https://doi.org/10.29321/MAJ.10.A04819

STUDIES IN SUGRACANE III.

Preliminary Note on the responses of Sugarcane to Different Nitrogenous Manures.*

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In the course of some pot culture studies undertaken to investigate the differential influences of several types of nitrogenous manures on the quality and the proportion of the non-sugar-organic matter in the cane juice (1) which was indicated previously to have a considerable influence on the crystallisability of sucrose and the quality of jaggery (2), some very interesting differences were noted in the effects of the several manures used on some of the important agronomic characters of both the varieties of cane experimented upon viz., Co. 213 and Co. 421. These responses were consistent in all the repetitions in both the varieties.

As they appear to be general in character with an interesting bearing on the agronomy of sugarcane and possibilities of some definite practical utility, they are embodied in this paper.

The following manures were used in this experiment

(a) No manure (for control)
(b) Castor cake
(c) Ammonium sulphate
(d) Groundnut cake and
(e) Farm yard manure

The canes were grown in glazed pots of uniform size using 13 Kilo grammes of good paddy soil in each case. In addition to this, two other soils, viz., soil from Field No. 15-A (Central Farm, Coimbatore), and red soil, were also used. As a preliminary no manure was used in the cases of these two latter soils.

Although initially two separate buds were planted in each pot, after germination and the putting on of the first two leaves, one plant from each pot was removed, so that the experiment was confined to the study of the primary shoot and of the tillers resulting from a single bud in each case. Four repetitions were used in each treatment with each variety.

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* Paper presented before the twenty-fifth session of the Indian Science Congress held at Calcutta, 1938.

The following amounts of Manures were added

		N%	No. of grams added.
(a)	Farm yard Manure	1·25	416
(b)	Castor cake	6·00	86
(c)	Ammonium sulphate	20·00	26
(d)	Groundnut cake	8·40	64

At regular intervals of 10 days tiller counts and height measurements of both primary shoots and the tillers were taken. As the tillers were found to interfere after a stage with the normal development and the growth of the primary shoots, large numbers of the least promising of them were removed on 14—9—1936. The height measurements were continued at usual intervals on those remaining.

The height of the growing cane was measured from the level of the soil in the pot to the point of the highest visible ligule, the point indicated by the arrow in Plate 1.

TABLE I.

Statement showing the periodic heights of the primary shoots and the average number of the tillers.

Date.	No Manure		Castor cake.		Ammonium Sulphate.		Groundnut cake.		F. Y. M.	
	H	N	H	N	H	N	H	N	H	N
					Co. 213.					
May, 5	6	Nil.	6·75	Nil.	5·4	Nil.	6 58	Nil.	8·5	Nil.
May, 15	7·88	,,	9·42	1	7·5	,,	8·83	,,	10·0	0·66
May, 25	8·42	0·33	11·83	2	8·88	,,	9·98	1·25	12·67	2·00
May, 31	9 50	0·66	12·57	2·3	10·00	,,	11·31	1·25	13·98	2·00
June, 9	10·00	1·33	14·08	3·66	10·56	,,	12·75	2·00	15·33	2·33
June, 19	10·13	2 00	15·58	4·70	12·25	2·25	14·19	4·00	17·33	3·66
June, 29	12·13	2·75	17 25	6·70	13 88	2·75	15·81	4·75	18 50	6·00
July, 9	15 58	3·50	19·00	7·66	16·75	3 50	18·44	6·20	19·50	5 33
Aug. 9	24·50	4 00	25·62	9·33	23·12	4·50	23·50	7·50	23 66	7·33
Aug. 20	27·62	4 00	26 66	9 33	24·33	4·75	25·81	7·50	26 80	7·33
Sept. 1	32·12	3 75	30 17	9 00	26 00	5 25	27·81	7·25	30·58	7·66
Sept. 14	36·83	3·00	33·50	7·00	27·25	5·50	28·88	7·25	33 58	7·66
					Co. 421.					
May, 5	9 00	Nil.	5·67	Nil.	6·33	Nil	6·50	Nil.	5·88	Nil.
May, 15	9·63	,,	8 67	,,	7·38	,,	8·17	,,	8·25	,,
May, 25	12·19	,,	12 25	,,	10·21	,,	11·17	,,	11·25	0·50
May, 31	13·10	,,	14·02	,,	11·82	,,	12·70	,,	13·00	0·50
June, 9	14·75	,,	15·88	,,	14·06	,,	14·50	,,	15·25	0·50
June, 19	15·42	,,	19 08	0·67	16 99	,,	17·17	0·66	16·63	2·50
June, 29	16·00	,,	20·16	1·00	18 31	1·00	18·83	1·33	19·25	3·25
July, 9	18 58	0·66	22·42	1·67	21·19	2·25	20·67	3·00	20·25	4·00
Aug. 9	24·25	1·33	28 10	5·00	30·69	4·75	28 08	5·00	24·00	5·50
Aug 20	25·92	1·33	30·75	5·30	32·44	4·75	30·06	5·00	26·00	6·66
Sept. 1	30 83	1·33	36·33	4 67	34·50	4·75	34 50	4·50	31·33	6·66
Sept. 14	37·50	1·66	40·33	4·33	36·38	4·75	36·75	5·00	34·75	4 00

