

Farming will never be a success unless the farmer  
had more voice in the disposal of  
his produce.—P. Morrel.

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## SUGAR-CANE IN BELLARY

ITS CULTIVATION, MANUFACTURE OF JAGGERY AND THE NEED  
FOR A SUGAR FACTORY

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In the neighbourhood of Hospet in the Bellary District, there are large areas of land devoted to growing sugar-cane. There are between 6,000 to 7,000 acres within a radius of 10 to 15 miles, and as much as 3,000 to 3,500 acres can be easily had for any sugar factory which may be established in the locality.

In view of such possibilities, a careful study of the sugar-cane and the local conditions, etc., was undertaken. A sugar-cane mill was hired from the Department of Industries to collect the necessary data. Consultations were held both with the ryots and the merchants.

There are two varieties of the *Pundya cane* grown in these parts:

The *Hotte* and the *Javari*. In not one of the fields observed did I find them unmixed, though one or the other predominated. The cane is usually rotated with paddy and sometimes cane succeeds cane in better soils. The former is called *Kanagaddi* and the latter *Kabbinamandu*. In the latter soil, the yield of cane is not so good as in the former.

Java cane, it is said, was tried in some fields, but had to be given up owing to difficulties in crushing with bullock-driven mills, the cane being hard, although it gave them a larger quantity of jaggery per acre, and of a better quality too.

**The Agriculture of Cane.**—The method of cultivation is very old in these parts, and the local ryots can lay claim to a certain amount of specialization. The fields are ploughed soon after cane is harvested in March or April, and the cane that has been set apart from the previous year's crop is used for the following year's seed.

After ploughing the field two times, the farm-yard manure is spread. Drainage channels are made, and the excavated earth is spread over the field and ploughed for the third time. The ryots use the plough for making the furrows as well as the cross furrows for irrigation, finally finishing off with the hand.

The furrows are 2 to 2½ feet apart, and the setts placed about 9 inches apart. The depth of ploughing is 9 inches, and the furrows also are about the same depth. Roughly, 9,200 setts are planted per acre. After the seeds are planted, just enough water is allowed to fill the furrows and the seed is pressed in. After 5 days, it is irrigated again. The cane germinates after an interval of 15 to 25 days. After germination, the field is irrigated once a week. The weeds are removed once or twice during the first 25 days. Oil-cake is added and the cane earthed. The weeds are again removed twice to four times after germination and within the end of the third month, and once or twice after earthing the cane. The irrigation is continued. The cane matures in about ten to eleven months' time.

Twenty to thirty cart-loads of farm-yard manure are added, and 4 to 6 bags of oil-cake (32–48 mds.\*) are added per acre.

The field is flooded before harvest 4 times at intervals of a week. The ryots wait about 4 days after the last irrigation and commence harvesting. They usually cut the cane into 2 or 3 pieces, each 2½ to 3½ feet long. The top is not completely removed. The yield of cane per acre is roughly 20 to 25 tons.

The expenses incurred, up to the time of harvesting, are noted below. The other expenses will be noted under the head of Jaggery manufacture.

Sugar-cane cultivation expenses per acre at Hospet :—

	Rs.
Cattle manure ... ..	25
Seed-bed preparation ... ..	12
Setts... ..	24
Planting, etc. ... ..	5
Weeding ... ..	24
Earthing ... ..	4
Oil-cake or Am. Sulph. ... ..	30
Watering ... ..	12
Sundries ... ..	4
Total ... ..	140

\* A Maund is 25.92 lbs.

**Manufacture of Jaggery.**—The preparation of Jaggery though, in general principles, the same as elsewhere, has some peculiarities of its own in these parts. The juice is delivered and boiled in rather large pans of 8 to 9 feet in diameter and  $2\frac{1}{2}$  to 3 feet in height. Six pots, each holding roughly 70 lbs. of juice, make a *Bani*, and 6 such *Banies* are taken per boiling. The pan is fired with bought fuel in the beginning, and, later, with the *bagasse* and the dried leaves of the cane. The jaggery obtained per pan varies from 14.5 to 16 mds.

Liming is done, but there is no definite rule which guides the quantity of lime to be added. Each pan has a jaggery maker who thinks he is an expert in himself. He supervises the addition of lime, the firing, and determines the time when the pan has to be lifted off the fire and the thick fluid jaggery poured on to the mats. The mats are spread in shallow squares of each  $3\frac{1}{2}$  to  $4\frac{1}{2}$  feet and with arrangement for the mass to flow from one to the next. There are usually four in number and are called *Angadis*. The thickness of the jaggery slab varies from  $\frac{3}{4}$  to  $1\frac{1}{2}$  inches.

