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the Government of the chairmanship of the use of fertilizer recommendation after an examination of the available data that are available in the country. Findings of the experts that considering the climate and the difficulty in our water supply, of increasing our plant attacks on the recent years and an area, in fact, there is a agriculturist minimises the care of the fullest attention to the fullest. But it should not be about a century ago throughout the world have trebled their the fact is attributable

many crops benefit and there instances manuring it will be need manuring has

eagerly awaited by this country and we with expedition.

More Sugar Per Acre

By

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I. **Introduction.** In any balanced system of food production, the production of sugar must form one of the important items. The demand and consumption of sugar is increasing and we are feeling more and more the deficiency of sugar in this Province, whose quota has to be supplemented from the other Provinces. Sugarcane cultivation is mainly confined to the tropical belt but in this country, its cultivation as well as the sugar industry is developed to a greater extent in the sub-tropical North India than in the tropical Southern Peninsula. Considering the favourable soil, climatic and varietal conditions for sugarcane in the Madras Province, the white sugar industry must be said to be still very backward when compared to the other Provinces as shown below:

TABLE I.

Number of sugar factories working in 1944-'45, actual quantity of cane crushed, sugar produced and recovery per cent obtained.

Province.	No. of mills working.	Cane crushed (Tons)	Sugar (Tons)	Cane consumed in factories as % of total cane produced.	Sugarcane Recovery per cent.
United Provinces	67	5,185,000	528,900	21.6	10.20
Bihar	29	1,588,600	169,900	30.9	10.69
Madras	11	510,400	46,500	6.0	9.11
Bombay	10	694,200	74,900	14.0	10.79

It is thus clear that to meet the demand and to make up the deficit of sugar in our Province an all-out drive for greater sugar production is essential and it is the object in this small note to make some suggestions for production of more sugar without increasing the area under sugarcane.

II. **Varietal.** One of the chief means by which improvement in sugar production is achieved is by the selection of better varieties than the ones in use. No doubt, our objective is to select high yielders coupled with high sugar content. Unfortunately few varieties combine those two qualities. The cultivator prefers to grow high-yielding varieties of cane, while the sugar manufacturer prefers high sugar varieties. Since our objective is "More sugar per acre" so as to increase the output per unit

area of land, the selection of varieties from the factory point of view should be on the basis of "more sugar per acre". Work done at Anakapalle has shown that varieties differ considerably as regards their sugar yield per acre.

TABLE II.

Approximate amount of available sugar—Tons per acre.

Variety.	November.		December.		January.		February.		March.		April.		Yield of cane per acre	Serial No.	Variety.	Nov.	
	Sugar	C. C. S.	Sugar	C. C. S.	Sugar	C. C. S.	Sugar	C. C. S.	Sugar	C. C. S.	Sugar	C. C. S.				Suc %	Purity %
Co 419	4.6	8.33	5.5	9.97	5.9	10.63	6.7	12.26	6.8	12.42	6.0	10.95	55	1.	Co 527		
Co 421	3.9	9.22	4.6	10.93	5.2	12.27	4.9	11.69	4.4	10.35	4.3	10.26	42	2.	Co 449	7.82	14.16
Co 443	3.7	8.82	4.3	10.18	5.0	11.93	5.4	12.76	5.2	12.35	4.9	11.60	42	3.	Co 419	13.36	82.77
Co 508	4.0	10.73	4.8	12.96	4.7	12.68	5.1	13.70	4.8	12.95	4.9	13.35	37				
Co 523	3.9	9.37	4.2	10.03	4.6	11.02	4.8	11.38	4.8	11.30	4.7	11.20	42				
Co 527	3.6	8.46	4.7	10.96	5.2	12.07	5.4	12.45	5.2	12.12	5.2	12.14	43				
POJ																	
2878	3.3	9.72	4.5	13.12	4.3	12.59	4.8	14.05	3.9	11.34	3.9	11.36	34				

The data would show that varieties like POJ 2878, in spite of high CCS% cannot compete with Co 419 with respect to total sugar out-turn because of the lower yields. Certain varieties like Co 527 keep for longer time than other varieties and can be crushed from December profitably taking the minimum C. C. S. requirement of sugar factories to be 10%.

In Table I, it was noted that the present recovery of sugar on cane in Madras is comparatively less than in Bombay and other Provinces. This may be partly due to immature canes being crushed by some of our factories. At least in the Madras Province, all the cultivators invariably take to Co 419 because of its high tonnage and its resistance to many unfavourable conditions. But, unfortunately, the cane is late-maturing and hence the recovery is poor in the initial stages. For the sugar factories to obtain higher recoveries and produce more sugar in unit time, as also prolong their crushing period, they should take up the cultivation of varieties that give uniform recoveries and sucrose percentages for at least five months. Work at Anakapalle has shown that by crushing "Early", "Mid-season", and 'late' canes, the factories can prolong their crushing period and also get uniform recoveries for a longer time. Varieties Co 527 for early season, Co 449 for mid-season and Co 419 for late season have been recommended by this Station after much research on the basis of their ripening qualities as shown below :—

Juice quality

Nov.

