

## SUGARCANE \*

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Apart from the mythical halo surrounding the origin, introduction and cultivation of sugarcane which chroniclers often take delight in referring to, the culture of this crop has been carried on in this land from ancient times. References in literature are not wanting regarding the opinions held about the fertility of the tract growing sugarcane and statements about the prosperity of the villagers engaged in cane farming.

2. Hadi makes a delightful reference to the proud position sugarcane occupied in Akbar's time and quotes Fajzi, Akbar's Minister. 'The grandee was the proud possessor of a sugarcane plantation, deserving of high encomiums. Nowhere else in Malwa did sugarcane of equal nicety or taste display its growth.'

In South India also sugarcane has been a favoured crop with substantial farmers. In fact it is a rich man's crop, and tracts abounding in sugarcane cultivation have been eulogised by poets and historians. I may be allowed to mention here a couplet composed by one of the illustrious Tamilian Poets of the 9th or 10th Century in praise of a village whose original name persists to this day where this crop was largely cultivated and the villagers seem evidently to have been in a prosperous condition. The couplet sounds rather harsh and unmusical to the ear consisting mostly of gutturals in contrast to the sweetness of the subject the author refers to

‘இக்கு முற்றிக்கணுச்சற்று விட்டுத்தெறித்திட்ட முத்தைக்  
கொக்கு மொக்கிக்கக்கி விக்கீனு மச்சோலைக் குறுக்குடியே’

Translated freely—this means that 'the villagers are prosperous and enjoy the fruits of sugarcane cultivation in plenty in the form of valuable pearls which burst and get scattered about from the hard ripe nodes that crack with a crash. These pearls are swallowed by the cranes and regurgitated by them on the ground.'

This is certainly a hyperbolic expression, but it cannot be doubted that its significance is real. Pearl is always associated with a rich man's possession and people of a sugarcane tract like the one the Poet refers to, were rich and prosperous and were adorning themselves in gems, pearls and jewels. This position is of course symbolised in the Poet's expression in such catching words.

3. My object in introducing this subject with these preliminary remarks is only to show that the sugarcane has been a very important crop in South India. It posits an affluent position of a ryot cultivating this crop and in fertile valleys favoured by nature this crop has always been popular with the farmers. One could therefore confidently assert that there is a large amount of experience and knowledge gathered round the cultivation of cane, and in suggesting or recommending proposals for the improvement in the cultivation of cane and for the amelioration of the sugar industry one cannot lightly ignore such experience and knowledge as results of trials and enquiries have largely tended to strengthen the views held by farmers in the country.

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4. Gentlemen, under these circumstances I propose to place before you certain salient features of sugar-farming and manufacture of jaggery.

5. *Soil.* Cane is cultivated in South India on various types of soil which range from sandy loams to heavy clays, best growth and best product are always associated with lands where the soil is a friable loam of good depth permitting free drainage and aeration. The surface soil may be a little heavy and sticky owing to long cultivation under puddle conditions, but the underlying sub soil should be of a loose nature permitting a free passage of water down. It is only in places where these soil conditions prevail that the product is good and highly priced.

Jaggery obtained from tracts of the above description is noted for colour, texture and keeping qualities. In the District of Coimbatore, Kodumudi in the Cauvery-Bhavani Valley, and Udumalpet in the Amaravathi Valley, answer to this description of conditions and the produce of these tracts is valued more. Similarly round about Hindupur in Anantapur district, in the Cauvery valley of the Mysore Plateau and in parts of Chittoor where also the soil conditions are similar sugarcane cultivation is carried on in a large scale and very profitably too.

There are other tracts, of course, like the Godavari Delta where cane farming is carried on extensively with the necessary processes of trenching and training and supporting the huge canes, which are offset against the initial defects in the soil texture associated with the formation of that delta.

