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Manuring of Ratoons in Sugarcane

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Introduction: The practice of ratooning sugarcane is common in most of the sugar-producing countries of the world. In India too, it has become a common practice, in view of its advantages like reduction in cost of cultivation and earliness in maturity. With the introduction of Coimbatore canes this practice has established itself in this State.

Experiments on the ratooning of sugarcane were in progress at the various research stations in this State. These indicated that ratoons should be manured for getting good yields but the increased dose of nitrogen to be applied over that of plant crop was not indicated. The results of investigations made to evolve a suitable manuring schedule for ratoons, for getting high yields with good juice quality, are presented in this paper.

2. **Material and Methods:** An experiment was laid out with the popular variety Co. 419, in a split-plot design with plant crop, first ratoon, and second ratoon as major treatments and nine manurial doses as minor treatments. The doses of manure consisted of 100 lb., 150 lb., and 200 lb. nitrogen, in combination with 0 lb., 50 lb., and 100 lb. P_2O_5 per acre. The nitrogen was supplied in the form of groundnut cake and ammonium sulphate, in the ratio of 2 1 on nitrogen basis. P_2O_5 was supplied in the form of superphosphate. The manures were applied in two equal doses, half at planting and the other half at earthing-up time in June. All the treatments received a basal dressing of 10 tons of farmyard manure per acre.

3. **Results:** (i) *Height:* The data of periodical heights in plant crops, first and second ratoons are presented in Tables 1 & 2. The results show that first ratoons showed more initial vigour upto July–August but the plant crop made better progress and attained equal height with the first ratoons. In the treatments receiving higher doses of Nitrogen than 100 lb. Nitrogen, the first ratoon showed better height and was even slightly more than 100 lb. Nitrogen treatment of plant crop. In the case of second ratoons however, there was no increase in crop height even with higher doses of Nitrogen. Comparing the crop height of first ratoon with that of plant crop there was a slight difference in favour of the plant crop but the second ratoon was far below the plant crop.

(ii) *Population:* The total number of canes is an important factor in the yields of plant and ratoon crops. The effect of increased doses of manures on the population was not seen in the case of plant crops but in

ratoons and particularly in second ratoons there was a marked increase in population with increased doses of manure. Between 150 lb. and 200 lb. Nitrogen however, there was no appreciable difference in population in the first and second ratoon crops. There was no difference due to differences in P_2O_5 doses. The data are presented in Table 3.

(iii) *Weight of single cane:* There is a gradual fall in the weight of individual cane from plant crop to first ratoon and from first to second ratoon. There is increase in weight of cane in the case of plant and ratoon crops from 100 lb. to 150 lb. Nitrogen treatments. But between 150 lb. and 200 lb. Nitrogen there was no such increase. The weight of single canes of first ratoons under high doses of Nitrogen was almost equal to the weight of single canes of plant crop from 100 lb. Nitrogen treatment. The second ratoon crop, though somewhat improved with increased doses of manure could not come up to the level of plant crop or first ratoon. The data are presented in Table 4.

(iv) *Yield:* Plant crops recorded significantly higher yields than first and second ratoons and first ratoons yielded significantly more than second ratoons. There is increase in yield upto 100 lb. Nitrogen but between 150 lb. and 200 lb. Nitrogen treatments there was no increase. The increase in yield was more pronounced in the case of ratoon crops than in plant crops. The yield of first ratoon crop with 150 lb. Nitrogen treatment was found to be on a par with the yield of cane of plant crop in 100 lb. Nitrogen treatment. The second ratoon were always poorer than plant and first ratoon crops. Varying doses of phosphoric manures did not influence the yield in any of the three crops.

(v) *Arrowing:* There is increase in arrowing from plant crop to first ratoon and from first to second ratoons (Table 6). With increase in dose of nitrogenous manure there is decrease in percentage of arrowing. There are no differences due to doses of phosphatic manure in any of the three crops.

(vi) *Juice quality:* Juice analysis of the three crops in the different manurial treatments was conducted from November to February and the results are presented in Tables 7 & 8. Ratoons in general record a richer juice quality earlier in the season than plant crops. Increased doses of Nitrogen reduced the sucrose content of the juice in plant crop while in first and second ratoons there was no such marked reduction. Phosphates did not show any influence on juice quality in any of the crops. The difference in quality of juice between 100 and 150 lb. Nitrogen treatments was not so wide as between 100 and 200 lb. Nitrogen treatments.