These jaggery makers are often ignorant and they do not know the elementary principles in handling the syrup. Very often the poor ryot has a large stock of bad jaggery.

A standardization in the manufacture of jaggery could easily be effected by careful study.

One of the obvious drawbacks is the size of the pan. Being very heavy, it requires 8 men to lift and a ninth to hold it from tilting. Then the mass is poured into the moulds.

Below is the table incorporating the results of the observations made with regard to the cane from various fields:—

192. Chattanooga Sugar-cane Mill driven by a 14-H.P. Petter's Crude oil-engine was used. The density of the juice varied from  $14^{\circ}$  to  $18^{\circ}$  brix at temperature ranging from  $20^{\circ}$  to  $30^{\circ}$  C.

No.	Variety	Rotation	Lbs. Cane for 72 pots of Juice	Per cent Extraction on Weight of Cane	Lbs. Jaggery for 72 pots of Juice	Residue in Pan	Tons Cane per acre
I	Hotte ...	After Paddy	7,316	68.8	739	56	18
II	Javari ...	Do.	7,732	62.5	828	59	29
III	Mixed ...	Do.	8,299	60.7	632	60	24
IV	Hotte ...	After Cane	7,747	65.2	...	...	16
V	Mixed ...	...	7,248	69.5	875	50	...
VI	Hotte ...	...	6,961	72.33	771	80	$23\frac{1}{2}$
VII	Javari ...	...	7,320	68.6	827	53	$24\frac{1}{2}$

The cost of harvesting and converting the cane into jaggery is about Rs. 11 for two pans. About 16 pans are obtained from each acre under good conditions. This works at Rs. 88 per acre. This sum, when added to the cultivation expenses, brings the total expenses of the ryot to Rs. 228.

The present selling rate of jaggery varies from Rs. 12 to 16 per bag of 9 mds. Calculating on the aforementioned figures, one expects to sell 216 mds. bringing an average total income of Rs. 336. The gross profit comes to nearly Rs. 100 per acre. As a rule sugar-cane crop is followed by paddy which does not give more than a profit of Rs. 20 to 30. So that the average income from land is not even as much as one may get on the value of the land if invested in Government securities—the land of the sort considered above is worth Rs. 1,000 to 1,500 per acre.

**The Sindevahe Furnace.**—At my request, the Agricultural Demonstrator gave a demonstration of the use of this furnace which is said to be an improvement on the local method, giving better jaggery. The Sindevahe pan and furnace are described by the Department of Agriculture in one of their leaflets. Its essential advantage appears to be in the use of the smoke-vent which takes away the smoke and prevents the soot from darkening the jaggery. The scum is removed with a bamboo strainer and dropped into a gunny filter which naturally clarifies the syrup, and a better quality of jaggery is obtained. I recorded the time taken and the weight of fuel used per boiling and its equivalents with the indigenous pan and furnace.

<i>Sindevahe.</i>	Pots	Fuel.	Time.	Jaggery.
Two boilings.	18 × 2.	1,139 lbs.	3½ to 4½ Hrs.	16 mds.
<i>Country.</i>				
One boiling.	36	1,077 lbs.	3½ to 4½ Hrs.	16 mds.

It is interesting to note that the time taken by the Sindevahi furnace is the same as for the country pan, though only 18 pots of juice are boiled per pan and two pans worked simultaneously. But it consumes more fuel to obtain the same quantity of jaggery. It would therefore appear to an outside observer that the same improvements may be effected by attaching a smoke-vent to the existing pans and using a strainer, thus converting the present pans really into the Sindevahe type. This might appeal better to the ryots, for this would save them the necessity of fresh investment on new pans, and what is more, they would still be able to deal with larger quantities than they can by the Sindevahe furnace and pan demonstrated to them. This is bound to be an important consideration in a large jaggery-producing centre like Hospet.

**Work to be done.**—A careful study of the conditions of sugar-cane in Hospet has suggested to the writer some changes in the methods now in vogue in the agriculture of cane, as well as its conversion into jaggery. It is possible that some points have been overlooked. The observations need to be continued in subsequent years for further lines of improvement.

In the actual agricultural methods, our ryots are good enough, but they are exceedingly illiterate and poor. Their illiteracy keeps them away from the latest literature on the subject and their poverty from making use of any improvements that may be brought to their notice.

I believe that effective work needs to be done in two principal directions in the agriculture of cane:—(1) Increasing the sugar content of the cane itself and (2) increasing the yield of sugar-cane per acre. How this is to be effected, is a matter for experiment and research.