6. *Climate and Season.* Soil conditions alone are not enough. The weather factor affects cane cultivation. The high tonnage of the cane crop in tropical islands in the Pacific is a sure evidence in this point. South India possessing tropical conditions of climate, is therefore equally well suited for the purpose and we are, as you know, in a position to grow heavy crops in several places. Except in places where water supply, labour scarcity and dearth of capital act as a deterrent factor cane is grown in this Province in some tracts or other all through the year, Coimbatore serving as a good sample of it. This of course, is an essential for a continuous supply of cane for a factory engaged in the manufacture of sugar direct from canes.

There are, however, even in Coimbatore two well defined seasons which are considered more suitable for starting a sugarcane crop. January to April and July to September are the usual periods when plantation is laid on a large scale. The idea seems to be that in one case advantage can be taken of the warm humid conditions of the early season to induce the crop to grow and finish its vegetative growth before the cold weather sets in and that in the other the harmful effects of high storms blowing in the north-east monsoon period on the tall and finished growths of the cane crops can be materially warded off.

7. In districts like Godavary, elaborate precautions are taken beforehand to counteract the effect of cyclonic storms that prevail in October and November. February-March planting seems to be the rule and canes grow tall and high with a surface root system—because of the nature of the soil conditions, and succumb to the heavy gales of the north-east monsoon if such precautions are not taken.

8. *Methods of Cultivation.* The ryot is quite alive to the necessity of producing a very good and deep tilth in sugarcane land. Various devices are adopted by him which are familiar to us. Several of these are rather clumsy and

the process is slow and costly. Improvements are therefore necessary and welcome. A fairly good heavy plough like the Chattanooga 45, a Turnwrest E. T. plough for heavy soils, a victory plough for lighter soils is necessary to produce satisfactory seed beds. In a friable loose soil, working once with this type of plough and following it up with two or three ploughings with a light plough and one or two harrowings in the interval would be found quite sufficient to produce necessary conditions. On the Central Farm here, this practice is followed. What is required, is, to set up weathering action and attain very fine tilth fairly quickly and for this 3 to 4 months of cultivated fallow seems to be necessary.

In Java, however, as the Sugar Commissioners say, 'a prominent feature of the cane cultivation is the rapidity with which land is prepared for cane plantation. The structure of the soil is such that they do not pack and dry into a hard mass when worked wet' and the land is therefore taken over for cane cultivation immediately after the rice crop is harvested. No ploughing is done. Trenches are made in wet soil and the bottom after some time is stirred up and cane sets are planted within a month or so.

Demonstrations of the economical method of preparatory cultivation as suggested above will when carried on under suitable circumstances be of much educative value to the ryot.

9. Details in laying out the cane area for planting are different in different tracts.

To a large measure, the long established local custom decides. Planting on the surface is practised in certain tracts like Godavary where the soil is easily softened and is of an yielding nature. The seedbed is divided into long strips with furrows between, which are opened by the country plough, and cane setts are planted on the moistened tops of these strips.

10. In almost all other places, fields are divided into ridges and furrows and planting is done in the furrows. Trenching is practised in certain parts, the bottom of the trenches is a bit loosened and setts buried in. Rarely small pits are dug at definite distances and setts put in and covered over with a thin layer of earth.

The distance between the sets again varies with places and the ryot is guided here by considerations of having a good stand of the crop, allowing for failures due to soil and weather conditions, soundness or otherwise of the seed sets, and the stooling capacity of the variety planted.

11. There is a fair scope for improvement in this line. The Godavary practice of broadcasting on the top is certainly a faulty method and line planting is therefore advocated and is nowadays largely adopted.

In other places where planting in line is a well established practice wider spacing between lines may be recommended. This question of spacing is to a large extent dependent on the soundness of the seed sets and on the individual quality of the variety to tiller. The seed rate adopted by the ryots varies from 12,000 to 30,000 sets per acre and sometimes even more. Where the ryot is forced by circumstances to prepare the setts out of the whole cane the seed rate is necessarily high, since the bottom portions contain over ripe buds which fail to germinate. Where he uses tops or top portions the seed rate is brought down to 15,000 or so.