H: Average height of primary shoot in inches.
N: Average number of tillers.

From the figures presented, the following points become clear:

1. Excepting the no manure series, the number of tillers is lower in the ammonium sulphate series and greater in the cases of castor cake and farm yard manure, in both the varieties. It will be further noticed that this maximum number of tillers was attained in the cases of the two latter manures even in August, while in the other two cases, it took much longer. The relevent figures from Table I are presented below:

	No Manure.	Castor cake.	Ammonium Sulphate.	Groundnut cake	F. Y. M.
			Co. 213.		
Max. No. of Tillers.	4	9·33	5·5	7·5	7·66
Date	9—8—36	9—8—36	14—9—36	14—9—36	20—8—36
			Co. 421.		
Max. No. of Tillers.	1·66	5·3	4·75	5·0	6·66
Date	14—9—36	20—8—36	9—8—36	9—8—36	9—8—36

2. Another interesting point to be noted is that for every variety there appears to be a minimum of vegetative growth as indicated by the height of cane, before which is attained, no tillers would begin to appear ordinarily. This is as can be seen from the following figures:

Height of primary shoot when first tillers made their appearance.

	No Manure.	Castor cake.	Ammonium Sulphate.	Groundnut cake.	F. Y. M.
			Co. 213.		
Height in inches	8·42	9·42	12·25	9·99	10·00
Date	25—5—36	15—5—36	19—6—36	25—5—36	5—5—36
			Co. 421.		
Height in inches	18·58	19·09	18·31	18·83	16·63
Date	9—7—36	19—6—36	29—6—36	29—6—36	9—6—36

These figures further reveal that the magnitude of the minimum for Co. 421 is far greater than the corresponding minimum for Co. 213 and this is so in each treatment.

Again, this minimum growth at which tillers appear, is attained earlier in the castor cake and the farm yard manure series than in the ammonium sulphate and the groundnut cake series. Both the varieties respond similarly in this respect.

Between the two varieties under experiment it will be seen that tillering occurs earlier in Co. 213 than in Co. 421.

	Time of Appearance of Tillers.	
	Co. 213	Co. 421.
Farm Yard Manure	5—5—36	9—6—36
Castor cake	15—5—36	19—6—36
Groundnut cake	25—5—36	29—6—36
Ammonium Sulphate	19—6—36	29—6—36
No manure	25—5—36	9—7—36

These also indicate that ammonium sulphate tends to delay the appearance of the tillers.

4. Under any one treatment, Co. 213 is a better tillerer than Co. 421.

Thus from the foregoing it would appear that the character of manure seems to exercise a considerable influence both on the tillering capacity and on the time of tillering of any given variety. Castor cake and the farm yard manure seem not only to increase the number of tillers formed, but also to hasten their formation.

TABLE II.

Height Measurements of the Primary Shoots and of the Promising Tillers Under Different Manurial Treatments.

