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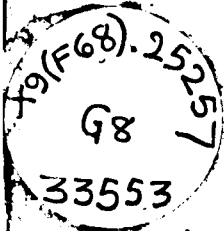
**SUGAR**  
IN  
**THE FIELDS, THE WORKSHOPS  
AND THE FACTORIES**

A SURVEY OF THE PROSPECTS OF SUGAR  
INDUSTRY IN ROHILKHAND

BY

**NAWAL KISHORE KATIHA, M.A.,**

*University Gold Medalist, Formerly Post-graduate Research Fellow,  
Lucknow University*



ALLAHABAD:

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1938

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## PREFACE

THE present work forms a part of the research thesis which the author submitted in lieu of the papers for his M. A. (Economics) degree at the Lucknow University. The survey was conducted during those months when simultaneous inquiries were being made by several departments of the Government for the purpose of fixing a minimum price of cane, levying the excise duty, taking the census of the *khandsalis*, etc.—and the people concerned, who are mostly illiterate and conservative, were averse to giving the correct information. The figures obtained from the cultivators, the *khandsalis* or the managers of sugar factories were vastly different from those collected from the Government departments, most probably because the former did not want to disclose facts. It is on account of this fact that, in spite of every care devoted to collecting and collating the data, some inaccuracy might have crept here and there in the course of the book.

I must take the opportunity of offering my thanks to all those who very kindly supplied me the needful information, and to those officers of the Government who helped me in obtaining the requisite material from their offices. My thanks are also due to Professor Radhakamal Mukerji, M.A., PH.D., P.R.S., Head of the Department of Economics and Sociology, Lucknow University, for his kindly suggesting to me the lines of the research, and to Mr. R. L. Sethi, I.A.S., Economic Botanist to Government, United Provinces, and Incharge, Government Sugarcane Research Station, Shahjahanpur and Dr. D. Pant, B. COM., PH.D., Commerce Department, Lucknow University, for their going through the manuscript and making several suggestions.

LUCKNOW  
9th October, 1937.

N. K. KATIHA.

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# Sugar in the fields, the Workshops and the Factories: A survey of the prospects of Sugar Industry in Rohilkhand

## CHAPTER I

### SUGARCANE CULTIVATION

SUGARCANE is usually sown in February or March and Tillage. cut in the following winter (December—March). It is an exhausting crop and requires a very thorough preparation of the soil before sowing. The number of ploughings and the method of tillage differ from village to village and from field to field. When the field is left fallow for one year to be followed by cane plantation the cultivators plough it from July (*Asarh*) till February and March and on an average give about 20 ploughings. In case a previous *kharif* crop has been taken the ploughing operations begin in November and about 14 to 16 ploughings are given. In fact ploughing operations are carried on through out the year whenever opportunity arises and the monsoon permits. The object is to loosen and break up the layers of soil at the bottom of the furrows to a depth of 3 or 4 inches, so that the roots, when they sprout from the sets, are not deflected from their downward growth by a hard pan or layer of soil are, therefore, able to go deeper into the layers of the sub-soil to the soil moisture. The advantages of hot weather deep ploughing are :—

- (1) The sun's rays go down deep into the furrows and impart oxygen to the soil.
- (2) Water drainage and percolation become easier.
- (3) The roots of the plant go deep down into the soil easily.
- (4) Weeding is facilitated.
- (5) Insoluble plant food is converted into soluble material easily.

Rainy season cultivation is supposed to possess the following advantages :—

- (1) Weeds in the fields are ploughed into the soil and serve as manure.
- (2) The rotten seedlings, stems, and field trash go down deep into the soil and fertilize the fields.

Two varieties of indigenous ploughs are used in Rohilkhand. They are locally known as *thariya* and *lutna*. The former has more or less a vertical blade and can make a furrow as deep as  $1\frac{1}{2}$  ft. The latter scratches the soil only  $\frac{1}{2}$  ft. deep. The *desi hal* costs about Rs.1-12. Ordinarily the fields are ploughed from 4 in the morning to 12 in the noon. A labourer

with a plough and a pair of bullocks can till about an acre of land in this period if the bullocks are of ordinary strength and the soil is not uncommonly stiff. Twenty days' fodder (*bhusa* and *chana*) for a pair of bullocks costs Rs.6. A servant can be hired for 20 ploughings for Rs.4 at the rate of Rs.6 per month. This includes the charges for *chabena*, *sharbat* or *tamakhul*. If it is desired to plough the fields wholly on hire, 20 ploughings will cost Rs.10 at the rate of 8 annas per ploughing, inclusive of bullocks, plough and labour charges. Therefore, the tillage expenses of an acre (20 ploughings including *patela*) comes up to Rs.10 to Rs.12. When cane is sown after *rabi* and without an year's fallow the fields are ploughed only about 14 or 15 times and the expenses also proportionately go down. In practice the cultivators do not pay for ploughing operations. The fodder is raised on their own fields, the plough and bullocks belong to them and they put in their own labour, being assisted by members of the family.

Sugarcane is a crop which requires deep ploughing. The indigenous plough (*desi hal*) is, however, useless for the purpose. Improved ploughs, like the Meston (costing Rs.5-8 and tilling 1 acre a day), the Cultivator or Planet Junior (costing Rs.32 to 46 and tilling 1 acre in 3 hours), the Punjab (costing Rs.36 and tilling  $1\frac{1}{2}$  to 2 acres a day) or the Raja (costing Rs.40 and tilling  $1\frac{1}{2}$  to 2 acres a day) give sufficiently deep furrows. But they present their own difficulties to the Indian cultivator. Their cost is prohibitive and the draught cattle commonly used cannot easily draw these heavy machines. Another objection is based on the Indian peasants anxiety to retain the moisture in the soil and his unwillingness to widen the area to be manured when as often, the stock of manure is strictly limited. Improved ploughs, however, can be profitably employed on co-operative lines (if a number of farmers combine into a group) in conjunction with the *desi hal* which mixes the soil more thoroughly and breaks the clods of soil better. From 2 or 3 to 6 or 8 deep ploughings—depending on the circumstances of each case—with modern ploughs plus 10 to 12 shallow ploughings with the *desi hal* yield the best results. Such a practice is followed on the Shahjahanpur Government Sugarcane Farm.

Fields prepared for sugarcane are manured in February and **Soil dressing.** March before sowing; and the manure is hoed into the soil. In case an adequate supply of manure is not then available it is given during the months of April and May when the cane plants are about 1 to 2 feet high. In this case the manure is simply strewn by hand in the fields. After manuring, the

fields are watered so that the nitrogenous matter may dissolve and the solution may not remain very strong and concentrated.

In Rohilkhand, farm-yard manure is the only soil dressing agent which the average cultivator uses on his fields for the sugarcane crop. The cost of farm-yard manure varies from place to place and from time to time. The cultivators almost always use their own farmyard sweepings and they purchase it only very rarely. Sometimes it is difficult to obtain this manure even for a very high price. The price is generally higher near the towns and cities than in the interior of the villages. Two cart loads, containing from 20 to 30 maunds of farmyard sweepings, are applied per *bigha* of land. One cart load on an average costs 4 to 6 annas, but near the cities the price is as high as 8 annas to one rupee. The manuring charges, on an average, come to Rs.3 to Rs.3-8 per acre. The cultivators put in their own labour for applying the manure and in this operation they are helped by their family members and neighbours. Labour is also occasionally hired at 3 to 4 annas a day.

Alternative kinds of manure that might be used for cane cultivation are—

(1) *Green manuring (ordinarily sanai)*—It should be used in conjunction with farmyard manure. It requires only (san hemp) *sanai* seed worth Rs.2 to Rs.4 for an acre. The rate at which the seed is available varies between 1 to 2 annas a seer. Other expenses come up to about Rs.2 per acre. *Sanai* green manure is best for loam and light soils. The more this type of manure is applied the less irrigation will the cane crop succeeding it require. Such is not the case with other manures. *Sanai* green manure liberates 60 lb. of nitrogen per acre.

(2) *Castor Cake*—10 to 20 maunds per acre are ordinarily required. It contains 3 to 4 per cent. nitrogen on its weight. The average cost is Re.1 per maund. A moderate quantity of this cake manure if applied to a field of average fertility with a good cultivation gives an yield of 800 maunds of cane per acre against 350 maunds without any soil dressing. Castor cake is supposed to be one of the best types of indigenous manures.

(3) *Mahua Cake*—15 to 20 maunds per acre are sufficient for an ordinary field. It contains 2 per cent. nitrogen and costs 4 annas a maund. It is the least soluble of all the manure cakes and hence requires heavy watering.

(4) *Neem Cake*—10 to 15 maunds of cake per acre are generally required. Its nitrogen contents are 3 to 5 per

cent. on the weight. It is not available everywhere. Its cost is Re.1 to Re.1-8 per maund. It is less soluble than castor cake but more than mahua cake. It requires less watering but imparts a considerable amount of fertility to the soil. Its use on cane fields gives some immunity to the plants from the attacks of white-ants.

*Particulars of auxiliary chemical fertilizers (all to be used in conjunction with other manures):*

(1) *Sulphate of Ammonia*:  $(\text{NH}_4)_2 \text{SO}_4$  —It is converted into nitrates before being assimilated. Its nitrogenous contents are 20·6 per cent. on the weight. Of this a residue of 15 per cent. remains available for the succeeding crop. Three to five maunds per acre are required for chewing varieties;  $2\frac{1}{2}$  to 3 maunds for ordinary medium Co. varieties; and  $1\frac{1}{2}$  to  $2\frac{1}{2}$  maunds for thin varieties of cane. It is rapid in action and should, therefore, be applied in top dressing when the plants have germinated and are about a foot high.

(2) *Sodium Nitrate*:  $\text{NaNO}_3$  —Being in itself a nitrate, it is very easily assimilated. Its nitrogenous contents are 15·6 per cent. Of this 10 per cent. residue is available for the next crop. Three or five maunds per acre are generally required for the Co. variety. Its cost comes up to Rs.5-8 to Rs.6 per maund. It is rapid in action and is used in top dressing.

(3) *Potassium Sulphate*:  $\text{K}_2 \text{S O}_4$  —It contains 40 to 50 per cent. potash and is generally given to provide about 60 lb. potash per acre. Its cost is Rs.178 per ton, f. o. r. Calcutta. It should be used before sowing.

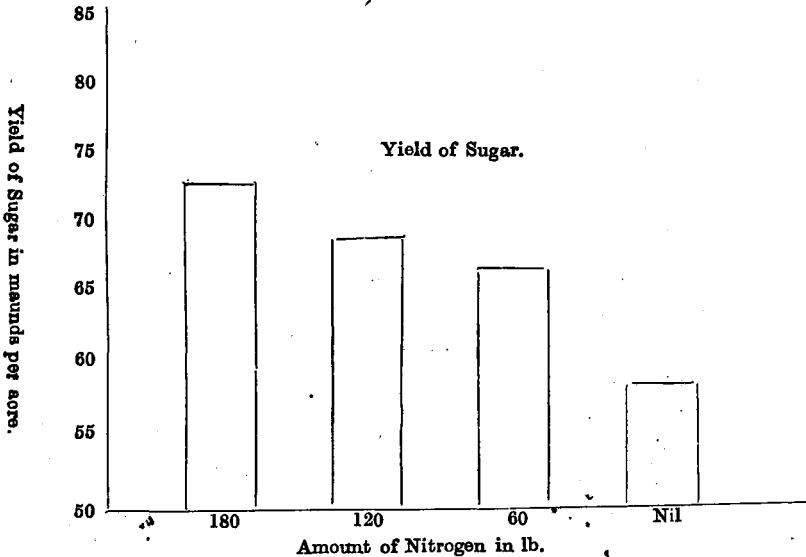
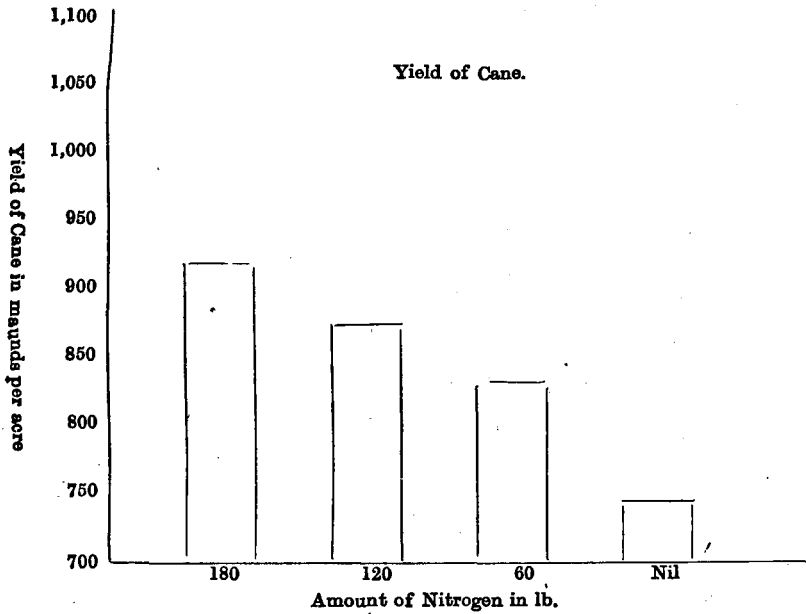
(4) *Super-Phosphates*: (*Single or double*)—The phosphate contents of Double Super-Phosphates are 40 to 45 per cent. and those of Single 20 per cent. About 3 maunds per acre of Single and  $1\frac{1}{2}$  maunds per acre of Double Phosphates are generally required. The market rate for the Single variety is Rs.9 for 2 cwt. It is applied before sowing.

(5) *Ammono Phos*:  $(\text{NH}_4)_3 \text{PO}_4$  —The phosphate and nitrogenous contents of this fertilizer are 22 per cent. and 10 per cent. respectively. Three to five maunds per acre are commonly used for the chewing variety of cane and 2 to 3 maunds for the Co. variety. Its cost comes up to Rs.8 per maund. It is also applied in top dressing.

Cane plants per acre require 100 to 120 lb. of nitrogen for Co. varieties and 150 to 200 lb. or even more for the chewing variety. A deficiency of ferric oxide renders the plant diseased and makes it yellow.



The following diagrams show the results obtained by applying different quantities of nitrogenous manure to Co. 313 variety of cane sown on the flat system : (1)



(1) Figures obtained from the Government Sugarcane Research Station, Shahjahanpur.

The under-noted figures show the result of nitrogenous experiments with different combinations (Co. 313 variety): (1)

Particulars	Cost of manure	Yield of cane per acre	Yield of sugar per acre
	Rs.	Mds.	Mds.
Castor cake 120 lb. ..	47	1,075	86
Farm-yard manure and Am. Sulph. 60 lb. each.	35	1,050	83
Castor cake and Am. Sulph. 60 lb. each.	46	1,040	82·6
Farm-yard manure 120 lb. ..	28	960	76
No manure .. ..	Nil	825	66·7

On the cultivator's field the yield of cane per acre under the best agricultural conditions is 880 maunds with green manure and 500 maunds without manure.

A common belief, among the cultivators of Tilhar and neighbouring tahsils, is that cane loses its sucrose contents if it is manured with bone meal.

Over-manuring with nitrogen gives rise to excessive vegetative growth and delays the ripening of the cane till the time when crushing operations become difficult owing to the claims of the *gabi* harvest and the advent of the hot weather. Further, in the case of very heavy manuring the plant gets its food material from the upper strata, and its roots do not penetrate deep into the soil. The result is that the plant shoots up high prematurely, while its roots remain weak and atrophied, so that it easily lodges when the winds are strong and its sucrose contents are inverted. Over-manuring may wither the plant altogether, for the cane plant cannot suck up its food material through the normal plant physiological processes, if the soil solution is concentrated and thick. In fact a heavy manurial solution sucks up the weaker solution circulating within the plant itself. It is, therefore, necessary to apply manure judiciously.

#### Sowing.

After the soil has been prepared—i.e. ploughed, manured, harrowed and levelled—the sowing operations begin. Pieces of cane usually 1 to 2 feet in length called sets are planted in

(1) Figures obtained from the Government Sugarcane Research Station, Shahjahanpur.

the soil; and from each joint sprouts a bud and canes grown up therefrom.

There are two systems of cane cultivation, viz. trench and flat. In Rohilkhand trench cultivation is popularly known as *khari* and the flat system is termed as *ukhari*. The trench system of cultivation, being expensive, is only followed on Government and big private farms. On the Shahjahanpur Government Cane Farm the trenches are approximately 2 feet wide, 9 inches deep and 4 feet from centre to centre. "Where trenching is adopted it should be preceded by a summer fallow during which the land should be worked at intervals and the trenches should be made in November as soon as the cultivator is free from sowing of his *rabi* crop. In a normal season the trenches should be irrigated as soon as they are made. With careful cultivation of the trenches, the moisture thus given should be sufficient to last until the cane is sown. A second irrigation will be required about ten days after sowing, and about four additional irrigations before a normal monsoon. It has been ascertained that the cost of making trenches in Rohilkhand and Gorakhpur is Rs.15 per acre when the labour rate is 4 annas a day." (1)

In flat cultivation the seedlings are sown either by ploughs or hoes. In the former case 4 ploughs (3 *hal* and 1 *hari*, which makes a little deeper furrow, i.e. 4 inches to 5 inches deep) and 8 bullocks are required. One plough works in the middle and two on each of its sides at a distance of about one foot. Just behind the middle plough the *hari* is worked. As the furrows are made by means of the *hari* the seedlings are planted by some people, others work on the ploughs and bullocks; while still others are engaged in picking up the sets scattered here and there in the course of planting. The rows in which the sets are sown are invariably from east to west, and seldom from north to south, so that the strong winds in July and August may pass easily through the rows without uprooting and lodging the plants and thereby deteriorating them. The ordinary cultivator, however, does not sow with the help of ploughs. "In Rohilkhand no plough is used, sets being planted by small gangs of men using *kalsis* (hoes). The period of planting extends from the middle of February to the end of April" (2). First, straight lines, from east to west, are marked with the help of a cord or rope. On these lines small ditches or pits are made by hoes (*kalsis*). Cane sets are then laid into these ditches and covered with earth. This operation takes a longer time.