If the nursery system, nowadays recommended for the rapid multiplication of seedling canes, is generally adopted, this seed rate problem can easily be



solved. In fact even here, ryots of certain tracts are alive to the benefits resulting from the nursery system. The 'Kondamunji' system in Ganjam of multiplying the seeds for the succeeding year's planting is an instance in point.

Roundabout Kodumudi this method is regularly adopted. The ryots on the other side of the Cauvery Valley grow seed cane for supplying seed to the cane growers of Kudumudi. The seed crop is cut when 7 or 8 months old just at the main planting season at Kodumudi and the ryots of the tract purchase these seeds. As a result of this practice, the seedrate in Kodumudi is only 12,000 to 13,000 setts. This method deserves to be widely popularised. In fact, a Society of Seed Growers can be established for a sugarcane tract nearby and the system at Kodumudi be regularised into a business. Anakapalle and Palur Farms are experimenting on this method. The Anakapalle report reveals that the seed obtained from a nursery plot of 6 months growth is capable of supplying seeds for nine times the area.

Ryots with limited resources of capital and facilities but living near a large sugarcane area could make a business of this system of nursery plot cultivation.

In this connection it may be mentioned that at Manjri experimental farm as the Sugar Committee reports, very good crops are obtained with a seed rate of 6,000 setts per acre planted in rows 5 feet apart, greatest care being taken in regulating the water supply, in keeping the land free and friable and in banking up the canes in high ridges.

12. Manuring is an important item of cultivation charges in sugarcane. Various manurial ingredients are used, cattle manure, cakes of different sorts, fishmanure, poudrette, leaf manure either bought from outside or grown on the land and ploughed in, and recently chemical manures as Ammonium sulphate and Superphosphate are being applied. We are not in a position to suggest or make definite recommendations as to the quantity and quality of the manure to be applied. Our experiments have not reached finality. However from an empirical analysis of the results of the various trials made on the Agricultural Farms, it would appear that with a basal dressing of well rotten farm yard manure of 15 or 20 cart loads per acre an application of a combination of cake and Ammonium sulphate to supply 100 lbs. of Nitrogen gives good results. In place of Farm yard manure it may be possible to grow *in situ* and plough in green manure, preferably Sunnhemp.

13. Manures seem to exercise an influence over the quality of the product turned out. Bulky organic nitrogenous manures tend to delay maturity and produce juice of less purity. Even here different organic manures act differently. It is the confirmed belief of the ryot of the Coimbatore district that wild indigo applied to cane when it is about 3 or 4 months old improves the colour and texture of the jaggery. So does groundnut cake to some extent, whilst Daincha seems to produce a dark coloured jaggery.

Large doses of nitrogen in any case over and above the actual requirements of the crop whether in the organic or mineral form tend to produce a very heavy crop which lodges and which in consequence does not mature uniformly. The resulting produce of cane juice contains much impurities.

14. *Irrigation.* To irrigation as well, a good deal of care and attention is to be devoted, where surface planting is done and the root system is not deep enough, constant watering is needed, in many cases amounting to as many as forty. This frequent application of water prolongs

the vegetative growth and interferes with proper ripening. If canes are planted deep enough and earthed up well, and sufficient spacing is given say about 3 feet between lines it would be possible to keep the soil worked up as often as necessary and as often as the soil admits between two irrigations. This will keep the soil moisture in the right proportion for the crop. It has been found possible to grow a successful crop of cane with about 10 or 11 waterings as against 30 or 40. The Manjri method is confirmatory of this statement. Hadi also in his latest book on the cane industry in the Bhopal State supports this view.