	No Manure Paddy soil.	Castor cake.	Ammonium Sulphate.	Ground-nut cake.	F. Y. M.	No Manure Red Soil from F. No. 15-A Central Farm.	
			Height in inches.				
			Co. 213.				
Primary Shoot	49·00	48·33	38·50	35·75	48·17	33·75	37·50
Tiller (1)	...	50 33	33 83	27·75	26·50	...	...
Tiller (2)	...	29·50	29·50	23·12	13·13	...	...
Tiller (3)	...	24 0	...	...	...	...	...
			Co. 421.				
Primary Shoot	49·63	57·83	54·63	46·06	49·50	45·00	28·50
Tiller (1)	...	42 00	33·40	32·83	26 83	...	...
Tiller (2)	...	17·50	17·00	28·50	17·00	...	...
Tiller (3)	...	...	...	...	...	...	...

The figures show that the number of the more promising tillers is greater in castor cake series in Co. 213. Comparing the heights of the primary shoots and of the tillers in the several treatments, it would seem that manuring with castor cake is considerably more advantageous. This observation appears to hold good in both the varieties.

A sugarcane is valued for its capacity to tiller, and to tiller early in its life, so that large numbers of canes of uniform, or very nearly uniform state of maturity, could be secured into the final harvested sample. The indications of the foregoing considerations appear to be that manuring with castor cake and farm yard manure seem to go a long way to contribute towards this end. Plot and field scale experiments are proposed to be carried out to verify these conclusions.

Mutual influence of the primary shoots and of their tillers on each others growth.

An examination of the periodical height measurements of the primary shoots and of their tillers appears to show that they mutually adversely influence each others growth and development. Growth curves of some typical main shoots and of their tillers are represented in Plates 2 and 3. A study of these curves seems to lead to the following inferences.

PLATE 1

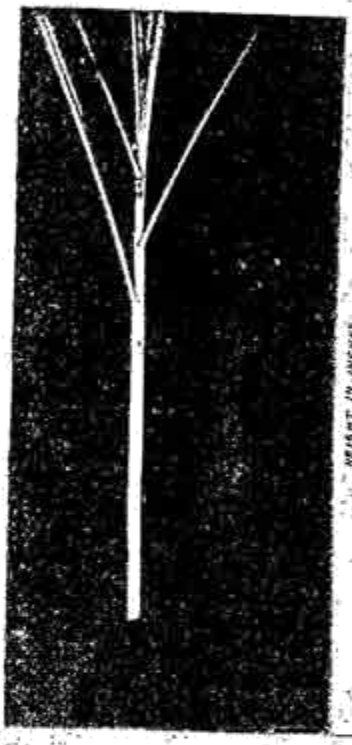

PLATE 2.