The rows of the plants sown differ very widely in distance from one another. But the average Rohilkhand cultivator

(1) Report of the Indian Sugar Committee, 1920, page 53.

(2) Op : cit, page 40.

sows his seedlings in rows  $1\frac{1}{2}$  to 2 and in a few cases even 3 feet apart. On private farms the average distance between the rows is 3 to  $3\frac{1}{2}$  feet and on Government farms 3 to 4 feet. On a standard plot of 600 feet  $\times$  180 feet there are 60 rows 4 feet apart or 70 rows  $3\frac{1}{2}$  feet apart or 80 rows 3 feet apart. The results so far obtained at the Government Sugarcane Farm, Shahjahanpur, show that in poorer soils shorter distances between rows of the plants and in richer soils longer distances give better results.

When the moisture in the soil is adequate to ensure good germination; the sets should be planted mouth to mouth or head to head, and when it is less they should be laid eye to eye or bud to bud. Cultivators often sow sets at a distance of about 4 to 5 inches apart. Special care is required to cut the canes for preparing sets. They should be cut by choppers (*garasas*) and their leaves should be stripped off by hand and not by scythes (*hansiyas*). The sets should be carefully cut, avoiding every injury to joints or buds. Each set ordinarily contains three buds and measures about  $1\frac{1}{2}$  feet in length. From a normal cane 5 to 6 sets are obtained. Formerly when *desi* varieties like *dikchan*, *dhaur*, *matana*, *chan*, *khatuiya*, *tatti*, etc. were more prevalent, tops of canes were also used as sets. Tops are rich in glucose, and since the sucrose contents are first converted into glucose before germination takes place, the germination in the case of tops is surer and sooner than in the case of middles and ends. The whole of the improved Co. varieties of canes are often used for preparing seedlings, but generally the tops are set apart as cattle fodder or are given away in the shape of harvesting labour remuneration. In some villages the lower ends of the canes are discarded for sowing purposes. A common belief prevalent among the villagers of Mundia (district Shahjahanpur) is that softer canes are better for germination than harder ones.

Sometimes harder varieties are planted round the fields of softer canes to safeguard against incursions of wild animals. In Rohilkhand generally Java, a softer variety, is sown in the centre and it is surrounded by the Co. 290 or *hathi chinghar*, which is a harder type. The cultivators in some of the villages of Bareilly District sow melloon plants between two rows of cane. But this is not a good practice as a large part of the fertility of the soil is eaten up by the melloon plants, and the cane crop is stunted.

When *desi* varieties were commonly prevalent cane sets were preserved in field pits after sprinkling a little water over them and covering up with earth. The improved varieties are

cut, stripped and sown simultaneously. The sets deteriorate on standing after they have been prepared. They should, therefore, be sown immediately after having been cut or on the same day.

The number of sets sown per acre varies with the distance between rows in which they are laid as also on the thickness of the variety sown. The following table shows the approximate amounts of cane sets required for sowing an acre of land, with varying distances between the rows :

Amount of sets (in maunds) per acre of medium cane ..	Distance between row				
	4 feet	3½ feet	3 feet	2½ feet	2 feet
	Mds.	Mds.	Mds.	Mds.	Mds.
	35	40	45	30	35

The ordinary cultivator sows from 4 to 5 maunds of sets per *bigha kham* (*kachcha bigha*), which comes up to about 25 to 30 or 32 maunds per acre. He keeps his seed rows 1½ feet to 2 feet apart. From 7,000 to 10,000 sets per acre may be laid, but on an average 10,000 sets are sown in rows 3 feet apart; 6,000 sets will be required when the sets have been laid in rows 4 feet apart; and 13,000 when the rows are closer and *desi* varieties have been planted. "The number of sets sown by the cultivator is excessive, amounting in some cases to as many as 26,000 per acre. Even with a moderate germination this is far too close together for the full development of each stool . . . At the present time, while great pains are taken to preserve the soil moisture by hoeing at the time of sowing and until germination is assured, subsequent inter-cultivation is often rendered extremely difficult, if not impossible, by the manner in which the canes are sown. Sowing in lines 2 feet apart would make inter-cultivation possible after each irrigation and thus reduce the amount of water required. With better inter-cultivation this could be reduced to two or at the most three." (1)

The expenses of sowing vary widely. The cultivators in Rohilkhand put in their own labour, plough and bullocks. The members of the family and neighbours help them in all their field work and this makes it difficult to ascertain the accurate money value of various operations. The practice of hiring labour for these operations is uncommon. In face of these-

(1) Report of the Indian Sugar Committee, 1920, page 51.

difficulties only approximate figures of the money value of such processes can be obtained.

For sowing by means of ploughs we require—

8 bullocks : 2 bullocks per plough.

4 ploughs : 3 *hal* and 1 *hari*.

9 labourers : 2 for cutting the sets ; 2 for handing over the sets ; 1 for picking up the scattered sets ; and 4 on the 4 ploughs.

With this arrangement and fitting we can sow a field of about one acre in a day—laying the sets in rows at a distance of  $1\frac{1}{2}$  feet apart. Putting the labour charges at 4 annas a day for a man and the hire of a pair of bullocks and a plough at 8 annas a day, plus 1 anna a day for tobacco smoking, the cost of sowing comes to Rs.3-12. The cost per maund of seedlings vary from 4 annas to 8 annas. Keeping the average at 6 annas per maund, the cost of 30 maunds of sets, required to sow an acre in rows,  $1\frac{1}{2}$  feet apart, comes to Rs.11-4.

Sowing by means of hoes or *kalsis* (or *kasis* or *karsis*) is cheaper but requires more labour and time. Moreover, the Rohilkhand cultivator very often does not sow the cane sets in straight lines and the rows are, not infrequently, huddled together very close to each other. His selection of sets, similarly, is poor ; and occasionally diseased and inferior types of seedlings are used.

**Germination.** Germination takes place some 10 to 15 days after sowing. If the sets have been planted towards the tail-end of March (*Phagun*) the buds sprout by the middle of April (*Chait*). Practically each bud produces a plant ; and from each of these spring forth eight to ten or even more offshoots forming the clump or stool of cane. Some cultivators, after the plants have germinated, heap up small mounds of soil at the foot of each stem (*kunr banana*) ; and when towards the monsoon the winds are very strong, they tie up the tops of the plants to prevent lodging. Even then during the months of July and August (*Asarh* and *Sawan*) some plants, due to the force of strong winds and rains, fall down ; and from their joints sprout new buds. This is locally known as *ukhari ka biya jana*. The sucrose contents of the canes, thus lodged, become inverted, and the massequite (*rab*) prepared from the juice of such canes is sticky and inferior.

**Irrigation.** The sugarcane crop requires a great deal of moisture, which has to be provided partly by monsoon rain and partly by irrigation, and this makes the crop expensive. The number of waterings depends mainly on the resources of the peasant and the quality of the soil. A sandy soil, for example,

ordinarily requires 5 to 6 or more waterings, whereas for loan only 3 to 4 do very well. The *khadar* fields (i.e. the fields lying on the banks of canals, rivers or tanks) give adequate yields without watering or with only one irrigation. The average Rohilkhand cultivator gives 2 to 3 waterings, private cane farms 4 and Government farms from 4 to 6 or more to cane fields. For chewing varieties of cane about 8 irrigations are required.

If the soil is dry, at least one irrigation is given before sowing, but if the moisture is adequate, this watering is dispensed with. Ordinarily the first irrigation is given after germination (i.e. 10 to 15 days after sowing) towards the end of March (*Phagun*) or the beginning of April (*Chait*). The second watering is given at about the end of May (*Baisakh*) or the beginning of June (*Jeth*), when the plants have attained the height of 2 to 3 feet. If monsoon water is not available by then, a third irrigation is given towards the end of *Jeth*. Thus cane fields require irrigation from April to June. If, however, the monsoon is late or very weak the fields are watered several times. On Government farms two irrigations are given from March to April and three during May and June.

Broadly speaking the three chief sources of irrigation are canals, wells, and tanks. Wherever there are canal distributories and channels the peasants take water from them; but in those tracts which are not served by canals their main-stay is the well or tank.

Various methods of drawing water from these sources are in vogue; and the cost of each varies widely. Canal water is taken either by lift system (*nadha*) or by flow (*gool, tor*). In canal flow system, the fields to be watered lie adjacent to and on or below the level of the canal distributory from which an outlet (called *bamba*) is provided, which when opened, floods the field. Lift irrigation is resorted to when fields are at a higher level. At times 3 to 4 lifts (*nadhas* or *beris*) are utilized, but 1 or 2 are very commonly met with. A lift consists of an elevated platform made of mud and built adjacent to the canal distributory on one side and on the other side a sort of pit (*hauz*) is built on a still higher level. A square basket, generally made of bamboos or reeds to which are tied four ropes, is used for lifting the water. Two men on each lift work at a time—each of them standing face to face and opposite to each other on the mud platform, each of them holding two ropes, tied to the basket, in his two hands, dipping the basket in the canal distributory, swinging it up and emptying the water in the pit or *hauz* on the other side from which

the water flows into the field through small channels. If the field is on a still higher level, a second lift (*nadha*) adjoining but higher than the first one is built, which is utilized to lift the water from the *hauz* of the first lift to that of the other made a little higher up. Lift irrigation is, therefore, very costly. Water is also lifted from tanks in a similar manner.

For well irrigation *kachcha* wells are sunk every year in the month of March (*Phagun*). Various local methods of watering the fields from the wells are prevalent here. They are known as *Dhukli*, *Rahti*, *Charsa*, *Pul*, etc. Leather buckets are ordinarily used to lift water from the wells. Bullocks and often buffaloes are employed for this purpose, but it is not uncommon to employ human labour in place of bullocks for drawing water from wells. Other modern labour-saving machines for watering the fields from wells are on the market. They are *Baldeo Balti*, chain pump, double chain pump, Egyptian Pump, centrifugal pump (worked by electricity, diesel oil or steam engines, etc). But all of them are expensive for the cultivator.

Under the system of canal flow irrigation the fields are flooded 5 inches deep and this works up to 100,000 to 120,000 gallons of water per acre per irrigation. Under canal lift irrigation a 4-inch deep flooding is generally given, and this comes up to 98,000 gallons per acre. In well irrigation the cultivators flood the fields only 3 inches deep and the amount of water per acre thus comes up to 60,000 gallons.

The following tables show the results of various irrigation varietal experiments carried on in Shahjahanpur Government Sugarcane Research Station:

## A

Number of irrigations	Cost of pumping water in rupees	Yield of cane per acre in maunds	Yield of sugar per acre in maunds	Cost of sugar manufacture in rupees	Net profit in rupees
3	10	773	61	130	187·93
4	12	860	68	148	222·4
5	14	925	74	156	247·84
6	16	963	77	164	261·25

N.B.—Rs.119·86 represents the cost of producing cane.



## B

Quantity of water per irrigation in gallons	Cost of pumping water in rupees	Yield of cane per acre in maunds	Yield of sugar per acre in maunds	Cost of sugar manufacture in rupees	Net profit in rupees
60,000	10.0	870	69	160	225.37
80,000	10.0	910	71.5	166	237.86
100,000	10.0	875	70	160	226.83

N.B.—Rs.119.86 represents the cost of production of cane.

The amount of labour utilized and the money cost of irrigation by various methods differ considerably. The subjoined table shows the approximate cost of irrigation per acre.

## A. Irrigation from canal

## (i) Flow system—

	Rs.	a.
One day's labour of one man at 4 annas a day	..	0 4
Canal dues from January to December	..	10 0

If the flow is proper 1 acre can be flushed in 4 hours.

## (ii) Lift system—

(a) For 1 lift (*nadha*) :

	Rs.	a.
One day's labour of 6 men at 4 annas a day (2 men to mend the field beds and 4 men to lift water by turns, known as <i>Dugla Dena</i> or <i>Beri Dalna</i> )	..	1 8
Canal dues per season under lift system	..	5 0

(b) For 2 lifts (*nadhas*) :

One day's labour of 8 men at 4 annas a day (2 men to mend the field beds and 6 men to lift water by turns—2 being engaged at each lift at a time)	..	2 0
Canal dues by lift system per season	..	5 0

In one day only 1 acre can be watered.

## (c) Power Pump Irrigation :

Cost of every 5 acre irrigation including canal dues per season (5 acres can be irrigated in a day by power pump irrigation system. The capital cost comes to a high figure and the cultivators, therefore, cannot afford to instal them)	..	9 0
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## B. Irrigation from wells

(i) Four men can irrigate from a well (by *rahi* or *charsa*) at the rate of 2 bighas a day.

	Rs.	a.
Wages of 4 men at 4 annas a day..	..	1 0
One man will drive the two bullocks on <i>charsa</i> .		
One man will draw out water.		

One man will give outlet to water.  
One man will mend the field beds.

	Rs. a.
For one acre 3 wells (by <i>rahti</i> system) are used and the cost will, therefore, come up to .. ..	2 8
Three pairs of bullocks can be hired for a day at 6 annas to 8 annas per pair .. ..	1 8
(ii) Tube-well .. ..	5 0

### C. Irrigation from tanks

Two lifts (8 men) .. ..	2 8
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The cultivator, however, does not generally hire labour. He is assisted by the members of his family and neighbours. It is only in exceptional cases that he hires labour for money wages.

Tube-wells worked by diesel oil or steam engines cost about Rs.8,000 and can irrigate at the rate of 3 to 4 acres a day. The hand chain pump flushes  $\frac{1}{2}$  an acre in a day, and the double chain pump, 1 acre. Similarly, the centrifugal pump, worked either by electricity or steam power, irrigates quickly and economically.

Due to its comparative cheapness, the cultivators always prefer irrigation from canal. Since the opening of the Sarda Canal the cane acreage in these districts has considerably increased. Notwithstanding this expansion the importance of well irrigation in parts, not accessible to canals, cannot be over-estimated. In the interior of the villages, water is lifted from the wells by the old *charsa*, *rahti* or *dukhli* system.

#### Hoeing.

After cultivation is practically confined to irrigation and hoeing principally during the period of germination and growth. Each watering is followed by one or two hoeings, which are given by gangs of men using *kasis* (short-handled heavy hoes). The number of hoeings required depend chiefly on the type of soil. Sandy soils require 5 to 7 hoeings, while loamy ones demand only 3 or 4. Hoeings make the soil more porous; and the compact clods of earth and crusts, formed by watering, are broken up and thoroughly pulverized. This facilitates healthy germination and growth. On an average 3 hoeings are given by the farmers in these districts, whereas private and Government cane farms are hoed 4 to 5 times. The first hoeing is given 2 or 3 days after sowing. After this between every two waterings the fields are hoed once or sometimes twice. In some tracts where the soil is very compact, as many as 8 to 10 hoeings have to be given—the first after sowing, the second after germination, the third after watering, the fourth closely repeated after 4 to 10 days, the

fifth after re-watering and the later ones 1 or 2 days after each irrigation. During the month of July (*Asarh*) the fields are hoed at least twice. The July (*Asarh*) hoeings are believed to be a necessity for a good cane crop, as they do not allow weeds to overgrow, which might otherwise eat up the fertility of the soil. When the plants attain a height of 3 to 4 feet the hoeing operations are stopped.

Five to six men can hoe one acre in a day. Putting the money wages at 4 annas a day per man, the cost of 3 hoeings of an acre of land comes to Rs.6. It is easier to hoe the fields before irrigation, and in practice only 4 men can hoe a dry field of one acre in a day. The total cost of 3 hoeings is, therefore, proportionately reduced. An ordinary hoe (*kasi* or *karsi*) costs 12 annas (8 annas for the iron spoon and 4 annas for the wooden handle). Various modern types of hoeing implements, e.g. Hand Hoe, Planet Junior, etc., which are really labour and time saving tools, but which are also very expensive for an average farmer, are in the market.

The Rohilkhand cultivators do not attend to their cane fields during the month of August (*Savan*), for the plants during this period are supposed to grow very rapidly "in a state of nudity", to use the peasants' vocabulary. The period of the ripening of cane depends on many factors, the most important among them being the nature of the variety, the amount and distribution of rainfall and the adequacy of the artificial water supply. The plant, generally speaking, begins to mature with the approach of winter. It ordinarily remains on the ground 9 to 11 months according as it is an early or late variety. On an average, the plants in the cultivator's fields attain a height of 6 to 8 feet; whereas on Government farms they go as high as 10 or 12 feet. Normal sugarcane contains from 90 to 95 per cent. juice. The conversion of glucose into sucrose begins in winter. During the period of growth the glucose, which assists plant metabolism, increases in quantity, but there comes a time when the growth stops and the increase in the percentage of glucose is also arrested. The sucrose contents then begin to rise.

Harvesting begins from November and December and continues till March and April. Sometimes the crop is harvested long before the plants have fully matured. This is done to obtain a longer working season for sugar manufacturers. When the plants are ripe, the stalks are cut off close to the ground. The upper end may be topped just

above the highest coloured joint. The cultivators use their ordinary chopper or *garasa* for cutting the canes. The scythe or *hansia* is used for stripping off the leaves. Some canes are set aside. These are carefully cut and their leaves stripped off by hand. Hoes are also often times used for harvesting purposes.

