Optimum Nitrogen Requirements of Sugarcane in the Anakapalle Tract

By

M. LAKSHMIKANTHAM, B. Sc., (Agri.),
(Assistant in Agronomy).

and

A. SANKARAN, B. Sc., (Agri.),
(Assistant to Government Agricultural Chemist,
Sugarcane Research Station, Anakapalle.)

I. Introduction. One of the main objects of sugarcane research at Anakapalle, is to draw up a manurial schedule for the tract in which the research station is situated. Earlier experiments on the problem on this station, indicated that nitrogenous manuring was a difinite necessity for sugarcane, while in the case of phosphatic and potassic manuring distinct advantages have not been secured. Attention was therefore concentrated on nitrogen, and to this end, an experiment with six levels of nitrogen with and with out a basal dressing of farmyard manure was conducted over a period of three years (1944–47) to study the influence of the different manurial doses on the yield, juice quality and economics of manuring, in respect of Co 419, the standard cane variety of the tract. The results of the experiment are presented in this paper.

II. Material and Methods. The experiment was laid out with six treatments, consisting of six levels of nitrogen (a) 0 lb. (b) 50 lb. (c) 100 lb. (d) 150 lb. and (f) 250 lb. of nitrogen per acre supplied in the form of groundnut cake, independently and in combination with a basal dressing of ten tons of farmyard manure per acre. The layout was in a split-plot design with four replications where farmyard manure and no farmyard manure constituted the two major treatments, while the six levels of nitrogen formed the minor treatments. The farmyard manure was applied fifteen days prior to planting and covered by working with ploughs. Analysis of this manure during 1945–46 and 1946–47 indicated that application at the rate of ten tons per acre was equivalent to 72·8 lb. and 86·5 lb. of nitrogen per acre in the two years respectively. The minor treatments were applied to the crop in two equal halves, one at the time of planting in March and the remainder at the time of trenching and earthing up in June. During the year 1944–'45 the experiment was laid out in wetlands but in the two subsequent years had to be accommodated on garden land. Germination, growth, arrowing, quality of juice and yields of cane and jaggery were the different items of study during the three years of experiment. The results obtained for each of three years separately are presented and discussed below.

III. Results: *(i) Germination.* In all the three years of the experiment the crop was planted by the middle of March with seed material

taken from a crop aged about seven months, as is usual on the station. The seed rate adopted was 15,000 three-budded sets per acre. Starting from the fifteenth day after planting, the extent of germination of the planted buds in the entire field was noted four times at weekly intervals. As such the influence of the major treatments and half the quantity of each of the different levels of nitrogen was reflected in the extent of germination in the respective treatments. The final germination percentages recorded five weeks after planting, are presented in Table I.

TABLE I.

Effect of nitrogen levels on the percentage of germination

Treatments		Years 1944—45	1945—46	1946—47	Average
Minor Treatments.					
0 lb. N	F. Y. M.	60	64	73	65·7
	No F. Y. M.	59	65	73	65·7
	Average	59·5	64·5	73·0	65·7
50 lb. N	F. Y. M.	62	64	74·0	66·7
	No F. Y. M.	63	65	74	67·3
	Average	62·5	64·5	74	67·0
100 lb. N	F. Y. M.	61	67	76	68·0
	No F. Y. M.	64	70	76	70 0
	Average	62·5	68·5	76·0	69.0
150 lb. N	F. Y. M.	62	65	77	68 0
	No F. Y. M.	64	70	74	69·3
	Average	63·0	67·5	75·5	68·7
200 lb. N	F. M. M.	61	67	77	68·3
	No F. Y. M.	64	71	75	70·0
	Average	62·5	69·0	76·0	69·2
250 lb. N	F. Y. M.	64	70	73	69·0
	No F. Y. M.	63	69	75	69·0
	Average	63·5	69·5	74·0	69·0
S. E. of treatment Mean %		1·63	2·06	1·70	
C. D (P = 0·05) %		4·71	5·94	4·92	
Major Treatments.					
	F. Y. M.	62	66	72	66·7
	No F. Y. M.	61	68	71	66·7
S. E. of treatment mean %		1·52	0·80	0·90	
C. D. (P= 0·05) %		6·84	3·60	5·23	

Treatmental differences in minor as well as major treatments were not significant by 'Z' test in any of the three years.