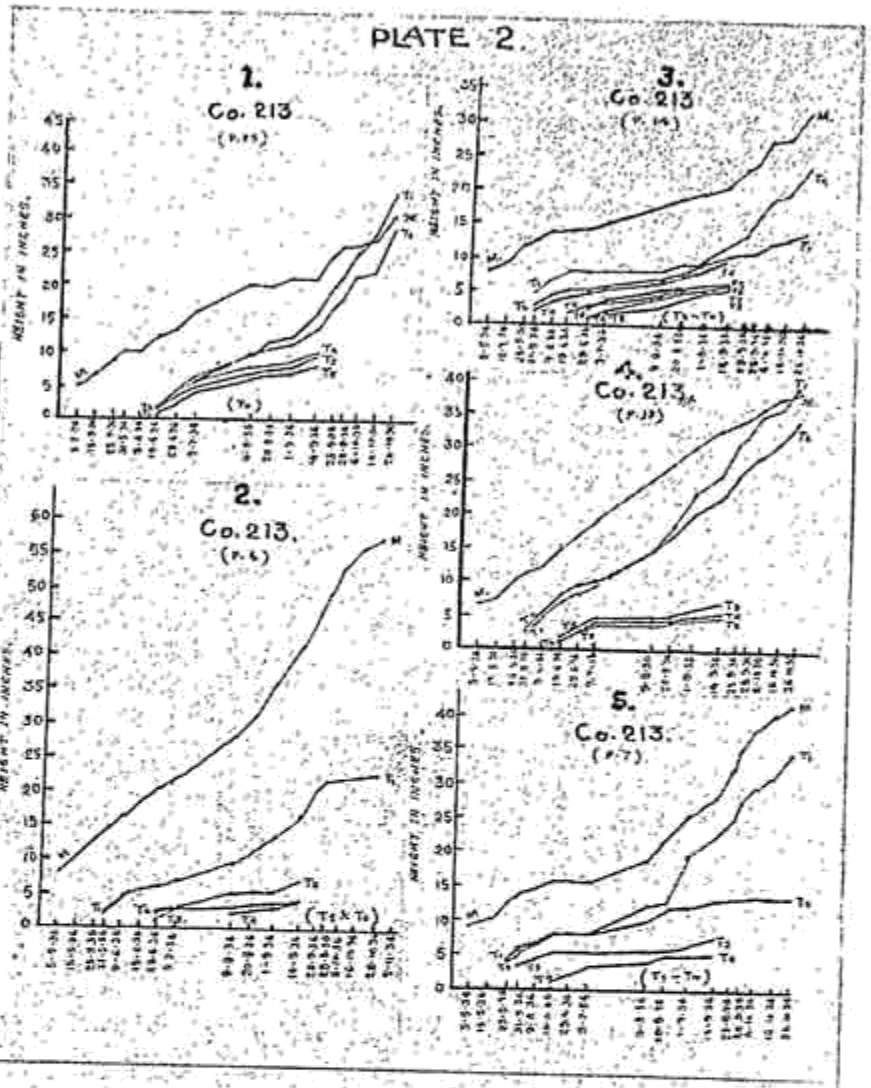

PLATE 3.

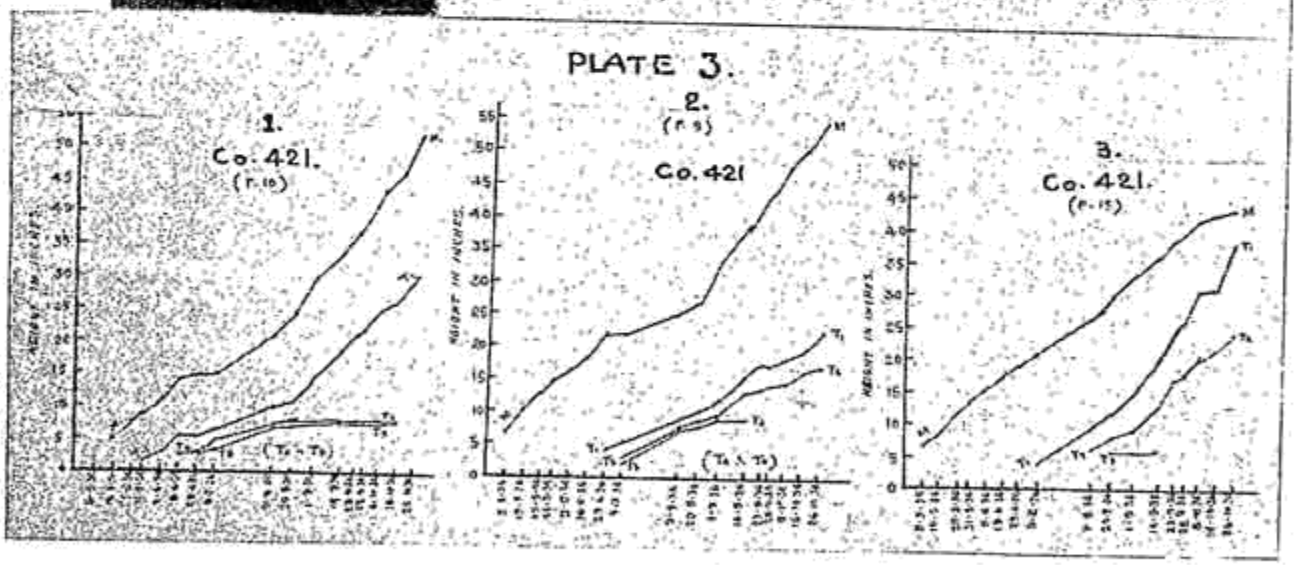

PLATE 2. Co. 213.