Most of the cane-growers in Rohilkhand begin the harvest operation of cane on and from the *Ganga Ashnan* festival in the month of *Kartik* (November). This is continued till March and April. Generally no money wages are paid for cutting and stripping the canes. The farmers put in their own labour, being assisted by the members of the family and neighbours. A common practice is that those who harvest cane receive no remuneration in cash but take away the tops of as many plants as they cut and strip. In addition to this they are given 5 canes, *chabena* or 2 loaves of bread and *sharbat*. The tops are used as fodder for cattle. Occasionally, however, money wages have to be paid for the labour hired for harvesting purposes. The wages differ greatly, but ordinarily they range between Re.0-2-6 plus *sharbat* and *chabena* or 2 *rotis* to 4 annas a day without the extras. One man cuts, peels, and ties into sheaves (*phandis*) 6 to 7 maunds of cane in a day—5 to 6 sheaves each containing about 50 to 60 canes and weighing  $1\frac{1}{2}$  maunds. An average crop of 360 maunds of cane per acre requires 24 labourers to harvest it in one day, and taking the labour charges at 4 annas per man per day the money wages of cutting, peeling and tying the canes into sheaves would come to Rs.6 per acre.

The cartage  
of cane.

The sheaves or *phandis* are carted to the *bels*<sup>(1)</sup>, railway stations, sugarcane factories, or sugarcane factory weigh-bridges for disposal. The cartage expenses vary considerably. The cultivators ordinarily use their own carts and bullocks or borrow them from their neighbours for the purpose. Carts and bullocks are occasionally hired at Re.1 for 4 to 5 rounds for a distance of 5 miles each. This includes loading and unloading charges also. An ordinary cart with two bullocks carries 20 to 25 maunds of cane at a time. The cartage, at this rate, on a crop of 360 maunds, varies from Rs.3 to Rs.4-8, and is, on an average, about Rs.3-8 an acre.

Rent and  
zamindari  
tolls.

The rent or *lagan* on cane-lands in Rohilkhand differs greatly from village to village and from field to field in the

(<sup>1</sup>) *Rab-boiling* workshops.

same village. The amount of rent depends upon the kind of tenure, the fertility of the soil, the distance from the village, irrigation facilities, etc. *Auwal dumat* fields fetch rents between Rs.4 to Rs.12 per acre. Eight to 12 annas per *bigha* (*kham*) is the average rent for a very ordinary field. Average fields on the other hand pay from Re.1 or Re.1-8 to Rs.2 per *bigha* (*kham*).

As the cane crop is very often preceded by a fallow period of 8 to 12 months the rent per unit of land for a crop, in fact, works up to one and a half to twice these figures. Rents are collected in convenient instalments in different months of the year, viz. October, January and May.

In some villages the *nazrana* system<sup>(1)</sup> in some form or other still survives. It is generally charged at the time of letting a field to a tenant. Its amount in such cases ordinarily ranges between 8 annas to Rs.2 per *bigha* (*kham*). The zamindars of some villages in Shahjahanpur District charge *hathiawan* (fodder for elephant); and each tenant growing sugarcane has to give one *biswa* of his cane crop to his zamindar as *hathiawan* irrespective of the fact whether the latter keeps any elephant or not. It is satisfactory to note that the practice of charging *nazrana*, *hathiawan* and similar other customary tolls is now disappearing.

The yield of cane per acre depends directly upon the type Yields. of soil and the method of cultivation adopted. An ordinary Rohilkhand farmer, under normal conditions, obtains 400 to 500 maunds of cane per acre on light loam, 300 to 400 maunds on heavy loam and 200 to 300 maunds on clay soils. If the cane crop has been preceded, and by year's fallow, the yield is increased by about 12 to 15 per cent. Furthermore, the yield per acre in trench cultivation is more than that in flat. In private farms the yield per acre in trench cultivation is 850 to 950 maunds against 600 to 800 maunds under flat system. The cultivators, however, obtain 400 to 500 maunds per acre in flat cultivation under good conditions of farming. In Shahjahanpur, at the Government Sugarcane Farm the average yield per acre of Co. 290 comes to 900 maunds and of Co. 213 to 800 maunds per acre, as against 550 and 500 maunds respectively on the cultivators' fields applying improved methods of cultivation. Again, the yield per acre, other things being equal, increases directly, up to a certain optimum, with an increase in the distance between the rows of the plants. The following

(<sup>1</sup>) Zamindari imposts.

table shows the yield of cane per acre on an average field under different agricultural conditions.<sup>(1)</sup>

Particulars	Yield per acre Mds.
Trenches 4½ feet apart .. ..	884·3
„ 3½ „ „ .. ..	791·72
„ 3½ „ „ followed by earthing .. ..	763·000
Flat 3 feet apart .. ..	895·7
„ 3½ „ „ .. ..	728·7
„ 2 „ „ .. ..	837·2

The undermentioned table shows the yield of cane per acre under different types of cultivation :<sup>(2)</sup>

Particulars	Yield of cane per acre Mds.
Ordinary cultivator's field—Local <i>desi</i> varieties .. ..	200 to 250
Ordinary cultivator's field—Improved Co. varieties .. ..	300 to 400
Improved cultivator's field .. ..	500 to 650
Private farms .. ..	850 to 950
Government farms with up-to-date methods of cultivation—Improved varieties .. ..	900 to 1,200

The yield also naturally depends on the variety of the cane sown. Co. 290 and Co. 213 are the most prevalent types sown at present. They are known by different local names, differing from district to district. Generally they are called *urisa*, *hathichinghar* (Co. 290); *tatti* (Co. 213), *koyam* (Co. 214), etc.

The following is a brief description of the characteristics of some of the important varieties of cane :

*Co. 213*—It is suitable for all types of land under poor irrigation facilities. It matures in January. It is yellowish white in colour.

*Co. 290*—It is suitable for intensive cultivation. It does not thrive well on low lands or where irrigation facilities are poor and incursions of wild animals is a common feature. It matures in February. It is protected from losing its juice content, after harvest by a sort of dust deposit on its internodes. Its colour is grey or reddish grey.

*Co. 331*—It is very hard, a heavy yielder, good in growth, poor in sucrose in the beginning of season, very

<sup>(1)</sup> Result of experiments conducted at Government Sugarcane Research Station, Shahjahanpur.

<sup>(2)</sup> Figures supplied by the Government Sugarcane Research Station, Shahjahanpur.

late to mature. It ripens in the beginning of March. Its colour is red.

Co. 313—It is hard, heavy yielder and rich in sucrose. It is of considerable promise as one of the highest yielders under suitable farming conditions. It is more susceptible to mosaic attacks. It matures in December and its colour is green.

Co. 300—It is hard, a good yielder, of ordinary growth, and rich in sugar. It is a fine cane with high sucrose content and good purity. It is very sweet, and on this account is liable to be damaged by wild animals. It matures towards the close of November. Its colour is yellowish red.

Co. 214—It is thinner and poor in yield. Cultivators do not, therefore, grow it. It matures in November.

Co. 312—It is soft, better in sugar content, a heavy yielder and better for chewing than all other medium varieties. It has a tendency to lodge on fertile soils and under intensive cultivation. It flowers early and is liable to be damaged by wild animals. With regard to yield it is regarded as the best by many.

Co. 244—It has hard and thick leaves and is called the "poor man's variety". It is most popular in the western districts of the United Provinces. It has shown immunity from the attacks of shoot borers (pyrella insect) because of its hard and thick leaves. Where the rains end early or a big gap occurs in the rains this variety proves to be the best.

The following table shows the yields of important Co. varieties of cane :

*Statement showing the yield of cane per acre by growing different varieties of sugarcane under uniform conditions at Government sugarcane Research Station, Shahjahanpur*

Varieties				1932-33	1933-34
				Mds.	Mds.
Co. 312	..	..	..	1,145	1,146
Co. 331	..	..	..	1,000	997
Co. 313	..	..	..	930	947
Co. 290	..	..	..	885	873
Co. 213	..	..	..	850	859
Co. 300	..	..	..	785	787

It must be remembered, however, that the prevalence or absence of diseases may affect the outturn very considerably.

In short, the yield varies very widely from field to field. It is consequently very difficult to arrive at a correct figure representing the mean conditions. Taking the yields of different fields at random and averaging them, we can say that the average Rohilkhand farmer, in a normal year and under ordinary agricultural conditions, obtains about 360 maunds of cane per acre.

Cost  
accounts.

An attempt has been made to find out the cost of cane cultivation which the average Rohilkhand farmer incurs and the profits he makes. The subjoined figures show the actual cost of cultivation on different fields, obtained from different sources in the districts of Bareilly and Shahjahanpur.

*Table showing the sums of money expended on various items of cost of cane cultivation on a  $\frac{3}{4}$  acre field on Government Sugarcane Farm, Shahjahanpur*

Particulars	Cost
	Rs. a.
<i>Ploughing :</i>	
20 ploughings, at 15 annas per ploughing ..	18 12
<i>Manuring :</i>	
Farm-yard manure 6 cart loads .. ..	7 8
<i>Labour .</i>	
6 men for spreading the manure at 5 annas per man	1 14
<i>Seed sowing :</i>	
25 maunds of improved seeds at 8 annas per maund	12 8
<i>Labour—</i>	
8 men for showing at 5 annas per man .. ..	2 8
<i>Hoeing :</i>	
<i>Labour—</i>	
40 men at 5 annas per man .. ..	12 8
<i>Irrigation :</i>	
Canal dues .. ..	4 12
<i>Labour—</i>	
8 men's labour at 5 annas per man .. ..	2 8
<i>Rent</i> .. ..	10 0
Total Cost ..	72 14
Yield of cane—350 maunds. Estimated value of the crop at 5 annas per maund. ..	109 6
<i>Deduct—</i> Cost of cultivation .. ..	72 14
Profit ..	36 8



It would thus appear that the cost of cultivation for a whole acre is Rs.194; the outturn per acre is 933 maunds, and its value at 5 annas a maund is Rs.291 and so the profit per acre is Rs.97.

*Statement showing the figures of actual cost, yield and value of crops raised and of profits obtained by sale thereof*

Particulars	Commercial farm of Mrs. Jwala Prasad, tahsil Tilhar, district Shah-jahanpur	Village Gul-champa, tahsil Tilhar, district Shahjahanpur	Village A district Bareilly	Village B district Bareilly	Village C district Bareilly	Estimates obtained from the Agricultural Superintendent, Shah-jahanpur
	Field 1 acre	Field 1 acre	Field 1 acre	Field 1 acre	Field 1 acre	Field 1 acre
	Rs. a.	Rs. a.	Rs. a.	Rs. a.	Rs. a.	Rs. a.
Ploughing ..	4 8	15 0	15 0	10 0	10 0	12 8
Harrowing ..	0 10	0 8	..	..	..	..
Manuring ..	6 0	6 5	8 10	4 0	2 0	12 0
Seeds and planting	11 8	15 0	12 4	10 2	11 2	14 4
Hoeing ..	9 0	4 8	8 4	5 0	3 0	15 0
Irrigation ..	10 4	10 4	12 8	12 0	7 0	10 0
Rent ..	12 0	6 0	6 0	12 0	9 0	12 0
<b>Total ..</b>	<b>53 14</b>	<b>57 9</b>	<b>62 10</b>	<b>53 2</b>	<b>42 2</b>	<b>75 12</b>
Yield of cane in maunds.	450 0	420 0	360 0	300 0	300 0	450 0
Value of the crop if sold as cane at an average price of 5 annas per maunds after deducting cartage.	136 0	127 0	109 0	91 0	91 0	136 0
Value of the crop if sold as juice at Rs.20 per karda <sup>(1)</sup> .	120 0	112 0	96 0	80 0	80 0	120 0

(<sup>1</sup>) 65 maunds (100 maunds *kham*) 65 approximately of juice.

Particulars	Commercial farm of Mrs. Jwala Prasad, tahsil Tilhar, district Shah-jahanpur	Village Gul-champa, tahsil Tilhar, district Shah-jahanpur	Village A district Bareilly	Village B district Bareilly	Village C district Bareilly	Estimates obtained from the Agricultural Superintendent, Shah-jahanpur
	Field 1 acre	Field 1 acre	Field 1 acre	Field 1 acre	Field 1 acre	Field 1 acre
	Rs. a.	Rs. a.	Rs. a.	Bs. a.	Rs. a.	Rs. a.
Profits obtained per acre if the crop is sold in the form of cane.	82 0	69 8	46 8	38 0	49 0	60 0
Profits obtained per acre if the crop is sold in the form of juice to the khandsali <sup>(1)</sup> .	66 0	54 8	33 8	27 0	38 0	44 0

The conditions vary so widely from village to village that an accurate calculation, representing the actual state of affairs becomes impossible. Wages fluctuate from place to place and time to time. In general the agricultural wages in these districts range from 3 to 4 annas a day. Influential people like zamindars and *mahajans* can hire labour even at 2½ annas a day. On the other hand, during the full swing of the agricultural season the supply of labour becomes so limited that even a wage of 6 annas a day is not sufficient to attract workers. Some payment in kind in the shape of *chabena*, *tamakhul* or *sharbat* is also made.

Various agricultural operations, like ploughing, manuring, seed sowing, watering, harvesting, etc. are carried on by the peasant himself, and it is, therefore, difficult to arrive at their correct money values. The cultivators are always averse to hire labour for money wages and try to dispense with such contingencies as far as possible. They are helped by the members of the family and relations in various field operations. A good deal of agricultural work is carried on under what is known as the "jita system" according to which the peasants help each other mutually in all farming operations.

(1) Indigenous sugar manufacturer.

## CHAPTER II

## THE FINANCING OF SUGARCANE

IN Rohilkhand there has been a remarkable expansion of the sugar industry for some time past. Only a decade has witnessed a phenomenal growth of area under cane as well as an increase in the number of *bels*<sup>(1)</sup> and *Khauksals*<sup>(1)</sup>. There were formerly only two sugar factories, viz. at Rosa and at Pilibhit. To these recently were added five new ones in the districts of Bareilly and Pilibhit. Co-extensive with this two-fold development there has been a parallel growth of two distinct classes of sugarcane financiers consisting of the factory owners, their commission agents and contractors on the one hand and the *khandsali mahajans* on the other. A complete study of financing of sugarcane must, therefore, include an account of the nature and methods of business of these two classes of credit agencies.

Before we proceed to discuss the two financing agencies it may be mentioned that the contractors and agents of the factories in their turn get advances of money from the factory owners to finance the cultivators for which they have to furnish adequate security—the amount of money advanced being generally equal to two-third of the face value of the security deposited. The factories are generally financed by the modern commercial banks by the system of *hundis*<sup>(2)</sup> and bills as also by overdrafts and cash credits. The *khandsalis* on the other hand do not deal with the banks—their main source of credit being the city *mahajans*<sup>(3)</sup> or the *arhatiyas*<sup>(4)</sup>. The *mahajans* and *arhatiyas*, on the other hand, have extensive dealings with the modern banks and other big financial houses. Thus we see that there is a chain, though a very loose one, which links together the modern credit agencies, the *beoparis*, the *arhatias*, the *mahajans*, the *khandsalis* and the cane growers.

Sugar milling must be carried on close to the cane fields, as a considerable wastage of juice and sugar content takes place if the cane is not crushed quickly after being harvested. Another fact is that the sugar factories, with a view to reduce

The chain of credit.

Need for regular cane supply.

(1) Indigenons sugar refining workshops.

(2) Inland trade bills.

(3) Money lenders.

(4) Commission agents.

their working cost and overhead charges, work for all the 24 hours with three shifts. These two features necessitate, as a condition for their success, a continuous stream of adequate intake of cane. Further, towards the close of the season during the middle and later half of April when each factory tries to draw as much cane as possible so as to prolong its working season, there ensues a very keen competition among them which ends in unduly inflated cane prices. Naturally the attempt of each factory is to make advance contracts for the supply of as much sugarcane with as many cane growers as possible. The means employed to achieve this end are diverse and varied.

Sugar factories usually obtain their supplies of cane through contractors, but sometimes they purchase cane direct from cultivators.

Factory as  
the financing  
agency.

When a factory deals with the cultivators the latter come to its cane department from June and July to September to mortgage their standing crop and to execute bonds or *sattas* in favour of the factory owners in return for advances of money made to them. The factories take care to see that the amount of money advanced in the first instance to any particular cane grower is not more than half the estimated value of the probable crop from his field. In every case a stamped receipt for the money advanced is obtained. During the cane-growing season the cultivators come to the factory from time to time and take small sums of money to meet the recurring expenses of agricultural operations and domestic necessities. The accounts of each cultivator are kept properly and, except in rare cases, the dealing is on the whole fair. At the close of the crushing season the accounts are adjusted and settled. The terms of the agreement are almost similar to those entered into between the cultivators and agents or contractors. It may be added that, save in a few cases, the factories do not favour direct dealings with the cane growers; nor is it possible for them to do so with the existing organization. With regard to one factory in Rohilkhand, it was reported that the owners of the factory were formerly not quite fair in their dealings with the cane cultivators in so far as they never let the latter know as to what actually they were going to get for their cane. The cultivators, finding themselves under the thorough grip of the factory owners, were forced to supply their cane to them, and only at the end of the crushing season when the appropriation of profits had been made and a rateable sum allowed to each cultivator in proportion to the amount of cane supplied by him, could the latter definitely know as to where actually he

stood. In exact contra-distinction to this state of affairs the Rosa Sugar Works and Distillery, owned and managed by Messrs. Carew & Co., Ltd., have got very fair dealings with the cane growers, keep excellent accounts, make due and punctual payments and never attempt to take undue advantage of the passive position of the cane growers.

The terms of agreement for the supply of cane under a contract are practically the same as those when direct purchases are made, except that in the latter case factories exercise a closer and more real control over the dealings between the cane growers and their own employees; under the contract system such control is either ineffective or entirely absent. When direct purchases are made, the factories regulate the price of cane from time to time so as to keep themselves in close adjustment with the latest market conditions. Under the contract system, on the other hand, the contractors are left to deal with the cultivators in whatever manner they like, the only concern of a factory being to see that it gets the supply of cane contracted for.