One finds that no effort is made in these parts to select the seed. The setts are taken from the previous year's cane plantation irrespective of the condition of the cane. A common disease which could be minimized or even eliminated by selection, is 'red rot'. Many diseases of cane could be minimised by selection of healthy setts for planting. A seedling-farm, from which healthy setts could be distributed, is a desideratum now.

It is well known that cane-tops are used for setts and they make good seed. Many plantations in Hawaii and Java have separate seed-cane plantations. Three-fourths grown cane is used for setts. This again is a matter for research.

The depth of ploughing affects the growth of cane. It is hardly 9 in. here, and the furrows are 2 to 2½ feet apart, and the setts are planted 9 inches apart. In Hawaii, the furrows are seldom less than 1½ feet deep and 3½ to 4½ feet apart, the setts being planted end to end. A trial demonstration on the above lines will, I think, be well worth the trouble. If found advantageous, the ryot will naturally take it up without hesitation.

It is common knowledge that certain combinations of fertilizers affect the sugar content of the cane as well as the yield per acre. How and in what proportions these fertilizers have to be combined for the Hospet lands, is not known. The only chemical fertilizer used here and by a few, is *Nitrates*.

Lastly, more important than all, perhaps, is the question of breeding new varieties of cane. This question I hope to deal with separately, later.

Results on these lines of work cannot be expected in a year or two. Often it takes many years, before something revolutionary is discovered. The *H.S.P.A.* experiment station was a disappointment to many in the beginning, but when it was discovered that the tonnage of cane per acre is almost doubled by just leaving the cane to grow for another 8 to 12 months, they recognized the value of research. With nearly the same amount of work, the Hawaiian grower obtained twice the quantity of sugar! Ever since, the *H.S.P.A.* has been highly esteemed in the Islands.

I have suggested above, a few lines of work in the agriculture of cane, and I may similarly mention a few for the improved manufacture of jaggery.

At present, bullock-driven mills, unwieldy pans and unscientific furnaces are used. In a locality where there are thousands of acres under sugar-cane, there ought to be a quicker and a more efficient method of milling cane and a better method of making jaggery. The introduction of power-driven sugar-cane mills and of any one of the types of multiple pan furnaces (now commonly in use in many parts of the cane-growing centres in this country) would be useful.

In the preparation of jaggery, proper liming is a very important factor. Often, several pans of jaggery are spoilt because of bad liming. It is found

that testing with litmus paper is a simple and good guide to the addition of the required quantity of lime.

The firing of the pan must be well regulated. There is always a tendency on the part of the firemen to stuff the furnace with fuel, to avoid the tediousness of slow firing, and the jaggery gets therefore charred owing to overheating. A properly constructed multiple furnace as aforementioned will avoid such a mishap.

**Need for a Sugar Factory.**—I was discussing the question of establishing a sugar factory with the local merchants and the ryots. The co-operation of the merchants is a necessity, and also of the ryots. If one can show some real improvement in the productivity of the land and enable the ryots to get a better quality of jaggery fetching a better price, something would have been done to secure their confidence, and, when once that is established, a sugar factory will be a comparatively easy affair.

The merchants even now recognize the need for a sugar factory, but just now, owing to the prevailing financial stringency, it is rather hard for them to find all the capital needed. But there is no reason why the required capital should not be found, at least in part, from outside the cane area.

[In this connection a paper on 'Jaggery-making in Hospet and Suggestions for its Improvement' by Mr. T. Lakshmana Rao, published in vol. xvi, No. 10, October, 1928, of the *Madras Agricultural Journal* will be read with interest.—ED., *M.A.J.*]

## A NOTE ON *ORYZA SATIVA* VAR. (*PLENA*) PRAIN\*

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**Introduction.**—This Bengal variety of paddy, popularly known as 'Double rice' or double grain paddy was obtained from Poona Agricultural College in the year 1920. It is similar in most of the morphological characters to the cultivated types, but differs essentially from them in having more than one pistil in each spikelet—the unit of inflorescence. In this 'Double rice' 6.3,4 the number of pistils varies ordinarily from two to four, and rarely five are met with. The number of developed rice-kernels found in each paddy grain varies from one to three so that the popular name 'Double rice' is a misnomer. The failure of some of the pistils to develop into kernels may probably be due to the infertility of those ovules, and this remains to be investigated.

2. **Rices.**—Rice kernel is enclosed within the covering of the third or flowering glume and the fourth or palea, the first two being small and sterile. The position of the embryo in the rice is opposite the base of the ridge of the flowering glume. In the 'Double rice'—calling the rice developed from the pistil nearest the flowering glume the 'first rice' and the next 'Intermediate' and the last the 'second rice'—it is observed on husking the samples of this paddy that (1) most of the single or whole

\* Paper read before the Association of Economic Biologists, Coimbatore, on the 13th March, 1931.