosphate and other phosphatic fertilizers were recorded up to the fourth ratoon crop, no phosphatic fertilizer having been added after the original application at time of planting. It is evident that in many cases additional applications of superphosphate to

ratoon crops have not proved profitable after adequate quantities had been supplied at time of planting, but in other cases they have done so. More experimental work in different representative types of soil is required to clear up this problem.

In those few experiments where varying quantities of superphosphate have been applied at time of planting, quantities of 600 lbs. and upwards per acre have proved the most profitable, even where similar quantities have been regularly applied in preceding years.

At present prices for superphosphate approximately 5/- per unit of P_2O_5 , it will pay to use 600 lbs. of the 16 per cent. superphosphate now available in limited quantities if the resulting increase is not less than 0.2 tons of sucrose or, say, 1.5 tons of cane per acre, or, of course, other quantities of superphosphate with proportional results.

Although several further potassic fertilizer experiments have been harvested there is nothing to add to the conclusion stated last year, that there are very few cases where any response is indicated, and none where any highly important differences were found. We are fortunate that our soils are naturally so well supplied with this important element.

At pre-war prices for fertilizer it was almost invariably found that the quantity of fertilizer promoting the greatest yield in terms of sucrose per acre was the most profitable quantity to apply. Now, that frequently does not occur, fertilizer applications somewhat less than those promoting the maximum yield of sugar being very apt to prove the more profitable at present prices for fertilizers and sugar, if indeed there is any indicated profit from the fertilizer at all.

Fertilizer prices have nearly doubled in unit price, while the value for sucrose paid to the grower for the 1942-43 season is slightly under 22 per cent. more than that paid in the last pre-war season of 1938-39.

It is recognised that this paper deals only with concentrated sources of the principal fertilizer elements, and that, in this country at all events, there are other important aspects of soil fertility. There is no getting away from the fact, however, that the supply of nitrogen, phosphorus and potassium is of primary importance to our sugarcane crop, and must always receive most careful attention.

I wish to express once more my keen appreciation of the facilities and help we have received at the Experiment Station over many years from the owners and managers of estates where our co-operative experiments have been located; also of the enthusiastic team-work of the various departments of the Experiment Station staff which have contributed to make a comprehensive record of this kind possible.

SUMMARY AND CONCLUSIONS.

Fertilizer experiments over a period of 10 years are summarized and average results compiled. They show that, with certain exceptions, it has been profitable to apply both phosphatic and nitrogenous fertilizer to sugarcane over a wide range of soil and weather conditions in this country.

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Mount Edgecombe.
March, 1943.