The differences in germination percentage between the various treatments (major and minor) were found to be statistically not significant. Thus the findings of Rege and Sunnabhadti (1944) that a minimum of 15 lb. of nitrogen (when applied as sulphate of ammonia) per acre was necessary to ensure optimum germination was not borne out here. There was no doubt a slight improvement in germination due to manuring, but it was not statistically significant. From the stand point of

total germination, application of 50 lb. of nitrogen as groundnut cake at planting i. e., (100 lb. nitrogen treatment) was as good as 125 lb. nitrogen treatment i. e., (250 lb. nitrogen treatment).

(ii) *Growth.* Ten canes were selected at random from each sub. plot (40 canes from each treatment) and their height (from the base to the last visible leaf joint) measured from July to January every year. The average maximum and initial heights recorded in each year are furnished in Table II.

TABLE II.

Average crop height in inches Co 419.

Nitrogen level lb. per acre.	Treatment.	1944—45		1945—46		1946—47.	
		July '44	Jan '45	July '45	Jan '46	July '46	Jan '47
Minor :—							
0	F. Y. M.	48	123	54	134	44	140
	No F. Y. M.	52	129	53	136	44	134
	Average	50·0	126·0	53·5	135·0	44·0	137·0
50	F. Y. M.	57	146	60	144	49	142
	No F. Y. M.	53	138	55	142	45	140
	Average	55	142·0	57·5	143·0	47·0	141·0
100	F. Y. M.	56	151	63	150	50	147
	No F. Y. M.	55	150	61	151	50	146
	Average	55·5	150·5	62·0	150·5	50·0	146·5
150	F. Y. M.	58	147	63	146	49	148
	No F. Y. M.	54	147	61	149	51	140
	Average	56·0	147·0	62·0	147·5	50·0	144·0
200	F. Y. M.	56	151	65	149	55	149
	No F. Y. M.	59	147	65	152	50	146
	Average	57·5	149·0	65·0	150·5	52·5	147·5
250	F. Y. M.	57	151	66	149	49	146
	No F. Y. M.	57	146	64	147	44	142
	Average	57·0	148·5	65	148·0	46·5	144·0
S. E. of treatment Mean %		1·39	2·33	1·73	1·94	2·60	2·57
Critical Difference (P = 0 ·05) %		4·01	6·73	5·00	5·60	7·51	7·42
Major :—							
F. Y. M. Series		55	145	74	145	48	155
No F. Y. M. Series		55	143	72	146	47	141
S. E. of treatment Mean %		0·854	1·40	1·08	0·74	1·38	0·33
Critical Difference (P = 0·05) %		3·840	6·30	4·86	3·33	6·21	1·48

Statistical analysis of these data disclosed that differences due to minor treatments alone were significant during the first two years both with regard to initial and maximum heights. In the final year, however, only the differences between the major treatments were significant; and that too, with regard to maximum heights alone. There was an indication that farmyard manure had a beneficial effect on crop height, though it was not very marked in 1946–'47, when conditions were abnormal in that the rainfall from planting till the end of the grand period of vegetative growth was very low. It was only 22·09 inches, as against nearly twice this quantity received in the previous two years. The crop was kept alive by lift irrigation and farmyard manure plots probably retained more moisture and consequently promoted better growth than

in the "no farmyard manure" plots. Doses of nitrogen beyond 100 lb. per acre did not improve the average crop height. Fifty pounds of nitrogen was distinctly inferior to 100 lb. nitrogen treatment. There was no interaction between the major and minor treatments in any year.

Thus the general indication of these results was that manuring gave initial advantage in growth, prior to July or setting in of the South-West Monsoon. Afterwards, weather conditions rather than manuring must have influenced the growth of plants as was evidenced by the nonsignificance of the difference between the rates of growth recorded by major and minor treatments in two out of three seasons. These results agree with those recorded on this station and the Sugarcane Research Station, Gudiyatham, in the same year reported by Vasudeva Rao (1940). Carnelison A. H. and Cooper H. F. (1940) also reported, though in another context, that growth rate did not vary exclusively with variation in nitrogen treatments alone. Under their conditions temperature was the dominant factor determining the growth whatever be the amount of nitrogen supplied.