The contractors, having obtained advances of money from the factory owners against securities deposited with them, proceed to accommodate the cultivators in the villages with small sums of money against bonds or *sattas* executed by the latter, mortgaging their standing crop and agreeing to supply a stipulated amount of cane to the factory at its yard, weigh-bridge or railway station at such time and upon such terms and conditions as may be decided upon. The advances are generally made during the months of July, August and September, when the crop is actually growing in the fields so as to afford some basis for making a preliminary forecast of its future prospects. In the first instance the contractors do not give money for more than half the value of the expected yield of the crop. The average produce of sugarcane is taken at 300 to 350 maunds per acre. Generally a sum varying between Rs.30 and Rs.60 per acre, depending on the credit of the borrower, is advanced. During subsequent months the cultivators take small sums of money for meeting expenses incidental to agricultural operations (like irrigation, manuring, harvesting, seed, sowing, rent, etc.) and domestic necessities (like marriage, funeral ceremony or some other social or religious ritual). In each case the contractor takes care to obtain a receipt for all such advances.

The cultivator in his turn, while hypothecating his standing crop, declares that it is free from any encumbrance. He has further, to supply only wholesome and fresh canes with leaves

and tops stripped off and roots removed. It is stipulated that the canes delivered will have been freshly harvested within not more than 24 hours. The cultivator has to bear the cost of carriage and cartage from his field to the place of delivery. The cane is weighed either at the weigh-bridge or beam-scale of the factory and the cultivator was formerly required to give 41 seers of cane for every maund. The cane grower may be asked to supply his cane any time between the months of November and April to suit the necessity of the factory. The factory may at any time stop working, when after due notice to the cane supplier, it has a right to suspend taking further deliveries of cane, until such time, when again after due notice, the factory restarts working, the cultivator, thereafter, being required to resume his cane supplies. In case the cultivator fails to supply the agreed amount of cane at the proper time, he is charged with damages amounting to either Rs.5 per 100 maunds of cane or Re.1-5 per acre on the deficiency of his supplies, subject to the exception that a deficiency of 5 maunds per every 100 maunds of cane is generally ignored by both parties. On his part the contractor agrees to pay damages on the same scale, viz. Rs.5 per 100 maunds of cane if he fails to accept the contracted amount of cane offered to him. Not infrequently, the arrangement for the supply of sugarcane is entrusted to the *mukhia* or *pradhan* of the village, who, in consideration of his services is paid by the contractor a commission at 8 annas per 100 maunds of cane. Occasionally the zamindar also acts as an intermediary between the contractor and his tenant cultivator. He charges a commission of one to half an anna per maund of cane supplied through him.

Some mal-  
practices.

The contractors are often an unscrupulous lot of people who attempt to take full advantage of the weaker position of the cultivators. Before the issue of the Sugarcane Rules in 1934, contractors often used to reject fresh and wholesome cane as defective and force the cultivators to accept a deduction arbitrarily fixed by them in the price. They unduly delayed the weighing of cane and took from the cane suppliers free services like loading, unloading of cane, etc. without payment. The beam-scales and weigh-bridges were either deliberately or negligently kept unbalanced, and the weights were defective, with the inevitable consequence that the cultivator was very often deceived in weighing. A deduction was made for *karda*, i.e. for tops, leaves, roots, and bindings of sheaves which may be found in the cane bundles. This charge was sometimes deducted secretly a second time. Occasionally

*karda* was also charged on the gross weight of the cart loaded with cane. Over and above all these a maund was taken to mean a weight of 41 seers (each seer being equal to 100 tolas in Bareilly, 105 in Pilibhit and 80 in Shahjahanpur). The accounts kept by the middlemen were rarely clear or intelligible. Nor were due payments made to cane suppliers fully and punctually. In short, the contractors taking full advantage of their superior position, lost no opportunity of deceiving cane growers, and their aim was to keep as many cane suppliers under their grip as possible, so as to make their business secure.

Generally no interest is charged for the period commencing from the date of advance of money to the date when the cultivator has actually ceased supplying his cane. The underlying idea of making such interest-free advance is to get the cane at a rate sufficiently lower than the prevailing market rate, and secondly to make the position of the factory as well as that of the contractor safe and secure with regard to the continuity and adequacy of cane supplies. It is stipulated that the sum due from the cultivator to the contractor, after the former has finished supplying his cane, will begin to earn interest at the rate of 12 annas per cent. per mensem from the date of contract to the date when the overdue balance is fully cleared, and in the intervening period the future crop of sugarcane on the fields of the executants always remains pledged. Interest.

The outstanding increase of area under cane in Rohilkhand has brought into existence a distinct class of financiers, known as *khandsalis* who advance money to the cultivators many months before the sugarcane crop is ripe—the stipulation being that the cane juice will be sold over to the *khandsalis* at a forward rate which is invariably much lower than the prevailing spot rate at the time of maturity of the crop. The nature of the business of the *khandsali* in Rohilkhand has been clearly depicted by the United Provinces Provincial Banking Enquiry Committee in their report at page 54 as follows: *Khandsu as the financier.*

“ The *khandsali* or dealer in sugar in Rohilkhand is a money-lender of great rapacity. His method is to advance to the cultivator a sum sufficient to finance his crop on condition that he receives the juice after extraction at a forward rate which he fixes himself. His rate of interest is not exorbitant, but he makes up for

it on the price. The general effect of the system is that the cultivator hands over all his profits to the *khandsali* in return for means of subsistence and the working capital required to grow the cane."

The cost of crushing the cane falls upon the cane grower and the hire of the crushing mill is also borne by him. The loss, which the *khandsali* seems to incur by not charging any interest at all, is more than counter-balanced by the cheapness of the price at which he gets the juice. Not less than 90 to 95 per cent. of cultivators, who sell juice instead of cane, cultivate cane on credit, being financed by the *khandsalis*.

Beginning from the month of April, May and June to August and even September the *khandsali* advances small sums of money to the cane growers, against bonds or *sattas*, executed by the latter in favour of the former, hypothecating their standing or future crop. Generally the practice is that the *khandsali* accepts these executants in batches of 20 or 30 or even more as the case may be and asks them to execute *sattas* jointly and severally, thereby making his own position very secure. Further, the bond usually provides for a penalty of about 8 annas on the deficiency of every rupee worth of juice. The executants have also to bear the cost of the stamps and writing charges (called *satta navis kharch*) of the *satta* which ordinarily comes up to 8 annas per head.

Conditions  
and extent  
of  
accommoda-  
tion.

The amount of money to be advanced in the first instance always bears a definite proportion to the estimated amount of juice yield from the crop mortgaged—keeping a safe margin of about 50 to 60 maunds of juice per acre for unforeseen losses. The credit of and previous dealings with the *asami*(<sup>1</sup>) also have some weight in the determination of the amount to be advanced.

Generally speaking, 200 maunds of juice per acre is taken as a fair average of the yield of juice from a normal crop for such purposes. To start with about Rs.12 to Rs.30 per acre are given. During the subsequent months small sums of money are advanced for meeting agricultural necessities. Thus about Rs.9 per acre is given for irrigation purposes, a similar sum for the payment of outstanding rent and some other petty sums of money for other agricultural or domestic necessities. But in no case does the *khandsali* ordinarily make such advances which exceed half the expected value of

(1) The term *asami* means a client. But in villages and *asami* is debtor of a money-lender or *Khandsali*, or a tenant of a *samindar* (landlord).



juice yield from the crop hypothecated. The *khandsali* in Shahjahanpur levies a charge, locally called *bataun*, which is a small deduction of about 1 per cent. from the amount of money advanced. It is deducted at the time of making the loan. The accounts having been adjusted, the balance is settled in the month of March or April within 15 days of the closing of the *bel*.

The rate of juice may or may not be settled in advance at the time of executing the *satta*; but when no price has been agreed upon in the bond, interest runs from the date of the advance to the date of settlement of the rate of juice; and thereafter no interest is charged till the final accounts have been adjusted. After the accounts have been finally settled and the *asami* is found to owe something to the *khandsali*, the former has to pay interest on such balance from the date of the *satta* to the date of the realization of the sums due. Some of the Mohammedan *khandsalis* do not charge any interest, but set off this loss by fixing the rate of juice at a level sufficiently lower than that at which interest-bearing agreements are entered into.

The forward rate in one village is influenced by the markets in the neighbouring villages. But in forward contracts the rates of juice are always fixed at Rs.5 to Rs.10 or Rs.15 lower than the prevailing harvest rates. The United Provinces Provincial Banking Enquiry Committee give the following illustration from Bareilly District: "The cultivator by a forward contract accepted a rate of Rs.20 to Rs.25 per 100 maunds of juice. As the proportion of juice to cane is 11 to 20, this works out roughly to 2½ annas per maund of cane. Sometimes the *khandsali* offers a higher rate of Rs.40 to Rs.50 per 100 maunds of juice, but in this case he charges interest at the rate of 24 to 36 per cent. on the advance, which counter-balances the better price. If the cultivators had sold it at the lowest rate they would have obtained 8 annas per maund (of juice)" (1). It is occasionally agreed between the *khandsali* and the cane grower that the rate of juice to be supplied will be Rs.5 or Rs.6 lower than the forward rate prevailing in a particular neighbouring village. The difference constitutes what they call "commission". Ordinarily this "commission" as well as the interest for the whole period of advance is not chargeable except in those cases where the *khandsali* is the *zamindar*, *mahajan* or *bania* of the village.

*Zamindar khandsalis* obtain the juice from their tenant cultivators at the lowest possible rates. Sometimes the

(1) See report of the United Provinces Provincial Banking Enquiry Committee, page 153.

forward rates which they offer are Rs.5 or more per *karda* of juice lower than those agreed upon between the non-*zamindar khandsalis* and juice sellers. It is a common practice among some of the *zamindars* to act as intermediaries between their tenant cane growers and the non-resident *khandsalis* for the supply of cane juice to the latter. In such cases they offer a lower rate to the tenants and charge a higher one from the *khandsalis*, thus intercepting a commission for themselves, which ranges from Rs.6 to Rs.10 or more per *karda* of juice. Such agreements are always disliked by the *khandsalis* as they have to pay a higher rate. *Zamindars* sometimes charge *haq zamindari* from their tenant cultivators who decline to sell juice to them.

**Accounts.** Separate accounts are usually maintained for advances of money for the receipt of juice and adjustments are made only at the close of the *bel*; the price of the juice is not set off against the loan on the date of its delivery.

The following is an extract of the form of account of cane juice of an *asami* obtained from the books of a *khand-sali* of Bareilly :

Number	Name of the <i>asami</i> with father's name and caste	Weight of the <i>nand</i> (1)	Number of <i>nands</i>	Total weight of juice	Khojar (2)	Net weight of juice	Rate of juice	Total price of juice	Sum due from <i>asami</i>	Sum paid by <i>asami</i>	Balance	Remarks

(1) *Nand* or *mata* is a spherical earthen vessel used for measuring cane juice.  
 (2) Allowance for leaves, straw, fibres, etc. in sugarcane juice.

Overdue accounts are adjusted half-yearly and the interest is compounded on the same. The bonds are renewed each year and when it is found that the realization of money is doubtful or expected to be late, the sum owing is either doubled or an addition of 25 to 50 per cent. made to it in the new bond. From an *asami* who appears to be troublesome, the bond is taken on blank paper, duly impressed with his thumb, and when the realization of money from him seems difficult the bond is completed for double or fourfold the original sum and a suit filed against him, for the interest only, so that after the realization of interest, the principal continues to earn fresh interest. The object of the *khandsali* is to keep as many *asamis* under their grip as possible, so as to have the continuity of their *bel* business secure and profitable. They, therefore, often tempt and persuade cultivators to take advances of money from them. Formerly *khandsalis* used to advance cane seedlings at 25 to 50 per cent. interest payable in terms of cane. This was known as lending at *sawai* ( $1\frac{1}{2}$ ) and *deorha* ( $1\frac{1}{2}$ ).

In addition to all this the *khandsali* charges about 50 <sup>Local</sup> seers of juice as *ras kharch* (3 *dolchi kalan* of juice in <sup>deductions.</sup> Shahjahanpur and 5 *kalsas* of juice in Bareilly and Pilibhit) and about 1 maund per *karda* of juice as *khojar*. Over and above this the Shahjahanpur *khandsali* deducts  $\frac{1}{2}$  seer per every *kalsa* (or 10 seers) of juice supplied as *ras ki chhut*. They also charge something as *labh* at the time of settlement of accounts which, they say, is based on customary rights.

Some *asamis* are just as bad as the *khandsalis*. A breach <sup>Undesirable</sup> of contract on their part is not an unusual practice, if they <sup>asamis.</sup> find a more profitable outlet for their produce. Sometimes they themselves cheat the *khandsalis* by hypothecating an already encumbered crop with the latter. Overdue accounts and late repayments of money are of common occurrence. It sometimes becomes extremely difficult to realize outstanding balances from the *asamis* and the *khandsalis* have to carry forward every year overdue accounts to the extent of 10 to 25 per cent. of the total accommodation granted. In such cases if they shift their *bel* business from the *mauza* of such doubtful debtors, the realization of outstanding accounts becomes extremely difficult and the doubtful debts ultimately become bad debts. The sub-joined figures, obtained from the books of a *khandsali* of Bareilly, show the

extent to which cane growers often fail to conform to their part of the contract for the supply of cane juice :

Mauza in which the <i>bet</i> was planted	Total number of cane growers who agreed to supply juice	Number of cultivators who actually delivered juice	Number of cultivators who did not give any juice	Total amount of money advanced to cultivators	Amount for which juice was received	Sum owing from the cultivators
				Rs.	Rs.	Rs.
Turkunia ..	45	40	6	10,815	6,815	4,000
Ismailpur ..	43	39	3	4,665	3,724	941
Rampur ..	57	57	..	7,284	3,690	3,594
Barepura ..	65	44	21	7,252	2,163	5,089
Bhandsar ..	63	63	..	8,025	2,781	5,241
Tigra ..	41	28	13	7,514	1,120	6,394
Gopalpur ..	171	162	9	13,753	9,937	3,816
<b>Total ..</b>	<b>485</b>	<b>433</b>	<b>52</b>	<b>59,308</b>	<b>30,233</b>	<b>29,075</b>

## CHAPTER III

## CANE CRUSHING AND MILLING

THE sugarcane crop in the United Provinces is utilized as follows : Average annual consumption of cane in *bel* industry.

- (i) Manufacture of *rab* and *gur* by cultivators;
- (ii) disposal of cane juice to *khandsalis*;
- (iii) cane sold to central factories;
- (iv) cane used for chewing purposes; and
- (v) cane set aside to be used as sets.

The bulk of the crop is consumed under the heads (i), (ii) and (iii). A large number of cane growers convert a part of their crop into *sairi rab*(\*) and *gur* either for their personal use or for marketing; but the proportion of cane thus utilized to the total annual crop, specially in Rohilkhand, is much lower than what may at first sight appear. The Tariff Board allocated 82½ per cent. of the total crop for the manufacture of *gur*. While such a high percentage might hold good for the country as a whole, it is at least not true for Rohilkhand where *khandsali* industry is generally practised and consumes about 2,500,000 tons of cane annually.

Long before the crop is ripe, the cane growers enter into forward contracts with the *khandsalis* or *zamindars* for the supply of cane juice, duly expressed, as also the bagasse at the *bels* of the *khandsalis* against advances of money made to them. The standing crop is mortgaged in favour of the creditors, and the terms and conditions of agreement are laid down in the *sattas* or bonds executed in favour of the latter. The expenses of cane cartage from the fields to the cane crushers, the loading and unloading charges and the expenditure incurred on crushing the cane are borne by the growers. The juice (*ras*) is delivered at the *bel* itself and the bagasse (*khoi* or *pata*) is never paid for. Sale of juice to *khandsalis*.

The *bel* is erected at a central place in the country side so that an adequate and continuous supply of juice may be drawn throughout the working season from the surrounding villages. An open space is always provided round each *bel* where the crushers (*kolhus*) are worked and the wet

(\*) *Rab* boiled out of juice in single open pans by the cultivators in their own cottages.

bagasse is dried in the sun, to be later used as fuel for boiling the juice. Actual crushing work generally starts in the month of December or January.

The  
*kolhus*  
used.

Different types of *kolhus*, varying in size and shape, are used in these districts. Stone mills have now disappeared and the use of the primitive country wooden *kolhu* is also becoming an object of memory. Iron mills are now practically universal. The type of crusher, most prevalent in rural tracts, consists of a wooden frame with two or three iron rollers. All-iron mills fitted with 3 rollers of varying dimensions are occasionally used. Five-roller iron crushers are rarely used.

Crushing mills are generally hired for the season. Either the *khandsali* himself hires the *kolhus* and lets them to the *asamis* or the latter combine in groups of two or three and hire the crushers themselves. Well-to-do cultivators own their own *kolhus*. The *bhairon kolhu* (wooden mill) which has now become out-of-date, costs six to seven rupees. Mills consisting of wooden structures and fitted with 3 iron rollers cost about Rs.35 to Rs.40, and are hired at Rs.15 to Rs.20 per season. The market price of the all-iron 3-roller mills is about 50 to 60 rupees, their hire for the season being Rs.20 to Rs.30. The *khandsalis*, as also some well-to-do cultivators hire the mills directly from the dealers in cities, and, in their turn, let them to the smaller cane growers at Re.1-8 for every 100 maunds of juice expressed. In every case the owners of the mills take upon themselves the responsibility of all repairs and replacements in cases of stoppage and breakdown.

Capacity of  
the crushers.

