

Trial of Sugarcane Varieties under Swamp Conditions in South India—(A Review).

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Introduction. Manuring, irrigation and provision of proper facilities for good drainage are considered to be essential factors that determine cane yields. Formerly, when the hardy types of cane seedlings, that are now available, were scarce and the ryots had to cultivate some of the old Barbados and Mauritius varieties like B. 208 and purple Mauritius, irrigation and drainage played the most important part with regard to yield of sugarcane. These canes were 'Noble' in lineage and wanted a truly royal treatment. They needed irrigation at very short intervals and could not tolerate any water stagnation. They came up best on rich, well drained loamy soils commanding good irrigation facilities.

In Madras, which grows about 3 per cent of the total area under cane in India, sugarcane is mostly grown in wet lands or lands which usually grow rice under swamp conditions. Once in every two to four years cane is grown in the same land, rice being the rotation crop. The cultivators select, as far as possible, lands that are comparatively at a higher level than the surrounding fields for growing sugarcane. They have at times, to dig deep trenches all round the field to prevent seepage of water from the paddy lands round about. To see which of the numerous cane seedlings now available from the Sugarcane Breeding Station, Coimbatore, suits lands liable for submersion in the monsoon months, as a consequence of wet cultivation in the surrounding fields, trials were conducted in some of the important cane research stations of this province, viz., Anakapalle, Samalkot and Palur. Results achieved at these places during the past decade are summarised in this article.

Details of Experiments. These trials were conducted from 1933—34 to date at Anakapalle, from 1934—35 to 1936—37 at Samalkot and from 1931—32 to 1938—39 at Palur. Two plantings were adopted at Anakapalle. One was early, in the second fortnight of February and the second late, in the first week of May. Plantings were done only once in March or April at Samalkot and Palur. The plots were unreplicated at Anakapalle for want of space. In two out of the three years replicated trials, including only three varieties, were conducted at Samalkot, the rest of the varieties being tested in single series plots. Except during the first year, replicated trials were conducted at Palur.

Most rigorous conditions in the form of actual stagnation of water upto about 2 feet or even more at times were created at Anakapalle and Samalkot, while at Palur the crop was grown in wet lands only, without any extra attempts at creating artificial and permanent conditions of swampiness. Water stood in the field at Anakapalle from about the third week of August to the end of November, the period and depth of water varying according to seasonal conditions. At Samalkot water was regularly impounded in the

field from July to December. Thirty-six varieties in all at Anakapalle, 17 at Samalkota and 14 at Palur were tested in these trials in replicated or unreplicated plots as the case may be.

Results. It is necessary at the outset to mention two important points which have to be taken into account while reviewing these results :

Results from swamp trials and normal plantings are furnished side by side for purposes of comparison wherever possible in this article. But they are not strictly comparable, for the planting dates of the two trials were not the same and they were laid out in two different fields. Nevertheless, it is hoped they will just afford a general comparative idea.

Co. 419 was taken to illustrate many of the observations from these trials, as it is the most popular variety of the province. The conclusions arrived at with regard to this variety generally hold good in the case of other varieties also.

(i) *Growth and development of canes*.—Sugarcane is mostly planted from February to April in this province. It takes normally about six weeks for all the buds to complete germination. By about the end of May, most of the useful tillers would have been formed. From about the middle of June till the end of October the crop passes through the most vigorous growth period. This is called the grand period of growth. And at this time, if optimum growth conditions prevail, the crop records maximum growth. But in these trials water is allowed to stagnate in the field during this period. Consequently the growth rate of the crop is checked with a resultant loss in yield. The following table illustrates this point with reference to Co. 419 and Co. 449.

TABLE I (Anakapalle).

Month.	Swamp trials planted second fortnight of February. Average growth rate (in inches) during a month.		Normal planting (Study plots) Planted in the first fortnight of March. Average growth rate (in inches) during a month.	
	Co. 419	Co. 449	Co. 419	Co. 449
June	24.6	27.3	23.1	30.7
July	20.2	24.7	24.7	29.3
August	20.6	28.0	20.4	23.9
September	16.6	10.7	18.5	18.2
October	11.7	9.6	11.8	12.4
November	6.1	3.9	8.0	6.6
December	...	5.0	...	7.3

It is evident from the figures furnished in the above table that the rates of growth of the crop in September, October and November in the swamp trial, i. e., after water is let into the field, are less than in the normal planting. The differences are more marked in the case of Co. 449, indicating the superiority of Co. 419 with regard to tolerance of water stagnation.

Even though the crop in the swamp trial had an initial start of about 15 to 20 days in planting, the ultimate height in December, at the end of which the swamp crop was harvested, was practically the same as that of the normal crop, since the rate of growth of the latter was more. Results are presented in the table below.