(iii) *Arrowing.* Co 419 does not flower freely at this station even in wet lands. On garden lands it does not flower at all. In this experiment there was arrowing in only one season (1944–1945) and the results are included in Table III below. Arrowing was suppressed in the higher nitrogen treatments (100 lb. nitrogen and over) and even in the lower levels the extent of arrowing decreased with an increase in the nitrogen level.

TABLE III.

Extent of arrowing

Treatments	Percentage of arrowed to total number of stalks in the different treatments.
Major.	
No farmyard manure series	6·13
Farmyard manure series	0·17
Minor.	
0 Lb. of Nitrogen	5·75
50 lb. of Nitrogen	0·56

There was no arrowing at all in the higher nitrogen levels

(iv) *Incidence of stem-borer.* To study the incidence of borer attack in relation to the different levels of nitrogenous manuring, 50 canes from each sub-plot and 200 canes in all for each treatment were examined. The percentage of canes and internodes affected by borers were determined in all the three years and the results are given in Table IV. From the data it is seen that the differences between the several treatments (major and minor) were statistically nonsignificant. Maximum borer attack was noted in the highest nitrogen treatment in two out of three years and this observation is in agreement with that reported by Dutt (1946).

TABLE IV.

Percentage of canes affected by borer.

S. No.	Treatment.	1944—45 Canes.	1944—45 Inter-nodes	1945—46 Canes.	1945—46 Inter-nodes.	1946—47 Canes.	1946—47 Inter-nodes.	Average of 3 years. Canes	Average of 3 years. Inter-nodes.
Minor									
1.	0 lb. N.	42	5·43	86	8·10	36	1·98	56	5·17
2.	50 lb. N.	44	4·16	86	8·80	34	1·68	55	4·87
3.	100 lb. N.	46	4·32	80	7·82	36	2·11	54	4·75
4.	150 lb. N.	39	4·74	80	7·72	36	1·94	52	4·80
5.	200 lb. N.	36	5·59	72	5·03	40	2·03	49	4·22
6.	250 lb. N.	40	4·83	91	9·61	44	2·77	58	5·74
S. E. of treatment Mean (%)			11·74	...	...	...	16·08	...	...
C. D. (P = 0·05) %			33·90	...	...	...	46·30	...	...
Major									
F. Y. M Series.		...	4·60	...	...	...	2·14	...	...
No F. Y. M. Series		...	5·11	...	...	...	1·96	...	...
S. E. of treatment Mean %.		...	14·00	...	...	...	...	...	2·30
C. D. (P = 0·05) %		...	63·03	...	...	...	...	...	10·37

N.B.—Treatment differences were not significant by 'Z' test.

(v) *Juice quality.* Samples of cane juice from each of the treatments were analysed once a month from January till harvest each year. The results of chemical analysis recorded in March (the usual month of harvest of Co 419) for each of the three years separately are presented in Table V.

On an examination of the data presented in Table V, it is seen that the effect of the different treatments (major and minor) on juice quality was not consistent. In a majority of cases "no farmyard manure" series registered more brix, sucrose, purity and glucose values than the "farmyard manure" treatment. In the first year, when there was no lodging of the crop, the average values of sucrose for the different minor treatments progressively decreased with an increase in nitrogen level. In the next two years, the trend of the results was inconsistent, for the reason that there was extensive lodging of the crop and it affected the quality of the juice to varying degrees. However, in all the three seasons, 200 lb. and 250 lb. of nitrogen tended to record lower sucrose and purity values but higher glucose contents. The results are in general conformity with those recorded at the Agricultural Research Station, Palur (1941) of this Province and in Bombay as reported by Rege and Sunnabhadti (1941). That increased nitrogen fertilisation resulted in increased glucose contents in cane juice was also reported by Borden (1945) from Hawaii.

TABLE V.