The crushing capacity of these mills depends upon the condition of the crushing rollers, the type and condition of the cane and the strength of the animals working them. Broadly speaking, the amount of juice extracted by different types of mills, from 100 maunds of cane is as follows :

	Mds.
Wooden <i>kolhus</i> .. .. .	45—50
3-roller iron bullock-driven mills .. .	55—60
5-roller Massey's mills .. .. .	60—65
Sultan Nahan bullock mills .. .. .	65—70

The crushing capacity per hour of the various types of mills under most favourable conditions is shown below :

2½ maunds of cane per hour is crushed by 3 roller bullock driven mills.			
18 to 20	ditto	ditto	8 × 8 Massey's 3-roller power-driven mills.

27 to 30 maunds of cane per hour is crushed by	10×14	Massey's 3-roller power-driven mills.
35 to 40 ditto ditto	10×14	Massey's 5-roller power-driven mills.
45 to 50 ditto ditto	12×18	Massey's 3-roller power-driven mills.
55 to 60 ditto ditto	12×18	Massey's 5-roller power-driven mills.

Each *asami* brings his cane in bundles either in a cart or on his head to the crusher. Two or three *asamis* combine to crush their cane in a *kolhu*. They provide their own *matas*. *Matas* are spherical earthen receptacles with an average capacity of 5 maunds of juice and cost about Rs.2 each. The *kolhus* generally are worked by a pair of country bullocks called *gohi*. Two persons are engaged at a time in working a *kolhu*. One man, the *mutha* feeds the cane into the mill and the other drives the bullocks. Ordinarily the *asami* himself acts as the driver of the bullocks, and either some member of his family or his co-partner in the mill acts as the *mutha*. *Muthas* are also sometimes hired labourers for about Rs.4 a month. The pair of bullocks generally belong to the *asami* himself or they are hired at 8 annas for crushing 25 maunds of cane. Each *gohi* is changed after a *mata* has been filled; and the cattle are then let loose to graze. It is commonly agreed between the *asamis* acting as co-hirers of a mill that their pairs of bullocks will draw the mill alternately, turn by turn, after filling up each *mata* with juice.

Crushing operations begin at 4 in the morning. If the weather is very cloudy or it is raining so that the bagasse cannot be dried the business is suspended till the return of fair weather. By sunset the crushing work is stopped for the night. On every *kolhu* about 3 *matas* or 15 maunds of juice are expressed. It takes about 3½ hours to fill a *mata* with juice when the animals employed to work the *kolhu* are of average strength and the mill itself is working satisfactorily.

When the *mata* or *nand* becomes full the *asami* in question informs the juice-carrier (*bhisti*) of the *bel*, who fills up his leather bag with a small skin bucket—each bucket having a capacity of ½ to 5/8 maunds of juice. When the *mata* has been completely emptied the watch-man (*daroga*) of the *bel* comes to see that no juice has been left behind. The crushing work is then again resumed. The furnace-feeder (*jhukha* o.

*jhukia*) of the *bel* takes away the bagasse to spread and dry it in the sun.

Cost of  
crushing.

On the basis of these figures the cost of juice extraction can now be worked out. The normal cost of hiring a crusher and pans is Rs.35 for the season. Taking the season as four months or 100 working days, the pay of the *mutha* comes to Rs.16 while that of the second man employed with the bullocks would be Rs.25 at 4 annas a day. The cost of bullocks works out at Rs.50. Thus the total expense is Rs.125. As 3,000 maunds of cane would be crushed in the season producing 1,725 maunds of juice, this works out at 8 pies per maund of cane or Re.0-1-2 per maund of juice.

Juice  
consumption  
in *bel*.

An average *bel* consumes 100 *kardas* of juice in a season. (One *karda* is equivalent to 62.5 maunds in Bareilly, 65.62 maunds in Pilibhit and 66.66 maunds in Shahjahanpur.) The daily average consumption of juice in such a *bel* is about 15 *matas* of juice (75 maunds). Taking the average yield of cane per acre at 360 maunds, the juice yield from an acre comes a little over 200 maunds or between 3 and 4 *kardas*. Thus agreements for the supply of juice of at least 25 to 30 acres of crop have to be made before a *bel* can be started. But in actual practice the *khandsalis* get *sattas* executed in their favour for more than 100 *kardas* of juice, as, not infrequently, in every season some *asamis* fail to fulfil their part of the contract. For a hundred *karda bel* the *khandsali* enters into agreements with some 40 or 50 *asamis*. The author saw the books of a leading *khandsali* of Bareilly and found that every year he contracted with about 45 to 50 cane growers for the supply of juice for his 100 *karda bel*.

Weights and  
measures.

No standard weights and measures are used in these parts. In Shahjahanpur the *nands* or *matas* are measured by the following measuring vessels :

One <i>gagra</i> ..	..	This is made of iron, bronze or copper with a capacity of 10 seers of juice.
One <i>dolchi kalan</i> ..	..	This is made of tin or iron with a capacity of 15 seers of juice.
One <i>dolchi khurd</i> ..	..	This is made of tin with a capacity of 2½ to 5 seers of juice.
One <i>paua</i> ..	..	This is made of tin with a capacity of 1/8 seer of juice.

In Bareilly and Pilibhit the measuring vessels used are:

One <i>ka'sa</i> ..	..	Made of iron, copper or bronze with a capacity of 10 seers of juice.
One <i>lota</i> ..	..	Made of bronze or copper with a capacity of 2½ seers of juice.
One <i>gilas</i> ..	..	Made of bronze or copper with a capacity of 1 seer of juice.



The accountant (*munshi*) of the *bel* keeps the account of supply of juice of each *asami* in terms of so many *matas*, *gagras*, *lotas*, etc. At the close of the *bel* season the measuring vessels are filled with juice and weighed. The capacity of each *mata* is also measured in terms of the smaller measuring vessels and the total weight of juice supplied by each *asami* is calculated on this basis.

On the occasion of weighment of these vessels the *khand-sali* in Shahjahanpur expects some gain (*labh*) on each vessel from his *asamis* who indicate their consent by putting some pieces of mud lumps on the weight side of the balance according as the *mukhia* of the village thinks fit. The *khandsali* pays Rs.2 to the weighman (*taula*) as his *vajan kashi haq* (customary right to receive this amount for weighment.)

Every *khandsali* charges from each of the *asamis* 3 *dolhis* (*kalan*) of juice as *ras kharch* and  $1\frac{1}{4}$  maunds per *karda* as *khojar* (i.e. allowance for fibres, straw and leaves going with the juice). Over and above this, each juice supplier has to give *paua kalsa ras ki chchut* or  $\frac{1}{2}$  seer of juice on every 10 seers of juice supplied. Occasionally the *asamis* are also charged with the following :

One <i>gagra</i> or <i>kalsa</i> of juice as	..	..	<i>Bhisti kharch.</i>
Ditto	..	..	<i>Daroga</i> "
Ditto	..	..	<i>Munshi</i> "
Ditto	..	..	<i>Karigar</i> "
Ditto	..	..	<i>Patwari</i> "

The crushing season coincides with the *rab* manufacturing season. It begins in the month of December or January and ends in March or April. The accounts of the juice suppliers are finally settled in March and April within 15 to 20 days of the closing of the *bel*. The units of weight in which cane juice is dealt with are not standardized, and they vary from place to place. Agreements between *khandsalis* and cane growers for the supply of juice are entered into in terms of *kardas*.

The average extraction of 60 to 65 per cent. of juice on the weight of cane is a great advance in the direction of cane crushing if we compare these results with those of one or two decades past when the juice extraction was only 50 per cent. Alluding to such a low extraction, Mr. Hailey, the Director of Agriculture, United Provinces, observed in 1913 that "the amount of sugar burnt in the megasse, as fuel would amply supply all the needs of this province and obviate any necessity for imports."<sup>(1)</sup> Though the state of affairs has

(<sup>1</sup>) Report of the Industrial Conference, 1913.

considerably improved since then as the recovery percentage of juice on cane has now increased, yet it is much below the 80 to 90 per cent. obtained in a well equipped sugarcane factory. There can be no doubt that if the amount of juice annually burnt with the megasse as fuel were expressed in terms of money the figure would be a very high one.

Even an extraction of 60 per cent. of juice cannot always be obtained by the cultivators unless they use the best type of 3-roller iron mills properly worked by bullock power. The better the extraction of juice from a mill the heavier the strain on the animals used. The deterioration of cattle as a result of this heavy strain on their energy presents a serious menace not only to the future improvement of agriculture but also to the better and continued crushing of cane for a long time. A high efficiency cannot, for any length of time, be obtained by the use of light and underfed bullocks. The distance between the rollers of the mills has to be increased to relieve the strain on the bullocks and the efficiency of extraction then decreases. Again, the grooves of the mills are effaced with long and persistent use and instead of sugarcane crushers they become mere squeezers of cane.

Possible  
lines of  
improvements.

The efficiency of 3-roller iron mills might be increased by the addition of two extra rollers to enhance their crushing capacity. The extraction in a power mill is usually less than that in a mill worked by sturdy bullocks. But considering the fact that the cattle of the cultivators are generally ill-nourished, lean, thin and badly looked after, and that two agricultural operations, viz. crushing of cane and threshing of *rabi* crop have to be carried on at more or less the same time, it appears to be desirable to introduce power crushers. On an average a Massey and Clarke 10"×14" 5-roller crusher, run by a 25 B.H.P. Ruston Hornsby Crude Oil Engine crushes 35 maunds of cane per hour at a mean working cost (exclusive of the salaries of operators) of about 8 annas per hour or one pie per maund, but to this the cost of staff and depreciation must be added. With the growing popularity and increase in the catchment area of hydel power, electric power crushers are likely to be used by the cultivators more and more. The working expenses of an electric power-driven 5-roller crusher comes up to 2 to 3 pice per maund of cane crushed, apart from cost of staff and depreciation. Apparently, the working cost of hydro-electric mills is higher, but if we consider the capital cost involved in the installation of steam or diesel oil engines as also the resources of the cultivators, crushers, worked by electric power, seem to hold out better promise than do steam or oil engine-driven mills.

## CHAPTER IV

*Rab* MAKING BY THE OPEN PAN PROCESS

*Rab* is a semi-solid product obtained by boiling the cane juice to a slightly lower degree of concentration than that required for the manufacture of *gur*. The open-pan *rab* producing industry is concentrated in Rohilkhand, which has a large number of *bels* or small juice boiling workshops. Size of *rab* boiling industry.

The annual production of *rab* in India today stands between 200,000 to 300,000 tons. Rohilkhand, where the *bel* process is mainly practised, contributes the greater part of this tonnage. Some 20 lakhs of tons of cane are annually consumed for the manufacture of *rab* by the *bel* process. The major portion of the *rab* is produced in the *bels*; but a small part is boiled by the cane growers themselves according to their own primitive method similar to that employed in the manufacture of *gur*.

A *bel* is a hut, consisting of mud walls and thatched roof, temporarily erected for carrying on boiling operations. The hut is surrounded by an open space where the crushing mills work and the wet bagasse is dried. Occasionally the term *bel* is also used for the set of iron pans used for boiling the juice.

*Bels* are built, owned and run by *khandsalis*, *mahajans* or *baniyas* who may or may not be *zamindars*. They are erected in a central place in some village where an adequate and continuous supply of cane can be drawn from the surrounding tracts. The *khandsalis* do not purchase cane, but they enter into forward contracts for the supply of cane juice. Sugarcane grown on 25 to 30 acres of land is sufficient to keep an ordinary *ekgarha bel*(<sup>1</sup>) working for a season of about 100 days. The *khandsalis* enter into agreements for the future supply of juice with 40 to 50 growers. Generally one *bel* is built in one village, but very often even two or three congregate in one big *mauza* having a large acreage under cane.

The *khandsali's* position is somewhat uncertain. He does not know if he would be able to continue his *rab* making business in future in a particular village. He is not sure if he would get the requisite supplies of juice there in subsequent years. Every attempt is, therefore, made to keep the growers always in debt. Further, for building Floating business.

(<sup>1</sup>) Single *bel* with one furnace and one set of boiling pans.

a *bel* in a particular *mauza* the *khandsali* has to secure the permission of the *zamindar*, and he does not know if the permission would be granted to him in the ensuing years. Again, the *asamis* of some villages are notorious for their dishonesty and quarrelsomeness. A breach of contract on their part is a thing of not infrequent occurrence. Again, the business has also to be shifted due to what the *khandsalis* call *zamin ki kharabi* (deterioration of soil and produce) and the consequent deterioration in the quality of the juice. *Bels* are, therefore, nothing but temporary camps, built on shifting sand, and moving from place to place, sometimes here and sometimes there. This leads to waste of money and labour every year. The life of a *pucca bel* is several times more than that of a *kachcha* one. Nearly 30,000 rupees are annually spent in erecting and dismantling *bels*. If the *khandsali* hopes to continue his *bel* business next year in the same village, he removes only the boiling pans and leaves the hut, which is reduced to a heap of mud and earth by the commencement of the next season.

The *zamindars* are in a favoured position. They can compel their tenants to deliver their juice at the proper time. The *zamindars* can, therefore, if they carry on *rab*-making business, erect a permanent *pucca bel* in their own villages.

*Zamindari*  
in posts.

If the *zamindar* does not carry on the *rab*-making business himself, he generally permits other *khandsalis* to build their *bels* in his *mauza*, but he invariably charges some *nazarana*, *haq zamindar* or *zamindari kharch* for the privilege granted. This *nazarana* varies widely from place to place. Some *zamindars* take Rs.10 per *kolhu* erected or per 10 *kardas* of juice consumed. Others charge only Re.1 or Rs.2 per *kolhu*. Some *zamindars* take a *nazarana* of Rs.25 to 50. In addition to this every *zamindar* takes from 1 to 10 *kalsis* (each *kalsi* is equal to 20 seers) of *rab* from the *khandsali* and 1 *kalsa* of juice from each cane grower who supplies his juice to the *bel*. In *mauza* Alapur, district Bareilly, the *zamindar* takes a *nazarana* of Rs.2 per *karda* of juice consumed in addition to 4 *kalsis* of *rab*. In the Chena *mauza* in the same district the *zamindar* takes Rs.15 and 5 *kalsis* of *rab* as his *nazarana*.

Religious  
rite.

*Bels* are constructed during the months of November (*Agahan*) and December (*Pus*). They are built either by the *khandsali* himself or by a contractor under an agreement. An ordinary *bel* is built within 15 days' time. Before constructing

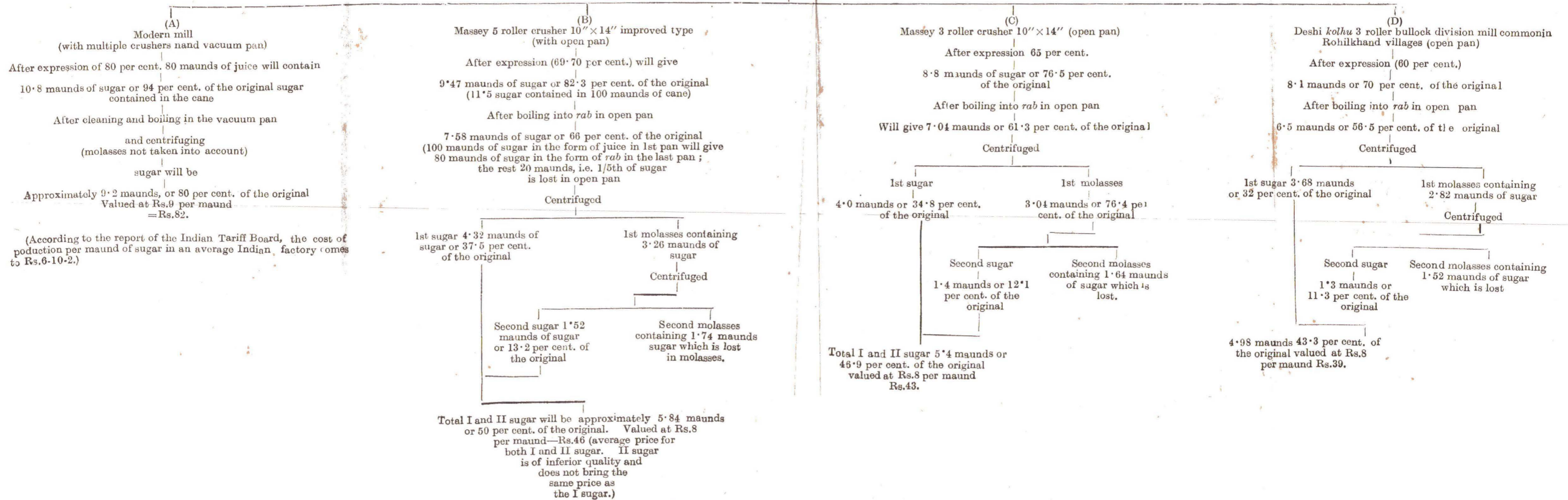
(1) Spherical earthen vessels utilized for potting *rab*.

CANE

100 maunds

containing 11.5 maunds of sugar

(average chemical sucrose for the whole of India which ranges from 10.5 to 12.5 maunds)



his *bel* the *khandsavi* performs a religious ceremony (*puja*) at the foundation wall of the *bel* and calls it the *Ganesh puja*. A trench is dug to lay the foundation of the northern wall of the *bel* in which a mud idol (*Ganesh*) is placed and worshipped (by offering some water, *roli*, *chawal*, flower, *pan*, *supari*, *gur*, *kalava* and 2 pice). Eight annas worth of sweets (*batashas*) are distributed and the priest (*pundit*) is paid a sum of 1 or 2 rupees (as his *dakshina*). As. 2-6 are given to the labourer who digs the trench and a similar sum is given to the flower seller (*mali*) for his flowers and betels (*pans*). The mason then lays a channel or drain through which the boiled and concentrated syrup in the *bel* flows from the last boiling pan to the aerating earthen vessels. He is paid Re.1-4. The work of further construction then proceeds.