TABLE II. Average height of Co. 419 (Anakapalle).

Month.	Swamp trial (in inches)	Normal planting (Study plots) (in inches)
June	42.3	34.1
July	66.9	57.2
August	87.1	78.9
September	107.7	99.3
October	124.3	117.8
November	136.0	129.6
December	142.1	137.6

Average maximum height (at harvest time in March)—155.7"

As will be seen later, cane from swamp lands has to be harvested by the end of December or early in January. Hence we lose about $13\frac{1}{2}\%$ of cane by cutting the crop early in the season and this results in the reduction of yields from these fields.

(2) *Number and weight of canes*:—Apart from the total height, the number and weight of canes also have got a direct bearing on the yield. As shown below less number of canes are harvested usually from the swamp trials than from the normal crop.

TABLE III. Average number of canes (Co. 419) harvested per acre (Anakapalle.)

Year.	Swamp crop.	Normal (Study Plots) crop.
1940—41	37,050	39,183
1941—42	34,533	37,400
1942—43	38,008	31,780
1943—44	32,617	39,533

* From Ratoon Experiment Plant Crop.

TABLE IV. Average weight of Single Cane (Co. 419)

Year.	Swamp. (Lbs.)	Normal (Study plots) (Lbs.)
1940—41	2.844	3.482
1941—42	3.330	3.643
1942—43	2.770	2.866
1943—44	2.750	2.974

* From Ratoon Experiment Plant Crop.

The weight of an individual cane from the swamp crop is definitely less than that from normal planting. The results furnished in Table II disclosed that about one foot height of the crop is lost by growing it under swamp conditions. The inevitable consequence of this shorter crop is reflected in the lower weights recorded by the individual canes from these trials.

(3) *Arrowing*:—Another important factor that influences yield is arrowing. Swampiness induces more arrowing. Arrowing limits vegetative development and consequently the yield.

Results are summarised below:—

TABLE V. Per cent arrowing. Co. 419.

Year.	Swamp trial.	Normal planting.
1939—40	—	—
1940—41	8.30	—
1941—42	—	—
1942—43	6.94	1.21
1943—44	6.18	—

(4) *Chemical analyses of juices*:—Chemical analyses of juices of all the varieties included in these trials at the different research stations, were

done at periodical intervals. The maximum average sucrose and purity percentages are furnished in table VI below. The figures for some of the varieties are not traceable. Only for one year results are available from Samalkot and several varieties at Anakapalle (Co. 290, Co. 423, Co. 373, H. M. 607, Co. 443, Co. 523, Co. 444, Co. 451, Co. 545) and Palur (Co. 365, Co. 400, Co. 401, Co. 403 to Co. 407, Co. 410, Co. 413 & M. A. 21) were tried only once in these experiments. Out of the remaining varieties many were tested for three years in succession and Co. 419 was under trial for the past 9 years at Anakapalle. (It is now planted as a standard in this trial for comparison with other varieties every year.)

TABLE VI. Showing the average maximum sucrose and purity per cent recorded by the different varieties at the three Research Stations:—

Serial No.	Variety.	Anakapalle.		Palur.		Samalkot.			
		Max. Sucrose.		Max. Purity.		Max. Sucrose.	Max. Purity.	Max. Purity.	
		Early plant-ing.	Late plant-ing.	Early plant-ing.	Late plant-ing.				
1.	Co. 213	15.31	14.91	87.50	87.13			17.70	88.53
2.	Co. 243	16.23	13.41	89.17	85.18				
3.	Co. 281	16.48	15.96	86.72	89.13	18.41	90.62	19.00	90.42
4.	Co. 285	—	16.04	—	88.33			18.11	88.82
5.	Co. 290	14.85	15.44	87.38	85.06				
6.	Co. 310	17.08	15.92	88.98	86.48				
7.	Co. 313	17.59	17.63	87.81	89.96				
8.	Co. 331	16.91	15.16	89.98	88.48				
9.	Co. 351							20.09	90.03
10.	Co. 356							17.75	88.08
11.	Co. 363					16.90	88.42		
12.	Co. 365					18.50	90.50		
13.	Co. 373	16.62	16.26	85.84	88.97				
14.	Co. 400					14.64	84.10		
15.	Co. 401					19.33	93.80		
16.	Co. 402					14.66	86.59		
17.	Co. 403					17.91	91.10		
18.	Co. 404					15.01	82.30		
19.	Co. 405					18.14	90.50		
20.	Co. 406					17.50	90.00		
21.	Co. 407	18.55	16.88	92.61	88.27	12.09	76.50		
22.	Co. 410					15.71	84.70		
23.	Co. 411	16.70	15.93	89.20	86.78				
24.	Co. 412	16.72	15.46	89.87	88.92				
25.	Co. 413					18.18	91.60		
26.	Co. 414	14.22	16.40	83.66	88.60				
27.	Co. 419	18.11	17.01	89.87	88.59	17.58	87.55		
28.	Co. 421	16.83	15.96	87.48	86.37	17.48	86.47		
29.	Co. 423	15.70	14.67	88.10	83.73				
30.	Co. 443	17.43	17.59	89.04	90.57				
31.	Co. 444	15.72	14.90	89.54	87.04				
32.	Co. 449	18.19	17.20	90.95	90.78				
33.	Co. 451	17.68	17.39	90.40	88.16				
34.	Co. 523	17.27	17.44	88.94	89.28				
35.	Co. 527	17.47	17.46	89.69	90.14				
36.	Co. 545	17.47	14.61	89.13	86.36				
37.	247-B	14.90	13.38	87.09	84.34	15.90	86.98	18.25	94.04
38.	Fiji-B					19.34	91.23		
39.	M-55					17.91	89.63		
40.	POJ. 2714					19.26	90.45		
41.	POJ. 2878	18.40	17.67	90.42	86.72			20.10	86.90
42.	H. M. 607	12.89	12.31	85.25	82.21				
43.	M. A. 21					18.56	90.30		