Results of chemical analysis of Juice, Co 419.

Nitrogen level lb.	Treatment.	Corrected Brix. 44—45	45—46	46—47	Av.	Sucrose % 44—45	45—46	46—47	Av.	Purity % 44—45	45—46	46—47	Av.	Glucose % 44—45	45—46	46—47	Av.

TABLE IV.

Results of chemical analysis of Juice, Co 419.

Nitrogen level lb.	Treatment.	Corrected Brix.				Sucrose %				Glucose %				Purity %			
		44—45	45—46	46—47	Av.	44—45	45—46	46—47	Av.	44—45	45—46	46—47	Av.	44—45	45—46	46—47	Av.
Minor.																	
0 lb.	F. Y. M.	21·01	18·54	19·34	19·63	18·98	15·95	16 93	17·29	0·57	0·93	1·13	0·88	90·36	86 04	87·54	87·98
	No F. Y. M.	21·71	19·58	18·36	19·88	19·40	17·46	15·66	17·51	0·47	0·67	1·36	0·83	89 35	89 17	85·29	87 94
	Average	21·36	19.06	18·85	19·76	19·19	16·71	16·30	17·40	0·52	0·80	1·25	0·86	89·86	87·61	86·42	87·96
50	F. Y. M.	20·11	18·14	17·66	18·63	17·61	15·81	14·97	16·13	0·74	0·94	1·41	1·03	87·56	87·66	84·78	86·67
	No F. Y. M.	20·41	19·58	18·88	19·62	18·06	17·17	16·55	17·26	0·69	0 89	1·08	0·89	88·49	87·68	87·64	87·94
	Average	20·26	18·86	18·27	19·13	17·84	16·49	15·76	16·70	0·72	0 92	1·25	0·96	88·03	87·67	86·21	87·30
100	F. Y. M.	20·41	19·46	18·26	19.38	18·69	16·80	15·81	17 10	0·67	0·84	1·36	0·96	91 58	86·34	86·60	88·17
	No F. Y. M.	19·11	1·928	18·26	19·22	16·96	17·25	15 28	16·50	0·93	0·69	1·50	1·04	88 78	89·45	83·47	87·23
	Average	19·76	19·37	18·26	19·13	17·83	17·03	15·55	16·80	0·80	0·77	1·43	1·00	90·18	87·90	85·04	87·71
150	F. Y. M.	19·81	19·78	17·36	18·98	17·58	17·65	14·68	16·64	0·84	0·75	1·22	0·94	88·74	89·21	84·98	87·64
	No F. Y. M.	20·11	19·38	18·66	19·38	18·10	17·05	15'90	17 02	0·85	0·81	1·22	0·96	90·01	88·14	85·21	87·79
	Average	19·96	19·58	18·01	19·18	17 84	17·35	15·29	16·83	0·85	0·78	1·22	0·95	89 39	88·68	85·10	87·72
200	F. Y. M.	19·01	19·21	17·66	18·63	16·43	16·63	15·33	16·13	1·13	0·84	1·19	1·05	86·42	86·58	86·80	86 60
	No F. Y. M.	18·61	18.18	18·56	18·45	16·56	15·88	15·36	15·93	1·08	1·03	1·72	1·28	89 00	87·36	82 75	86·37
	Average	18 81	18·69	18·11	18·53	16·50	16·26	15·35	16·03	1 08	0·96	1·46	1·17	87·71	86·97	84·78	86·49
250	F. Y. M.	18·81	18·68	18·46	18·65	16·85	16·02	15·85	16·24	1·26	0·78	1·36	1·13	89·58	85·74	85·88	87·07
	No F. Y. M.	18·11	19·18	18·66	18·65	15·38	16·70	15·66	15·91	1·31	0·87	1·54	1·24	84·92	87 08	83·92	85·31
	Average	18·46	18·93	18·56	18·65	16·12	16·36	15·76	16·08	1·29	0·83	1·45	1·20	87·25	86·41	84·90	86·19
Major.																	
	F. Y. M.	19·86	18·12	18 98	18·98	17·69	16·48	15·60	16·59	0·87	0 85	1·28	1·00	89·04	86·93	86·10	87·36
	No F. Y. M.	19·67	18·56	19·20	19·14	17·41	16·92	15·74	16·69	0·88	0 84	1·40	1·04	88·43	88·15	84·71	87·10

N. B.— (i) Percentages of each constituent on Juice weight are furnished.

(ii) Age of crop at the time of analysis was 354, 360, and 365 days in 1944—45, 45—46, and 46—47 respectively.

