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Sugarcane Research in Madras

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The opening of an agricultural research station at Samalkot in 1902, marked an era which led to the opening of the Indian Sugarcane Breeding Institute under the inspiring leadership of Dr. Barber. The crisis which the crop faced from *sereh* disease in Java and red rot in India stimulated new lines of research. After half a century of progress, the industry in Madras is now facing a second crisis, but it is hoped that history will repeat itself and sugarcane will record further progress.

Sugarcane presents many advantages to the research worker. For a breeder, it is a hybrid polyploid vegetatively propagated. It is both a plantation and a peasant crop. It can be cultivated only by resourceful ryots and requires good treatment.

The present and the future prospects are indicated below :—

Plant Nutrition : The sugarcane soils of United Provinces, Bihar, Punjab and Bombay are classified and surveyed on the genetic system. Varietal, manurial and cultural trials are now based on such trials. Investigations by Parthasarathy and Rama Rao (1951) indicated differential moisture uptake by the plant in clayey and loamy soils, wet and garden-land soils. Even though the clayey soil retains high moisture it does not easily part with it for the plant. Similarly, even when it is higher in fertility status, it is not efficiently utilised in clayey soils (Rama Rao, 1954). The inability of heavy soils to part with moisture and nutrients, necessitates higher doses of manure to be applied to them. The physical status of the soil is of great importance in the application and utilisation of artificial manures.

The complexity of transmission of applied manurial ingredients from the soil to the plant, necessitated the development of tissue tests, as better guides than chemical analysis of soil. Tests carried out at Anakapalle indicated that the levels of nutrients and moisture in plant tissues vary within a narrow range. This points to a fundamental mechanism in the tissues which regulate these levels. Foliar or tissue diagnosis may prove a better

guide to sufficiency or deficiency of nutrients than a direct study of the soils for the purpose.

Overhead irrigation was developed in recent years to save water. It is now known that sugarcane plant can absorb moisture through the leaf and pass it down to the roots (Van Dillewijn, 1952). Transpirating water takes up with it nutrient elements and the reversal of the process may leave the plant deficient in nutrition. But feeding the plant through the soil generally leads to wastage in the applied nutrients. It is now known that the leaf can absorb considerable quantities of salts in solution. Experiments with tagged elements indicated that the photosynthate of leaf moves rapidly to all parts of the plant, nutrients absorbed by leaf are rapidly distributed to all parts of the plant, nitrogen absorbed by root is redistributed to growing parts after three months and there is continual mixing of elements between tissues and all tissues are dynamic in exchanging old elements to new ones without altering concentrations. (Burr. 1953). There is not only quick transmission of elements by foliar feeding, but there is great economy in the same. This foliar feeding becomes necessary for the second and subsequent manuring when the crop is heavy and impenetrable. There is saving in manure by over 60 per cent (Sugar 47. page 64). Overhead spray irrigation leads to economy in water and leaves the soil in better tilth. By better distribution of irrigation water, sugar content in cane is increased. The use of anhydrous ammonia in irrigation water leads not only to economy in nitrogen but also to better distribution of the same (Baver & Humbert, 1953).

The high degree of negative correlation between moisture in tissues and sugar content was pointed out (Parthasarathy, 1951). The need for strict control of irrigation water was recognised more than two decades ago in Hawaii, but in earlier stages day degrees were adopted for irrigation control and in recent years leaf sheath moisture is adopted as guide. The possibilities of spray irrigation and foliar feeding may in future lead to considerable economy in water and a better distribution of nutrients and increased sugar content.

Interculture: Many of the intercultural operations, particularly in early stages of the planted crop, are designed to protect crop plants against weeds. In recent years selective weedicides have been used to kill broad-leaved plants. The annual and

perennial grasses are more difficult to deal with, although nut-grass is susceptible to 2, 4-D. The great potentialities of chemical weedicides are still to be developed in this State. A correct spraying schedule has not been worked out.

Planting in deep trenches, high banking, controlled irrigation, propping are all designed to minimise lodging in cane. Lodging brings many disadvantages in its wake and leads to loss in quality to the tune of 25% and in yield upto 40 to 50 percent. Detailed studies (Vaidyanathan, 1953) indicated that varieties differ in their reaction to lodging. Loss in sugar content in a variety like Co. 449 is much less than in Co. 419.

Resistance to wind is yet to be studied fully. In minimising lodging, cultural treatments are more important than other factors. In the Andhra area, canes are propped heavily, with 4,000 to 6,000 bamboos. Yet the clumps lodge badly, but that system facilitates lifting up the clumps to erect position. Cheaper techniques like stocking and trash twist propping (Parthasarathy and Reddy, 1951) are not efficient with very heavy crops. The cane plant is top-heavy and losses due to lodging are heavy even in a twelve-months crop. This factor had been mainly responsible for *adsali* and longer duration crops not being popular in this State.

Pests and Diseases: The early shoot borer *(Chilotraea infuscafellus)* and top borer *(Scirpophaga* sp.*)* are the two important pests on sugarcane in the State. The habits of the borers in the field and the broad cycles are yet to be studied in detail. The reaction of the cane plant to the infestation by early shoot borer was studied and reported (Parthasarathy *et al* 1953). Apart from variation in the degree of incidence between varieties, the reaction of the plant to the borer appears different. The two borers protect themselves from the earliest stages and spraying of chemicals may have only a limited significance. Systemic insecticides may be more intensively studied, to render the plant distasteful to the borer.