A perusal of the figures in the table indicates:—

- (i) that varieties planted early had a better quality of juice than those planted late at Anakapalle.
- (ii) that Co. 407, Co. 419, Co. 449 and POJ. 2878 recorded over 18% sucrose and about 90% purity in December when planted early.
- (iii) that even under late planted conditions these varieties registered over 17% sucrose in their juices.
- (iv) that among varieties tried at Palur Fiji-B and POJ. 2714 recorded over 19% sucrose and 90% purity.
- (v) and that POJ. 2878 had the richest juice at Samalkot

Varieties mature earlier on these lands than under normal conditions as is brought out by the figures furnished in the following tables (VII and VIII)

TABLE VII. Anakapalle. Co 419

Year.	Month of analysis.	Sucrose %		Purity %	
		Swamp.	Normal.	Swamp.	Normal.
1937-38	January	18.98	16.92	90.57	88.78
1938-39	"	17.00	15.57	87.66	86.26
1939-40	"	16.96	15.21	90.46	88.33
1940-41	"	19.45	13.71	91.75	83.14
1941-42	"	17.87	14.78	90.74	87.36
1942-43	"	18.40	14.45	89.93	84.59
1943-44	Dec.—Jan.	16.83	14.29	87.16	83.77

N. B.—(a) Planting of swamp trial was done early in the 2nd fortnight of February, whereas the normal planting was done in the first week of March.

(b) Analysis dates were not the same in both the cases. Juices from the normal planting were analysed always later.

(c) Varieties under normal planting reached their peak maturity some time in March.

TABLE VIII. Palur. Co. 419.

Year.	Sucrose %		Purity %	
	Wet land.	Garden land.	Wet land.	Garden land.
1936-37	18.12	16.67	88.07	85.01
1937-38	15.60	15.46	84.22	83.62
1938-39	19.11	12.45	90.35	75.44

Deterioration of juices set in at Anakapalle usually early in January whereas no such ill effects seem to have been noted at Palur. The crop had to be cut in January at Anakapalle whereas it was harvested during March—April at Palur. This must evidently be due to actual stagnation of water for long at the former place.

TABLE IX. Showing deterioration of juices at Anakapalle. (Variety—Co. 419.)

Year.	Date of analysis.	% Sucrose.	Date of analysis.	% Sucrose
1941-42	25-12-41	18.51	3-1-42	17.87
1942-43	21-12-42	18.18	5-1-43	17.73
1943-44	21-12-43	17.20	31-12-43	16.83

(5) *Yield*.—The yield figures of all the canes under trial at the different research stations are set forth in the table below, to afford a comparative idea of the relative performance of the several varieties.

TABLE X. Showing the average yield of the different cane varieties at the three research stations (Anakapalle, Samalkot and Palur.)