(vi) *Yield of cane.* The average yields of cane from the different treatments recorded in the three seasons are furnished in Table VI.

TABLE VI.

Yield of cane in tons per acre.

	Treatments.	1944—45	1945—46	1946—47	Average for 3 years.
Minor.					
0 lb. N	F. Y. M.	35·16	44·62	44·36	
	No F. Y. M.	35·34	44·80	39·94	
	Average	35·25	44 71	42·15	40·70
50 lb. N	F. Y. M.	51·11	49 70	49·09	
	No F. Y. M.	44·75	46·71	40·96	
	Average	47·93	48·21	45·03	47·06
100 lb. N	F. Y. M.	52·30	53 53	53·14	
	No F. Y. M.	52 48	51·96	49·09	
	Average	52·39	52·70	51·12	52·07
150 lb. N	F. Y. M.	55·60	45·95	47·78	
	No F. Y. M.	54·19	50·67	45·75	
	Average	54·90	48·31	46·77	49·99
200 lb. N	F. Y. M.	52·95	44·92	49·71	
	No F. Y. M.	55·13	48 90	47·21	
	Average	54·04	46 91	48·46	49·80
250 lb, N	F. Y. M.	57 88	47·35	50·46	
	No F. Y. M.	54·46	45·79	45·04	
	Average	56·17	46·57	47·75	50·16
S. E. of treatment mean-tons		1·264	1·57	2·337	
C. D. (P = 0·05)		3·649	4·53	6·749	
Major.	F. Y. M.	50·83	49·35	49·09	
	No F. Y. M.	49·35	48·14	45·00	
S. E. of treatment mean-tons		1·255	0·378	1·273	
C. D. (P = 0·05)		5·65	1·700	5·728	

The crop was harvested from 3rd to 23rd March, 17th April to 6th May and 17th March to 4th April in 1944—'45, 1945—'46 and 1946—'47 respectively. Although the farmyard manure series recorded higher yields, in general, there was no significant difference in yields due to major treatments. It was observed by Rege (1941) and Dutt (1946) that the influence of farmyard manure seemed to be more as a soil improver than as an effective supplier of plant food. But it was stressed that more elaborate and well-planned experiments were necessary to correctly assess the merit of this manure. This is borne out by the results of this experiment also. Among the minor treatments, treatment (f) 250 lb. N, gave the maximum yield in the first year (56·17 tons of cane per acre) but was statistically on a par with treatments (d) 150 lb. N and (e) 200 lb. N. Treatment (c) 100 lb. N recorded 52·39 tons of cane per acre and was fourth in order of merit. In the second year, treatment (c) 100 lb. N registered the highest yield of 52·70 tons of cane and was on a par with treatments (d) 150 lb. N and (b) 50 lb. N. In the final year the yield differences were not significant by 'Z' test. However, treatment (c) 100 lb. N, gave the maximum acre yield of 51·12 tons of cane. These results are at variance with those recorded at the Agricultural Research Station, Palur and Gudiyatham (1940) of this Province and by workers like Rege and Sunnabhadti (1944). But similiar results were recorded at the Agricultural Research Station, Samalkot (1940) where no significant