An average *ekgurha* or *tamancha bel* is about 12 yards long and 7 yards wide. But this dimension is by no means a fixed limit. The author visited some 45' x 24' *bels* in Pilibhit. The walls are made of mud (*godhi mitti*), but when the earth is sandy, sun-dried bricks are used for building the walls. The roof is thatched with timber pieces, bamboos, reeds, etc. The furnace is constructed by the furnace-feeders (*jhukahas*) under the direct supervision of the juice-boilers (*karigars* or *halwais*). Description  
of *bel*.

The construction of the *bel* is always north-southward. The furnace faces towards the north but the front doors of the *bel* are towards the south. The hut is surrounded with a big open space where the crushing mills (*kolhus*) are erected, the wet bagasse is dried in the sun, and the empty *kalsis*, tins or drums are stored. The furnace runs centrally through the *bel* from north to south. The front wall has two doors—each opening on either side of the furnace. Outside the *bel* in the south-western corner lies the kitchen of the watchman (*daroga*). Adjacent to this the accountant's resting place (*munshi's gaddi*) and kitchen are situated. Thus the accountant, (*munshi*) who is the most responsible employee of the *bel*, can always keep an eye over the door which opens just in front of him. In the north-western corner, next to the accountant's resting place, the receptacles containing *rab* are stored. On the side of the furnace the *daroga* has his sitting place. The kitchen and resting place for the juice-boiler (*karigar*), his assistant (*nikhara*) and the juice-carrier (*bhisti*) or in the east wing. The furnace-feeders (*jhukias*) live and cook their food in a hut built outside the *bel* near the mouth of the furnace. A *kachcha* well is also dug outside at the south-eastern corner. Recently a change has been introduced in the construction of

the *bel*. A semi-circular wall, known as *ghungat ki diwal*, is built from and enclosing the south-eastern entrance to the door before the accountant's resting place. Thus, any person coming in the *bel* has to enter through only one entrance which is before the accountant's resting place. Formerly, when boiling operations were being carried on, any person, masked by the vapour of the boiling pans, could sneak into the *bel* through the south-eastern door without being noticed by the accountant. People thus used to steal *rab* and juice in collaboration with the juice-boiler and his assistant. The cost of building an ordinary *kachcha bel* is Rs.30 to Rs.50 including the hut, the thatch and a *kachcha well*.

**The furnace.** The furnace of the *bel* runs centrally from north to south with its feeding mouth towards the north and chimney towards the south. It is built in a slope having a ramp 5 feet deep towards the mouth and an elevated incline of 3 feet to 4 feet towards the chimney. The furnace is the main thing in the *bel*, and its construction requires great skill and experience. Any defect in its construction leaves its traces in the *rab* boiled and in the sugar machined out of that *rab*. The furnace is always built under the direct supervision of the juice-boiler (*karigar*) who is conversant with all its dimensions and measurements.

The feeding mouth opens outside into a pit 11' x 5', known as *khuria* or *jhonkera*. There is an incline northward of the *jhonkera* up to the surface level. The feeding orifice, known as *bilaiya*, is a circular hole about  $\frac{1}{2}$  ft. in diameter and is located 2 feet above the surface of the *jhonkera*. Just below the *bilaiya* there is a *purdah* wall of temporary lattice work of pieces of bricks with small openings through which the air passes into the oven and aids combustion. This arch is dismantled every day for cleaning the fire channel and is bricked up before the commencement of the operations. An adequate amount of dry bagasse is stored in the *jhonkera* pit—the rest being stored above in the open space. The fire channel is so constructed that the flue produced by feeding at the *bilaiya*, passes below all the boiling pans and ends in an issue of smoke out of the chimney (*dhundhu*) at the back. The furnace is also cleaned through the chimney.

**The boiling pans.** The boiling pans are fixed on the top of the furnace at different levels—the biggest pan, the *hauz*, being placed towards the chimney and followed in order by the *nikhar*, the *phula*, the *phadka* and the *pahcha*. The usual Rohilkhand type of *bel*

consists of these 5 boiling pans, all of which are round bottomed. The following are the particulars of these vessels :

Pan number and popular name	Size (diameter and depth)	Average capacity	Height from the surface of the fire channel	Use
1. <i>Hauz</i> ..	7'—10½" × 2'—5"	7 to 8 <i>matas</i> or 38 mds.	1'—8"	Storage of juice.
2. <i>Nikhar</i> ..	6'—4" × 2'—½"	5 <i>matas</i> or 23 mds.	1'—10"	Clarification of juice.
3. <i>Phula</i> ..	5'—10" × 1'—9½"	3 <i>matas</i> or 10 mds.	1'—10"	Boiling of juice into syrup.
4. <i>Phadka</i> ..	5'—1" × 1'—7"	2 <i>matas</i> or 12 mds.	2'	Concentration of juice.
5. <i>Parcha</i> ..	2½' × 9"	2 mds. ..	3'—8"	Preparation of strike.

These pans are so arranged in a slope that their bottoms lie in a straight line. The boiling vessels are either owned or they are hired for the season by the *khandsali*. Their capital cost comes up to Rs.250 to Rs.300, and the hire of a good set of pans for a season varies between Rs.45 and Rs.50. The pans made in Pilibhit are known for their durability.

On both the wings of the furnace two mud platforms are built. On one side three earthen tubs (*mandias* or *nands*) are placed in which the defecants are kept. On the other side three baskets covered with cloth strainers are put on three wooden frames (*tipais*). These are meant for receiving the scum when it is removed from the pans. Left of the *parcha* three earthen tubs are fixed to the ground, and a channel covered with cloth runs between these tubs and the *parcha*. Thus, when the strike is ready it is laded into this drain through which it flows into the first tub where it is stirred and aerated.

No standard size is fixed for the tools and implements used. Slight variations are common. The size and number of tools and implements depend on the quantity of the material handled.



and the facility to the operators. The following are the particulars of the tools and implements used :

Number used in an average <i>bel</i> with popular name	Average capacity	Approximate cost	Description and use
2 <i>karanga dora</i> or <i>donga</i> .	6 seers of <i>rab</i> .	10 annas each..	These are ladles consisting of wooden handles and iron cups. They are used for transferring juice from one pan to another.
2 <i>Karangia</i> or <i>dori</i>	1½ seers ..	8 annas each ..	It is similar to the <i>karanga</i> and is meant for removing the strike from the <i>parcha</i> , aerating the <i>rab</i> and filling the <i>kalsis</i> with the same.
2 <i>Paunas</i> ..	..	4 annas each ..	These are perforated ladles used for removing the scum ( <i>dhandnoi</i> ) from the boiling juice.
1 <i>Adha</i> or <i>paunia</i>	..	2 annas each ..	Similar to but smaller than the <i>paunas</i> . Used similarly.
3 <i>Tipais</i> ..	..	<i>Tipais</i> : 3 annas each. Baskets : 2½ annas each, Cloth strainer : 3 annas each.	These are wooden frames to support baskets covered with cloth strainers for straining the scum. The whole arrangement is known as <i>chianna</i> .
3 Clarification earthen vessels <i>nanda</i> or <i>mandias</i> .	20 seers ..	..	These are used for keeping defecants and for holding soapnut water ( <i>andi ka pani</i> ).
3 <i>Mands</i> for aerating <i>rab</i> .	Do. ..	..	These are used for aerating and stirring the <i>rab</i> .
1,500 <i>kalsis</i> (earthen vessels) or empty kerosene oil tins or 500 empty petrol drums.	<i>Kalsis</i> : 20 seers. Tins : 24 seers. Drums : 36 seers.	Rs.4 to Rs.6 per 100. Rs.25 per 100 Rs.50 per 100	Used for potting the <i>rab</i> .

N.B.—The number of tins or iron drums may be reduced as they are re-used after their *rab* contents have been removed.

The chemical agents used for clarifying the juice are *deula*, Clarifying agents. *sajji*, castor seed extract, *bhindi* (*Hibiscus Esculentus*), *semul* (*Bombax Malabaricus*), lime, *falsa* (*Grewia Asiatica*), sodium hydrosulphite and stannous chloride; but the principal defecants commonly used are:

(a) *Deula* (*Hibiscus Ficulencus*)—The freshly cut stems of this plant are crushed and pounded in water and a mucilaginous liquid extract made by addition of some water. It has a thick consistency. It contains vegetable albumens which coagulate on heating, entangle the suspended impurities and bring them up to the surface. The scum is first of dark green colour, but with complete clarification it becomes white and frothy. It is considered to be the best agent for clarification. Two to 2½ seers of *deula* is added in an earthen tub full (about 20 seers of water. The market rate of *deula* ranges between Rs.6 to 10 per maund.

(b) *Sajji* (a mixture of crude sodium carbonate and sodium sulphate)—A solution of *sajji* is made by adding ¼ seer *sajji* to a *nand* full (20 seers) of water. It is boiled before use. *Sajji* solution is used after clarification with *deula*. The quantity of *sajji* solution used is very small so as to leave the juice acid. It contains carbonates as well as sulphates of sodium and evolves both  $\text{CO}_2$  and  $\text{SO}_2$ , thus serving both the purposes of liming and sulphitation. A strong smell of  $\text{SO}_2$  is noticed when *sajji* is added. This exercises a bleaching action on the juice but its excessive use leaves a dark colour in the *rab* (massecuite). After the *sajji* solution has been added a copious evolution of  $\text{CO}_2$  takes place and the heavy froth consisting of gummy impurities rises up and is removed. *Gulabi sajji* is supposed to be the best variety for defecation. The market price of *sajji* generally fluctuates between Rs.6 to Rs.7 per maund.

(c) *Castor seed extract*—An emulsion of castor oil and water is prepared by breaking crushed castor seed in water. After clarification, when a heavy frothing and ebullition of the juice is produced, it is used for controlling the overflow of juice and froth. Two to 2½ seers of crushed castor seed is soaked in a *nand* full (20 seers) of water. The market price of castor seed is 5 to 10 rupees per maund.

For the clarification of one *nikhar* (25 to 30 maunds) of juice 3 *karangas* of *deula* extract and ½ *karanga* of *sajji* water

is used—each *karanga* having a capacity of about  $2\frac{1}{2}$  seers. For one night's clarification work 1 seer of *deula*,  $\frac{1}{2}$  seer of *sajji* and  $\frac{1}{4}$  seer of castor seed are required.

Labour in  
*bel*s.

An average *bel* employs about 11 or 12 paid workers. They are—

- One *munshi* or accountant and general supervisor.
- One *daroga* or watchman.
- One *halwai* or *karigar* or juice-boiler.
- One *nikhara* or juice clarifier (juice-boiler's assistant).
- One *bhisti* or juice-carrier.
- Six or seven *jhonkias* or *jhonkahas* or furnace-feeders.

Some of these are employed on contract and others on monthly salaries.

The job of the *munshi* is of the greatest responsibility. A very honest and reliable man is required for this post. The *munshi* keeps the accounts of juice suppliers, of *rab* boiled, and of other sundry expenses incurred. He exercises general supervision over every other employee of the *bel*. The *munshi* is generally a Hindu. His salary is about Rs.15 per month.

The *daroga* of the *bel* is also a responsible office holder. He keeps a watch over the *matas* of juice and sees that the *asamis* do not dilute their juice by the addition of water. He is also responsible for seeing that the *matas* filled up with expressed juice are fully emptied and that nothing is left behind in them. The *daroga* asks the *munshi* to credit the account of the *asami* with the *mata* full of juice supplied by him. He keeps a general watch over the *bel* throughout the day and night. Some *khandsalis* keep two *darogas* in a *bel* instead of one. The *darogas* are ordinarily recruited from the Hindu caste and get a salary of Rs.8 to Rs.10 per month.

The duties of *halwais* or *karigars* and *nikharas* are very important as it is on their skill in boiling the juice that the quality of *rab* depends. The *nikhara* always comes with the *halwai*—both of them being employed on contract for the season of 3 to 4 months. The furnace of the *bel* is always built according to the directions of the *karigar*. The *karigar* is in charge of boiling operations and he is assisted by the *nikhara* who clarifies the juice as it is boiled. *Karigars* of *mauza* Kakrala, district Budaun, are reputed for their skill and experience in juice boiling. Similarly the *turki* (a sect among the Mussalmans) *karigars* of *mauza* Aliganj, tahsil Aonla, district Bareilly, are well known in these districts for their skill. The *karigars* are generally Muhammadans. They are

paid at 12 annas to Re.1 per *karda* of juice boiled or Rs.80 to Rs.100 for the whole season. This amount includes the remuneration of the *nikhara* who is paid by the *karigars*.

The *bhisti* is the juice-carrier. He transfers the juice from the *matas*, as they become full, into the *hauz* (the storage pan) of the *bel*. One *bhisti* ordinarily contracts to work on 10 to 12 *kolhus* for the season at Rs.2 to Rs.4 per *kolhu*. *Bhistis* are generally Mohammedans.

About half a dozen furnace feeders or *jhonkias* are employed in an average *ek garha bel*. One of these acts as the headman or *jamadar* over the rest. *Jhonkias* work includes the drying of the wet bagasse, the feeding of the furnace by turns, the cleaning of the furnace, the pans and the floor of the *bel* as also the miscellaneous work such as the lifting of water from the well, loading and unloading of *kalsis*, etc. They generally belong to the Chamar caste and are paid at Rs.6 to Rs.8 per month.

There is no fixed time for the payment of salaries. Sometimes an earnest money of rupee one is paid in advance to each of the employees. Subsequent payments are made from time to time according to the demands of the labourers when they require money for sending it to their homes. Some outstanding balance is always retained in the accounts of the *karigars* and *jhonkias* until the *bel* has been closed, for, if paid in full, they either run away or return late and thus upset the whole work for the time being.

In addition to cash something is also paid in kind to the *bel* employees. Often the *munshi* is provided with free food (*sidha*). The *munshi*, the *daroga* and the *bhisti* take 3 *dolchi* (about 9 to 10 seers) of juice from each juice supplier. The *munshi* and the *karigar* take one *kalsi* of *rab* (20 seers) each, and the *daroga* and the *bhisti* take one *gagra* (10 seers) of *rab* each. Each *jhonkia* is given daily 1 *dolchi* (5 seers) of juice to drink and one *dori* (2½ seers) of *rab* every week. In some places the *jhonkias* take the scum of the juice. These payments in kind are only based on local customs and usages, and they differ from place to place. In practice every employee of the *bel* drinks juice and eats *rab*. Occasionally the *munshi* and the *daroga* meet most of their sundry expenses by making payments in *rab*. The system of payment in kind is being gradually superseded by each payments.

All the employees of the *bel* are provided with free housing, light and fuel. They leave their families behind in their homes and come to take up the work for only a few months. They cook their food and sleep on straw in the *bel* itself.

The hours of work extend from midday till midnight. Holidays are observed on important Hindu and Muslim festivals. On rainy and cloudy days the work is suspended. Referring to the conditions of work in *bels* Mr. Agrawala observes, "Thus their housing arrangement is simple and well suited to their needs and temperament. They live under conditions which approach to perfect village life. The sanitary conditions are satisfactory and sun light and fresh air are found in abundance. They get their water supply from the *pucca* village wells or temporary wells dug for the purpose. For call of nature they make use of gardens and adjoining open fields. In short, they feel satisfied and happy." (1)

*Rab-making process.*

The *bel* having been planted, the *khandsali*, in consultation with his priest (*purohit*), starts the *rab-making* business on some auspicious day in the month of December. The *asamis* are previously informed and they bring their cane to the *bel*. Crushing work commences at about 4 a.m. The expressed juice is transferred to the storage pan (*hauz*) covered with a cloth strainer to retain suspended impurities in the raw juice.

When about 6 or 7 *matas* of juice have been stored in the *hauz* the fire is put into the furnace. Within an hour and a half the juice attains a temperature of 7°C which prevents its fermentation. The time of lighting the fire and working the *bel* depends upon the quantity and continuity of juice supplies. It, however, starts some time between 8 a.m. and midday.

Though dried bagasse is an excellent fuel for boiling the juice yet it is not always available in the requisite amount. With a 60 per cent. extraction, the yield of sun-dried bagasse per 100 maunds of cane, amounts to about 16 maunds. For the first 6 or 7 days the furnace has to be fed with wood fuel. Further, during rainy days when the store of dry bagasse becomes wet and fresh supplies cannot be dried, wood fuel has to be used. Bagasse fuel gives better heat which can be easily controlled. Wood fuel gives rise to excessive charring of the *rab*. The following table shows the fuel consumption in making *rab* when bagasse and wood are used :

	Bagasse	Wood chips
Juice boiled per hour (mds) .. ..	13·8	10·6
Fuel consumed per hour (mds.) .. ..	3·6	3·0

(1) Agrawal, R. D. Sugar Industry and Labour in the United Provinces, page 94.

When all the pans are filled with juice the furnace is vigorously fed at the *bilaiya*. After a few minutes the juice in the *parcha* (i.e. the smallest pan just above the fire) begins to boil. It is then defecated. The scum which rises on the surface of the juice is skimmed off. When the juice has been fully clarified the temperature of the *parcha* is raised to 111°C, by vigorous feeding at the *bilaiya*. This temperature is maintained for some time till the syrup is concentrated. The strike is then ladled out into the channel on the floor communicating with the earthen tubs where it is stirred and cooled to form into crystals. In the same way the juice of the *phadka*, *phula* and *nikhar* are clarified. Every time the *parcha* is emptied a fresh charge is ladled into each pan from the one preceding it.