Serial No.	Variety.	No. of years of trial.			Yield of cane in tons per acre.				
		Anakapalle.		Samalkot.	Anakapalle.		Samalkot.	Palur.	
		Early.	Late.		Early.	Late.			
1.	Co. 213	3	2	2	1	28.56	31.78	20.36	30.47
2.	Co. 243	3	2			39.09	38.90		
3.	Co. 281	3	2	2		27.41	25.91	18.86	
4.	Co. 313	5	4			39.95	29.13		
5.	Co. 351	2	1	1		30.30	22.67	18.30	
6.	Co. 356	3	2	1		31.10	30.94	33.30	
7.	Co. 357	1				24.04			
8.	Co. 358	1				27.28			
9.	Co. 361	2				28.11			
10.	Co. 408	2	1			31.57	31.35		
11.	Co. 414	3	2			28.42	35.27		
12.	M. A 21	2	1			28.87	20.84		
13.	Co. 285	1	2	2	1	40.05	33.00	23.86	31.60
14.	Co. 407	2	2			31.04	30.44		
15.	POJ. 2878	4	3	1	2	31.88	23.28	30.30	27.54
16.	Co. 290	1	1		1	38.44	51.07		45.80
17.	Co. 419	8	8		3	50.58	38.78		54.12
18.	Co. 423	1	1			33.31	48.35		
19.	Co. 412	4	4			33.33	27.05		
20.	Co. 373	1	1			32.06	26.97		
21.	Co. 360	1	1			27.59	27.14		
22.	Co. 368	1	1			3.71	30.40		
23.	Co. 421	3	3		3	51.42	37.13		50.18
24.	Co. 428	1	1			30.27	36.29		
25.	Co. 363				3				41.88
26.	Co. 411	3	3			50.13	35.65		
27.	J. 247	4	4	1	8	40.00	27.67	15.00	37.58
28.	Co. 310	3	3			37.04	33.59		
29.	Co. 331	4	4			44.72	37.59		
30.	H. M. 607	1	1			40.76	33.28		
31.	Co. 449	3	3			43.30	31.41		
32.	Co. 527	4	2			36.58	24.80		
33.	Co. 523	1	1			24.00	15.13		
34.	Co. 443	1	1			21.63	17.66		
35.	Co. 451	1	1			40.86	29.09		
36.	Co. 444	1	1			42.86	26.93		
37.	Co. 545	1	1			38.86	30.72		
38.	P. M.			1				9.00	
39.	Co. 210			1					
40.	Fiji-B				5				20.25
41.	M. 55				5				31.06
42.	B. 208				1				14.00
43.	POJ. 2714				4				31.88
44.	Co. 402				3				38.80

N. B.—Yield figures at Anakapalle have only indicative significance, since the plot size is small (2 cents).

The following inferences can be drawn from this table:—

- Varieties at Anakapalle yielded better under early planted conditions.
- Co. 421 (51.42 tons), Co. 419 (50.58 tons) and Co. 411 (50.13 tons) were the highest yielders at Anakapalle.

- c) Among the varieties tried at Samalkot Co. 356 (33.30 tons) recorded the maximum yield.
- d) Co. 419 excelled all the other varieties tried at Palur with 54.12 tons of cane per acre followed by Co. 421 with an acre yield of 50.18 tons of cane.

The average yield of Co. 419 under normal conditions is 54.77 tons (Yield trials) at Anakapalle. Against an average yield of 25.3 tons recorded under swamp conditions at Samalkot, 45 tons per acre was the average normal yield of the Station (1935--36). The average yield of Co. 419 from wet lands (54.12 tons per acre) was far below that registered by the variety under garden land conditions (69.59 tons) at Palur. Hence, varieties under actual swampy conditions tend to record lower yields than from normal fields. The loss in yield may, of course, vary with the period and depth of water stagnation; and vigorous growing varieties like Co. 419 may tolerate swampiness to a greater extent.

Summary and Conclusions. The influence of the inundation of fields with water in monsoon months on the sugarcane crop was studied at three research stations in this province. The results achieved during the past decade are presented in this paper. The following conclusions are drawn from these results.

- (1) In lands liable for submersion by water in monsoon months, planting of cane will have to be done as early as possible, preferably by the middle of February. Later plantings record lower yields.
- (2) Growth of cane is arrested after swamp conditions set in. This check in growth will be marked, or otherwise according to the particular variety grown. For instance, in the case of Co. 419 there was not much difference in the rates of growth registered by the normal crop and that grown in the swamp trial.
- (3) Uniformly good growth vigour throughout the life of the variety, such as that exhibited by Co. 419, seems to be essential for a cane to perform well under swamp conditions.
- (4) The number and weight of canes recorded at harvest time are lower than those obtained from a normal crop.
- (5) Arrowing is more profuse under water logged conditions.
- (6) Varieties mature earlier under swamp conditions. They deteriorate early in January or, at times, even a little earlier.
- (7) Yields of cane are comparatively lower than from normally grown crops.
- (8) Among the varieties tried, Co. 419 combines in itself good juice quality with high yield and is the most suitable cane for growing under these conditions.

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