(vii) *Sugar recovery:* Vasudeva Rao and Lakshmikantham (1946) found that ratoons gave less recovery of sugar than plant crops. For comparison they gave sugar recovery figures of earlier months of ratoon crops and those of plant crops of later months. The data indicate higher sugar per cent in ratoons upto February. The data are furnished below :—

	C. C. S. % during			
	Nov.	Dec.	Jan.	Feb.
Plant crop	8·06	10·21	11·53	12·79
First Ratoon	7·80	10·96	12 05	12·88
Second ratoon	9·24	12·05	13·49	13·52

(viii) *Glucose:* The percentage of glucose of the three crops in different months, from November to February was also studied. No specific differences in glucose percent could be seen between the three crops:

	Glucose % during			
	Nov.	Dec.	Jan.	Feb.
Plant crop	1·71	1·31	1·25	3·67
First ratoon	1·84	0·97	1·22	0·69
Second ratoon	1·99	0 91	0·96	0·96

4. **Discussion:** Data gathered on different aspects like height, population, weight of single cane, arrowing, yield and juice quality of the three crops as influenced by the different doses of nitrogenous and phophatic manures showed differences between the plant and ratoon crops. The height of cane was less in ratoons when compared with plant crops. The weight of single cane was in the descending order in plant, 1st and 2nd ratoon crops. The yields of plant crops were significanty, more than 1st ratoon and those of 1st ratoon significantly superior to 2nd ratoon. With increase in dose of nitrogen over 100 lb. there was no significant increase in yield in plant crops. First ratoon with 150 lb. Nitrogen dose gave yields significantly on a par with plant crop receiving 100 lb. Nitrogen. Increase in yield in 2nd ratoon, with increased doses of Nitrogen, did not put pull it up to the level of plant or 1st ratoon crop. 100 lb. of Nitrogen is judged as optimum for plant crops. In the case of 1st and 2nd ratoons there is significant increase in yield upto 150 lb. Nitrogen per acre.

The effect of phosphoric acid was not seen, in influencing yield or juice quality on either plant or ratoon crops.

Studies on the physiology of ratoons indicated that ratoons have lower hydration than plant crops and have less of root forming zones in the basal portions of shoots. The analyses of cane plant, leaf samples and juices in plant crops 1st and 2nd ratoons showed that ratoons under normal manuring showed less nitrogen content than plant crops. This indicates that ratoons are less efficient in the absorption of nitrogen than plantcrops and that they require a higher concentration of nitrogen. There was no increase in phosphoric acid content with increasing doses of P_2O_5 in the juice of all the three crops and this shows that there was no additional utilisation of this element even in ratoons, with increased doses of P_2O_5. The counts of smut whips show increase in incidence of smut with successive ratooning.

5. **Summary and Conclusions:** Ratoons are inferior to plant crops and they also become worse by successive ratooning. Ratoons require

more manure and water than a plant cropand there is greater response to increased doses of nitrogen. The following are the conclusions.

(1) Yield of ratoons are less than plant crops under the same cultural and manurial treatments.

(2) The optimum doses of nitrogenous manure is higher in ratoons than plant crop and it is 50 lb. nitrogen per acre over the optimum dose of plant crop.

(3) There is no effect of increased doses of P_2O_5, either in yield or juice quality, in plant as well as ratoon crops.

(4) Ratoons are richer in juice quality than plant crops earlier in the season.

(5) There is no difference in glucose percent between the juice of plant and ratoon crops.

(6) There is more arrowing in ratoons than plant crops and it is less with increase in dose of nitrogenous manure.

(7) There is increase in incidence of smut with successive ratooning.

7. **Future lines of work:** (1) Time of manuring a ratoon crop has to be investigated to see if by earlier manuring more growth of the crop can be induced. For preventing arrowing which causes cessation of growth, prolonged application of manure may be helpful.

(2) The populations of ratoons crops vary, due to varietal differences, but the possibility of improving the population by suitable cultural operations has to be investigated.