Serial No.

Variety.

Suc %

Purity %

1. Co 527

2. Co 449

3. Co 419

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TABLE III.

Juice quality of early, mid-season and late canes at Anakapalle.

				Nov.	Dec.	Jan.	Feb.	Mar.	April	May.									
				Suc %	Purity %	Suc %	Purity %	Suc %	Purity %	Suc %	Purity %	Remarks.							
Harvest.	April.	C. C. S.	Yield of cane per acre	Variety.		Nov.		Dec.		Jan.		Feb.		Mar.		April		May.	
C. C. S.	Sugar	C. C. S.	Yield of cane per acre	1. Co 527	2. Co 449	3. Co 419													
12.42	6.0	10.95	55	7.82	14.16	13.36	82.77	17.39	86.50	17.61	87.34	18.06	88.80	18.34	91.73	17.29	83.66	17.37	86.32
10.35	4.3	10.26	42	7.82	14.16	13.36	82.77	17.39	86.50	17.61	87.34	18.06	88.80	18.34	91.73	17.29	83.66	17.37	86.32
12.35	4.9	11.60	42	7.82	14.16	13.36	82.77	17.39	86.50	17.61	87.34	18.06	88.80	18.34	91.73	17.29	83.66	17.37	86.32
12.95	4.9	13.35	37	7.82	14.16	13.36	82.77	17.39	86.50	17.61	87.34	18.06	88.80	18.34	91.73	17.29	83.66	17.37	86.32
11.30	4.7	11.20	42	7.82	14.16	13.36	82.77	17.39	86.50	17.61	87.34	18.06	88.80	18.34	91.73	17.29	83.66	17.37	86.32
12.12	5.2	12.14	43	7.82	14.16	13.36	82.77	17.39	86.50	17.61	87.34	18.06	88.80	18.34	91.73	17.29	83.66	17.37	86.32
11.34	3.9	11.36	34	7.82	14.16	13.36	82.77	17.39	86.50	17.61	87.34	18.06	88.80	18.34	91.73	17.29	83.66	17.37	86.32

It would thus be clear that by a judicious crushing of early, mid-season and late canes, the factory economy can be increased and the output of sugar considerably increased.

It would thus be clear that by a judicious crushing of early, mid-season and late canes, the factory economy can be increased and the out-turn of sugar considerably enhanced. But, unfortunately, the early and mid-season canes cannot compete with Co 419 as regards yield and to encourage the above varieties, a premium should be offered to compensate for the low yield. Ratoons mature earlier and hence the factories start crushing ratoons first. But this practice cannot altogether dispense with the need for 'early varieties' which would be suitable for crushing from Nov-Dec. onwards. Further, continuous ratooning is not conducive to increased tonnage of cane. Therefore, high-yielding and early maturing varieties must be encouraged in the factory areas by the offer of bonuses to off-set their lower yields.

of sugar on canes of other Provinces.

III. Manurial. By careful and controlled manuring, increased yields of sugar can be realised. Of the plant-food elements, sugarcane responds most to nitrogen. Large applications of nitrogen especially in the form of Ammonium Sulphate and ground-nut cake in proportions of 2:1 or 1:1 have been tried in various Research Stations. In all these trials, one common conclusion is that while increasing doses of N may increase tonnage output of cane per acre, it delays maturity and may depress sucrose content also. The optimum dose, therefore, is one that gives increased yield per acre without delaying maturity or depressing sucrose content. In other words, maximum sugar per acre consistent with increased cost of manuring must be the criterion. This is illustrated by the data from the experiment on graded doses of N conducted at the Sugarcane Research Station, Gudiyatham.

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Dose of Nitrogen lb. per acre.	(1945-'46.)		Juice analysis at Harvest.	
	Yield in tons per acre.		Sucrose %	Purity.
	Cane	Sugar		
0	24.77	4.71	19.00	90.95
50	30.75	5.89	19.15	91.09
100	45.09	8.66	19.20	90.48
	43.86	8.03	18.30	88.76
200	50.30	8.76	17.42	85.72
250	49.77	8.67	17.42	85.31

It is seen from the data that increased yields in tonnage of cane per acre beyond 100 lb. N, have not resulted in a proportionate increase in tonnage of sugar per acre. Experiments on the application of Nitrogen to sugarcane were reported from the Agricultural Research Stations, Anakapalle, Samalkotta, Gudiyatham and Palur. A perusal of the data shows that the northern and southern districts differ in their N requirements for sugarcane. From the available data it may be recommended that:—

- (i) There is no significant increase in tonnage of cane between the dosage 100 lb. N to 200 lb. N in the Anakapalle and Samalkotta Farms.
- (ii) At Gudiyatham, there is evidence for increase in tonnage of cane upto 200 lb. to 250 lb. N.
- (iii) At Palur, there is increase in tonnage of cane even upto 250 lb. N and there may be response even to larger doses.
- (iv) The delay in maturity and depression in sucrose %, starts at about 150 lb. N level at Anakapalle and Samalkotta, while it is about 150 lb. N at Gudiyatham and at about 200 lb. to 250 lb. N at Palur.