Among the diseases, smut is important. Pineapple disease of planted setts as affecting seriously the plant population appears to be widespread. The solution for smut appears to lie in the development of varieties resistant to it. Pre-treatment of setts

may not prove popular with ryots and as such treatment of the soil to protect the setts may have to be developed. In the alternative, systemic fungicides may have to be applied to the seed nursery crop.

Yield Trends: The crop yield competitions in Madras (Reports on development scheme) brought to light the heavy yields recorded by cultivators in the State.

TABLE I

Maximum yields recorded with Co. 419 variety

Centres	Tons per acre.	
	1951–1952	1954–1955
Gudiyatham	96	81
Nilakottai	87	74
Pugalur	69	84
Nellikuppam	...	129

Agrobiologists calculate 197 tons as the possible maximum yield of sugarcane and the world record in 129 tons in a 24-month crop. An yield of 129 tons cane per acre was recorded in Madras in a 13-month crop. In Hawaii, a change in variety contributed 40 – 45%, irrigation control 20 – 25%, and control of pests and diseases 10 – 15% towards the total increase in sugar yield from five tons to nine tons per acre. The basic factor is the establishment of a well-equipped research station. The amount spent on research in some of the cane countries of the world is shown below:

TABLE II

Country	*Staff*	*Substations*	*Expenditure*
Louisiana	136	5	$ 4,96,989
Hawaii	59	10	$ 8,21,216
Hawaii University Experiment Station	40	11	$ 2,61,188
Puerto Rico	67	3	$ 6,85,600
Florida	121	6	$ 5,90,961
Madras	...	1	...

Even if we were to consider 100 tons of cane of good quality as our potential, ths present average yield of the State is only 27 per cent. Compare this with the over-all efficiency of a sugar factory which is 85 per cent. The plant in the field is a better machine than the machinery of a sugar factory. The plants do not require repairs, replacements, fuel etc. and there is no breakdown and stoppage of functions. The field efficiency in agricultural production is therefore chiefly the human inability to understand mature. The plant must therefore be placed in its natural environment to grow at its best and the recent advances in sugarcane breeding in hybridising the cane plant with *S. spontaneum* and *S. robustum* are only preliminary attempts in that direction.

A change in variety is the first step in increasing yield. The Coimbatore Sugarcane Breeding Institute has done yeoman service in its field. Collection of a large number of *Spontaneum* types from the Himalayas down to Cape Comorin is a heroic attempt in utilising the wild type. It is true that after Co. 419 no new types were released. This need not dishearten any one. There is no genetic deterioration in cane (Dutt and Subba Rao, 1949) and any possible deterioration in yield should be checked by proper fertilisation and control of pests and diseases.

The equable climate of the southern end of peninsular India permits planting and harvesting sugarcane almost round the year. Researches are already in progress to develop a second season for Nellikuppam. Cultural schedules suited to the characteristics of varieties and season are to be developed (Parthasarathy, 1951).

Price Policy: Last but not the least, is the stabilisation of price. While it is so with all crops, it is particularly so for sugarcane. The clash of interests between the cane supplier and the factory owner necessitated fixation of minimum prices. This system of laying on weight of cane without considering the sugar content, encouraged cultural systems that depressed quality. The factories took no practical steps to step up recovery percent but demanded fixation of a lower price for cane. The general remark that payment on quality basis is not feasible is in correct, and should not be sufficient reason for continuing this incorrect cane price policy. Tests conducted at Samalkot sugar factory indicated the possibility of testing small units like two tons of cane. The cane area may be split into small zones or in the alternative, the hourly analysis of the primary juice may be related to the supply units

at the carrier for payment on quality (Parthasarathy, 1954). Unless the ryots participate in increasing sugar content of cane by an alteration of price policy, all attempts in that direction are doomed to failure. In Australia where extensive lands are available, sugar content in cane is increased without reference to yield. In our State, where pressure on land is high, increased production per unit of land is necessary but this should also be combined with quality of cane (Dutt, 1950).

Conclusion: The selection of a variety combining the high yield and softness of Co. 419 with the resistance to breaking and smut disease and high sugar content of Co. 527 is our future aim. The utilisation of the new *spontaneum* collections at Coimbatore may lead to this achievement at an early date.

The newer techniques of feeding the plant through the leaf for its moisture and nutrient requirements will lead to considerable economy in the applied water and manure for the cane field. The development of newer forms of nitrogenous manures like anhydrous ammonia and ammonium sulphate nitrate combined with foliar feeding reduce the danger to the soil by the residuary chemical radicals. Pests and diseases remain to be tackled through selection of resistant varieties. Borer pests, which are the most important ones in this State protect themselves from the very first stage of their entrance into the plant. Similarly, the smut fungus is protected. Systemic insecticides and fungicides are to be tried. The habits of the borers in the field and the brood-cycles require intensive study. A schedule of spraying weedicides as related to the habits and regeneration of weeds in the field must be developed to eradicate pernicious weeds like *Nutgrass* and *Trianthema*.

High yields are being recorded through increased application of fertilisers. The cumulative effects of removal of larger quantities of nutrient elements from soil, the cumulative after-effects of large doses of fertilisers and the susceptibilities of highly fertilised crop to newer types of diseases remain to be investigated. Sugar industry in India cannot prosper without the participation of the farmer in the sphere of profits. In this, payment for cane on the basis of sugar content is to be developed in one or two phases in the immediate future.

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