(4) Since ratoon crops appear inferior in metabolism to the plant crop, the optimum combination of water, manure and cultural operations to improve the nutrition of the plant has to be investigated, so that a suitable schedule can be designed.

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TABLE I — Height measurements.

S. No.	Treatments	November, 1949-50 Plant crop Height in inches		1st Ratoon crop Height in inches		2nd Ratoon crop Height in inches		1948—49 Plant crop Height in January (inches)		1st Ratoon Height in January (inches)	
1	100 N+0 P	125		125		115		123		121	
2	100 N+50 P	123	125	124	124	121	118	104	119	128	117
3	100 N+100 P	126		120		118		131		123	
4	150N+0 P	825		128		117		126		124	
5	150N+50 P	125	125	120	127	119	118	130	127	126	126
6	150N+100 P	126		125		117		125		128	
7	200 N+0 P	126		123		116		120		122	
8	200 N+50 P	125	125	120	122	117	116	123	126	126	125
9	300 N+100 P	123		124		116		125		124	
Average			125		124		117		124		123

TABLE II—Periodical Height of crop (in inches) 1949—50.

Nitrogen treatments	Plant crop July	Aug.	Sep.	Nov.	1st Ratoon July	Aug.	Sep.	Nov.	2nd Ratoon July	Aug.	Sep.	Nov.
100 lb. N	47	77	101	125	53	79	105	124	42	68	92	118
150 lb. N	47	77	104	125	54	81	105	127	48	64	96	118
200 lb. N	50	80	105	125	53	79	104	122	48	75	96	116
Average	48	78	103	125	53	80	105	124	46	70	95	117

1948—49.

Nitrogen treatments	Plant crop July	Aug.	Sep.	Nov.	Jan.	1st Ratoon July	Aug.	Sep.	Nov.	Jan.
100 lb. N	28	41	68	98	119	35	47	70	91	117
150 lb. N	29	43	71	103	127	38	51	76	104	126
200 lb. N	30	44	72	101	126	39	52	78	105	125
Average	29	43	70	101	124	37	50	74	100	123

TABLE III—No. of canes at harvest per acre; 1949-50.

Treatments	Plant crop	Average	1st Ratoon	Average	2nd Ratoon	Average.
100 N+0 P	35,714		25,714		23,834	
100 N+50 P	32,331	33,885	31,805	29,449	30,150	26,466
100 N+100 P	33,610		30,977		25,413	
150 N+0 P	34,736		32,331		30,977	
150 N+50 P	34,060	33,909	30,000	31,303	30 601	31,102
150 N+100 P	32,931		31,578		31,728	
200 N+0 P	37,369		29,925		26,541	
200 N+50 P	32,481	33,995	31,127	30,902	31,127	29,774
200 N+100 P	34,135		31,653		31,653	
	Average per acre.	33,930		30,568		29,114.

TABLE IV—Weight of single cane in lb.; 1949—50.

S. No.	Treatments	Plant crop		1st Ratoon		2nd Ratoon	
1	100 N + 0 P	2·87		2·82		2·27	
2	100 N + 50 P	2·82	2·89	2·72	2·73	2·19	2·29
3	100 N + 100 P	2·97		2·65		2·40	
4	150 N + 0 P	2·87		2·84		2·61	
5	150 N + 50 P	3·08	3·07	3·39	2·98	2·58	2·57
6	150 N + 100 P	3·26		2·71		2·52	
7	200 N + 0 P	2·88		2·77		2·58	
8	200 N + 50 P	3·29	3·07	2·85	2·84	2·54	2·56
9	200 N + 100 P	3·03		2·89		2·57	
	Average.		3·01		2·85		2·47

TABLE V—Yield of cane in tons per acre; 1949—50.

S. No.	Treatments	Plants crop		1st Ratoon		2nd Ratoon.	
1	100 N + 0 P	45·79		32·42		24·15	
2	100 N + 50 P	46·72	43·71	38·36	35·86	29·45	26·04
3	100 N + 100 P	44·60		29·05		27·21	
4	150 N + 0 P	44·60		40·90		30 07	
5	150 N + 50 P	46·87	46·47	38·87	39·31	35 24	35·65
6	150 N + 100 P	47·94		38·15		35·88	
7	200 N + 0 P	47·95		36·97		30·56	
8	200 N + 50 P	46·52	46·87	39·52	39·11	35·28	33·51
9	200 N + 100 P	46·12		40·87		34·71	
	Average.		45·68		38·10		32·04
		Effect of phosphoric acid.					
	0 lb P	46·11		36·76		28·26	
	50 lb P	44·70		38·92		33·32	
	100 lb P	46·22		36 02		32·51	

TABLE VI—Arrowing in Ratoons.