The available data are not sufficient to calculate available sugar per acre and hence critical levels for sucrose recovery cannot be fixed at present. In general it may be stated that a lower dose of N is desirable in a richer class of soils, and higher doses in poorer classes of soils in respect of tonnage, increase of cane, sucrose recovery and normal maturity.

IV. Technical efficiency of factories. No amount of improvement in yield and quality of cane can help in stepping up sugar production, if the efficiency of the factory is poor. Compared to other sugar-producing countries, the technical efficiency of Indian factories is low:

Efficiency
Cane—Sucrose
Cane—Fibre per
Mixed Juice
Extraction
Over-all recovery
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Efficiency of factories and recoveries in India as compared to other countries.

	India	Hawaii	Java	Formosa
Cane—Sucrose per cent	12.18	11.95	13.22	13.30
Cane—Fibre per cent	16.18	13.44	12.60	12.60
Mixed Juice	80.45	82.38	84.30	85.30
Extraction	91.22	96.32	94.60	95.20
Over-all recovery	79.58	87.35	85.83	85.10
Over-all recovery reduced } technical efficiency }	85.04	89.44	86.36	84.92
Yield per cent as Sugar	9.74	10.74	11.16	11.48
Yield per cent as Sugar (96 Pol)	10.10	10.90	...	11.80

(From N. L. Dutt's Report.)

The low recovery in India as compared to Hawaii and Formosa cannot be attributed to low juice quality as can be seen from the figures given below (from Dutt N. L. 1936.)

TABLE

Juice analysis of varieties in India, Hawaii, Queensland and Natal

Particulars.	India.				Hawaii.			
	Co 312	Co 421	Co 419	Co 313	K. 107	D. 1135	31-1389	H. 109
Brix	19.8	20.4	21.8	20.6	21.3	21.4	18.5	17.9
Pol.	18.3	17.9	20.3	18.2	18.3	18.2	15.5	15.4
Purity	92.5	87.9	93.1	88.4	85.9	84.9	83.9	85.1
Particulars.	Queensland.				Natal.			
	E. K 28'	Badilla	POJ.2878	Co 281	Co 290	Co 301	UBA	
Brix	22.2	22.6	21.9	20.0	18.7	21.1	18.8	
Pol.	20.3	20.8	19.9	18.2	16.4	19.3	16.4	
Purity	91.2	91.9	90.6	90.9	88.0	91.5	86.9	

The juice quality is as high as in the other sugar-producing countries and the defect must be attributed to the lower efficiency of the factory machinery. It is necessary that our factories are equipped with up-to-date machinery to improve the extraction as well as recovery. Dutt pointed out that average recovery in this country improved from 8.70 in 1934 to 9.72 in 1940 and of this, 82.35% is due to improvement in varieties and 17.65% is due to improvement in factory efficiency. Therefore, under the existing conditions, large improvements in recovery are possible if a proper varietal schedule is adopted.

V. **Summary.** Yield of cane and sugar per acre and the development of sugar industry as well as its present efficiency, are all capable of further improvement in this Province. Among the varieties now released from Anakapalle Sugarcane Research Station, Co 527 for early Co 449 for mid and Co 419 for late seasons are recommended. In regard to manuring it is pointed out that nitrogen is the most important. Beyond a particular dose, there is delay in maturity and depression in sucrose per cent. Therefore, the nitrogen level is to be judiciously fixed. The northern districts in general, require a lower level of nitrogen than the southern districts. India in general, and this province in particular, is poor in factory efficiency with poor sugar recovery. Due to current international and post-war restrictions, it would be difficult to renew the machinery. Therefore, the factories can resort to proper varietal schedules in order to improve their recovery per cent. By the above methods it is suggested that total output of sugar per acre can be increased.

VI. **Acknowledgment.** Our thanks are due to Sri R. Vasudevarao Naidu, Sugarcane Specialist, Anakapalle, for the keen interest evinced in the preparation of this note.

VII. **Literature.** Dutt N. L. (1946) Report on Survey of Sugarcane Research in India. Gandhi M. P. (1946) Indian Sugar Industry Annual. Madras Agricultural Station Reports 1935-'36 to 1947-'48 Thirumal Rao W. and Sriraman K. (1943) Commercial cane sugar value and its importance. M. A. J. XXXI. p. 317.



Joss Sticks from Bagasse:— Yoshi Twata, Tsuneo Jatsuno and Toe Shiang Wu. (pp. 100—103, 1947)—When bagasse is soaked for about two weeks in lime water it undergoes fermentation and chemical change and becomes moldable by machine to form sticks or coils, which when dried burn smoothly and produce an abundant smoke that has a repellant effect on mosquitoes. If the molded material is mixed with 10% of powdered dry leaves of essential oil-bearing plants (eucalyptus, citronella) the smoke is strongly repellant and largely fatal to mosquitoes. (*Sugar*, Vol. 43, No. 7, July 1948, p. 49.)

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