In the *nikhara deola* and *sajji* extracts are added to the boiling juice after about half an hour of the application of fire into the furnace; but after working the *bel* for a few hours the time is reduced to 20 minutes or so. *Sajji* is added 5 to 10 minutes after *deola*. Whenever due to excessive heat the boiling juice in the *nikhar* begins to overflow a little amount of castor cake extract is sprinkled over it and the ebullition subsides. The first strike in the *parcha* is taken within two hours of the lighting of the fire and thereafter this time is reduced to 18 to 20 minutes. The syrup adhering to the sides of the *phadka* and the *parcha* are wiped off with a grass brush attached to a stick and dipped from time to time in the juice of the preceding pans. But as the *parcha* is fixed directly over the fire even these precautions prove inadequate and some amount of charring and caramelization inevitably takes place, which imparts a dark colour to the *rab* and molasses, reduces the percentage and deteriorates the quality of recoverable sugar.

Juice boiling is the most important of all the processes in the *bel* business. Its effect is carried right down to the end, and an improper handling of this work results in poor quality of *rab* sugar and molasses. It requires some amount of experience and practice to determine the striking point at which the *chashni* should be ladled out from the *parcha*. The *karigars* and *halwais* judge it by the size and shape of the bubbles and the sound produced by their bursting. Even in the dim light of the night lamp the experienced boiler makes the strike at the right consistency. The striking temperature is between 110°C and 111°C. Strong bubbling indicates a greater percentage of glucose in which case the *rab* should be thoroughly aerated. On the other hand smaller bubbles are indicative

of higher sucrose percentage and in this case too much stirring makes the *rab* very hard. A medium consistency of *chashni* is always preferable.

The final product, coming from the *parcha*, having been thoroughly crystallized by cooling and aerating into the three earthen *nands* fixed to the ground for the purpose, is potted either into the earthen *kalsis* or kerosene oil tins or iron petrol drums. Earthen *kalsis* are, however, most commonly used for potting, though this practice is responsible for considerable wastage. For removing their *rab* contents the *kalsis* have to be broken. The chips and particles of these broken pieces get mixed with the *rab*, make smooth and even centrifuging difficult, and deteriorate the quality of the sugar produced. Metallic vessels can be used several times; *rab* crystallization is however better in *kalsis* than in tins or drums. The latter have to be kept in some cool place as heat severely affects the quality of *rab* contained in them. Again, *kalsis* are useful when *rab* is produced for the market. The subjoined figures are set forth to show the comparative loss which takes place in potting the *rab* in *kalsis* and tins :

Particulars	Tins	<i>Kalsis</i>
I <i>rab</i> (net) stored in maunds .. ..	6.86	17.59
I <i>rab</i> (net) machined in maunds.. ..	6.82	17.33
Loss of I <i>rab</i> in maunds .. ..	0.04	0.26
Loss of <i>rab</i> per 100 maunds potted .. ..	0.54	1.49

If, on the above basis, the shrinkage is computed on the total amount of *rab* annually potted in *kalsis* the loss would come to large figure.

The cane crushing work is stopped at about 5 p.m.; but the boiling operations continue till midnight or thereafter up to 1 or 2 a.m.—the actual time depending on the quantity and continuity of the supply of juice.

The *bel* season ordinarily extends for about 100 days, commencing some time in December or January and ending towards the close of March or the beginning of April. The average capacity of a *bel* is taken at 100 *kardas* of juice. The *Rohilkhand ekgarha bel* controls about 115 maunds of cane or 75 maunds of juice per day—the daily consumption being about 15 *matas* of juice. The daily output of *rab* is estimated at about 15 to 17 maunds or 30 to 34 *kalsis* (of 20 seers each). The percentage of *rab* to cane depends upon the period of the

season, the quality of cane or juice and the efficiency of boiling. The following table shows the percentage of *rab* to 100 juice in different months :

100 juice = 16 <i>rab</i> in November.
= 17 <i>rab</i> in December.
= 18 <i>rab</i> in January.
= 20 <i>rab</i> in February.
= 20 <i>rab</i> in March.
= 18 <i>rab</i> in April.

The cane of *tarai* fields yields more *rab* than that grown on *bhur* lands—the ratio between the two being about 8 to 10.

A *dugarha bel*<sup>(1)</sup> is one in which two furnaces are made and a double set of boiling pans are placed. An average *dugarha bel* consumes about 200 *kardas* of juice per season. The comparative cost (as distinguished from the absolute cost) of manufacturing *rab* in a *dugarha bel* is less than that in an *ekgarha bel*, but the cost is not reduced in proportion to the size of the establishment. The oncost is doubled in a *dugarha bel*, but the general establishment expenses, though increased, are not doubled. The following table shows the cost of manufacturing *rab* in relation to the size of establishment :

Description of the <i>bel</i>	Juice consumed during the season in maunds	Number of <i>kaleis</i> of <i>rab</i> (each <i>kalei</i> having a capacity of 20 seers of <i>rab</i> ) turned out during the season	Total cost of production
			Rs.
<i>Tigarha bel</i> ( <i>mauza</i> Gopalpur, district Bareilly).	19,847	7,477 = 3738½ mds.	2,040
<i>Dugarha bel</i> ( <i>mauza</i> Ismailpur, district Bareilly).	15,016	5,507 = 2753½ mds.	1,419
<i>Ekgarha bel</i> ( <i>mauza</i> Barepura, district Bareilly).	5,507	1,983 = 991½ mds.	533

The costs of production come to 8 annas per maund of *rab* or Re.0-1-7 per maund of juice.

Due to local variations no rigid figures representing the actual conditions can be given. The following estimates

(1) A double *bel* with 2 furnaces and double set of pans.



arrived at from well verified data can be safely taken to represent the mean conditions:

*Fixed capital cost*

Particular	Amount
	Rs.
A set of 5 boiling pans .. .. .	250

*Annual working cost* of an average *ekgarha bel* consuming 100 *kardas* of juice per season of about 100 working days.

Particulars	Amount
	Rs.
Ordinary <i>bel</i> of earthen walls with thatch .. .. .	30
<i>Nazrana</i> to <i>zamindar</i> .. .. .	25
Hire charges of 5 boiling pans .. .. .	50
<i>Neev ki puja</i> .. .. .	3
Tools, implements and other accessories .. .. .	13
Utensils furniture and other sundry items .. .. .	14
Defecants .. .. .	25
Fuel 200 maunds of wood .. .. .	100
2,300 <i>kalsis</i> at Rs. 5 per 100 .. .. .	115
Labour .. .. .	308
Cartage .. .. .	10
Miscellaneous .. .. .	5
Total working expenses for the season .. .. .	698
Add the value of 100 <i>kardas</i> of juice at an average price of Rs.20 per <i>karda</i> (65 maund approximately).	2,000
Total cost of boiling 100 <i>kardas</i> of juice .. .. .	2,698
Total amount of <i>rab</i> produced : 2,280 <i>kalsis</i> (each <i>kalsi</i> being of 20 seers) or 1,140 maunds.	
Value of 1,140 maunds of <i>rab</i> at an average price of Rs.3 per maund.	3,420
Deduct total cost of production .. .. .	2,698
PROFIT .. .. .	722

The foregoing remarks refer to the *Rohilkhand* system of *rab* manufacture. There is yet another process, known as the *Hadi* or *Bhopal bel* system. Khan Bahadur Saiyid Muhammad Hadi, formerly Director of Agriculture, Bhopal State, has been interesting himself in the improvement of the open pan system of white sugar manufacture for the past 34 years and he is mainly responsible for evolving a new type of *bel* which has not yet been fully standardized. The description and process of the *Bhopal bel* are given in Mr. Hadi's *Indian Sugar Industry*. For some time past the attention of the Imperial Council of Agricultural Research and the United Provinces Department of Agriculture has been focused on the question of the comparative efficiency of the two rival *bels*. Several experiments were consequently carried out—the two most important ones being held at Bilari (district Moradabad) and Shahjahanpur—and valuable data obtained.

The *Hadi bel* consists of 12 pans, 7 of which are flat-bottomed cylindrical vessels and 5 round-bottomed ones. Of the later five the two smallest ones are removable finishing pans. In addition to these two more spare finishing pans are employed for replacing the two in use when the latter are removed after pouring off the finished product. The following relevant figures, showing the comparative efficiency of the *Hadi* and *Rohilkhand bels* have been taken from the United Provinces Agricultural Department Bulletin no. 63 entitled *The Open-Pan Boiling: Comparison of Hadi and Rohilkhand*

*Hadi and  
Rohilkhand  
bels  
compared.*

		Yield per 100 cane of I <i>rab</i>
		Average brix of I <i>rab</i>
		Cost of boiling juice to I <i>rab</i>
		Consumption of fuel per maund of juice boiled
		Yield of scum per 100 juice
		Sucrose content of scum
		Yield per 100 cane of II <i>rab</i>
		Average brix of II <i>rab</i>
		Cost of boiling molasses to II <i>rab</i>
		Yield per 100 cane of I sugar (dry)
		Sucrose percentage on I sugar
		Moisture percentage on I sugar
		Yield per 100 cane of II sugar
		Sucrose percentage on II sugar
		Moisture percentage on II sugar
	Rs. a. p.	Normal cost per maund of sugar
		Yield per 100 cane of final molasses
<i>Hadi bai</i>	13.56	80.82
<i>Rohilkhand bai.</i>	13.51	81.03
	5.6	2.4
	.311	.265
	3.71	4.92
	16.43	16.80
	6.20	6.34
	60.95	58.76
	20.6	137
	5.96	5.67
	96.98	97.73
	0.51	0.47
	1.47	1.51
	96.42	95.46
	0.55	0.84
	6 13 1	6 9 2
	4.68	4.79

The juice boiling capacity of the *Rohilkhand bel* is greater and more uniform than of the *Hadi*, but there is a greater percentage of inversion and charring in the former. Another drawback of the *Hadi* process is that it is difficult to get trained boilers in adequate numbers who can manage that *bel*. Again the *Hadi bel* employs more men and consumes more material. Both in juice and molasses boiling it consumes more fuel than does the *Rohilkhand*. The I sugar of the *Hadi bel* though greater in quantity, is lower in purity as compared to the *Rohilkhand bel* product. The case is, however, quite reverse with regard to II sugar. In spite of its lower purity and greater richness in moisture, *Hadi bel* sugar is whiter and fetches a better price than that obtained for *Rohilkhand* sugar. Though more tedious to work, the *Hadi bel* produces on the whole material of better quality. The cost of the various operations, e.g. juice boiling, molasses boiling, potting of *rab*, drying of sugar, etc. are decidedly higher in the *Hadi bel*.

## CHAPTER V

SUGAR REFINING BY THE CENTRIFUGAL AND *khanchi*(<sup>1</sup>)  
PROCESSES

WITHIN a fortnight of the starting of a *bel*, the *khand-sali* begins his *Khand* making business. The *rab* is brought to the *khandsal* after three to five days of its potting. *Khand* is indigenous sugar produced by curing the *rab* in the indigenous workshops known as *khandsals* either by centrifugal machines or by the *khanchi* system, and the proprietor of the business is known as the *khandsali*.

Centrifugal  
versus  
*Khanchi*.

Of the above two systems of refining the centrifugal process is modern and more recent and is replacing the primitive *Khanchi* method. It gives a quicker turn over, is more economical if applied on a large scale, and its products are always finer than those obtained by the *khanchi*. The initial outlay under this method of working is, of course, a little heavier. The *khanchi* process though cheaper in capital cost is long and protracted, and yields an inferior quality of stuff. But *khanchi* sugar appeals more to a section of orthodox people who are always willing to pay a higher price for it. The *khanchi* method is steadily decaying and it is now confined to some of the remoter rural areas.

*Centrifugal Khand Manufacture.*

Sugar  
Centrifugal.

Centrifugals are round machines, worked either by manual labour or motive power such as steam, electricity, etc. They spin round with a high velocity, always from left to right and are commonly used in chemical industries for separating solids from liquids. In *khandsals* they are employed for removing molasses from sugar crystals. Sugar centrifugals are lined with three or four perforated linings of copper or iron—the inner ones begin finer than the outer ones. The innermost lining is the finest and does not allow the sugar crystals to escape with the molasses. The receptacle formed by this lining is called the basket of the centrifugal. The basket and all the subsequent linings are enclosed in an iron drum to which is attached a gutter for the drainage of molasses. There is a device by which the under surface of the drum

(<sup>1</sup>) A primitive method of indigenous sugar refining by bleaching the wet brown sugar with water weeds (*sewar*). The term *Khanchi* is also applied to the whole arrangement where the wet brown sugar is treated for further refining.

opens and the wet sugar, after it has been centrifuged, is taken out. Sometimes a pug mill is attached to the centrifugal in which the *rab*, before passing on to the centrifugal basket, is thoroughly crushed and reduced to a homogeneous mass. Other accessories like spindles, belts, wheels, etc. are also fitted to the centrifugals.

The strength of labour in centrifugal *khandsals* varies with the amount of raw material to be dealt with, the hours of work, the number of machines and the type of motive power used. Labour in Centrifugal *Khandsals*.

In electric-driven centrifugals an engine driver operates the machine. Whereas in machines worked by steam power a driver is in the charge of the plant and machinery, a fire-man looks after the boiler and a jugman or *bhisti* lifts water from the well and fills up the tank for the generation of steam. A driver and a fire-man are also employed in a diesel oil engine driven machine. If the centrifugal is driven by hand these skilled workers are dispensed with and only unskilled labourers are employed to work the machine.

On each centrifugal there is a sugarman experienced in the sugar centrifuging art. Other labourers are generally unskilled. The *turias*<sup>(1)</sup> break open the *kalsis* of *rab*, remove their contents into the *lalori* (a masonry tank), break and pulverize the lumps of *rab* into a homogeneous mass and separate the chips and pieces of *kalsis* from it. Their number depends upon the quantity and quality of *rab* and the time in which the work is to be completed. The *chamaris*<sup>(2)</sup> are unskilled female labourers of the Chamar caste, and their duty consists in scraping the *rab* from the broken pieces of *kalsis* with the help of *sippis* or tin spoons. They are also required to do other sundry work of the *khandsal*. The *patias*<sup>(3)</sup> spread the wet sugar, obtained from centrifugals, on gunny carpets, known as *patas*, crush, roll and pulverize it by their feet and dry it in the sun. When a pug mill is attached to the centrifugal the *rab* is directly transferred into it from the *kalsis* and in this case extra unskilled labourers are required to work this mill. When there is an unusual rush of work, casual unskilled labour is recruited at the prevailing market rate. Over and above these paid labourers every sugar refining workshop employs a *munshi* or accountant who keeps the

(1) Ordinary unskilled male labourers employed to break the *kalsis* and remove their contents.

(2) Unskilled female labourers of *chamar* caste employed to scrape the residue of *rab* adhering to the chips and pieces of *kalsis* and to do other sundry work.

(3) Ordinary labourers employed for drying the wet sugar.

books of the *khandsal* and exercises a general supervision over all the operations and workers.

An average *khandsal*, using one centrifugal machine, employs two skilled and some ten unskilled workers. In electrified centrifugals, however, the number can be reduced to 6 or 7.

Some of the workers are recruited on daily wages system, while others are paid on monthly basis. Generally speaking the unskilled workmen come under the first category and the skilled ones under the latter.

Formerly these labourers were employed on contract system; but this has now been replaced by the time-wage system. Most of the Bareilly and Pilibhit *khandsals* keep the *khandsal* labourers on time wages. It is only in some of the hand-worked sugar centrifugal workshops of Shahjahanpur that the old piece-wage system still survives. Under the contract system the *khandsali* pays 5 pice to 2 annas per *ghan* (charge) of *rab* centrifuged—each charge being of 25 to 30 seers of *rab*. This includes all the labour charges of curing the *rab*. *Rab* may also be centrifuged at 6 to 8 annas per maund which includes all the expenses of machining.

No special system of labour recruitment is followed. The workers themselves come from the neighbouring villages and towns to the *khandsali* at the commencement of the working season. Some time an advance of Re.1 is given to each of the hands at the beginning so that he may not go elsewhere. The skilled workers do not receive any systematic training; but in course of time they acquire some skill and practice.

The monthly wage of an unskilled worker is about Rs.7 to Rs.8. The sugarman is paid Rs.12 to Rs.14 per month and the driver Rs.25 to Rs.30. Casual labourers are recruited at 4 annas a day and are paid every evening when their work is finished. The regular unskilled labourers are also paid on the same scale, but they are recruited on monthly wages. In times of need advances of money are also made to the regular hands. Accounts are finally settled at the close of the season. During off-seasons skilled workers are occasionally retained on half pay.

Apart from cash some payments in kind are also usually made. All the workers eat some *rab* from time to time and drink the *sarbat* of molasses twice daily. Every man gets  $\frac{1}{2}$  anna a day for *chabena* and  $\frac{1}{2}$  pice for tobacco. Cooking utensils, light and fuel are provided free and on the *Holi* festival one cap and one *kurta* are given to each worker. The workers

who come from distant villages or towns are provided with free housing accommodation and some gunny cloth for their bedding. At the commencement of the business each ordinary labourer gets 1 anna, the driver 1 rupee and the sugarmen 8 annas as *shagun* (a social rite).

The hours of work extend from sunrise to sunset for about 8 hours; but when the work is unusually heavy the business is continued for all the 24 hours. All important fairs and festivals are observed as holidays and on rainy days the business is suspended. In cases of pressing necessities, such as illness, important ceremonies, etc. the workers are allowed short leave or they absent themselves. The conditions of work are, on the whole, satisfactory and strikes and lockouts are unknown.