differences in yields were noticed between 100, 150 and 200 lb. nitrogen (per acre) treatments. Even at Shajahanpur (U. P.) in one experiment no significant differences between 100 and 200 lb. nitrogen treatments were noticed in two out of three years. This was reported by Rege (1941). In this connection, apart from the inherent fertility status of the soils, the influence of prevailing winds, usually common, in the East coast, should be taken into account. During 1944–'45 when there was practically no lodging, there was more or less a progressive increase in cane yields, with every increase in the nitrogen level. In 1945–'46 cyclonic winds prevailed in October followed by a flood and there was much damage due to lodging and breakage. During 1946–'47 also there was severe lodging and some breakage of canes. The crop under the treatments (e) to (f) which recorded practically similar maximum heights, seemed to have come in for a greater amount of damage than that in the lower nitrogen levels. Thus heavy lodging and breakage due to high winds in the higher nitrogen treatments seemed to be a contributory cause, apart from the inherent fertility status of soils, for the apparent inefficiency of treatments higher than 100 lb. nitrogen in increasing cane yields progressively. But one remarkable feature was the consistent performance of 100 lb. N, which recorded almost similar yields in all the three seasons, irrespective of the type of land and even under adverse seasonal conditions.

(vii) *Yield of jaggery.* Trial jaggery (Gur) boilings from each treatment were made once at harvest time each year. The percentage of gur on cane weight from the farmyard manure and no farmyard manure series in the different years are presented in Table VII.

TABLE VII.

Yield of gur in tons per acre

Treatments		1944—45	1945—46	1946—47	Average for 3 seasons for both the major treatments.
Minor.					
0 lb. N	F. Y. M.	4·690	4·565	4·822	
	No F. Y. M.	4·789	4·404	4·661	
	Average	4·740	4·485	4·732	4·656
50 lb. N	F. Y. M.	5·975	4·697	4·801	
	No F. Y. M.	5·929	4·545	5·112	
	Average	5·952	4·621	4·957	5·177
100 lb. N	F. Y. M.	6·511	5·642	6·122	
	No F. Y. M.	6·597	5·804	5·528	
	Average	6·554	5·723	5·825	6·034
150 lb. N	F. Y. M.	6·699	4·926	5 055	
	No F. Y. M.	6·828	5·837	4·689	
	Average	6·764	5·382	4·872	5·673
200 lb. N	F. Y. M.	6·433	4·366	5·220	
	No F. Y. M.	6·482	4·822	5·302	
	Average	6·461	4·594	5·261	5·439
250 lb. N	F. Y. M.	7·304	4·323	5·364	
	No F. Y. M.	6·219	4·620	5·081	
	Average	6·762	4·472	5·233	5·486
Major.					
	F. Y. M.	6·269	4·753	5·231	5·417
	No F. Y. M.	6·142	5·005	5·062	5·403

The computed gur yields (based on gur recovery) from the different treatments are included in Table VIII.

TABLE VIII.

Per cent jaggery recovery on cane weight.

Treatments		1944—45	1945—46	1946—47	Average
Minor.					
0 lb. N	F. Y. M.	13·34	10·23	10·87	11·48
	No F. Y. M.	13·55	9·83	11·67	11·68
	Average	13·45	10·03	11·27	11·58
50 lb. N	F. Y. M.	11·69	9·45	9·78	10·31
	No F. Y. M.	13·25	9·73	12·48	11·82
	Average	12·47	9·59	11·13	11·06
100 lb. N	F. Y. M.	12·45	10·54	11·52	11·50
	No F Y. M.	12·57	11·17	11·26	11·67
	Average	12·51	10·86	11·39	11·59
150 lb. N	F. Y. M.	12·05	10·72	10·58	11·12
	No F. Y. M.	12·60	11·52	10·25	11·46
	Average	12·33	11·12	10·42	11·29
200 lb. N	F. Y. M.	12·15	9·72	10·50	10·79
	No F. Y. M.	11·77	9·85	11·23	10·95
	Average	11·96	9·79	10·87	10·87
250 lb. N	F. Y. M.	12·62	9·13	10·63	10·79
	No F. Y. M.	11·42	10·09	11·28	10·93
	Average	12·02	9·61	10·96	10·86
Major.					
	F. Y. M.	12·38	9·97	10·65	11·00
	No F. Y. M.	12·53	10·37	11·36	11·42

The data presented in Tables VII and VIII indicate that the farmyard manure series generally recorded lower jaggery recoveries. In 1944 – '45 the jaggery recovery was found to decrease with an increase in the nitrogen level, as in the case of juice quality. In the second year (1945 – '46) there was no definite trend in the recoveries. In the final year (1946 – '47) treatments (a) 0 lb. N, (b) 50 lb. N and (c) 100 lb. N, gave recoveries very nearly equal to each other and the remaining three treatments gave lower jaggery out-turns. The influence of the seasonal conditions which governed the juice quality was also reflected in the jaggery recovery values each year. Maximum jaggery yields were recorded by the treatment (d) 150 lb. N followed by (f) 250 lb. N and (c) 100 lb. N, in the first season and in the subsequent years 100 lb. N treatment (c) gave the highest gur yields.