Fig. 1. Tillers T_1 and T_2 were vigorous and the growth of main shoot (M) was arrested. When T_3—T_6 were removed on 14—9—36, M also put on more vigorous growth. As T_1 & T_2 were improving by strides M could not keep pace.

Fig. 2. M is very steep and all six tillers were stunted. M became more steep after removal of tillers on 14—9—36. T_1 was flat after this.

Fig. 3. Eleven tillers, all formed early, stunted even the growth of M. Removal of 9 tillers on 14—9—36, caused M & T_2 to put on vigorous growth. T_1 was lagging behind.

Fig. 4. M and early formed tillers T_1 & T_2 were vigorous, and T_3—T_5 were stunted. M was flat after 14—9—36, and T_1 and T_2 became more vigorous, T_1 even overtaking M.

Fig. 5. M and all the tillers were stunted as the latter are excessive. Removal of T_4—T_{10} on 14—9—36 enabled M & T_1 to grow by strides. This made T_2 flat.

PLATE 3. Co. 421.

Fig. 1. Excessive tillers adversely affected both M and T_1; but when these two commenced to grow vigorously, T_2 and T_3 ceased to grow and T_4—T_9 had to be removed.

Fig. 2 T_1 and T_2 were vigorous and the growth of M was arrested. When T_3—T_5 were removed on 14—9—36, M put on more vigorous growth. As T_1 and T_2 were improving by strides, M could not keep pace.

Fig. 3. The tillers were few and were formed at long intervals. Hence, M as well as all the tillers, excepting the one last formed, grew well.

1. The rate of growth of the primary shoot tends to get reduced considerably when profuse tillering occurs.

2. If on the other hand, the main shoot grows vigorously the tillers would either wither or die, if too young, or would grow only very slowly, if they are already sufficiently advanced in age and growth.

3. The removal of the tillers which are superfluous and are not promising appears to result in enabling the main shoot and the surviving tillers to grow well.

These observations point to the desirability of removing the superfluous and the late formed tillers. This practice of removing the superfluous and the late formed tillers obtains very widely in the northern districts of this province, and it is evidently based on a very rational basis.

Summary. 1. The differential influences of castor cake, farm yard manure, ammonium sulphate and groundnut cake on two cane varieties Co. 213 and Co. 412 were studied in pot cultures.

2. The character of manure appears to influence both the tillering capacity and the time of tillering of any cane. Castor cake and farm yard manure seem not only to increase the number of tillers, but also to hasten their formation. Ammonium sulphate on the other hand appears to have a tendency to delay the formation of the tillers.

3. There appears to exist a minimum limit for the vegetative growth of every cane variety before the attainment of which no tillers would begin to form, and that the magnitude of this minimum varies with variety and with treatment.

4. The primary shoot and the tillers appear to exercise a mutual adverse influence on each others vegetative development. This points to the desirability of removing the superfluous and the late formed tillers, as this operation afforded evidence of exercising a beneficial influence on the growth of the surviving plants. This operation obtains as a practice in the northern districts of this province, and is evidently based on a very rational basis. By this means the presence of canes of widely varying degrees of maturity in the final harvested sample appears to be possible to avoid. Manuring with castor cake and farm yard manure would also appear to be beneficial in this respect as indicated by the results embodied in the present paper.

5. Field scale experiments are proposed to be carried out to verify the indications evidenced in this paper.

References.

1. Ramiah, P. V. Annual report of the Government Agricultural Chemist, Coimbatore (1935-36) p. 13.
2. Varahalu, T. Physical and Chemical Studies on Sugarcane Jaggery and its Manufacture. Unpublished thesis for the M. Sc. Degree of the Madras University (1935).