A large scope therefore exists for investigation into the question of manuring and irrigation. And to arrive at a definite solution as far as this Presidency is concerned I hope it will not be considered presumptuous if I suggest that definite experiments be laid out on the Sugarcane Farms and results worked out to secure statistical significance. Of course if cultivation methods as described above are carefully attended to, the outturn is bound to be satisfactory both in quality and quantity.

15. A large outturn means a large outlay. From an analysis of the figures of the Central Farm it is found that for a crop producing Rs 800 worth of jaggery about Rs 400 have to be spent on cultivation charges including manufacture. Our object should be to reduce by improved methods these charges to a reasonable minimum and to produce the maximum benefit. Savings could be effected in seed rate and by judicious manuring and irrigation, these three forming the major items in the cost of cultivation of the cane crop.

16. An outturn of 40 tones of cane giving about 20 candies of jaggery should be considered a very satisfactory yield for this Province. Samalkota and Anakapalle very often record this result. Ryots' field is generally below this figure, but there are not wanting tracts where a high yield of 12,500 lbs. of jaggery is obtained. The village of Budinattam near Udumalpet is one such.

Two years ago when the students visited the Sugarcane Farm of M.R.Ry. Rao Bahadur C. V. Narasimha Razu Garu at Etikopaka, a crop of J 247 was estimated at 15,000 lbs. of jaggery per acre, the estimate being based on the yield obtained from a previous crop of this same variety and of a similar stand. It seems therefore permissible to infer that growers of cane in South India may also reach up to the limits of Java yields provided facilities and resources and knowledge are placed at the door of the grower.

17. *Manufacture.* This phase of sugar farming demands a closer attention and investigation on the part of the members of this Department. Already sufficient attention is being given in this direction, in the construction of furnaces, in the introduction of efficient mills and in the methods generally to be adopted in boiling. Maximum extraction, general attention to cleaning, expeditiousness in the boiling process, proper clarification of the juice, and avoidance of waste are to be aimed at. The ryot requires to be educated in all these details. It is his want of knowledge of these details that is mainly responsible one could safely say, for at least 20 per cent reduction in the yield of jaggery.

Clarification he is not very particular about, though he removes the preliminary scum that rises to the surface. He does add lime to the juice which certainly helps in defecation and he is aware that the addition of lime helps to harden the jaggery. He is not particular about the colour, though in certain tracts colour is natural to the product due to the inherent quality of the juice. He is keenly alive to the keeping quality of the jaggery and therefore strives best to get a hard stuff. He is, however, handicapped in this inas-

much as the stuff gets soft and leaks out in rainy weather in certain tracts. A good deal of help, instruction and active propaganda is therefore essential to the lasting benefit of the sugarcane grower.

A word is necessary here in connection with reagents added for coagulation of albuminous and other miscellaneous impurities and for neutralisation of the juice. Coagulating agencies like milk, yoke of egg, or any mucilaginous infusion of certain plants like the Wild Bendi are added. These certainly exert an influence on the clarification of the juice.

Liming is generally adopted to neutralise either partly or in full the acidity of the juice. Partial neutralisation is in favour with some since the resulting product is not discoloured whilst complete neutralisation results in a dark coloured jaggery. Hadi suggests in the latest edition of his book 'Indian Sugar Industry' the use of Crude Sodium Bicarbonate which contains some sulphur as well. He recommends lime to a limited extent only when one deals with the juice of inferior qualities.

In this connection it may be of interest to know that trials made at Palur show that jaggery obtained from soil limed beforehand is of good quality and the juice does not need to be treated with milk of lime. It is also suggested that excellent jaggery is made at Chittoor without liming and this may be due probably to the lime already present in the soil.

Gentlemen, I am inclined to be sceptic about these results although I do not question the facts. To me, the effect of the addition of lime to the juice to promote certain action which is both chemical and mechanical should be certainly different from the effect of lime which may probably be present in the juice in organic combination being absorbed from the soil. I would attribute this result to the greater purity of the cane juice obtained from the crop of those soils. The addition of lime or the presence of lime in the soil should certainly bring about a better physical condition of the soil and thus promote growth of cane of better quality. Incidentally its absorption may also help to reduce the acidity of the juice. I would only leave it to Chemists to suggest an explanation.