(viii) *Relationship between yield (cane and gur) and nitrogen utilisation.* According to Borden (1944) who worked out the relationship between yields of cane and sugar and consumption of nitrogen by crops, 2·9 lb. of nitrogen per ton of cane and 7·9 lb. of nitrogen per month were necessary for producing a 40 to 49 ton crop grown over a period of 17·4 months at Hawaii. For 50 to 59 ton crop aged 18·3 months 2·6 lb. N per ton and 7·9 lb. N per month were necessary. At Anakapalle, the utilisation of nitrogen was more efficient as is evidenced by figures given below. The results in respect of treatment (c) 100 lb. Nitrogen alone are furnished, in Table IX.

TABLE IX.

Nitrogen utilisation

Season	Age of crop Months	Yield (tons) per acre		Pounds of Nitrogen utilised per ton of		per month
		Cane	Gur	cane	Gur	
1944—45	12·3	52·48	6·597	1·91	15·16	8·13
1945—46	13·2	51·96	5·804	1·92	17·23	7·58
1946—47	12·6	49·09	5·528	2·04	18·09	7·94

(ix) *Economics of manuring*. The cost of production per ton of cane in the different manurial treatments is presented in Table X. The lowest production costs were recorded by the treatment (c) 100 lb. N in both the farmyard manure and no farmyard manure treatments, except in one instance.

TABLE X.

Cost of production per ton of cane

Treatment Lb. N.	1944—1945		1945—1946		1946—1947	
	F. Y. M. Rs.	No F. Y. M. Rs.	F. Y. M, Rs.	No F. Y. M. Rs.	F. Y. M. Rs.	No F. Y. M. Rs.
(a) 0 N	15·41	13·26	22·89	21·66	25·22	26·30
(b) 50	13·55	12·60	21·81	21·31	23·88	26·48
(c) 100	13·73	12·29	20·92	19·80	23·42	24·00
(d) 150	13·69	12·46	23·96	21·02	26·06	26·00
(e) 200	14·24	12·67	25·12	27·43	25·83	25·96
(f) 250	14·03	13·01	24·66	23·44	26·10	27·60

IV. **Summary and conclusions.** With a view to determine the *optimum nitrogen requirement of sugarcane in the Anakapalle tract*, an experiment involving two major treatments (ten tons of farmyard manure per acre and no farmyard manure) and six minor treatments, (0 lb., 50 lb. 100 lb., 150 lb., 200 lb. and 250 lb. of nitrogen per acre) supplied in the form of groundnut cake was conducted over a period of three years in succession, 1944–'45 to '46–47. The variety of cane planted was Co 419. The results of the experiment indicate the following conclusions :

1. Application of farmyard manure did not influence the different phases of crop performance to any appreciable extent though the general indication was that it had some favourable effect. Under extreme conditions of drought its beneficial influence was more pronounced.

2. No significant effect of manures was noticed on germination of buds.

3. There was significant difference in growth due to minor treatments. Treatments (c) 100 lb. N and (f) 250 lb. N recorded almost similar heights. The rates of growth in the different treatments did not differ significantly among themselves.

4. Influence of manuring on the incidence of stem-borer was not significant.

5. The higher nitrogen treatments (e) 200 lb. N and (f) 250 lb. N yielded poor quality juice.

6. The maximum average yields of cane and gur were recorded by the treatment 100 lb. N (c), and the cost of production in this treatment was at a minimum.

7. From the point of yield, as well as cost of production per unit weight of cane , 100 lb. Nitrogen per acre, was found to be the optimum for sugarcane in this tract when applied in the form of groundnut cake.

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