S. No.	Treatments	Plant crop	Average	1st Ratoon	Average	2nd Ratoon	Average	Average of three crops
1	100 N+0 P	14·8		17·4		37·6		
2	100 N+50 P	15·0	15·67	14·3	17·1	32·9	34·8	22·5
3	100 N+100 P	17·2		19·6		33.8		
4	150 N+0 P	7·7		11·1		15·7		
5	150 N+50 P	13·1	11·07	12·2	12·8	18·8	16·1	13·2
6	150 N+100 P	13·4		14·2		13·8		
7	200 N+0 P	11·6		8·1		14·4		
8	200 N+50 P	4·5	7·70	7·3	7·2	13·4	15·9	10·3
9	200 N+100 P	7·0		6·1		20·0		
	Average	1·47		12·25		22·26		

TABLE VII.

Juice quality — Effect of nitrogen.

	100 lb. N per acre						150 lb. N per acre						200 lb. N per acre					
	Plant crop		1st ratoon		2nd ratoon		Plant crop		1st ratoon		2nd ratoon		Plant crop		1st ratoon		2nd ratioon	
	Sucrose	Purity	Sucrose	Purity	Sucrose	Purity	Sucrose	Purity	Sucrose	Purity	Sucrose	Purity	Sucrose	Purity	Sucrose	Purity	Sucrose	Purity
November	14·26	83·73	14·25	83·98	15·56	84·81	13·93	82·90	14·55	86·09	14·63	85·15	13·13	82·07	14·09	84·04	14·20	83·94
December	16·16	87·80	16·08	84·90	16·39	87·99	15·19	85·51	16·03	85·28	15·38	83·06	15·57	86·49	15 04	82·09	15·41	84·01
January	17.04	89·29	16·90	88·75	18·29	90·64	17·78	88·09	16·45	86·75	17·55	90·58	16·91	88·54	17·25	88·77	18·36	91·58
February	17·71	88·29	18·46	90·34	18·80	90·08	17·69	88·34	17·92	88 71	17·30	88·23	16.43	86·96	18·08	90 81	18·43	90·19
							1948 — '1949.											
December	14·52	84·82	14·31	86·04	...	...	13·34	81·21	12·98	80·67	...	...	12·93	80·37	13·40	81·40	...	...
January	15·98	88·05	16·07	86·66	...	...	16·01	85·02	16·16	86·21	...	...	16·02	87·29	15·51	85·17	...	...

TABLE VIII.

Juice Quality — Effect of Phosphoric Acid.

	0 lb. P_2O_5						50 lb. P_2O_5						100 lb. P_2O_5					
	Plant crop		1st ratoon		2nd ratoon		Plant crop		1st ratoon		2nd ratoon		Plant crop		1st ratioon		2nd ratoon	
	Sucrose	Purity	Sucrose	Purity	Sucrose	Purity	Sucrose	Purity	Sucrose	Purity	Sucrose	Purity	Sucrose	Purity	Sucrose	Purity	Sucrose	Purity
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
November	13·66	82·13	14·74	84·03	15·10	84·03	13·84	83·15	13·86	84·18	14·56	83·70	13·82	83.78	17·63	85 63	18·06	85·40
December	15·31	85 91	15·00	84·32	15·41	85·54	15·09	86·41	15·49	84·06	15·68	84·26	15·93	87·49	15·83	84·48	16·08	85·26
January	17·70	88·87	17·28	89·31	17 90	90 48	16·72	88·30	16·39	85·46	16·94	89·50	17·31	88·75	17 94	89·50	18·20	91·82
February	17·18	87·65	18·66	90·41	18·05	89·51	17·54	88·03	18·42	90·15	18·32	89·42	17·12	87·91	17·38	89·30	18·16	89·71