18. One great defect in the manufacture of jaggery is the use of the open pan system which however under the present circumstances does not look like being dispensed with. The ill effects of boiling in the open pan system over direct fire are well known—inversion and caramelisation. The improvements suggested by us are intended to reduce the chances of this inversion and caramelisation to a certain extent.

The multiple pan method is an improvement in this respect inasmuch as clarification and concentration are carried on in two or three different pans over a long furnace in which the maximum heat is utilised in the process and thus solidification of jaggery is expedited.

I recall to my mind just now Mr. Vellinigiri Gounder's suggestion before the Tariff Board this month that Sugar manufacture may be encouraged as a cottage industry. Open pan system however carefully elaborated and worked, entails loss of sugar by inversion and to a slight extent caramelisation. The jaggery or the massecuite prepared from that for conversion into sugar contains comparatively less sucrose and more glucose than what are yielded from factories worked on modern methods. Hadi who has been at this work for the past 25 years says again that he gets only 50 to 55 per cent of sugar from the 'Rab'. One should therefore hesitate several times before one makes bold to suggest sugar manufacture as a cottage industry under the existing



condition. I should therefore prefer to look at this venture as a rural industry worked by small groups in co-operation. We are now advocating power crushing and boiling of juice into jaggery on a moderate scale to be worked by co-operative concerns and we say that the produce of 150 to 200 acres could be profitably dealt with, although it is regrettable to note that a concern like this started and working for some time very near Coimbatore closed the business for reasons best known to themselves. My suggestion here would be the addition of a device to the power plant mentioned above—a sort of vacuum pan in which the juice can be boiled down at low pressure and temperature? My object in making this suggestion is to find out a simple method by which the evaporation and concentration of the juice may be done in a closed receptacle under regulated temperature and reduced pressure. I am not a technician and I leave it to the Research Engineer to take it up, if he thinks it worth his while. I am sure that with the modern rapid advance with mechanical devices and in simplification of the same, it should be possible to design and instal a plant for milling and boiling on a moderate scale of investment of a few thousands of rupees to enable villagers to take up. We have small scale rice-hullers, decorticators and ginneries. A sugar milling and sugar boiling plant combined in a small rural factory cannot be an impossibility.

19. If this is done, as I hope it will be, in course of time, the problem of the sugar industry in this country will be to a great extent solved, for after all even with the wildest stretch of imagination you cannot expect for a long time to come more than 25 per cent of the population to consume crystallised sugar; the remaining 75 per cent is satisfied with jaggery. The demand from this 25 per cent of the population may therefore be successfully met from the existing area of sugarcane. From the increased production by the introduction of better strains, improved methods of cultivation, and of boiling should certainly leave enough surplus produce to be made into sugar in the rural refineries.

## SUGARCANE BREEDING—ITS CHIEF CHARACTERISTICS \*

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### I. Introduction

I am grateful to the Working Committee of your Union for the opportunity they have given me to speak to you on the subject of Sugarcane Breeding. The success of the Breeding work attempted at my Station is directly dependent upon the amount of sympathetic interest that the Station is able to evoke from the Agriculturists assembled here and the guidance which the Station is able to get from them as to the kind of cane that is needed in each locality. I feel confident that both my colleague—Mr. Nand Lall Dutt, M. Sc., who is in immediate charge of the breeding of thick canes—and myself will have from this symposium many valuable suggestions that would materially influence our cane breeding programme with particular reference to at least Madras conditions.

As the time at my disposal is rather short—and I would add 'rightly so', as in such meetings the discussions that follow each talk are more valuable than the talks themselves—I shall confine myself to placing before you the

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