The following is a list of tools and implements with their popular names, cost, description and the numbers of each commonly used in a *khandsal* :

Popular name of tools and implements	Number commonly used in a <i>khandsal</i>	Approximate cost of each			Description
		Rs.	a.	p.	
<i>Thapi</i> ..	6	0	1	0	Iron rods used for breaking <i>kalsis</i> of <i>rab</i> .
<i>Sibar</i> ..	2	0	12	0	An iron rod with flattened end used for removing <i>rab</i> from the vessels and for breaking and pulverizing solidified lumps of <i>rab</i> .
<i>Khurpi</i> ..	12	0	2	0	A scraper used for scraping <i>rab</i> from the side of <i>kalsis</i> .
<i>Sippi</i> ..	12	0	1	6	A tin spoon used for scraping <i>rab</i> from broken pieces of <i>kalsis</i> .
<i>Tasla</i> ..	12	0	8	0	A round shaped galvanized iron vessel used for carrying pugged <i>rab</i> from the <i>latori</i> to the centrifugal and for receiving the wet sugar when it is discharged from the machine.
<i>Katta</i> ..	2	0	12	0	A small galvanized tin vessel used for collecting molasses from the centrifugal.

Tools and implements used.



Popular name of tools and implements	Number commonly used in a <i>khandsal</i>	Approximate cost of each		Description
		Rs.	a. p.	
<i>Pata</i> ..	10	28	0 0	A thick gunny carpet made by stitching together 8 <i>patias</i> and used for drying the wet sugar.
<i>Chhari</i> ..	30	0	1 0	Small sticks used by the <i>patahar</i> ( <i>patias</i> ) when drying the wet sugar.
<i>Belan</i> ..	10	0	1 0	A small wooden roller used for powdering lumps of sugar.
<i>Chhanna</i> ..	..	..	..	A galvanized wire-netting mesh enclosed in a wooden frame and used for sieving wet sugar for catching hard lumps of sugar and broken pieces of <i>kalsis</i> .

N.B.—The number of these tools and implements may be increased or decreased to suit local requirements.

*Dere ka Shagun.*

When the *kalsis* of *rab* are brought to the *khandsal* a conventional religious rite is performed by the Hindu *khandsali* before *rab* curing business is commenced. The *khandsali*, in consultation with his priest (*purohit*), fixes some auspicious day for the ceremony which is known as the *Dere ke shagun ka din*. Some *rab* and a sum of  $\frac{1}{2}$  anna are given to the priest. *Rab* is also distributed among the neighbours. The sugar refining business is then taken up.

Pugging of *Rab*.

To commence with, the earthen vessels containing *rab* are broken by wooden *thapis* and their contents scraped by *khurpis* into the *lalori* or *channi*. *Lalori* or *channi* is a masonry tank, some 5 to 6 feet square and 2 feet deep, with a capacity to hold about 50 *kalsis* of *rab*. The cost of building a *lalori* comes to about Rs.10. The floor of the *lalori* is interspread with brickbats and bamboos which are covered with a coarse blanket costing about Rs.4. At its base the *lalori* communicates with a drain which opens into a reservoir where molasses escaping from the *rab* is collected.

The *turias* break the solidified lumps of *rab* by means of *sabar* and reduce the whole substance into a homogeneous mass, separating the pieces of *kalsis* mixed up with it. Yet, in spite of every care taken to remove these broken pieces of *kalsis*, some small chips are retained in the *rab* and carried away into

the centrifugals, with the result that steady and even machining becomes impossible and the quality of sugar produced deteriorates. When a pug mill is used the *rab*, instead of being transferred into the *lalori*, is directly treated in the pug mill. The cost of a pug mill is about Rs.200.

When the *lalori* is nearly full the pugged *rab* is transferred by means of *taslas* into the centrifugal, and when about three-fifths of the "basket" is filled up the machine is set into motion. An 18 inches Broadbent centrifugal machine deals with 30 to 35 seers of *rab* in one turn or *ghan*.

Nine or ten men commonly work on a hand-driven machine. Eight of them work the machine by turns having alternate shifts after every charge of sugar centrifuged. Thus, while one set of four men are moving the centrifugal, the other four remove the *rab* from the *kalsis* and pug it. The sugarman looks to the velocity and revolutions of the centrifugal and attends to the washing of sugar and the removal of the finished product from the machine. At first the machine spins at a slower pace; but when an adequate amount of molasses has been separated its velocity is increased.

The molasses escaping from the machine is received into the *katta*. The amount of molasses recoverable depends upon the quality and consistency of the *rab* and the efficiency with which it is centrifuged. Ordinarily two *kattas* (one *katta* contains about 10 seers) of molasses are taken as the normal yield on every charge of 30 to 35 seers of *rab*.

When one *katta* of molasses has escaped, two syringes full of soapnut (*rectha*) water are sprayed into the centrifugal basket. To one empty kerosene-oil-tin of warm water  $\frac{1}{2}$  seer of soapnut peels is added for this purpose. The market rate of soapnut averages between Rs.6 and Rs.7 per maund and the cost of a bronze syringe is Rs.2 to Rs.3. By washing the sugar the molasses adhering to the sugar crystals is released and the sugar becomes whiter. After the sugar has been washed the machine is moved at a great speed and thin molasses begin to come out. When another *katta* of molasses has been recovered the centrifugal is stopped and the wet sugar is scraped into *taslas* or wooden receptacles (known as *patlas*).

The time required to centrifuge a charge of *rab* depends upon the consistency of the *rab*, the weight of the charge, the type of the machine used, etc. Two to four minutes more are taken in machining each charge of sugar in the early cold season than in the later months of March and April. On an average electric-driven centrifugals take 10 to 12 minutes in the warm months and 12 to 16 minutes in the cold season for

machining a charge of 30 to 35 seers of *rab*. The hand-driven machines take 4 to 5 minutes more for each charge. It takes 4 to 5 minutes in emptying and refilling another charge.

Most of the *khandsal* centrifugals in Bareilly and Shahjahanpur cities have been electrified. In the city of Pilibhit they are still driven by hand or diesel oil engines. This year electric installations are going on at a rapid pace in Pilibhit too. In village *khandsals* centrifugals are generally worked by hands, but occasionally, when the *khandsali* is a substantial man, he uses a diesel oil engine or steam power. Power-driven centrifugals always give better results than hand-worked machines, for in the latter even and uniform spinning can not be ensured. About  $\frac{1}{2}$  unit of electricity is consumed in machining a 30 seer charge of *rab*. Electric current is charged at 3 annas for the 1st 100 units and 4 annas for the subsequent ones for centrifuging and 7 annas per unit for lighting purposes.

A big *khandsal* consumes the *rab* produced in 15 or 16 average *bels* every season. A big machine can deal with 300 *kalsis* (or 150 maunds) of *rab*, producing 60 maunds of sugar in 12 hours. But, in general, the daily out-turn of sugar per day of 8 to 10 hours reaches only 18 to 20 maunds. When there is an unusual rush of work the work is continued for all in 24 hours. It has been estimated that "sugar worth Rs.600 to Rs.800 can be refined by a 30 inches centrifugal machine in 24 hours" (1). *Khand* refining business extends from the tail-end of December to the end of April and when the II *rab* is machined the business is continued in the rainy season.

When the *rab* of his own *bel* is exhausted the *khandsali* purchases more of it in the market at the prevailing rate. *Rab* is also centrifuged on contract at 6 to 7 annas per maund of sugar refined. This includes all the expenses up to the drying of sugar.

Drying of  
sugar.

The wet sugar scraped from the machine is collected in wooden boxes or gunny bags to be dried in the sun. The sugar which is centrifuged from 6 A.M. to 11 A.M. is dried in the afternoon and that which is refined in the afternoon is kept aside in a store-room to be dried on the following day up to noon.

Sugar is dried on a *pucca* floor of either a roof or a courtyard, and if the ground is *kachcha*, it is swept clean and some cow-dung is smeared on it. Thick gunny carpets called *patas* (each being made up of 16 stitched strips of gunny cloth

(1) Agrwala, R. D. Sugar Industry and Labour in United Provinces, p. 84.

and measuring about 16 feet to 17 feet long and 11 feet to 12 feet wide) are used for drying the sugar.

The wet sugar brought on the *pata* is lumped in hard masses. These are broken, crushed and pulverized by wooden rollers, called *belan*. Pieces and chips of *kalsis* mixed with sugar are separated and removed. These are called *chhali* or *binaun*. This crushing and rolling process makes the sugar whiter and finely grained. A galvanized wire netting mesh enclosed in a wooden frame and known as *chchanna* is employed to expedite the work of separating the *binaun*.

The wet sugar, having been sieved, rolled and reduced to a homogeneous mass, is spread on the *pata* and exposed to the sun. It is mixed up thoroughly by labourers, known as *patahas* (or *patias*) treading over it barefooted with sticks in their hands and in a particular way, known as *kuria katna*. This movement requires some skill and the *patahas* are trained in the art. The movement of the feet should be such that the grains may be separated and exposed to the bleaching action of the sun without being broken. About 16 maunds of sugar is spread on each *pata* and generally 3 *patahas* dry it. Thus each *pataha* has to dry 2 maunds of wet sugar. In a big *khandal* about 10 *patas* of sugar are dried every day.

A watch has to be kept on the *patahas* while they are drying the sugar otherwise they do not tread and mix it thoroughly with the result that it remains in unbroken lumps and moist and deteriorates during the monsoon. The more the sugar is crushed, rolled, mixed, pulverized and bleached, the more it gains in quality.

The sugar which has been dried on the *pata* is collected into a heap, known as *shakar ki ras*. Five pinches of sugar, called *sheoria ki khand* is taken out of it to be kept aside for some charitable purposes.

The *khand* is then weighed and stored in rooms, gunny bags, *thikias* or *kuthlas*. A *thikia* is a big gunny bag with open bottom. It contains about 50 maunds of sugar. A *kuthla*, on the other hand, is a masonry work built within a room with 6 to 7 feet high enclosures and an opening provided at the base through which sugar is taken out when desired. When sugar is stored in gunny bags about 100 bags costing Rs.28 to 30 are kept for the purpose.

The yield of sugar per 100 *rab* generally varies from 40 to 45 according as the *rab* is thick or thin in consistency. Thick *rab* yields more sugar than one which is thin. Too much washing and centrifuging reduces the percentage recovery of sugar. A charge of 30 to 35 seers of *rab* yields about 15 to 17 seers of *khand*; or 100 maunds (*rabhai* maund—each *rabhai*

maund being equal to 49 seers by Imperial weight) of *rab* yields 16 to 17 *pallas* (1 *palla*=3 maunds 25½ seers by Imperial weight) of *khand*. The yield of molasses per 100 maunds of *rab* similarly varies from 55 to 65 maunds, depending upon the quality of *rab*, washing and machining of sugar, etc.

*Sairi rab* is inferior to *bel rab*. One hundred maunds of *sairi rab* yield 13 to 14 *pallas* of *khand*. Some sugar which is carried away by wind and is spread on the floor at the time of drying the sugar is collected with a broom and is called the *barharan*. The *barharan*, *binaun* and broken pieces of *kalsis* are boiled, clarified and converted into *boora*, a variety of sugar sold at 5 to 6 seers per rupee.

#### Cost Accounts

##### Capital Cost :

The following items of capital cost have been obtained from the books of a *khandsali* of Bareilly :

Particulars	Amount
	Rs.
One 30 inch sugar centrifugal machine .. .. .	2,400
Installation of the machine .. .. .	50
One pug mill .. .. .	200
Electric fitting .. .. .	50
One <i>lalori</i> .. .. .	10
One <i>pucca</i> tank for storing molasses .. .. .	400
A set of scales ( <i>kanta</i> ) and weights ( <i>bant</i> ) .. .. .	60
A tube-well .. .. .	45
Total .. .. .	3,215

##### Annual Working Cost

The subjoined table shows the working results of a *khandsal* in Bareilly for a particular season :

Particulars	Amount
	Rs.
<i>Ders ka shagun</i> .. .. .	10
Tools and implements .. .. .	296

Particulars	Amount
	Rs.
Other accessories .. .. .	62
Furniture fixture .. .. .	45
Utensils .. .. .	27
Salaries and wages .. .. .	1,508
Rent of the <i>khandal</i> .. .. .	300
Electric consumption .. .. .	600
Total working expenses for the season .. .. .	2,848
Add the value of 17,000 <i>kalsis</i> of <i>rab</i> consumed in 60 days at Rs.3 a maund.	25,500
Total cost of production .. .. .	28,348
Yield of I sugar on the above <i>rab</i> (43 per cent. of sugar to <i>rab</i> ) 3,642 maunds.	
Yield of I molasses—17,800 <i>naps</i> (each being equal to 15 seers) =6,775 maunds.	
Price obtained for the I sugar at Rs.7-8 a maund .. .. .	27,315
Price obtained for the I molasses (6,775 maunds at 9 annas a maund.)	3,560
Total price of the products sold .. .. .	30,875
Less total cost of production .. .. .	28,348
Profit .. .. .	2,527

The cost of manufacture works out at Re.0-5-4 per maund of *rab* or 12 annas per maund of sugar.

Broadly speaking it may be said that 100 maunds of cane give 55 maunds of juice, 11 maunds of *rab* and 5 maunds of sugar. The cost of production from cane of 5 maunds of sugar comes to  $100 \times 2/3 + 11 \times 8 + 5 \times 12$  annas = 215 annas or 43 annas = Rs.2-11 per maund of sugar.

#### Khanchi process of making Khand

The indigenous method of refining sugar is known as the *khanchi* system.

The  
*Khanchi*  
system

*Khanchi* sugar refining business starts towards the beginning of January and extends till April and May. Afterwards *garawat* or second *rab* refining work is taken up.

Pagging of  
*rab*.

As in centrifugal refineries, the *kalsis* of *rab* are first broken by wooden *thapis* and the *turias* scrape their contents by *khurpis* and transfer the same into *lalori* (*chhanni* or *hauz*). The time required to fill a *lalori* with *rab* depends upon its size, the numbers of *turias* engaged in filling it, the consistency of *rab*, etc. In the *lalori* the lumps of *rab* are broken and rubbed into a homogeneous mass and the pieces and chips of *kalsis* are removed.

The *ara*.

The *rab* is then removed from the *lalori* into wooden bags which are very softly filled up to about  $\frac{1}{2}$  foot from the mouth. The bags are then closed—their mouths being tied with string as also their two lower corners. Two types of bags—*eksaria* (single) and *dosaria* (double) are used. They are sold at Rs.6 to Rs.8 or Rs.10 per dozen—the capacity of each of the bags being 30 seers of *rab* (or  $1\frac{1}{2}$  to  $1\frac{1}{2}$  *kalsis* of *rab*).

The bags are then transferred to an *ara*. An *ara* is a masonry pit made against a wall about  $3\frac{1}{2}$  feet deep, 3 feet long and  $2\frac{1}{2}$  feet broad. Its walls are about a foot thick. About 6 inches to 1 foot above the floor of the *ara* some bamboos and sticks are horizontally stuck against its walls. The cost of these bamboos comes up to about 5 annas. A wooden board is attached to the back wall of the *ara* so as to avoid the friction of the bags against the wall. It also serves as a protection against the soil and dust falling from the wall into the *ara*. Just in front of the *ara* a wooden *bareri* or *arana* (horizontal bar) is erected within easy reach and at a convenient height. Its cost is about 12 annas to Re.1. The floor of the *ara* slopes anteriorly so that the molasses expressed into the *ara* may have a free flow and get collected through a drain in an underground *hauz* or *mand* in the front.

The bags containing the *rab* are stacked in the *ara* one above the other. Generally a set of 12 to 14 bags is placed in the *ara* at a time. Three sticks called *thunas* are vertically passed through the strings tied at the two corners and the mouth of each bag so as to prevent the bags from slipping off from the whole column. The whole arrangement is called *aten* in Pilibhit. On the uppermost bag a circular mud lump known as *thua*, *matona* or *bhera*, weighing about 30 to 35 seers and measuring about 1 foot in height and  $\frac{1}{2}$  foot in diameter, is placed over which a man sits to press out the molasses from the *rab*.

Two *aras* are sufficient to deal with the *rab* produced on an average *bel* during a season. But an ordinary *khanchi khand-sal* consumes the *rab* boiled on three or four such *bels*, and hence some 5 to 7 *aras* are built adjacent to each other in such a *khand-sal*; the molasses drain from all these *aras* open into a common tank or *mand*. Two to three persons work on two *aras*. While one or two labourers are emptying the *rab* from *kalsis* into a *lolori*, another fills up the bags with the pugged *massecuite* and ties them. Thus, when two *bojhas* (sets of 12 or 14 bags, each filled with *rab*) are ready they are removed to the *ara*. The *thua* is put over each *bojha* upon which sits a *karigar* or *arawala* holding the *bareri* with both hands. He makes a backward and forward motion so that the molasses percolates through the bags and is drained into the molasses tank.

The ordinary unskilled labourers, called *turias* whose business consists in breaking open *kalsis* of *rab* scraping out and transferring the *rab* into the *lolori* get Rs.6 to Rs.8 per month or 4 annas a day. The *karigar* or *arawala* is paid Rs.7 to Rs.10 per mensem. Other conditions of their employment work and living correspond to those of their fellow labourers in centrifugal *khand-sals* with one exception that the work in *khanchi* workshops is simpler and slower.

The molasses escaping at the first instance from the *bojhas* does not contain crystals of *rab*. Being inferior, darker and cheaper, it is sold over to tobacco merchants who use it for curing tobacco. When an adequate amount of molasses has been expressed by pressing and squeezing the *bojha*, the *karigar* takes down the bags and puts them on the *patia* (i.e. the space lying between *lolori* and *ara*). The bags are opened one by one. They are beaten, twisted and turned and a little amount of water is sprinkled over their contents till the whole thing is reduced to an even mass. The bags are again tied and replaced on the *ara* and treated in a similar manner. This is technically known as *dubandi*—the former process being called *ekbandi*. Molasses which is expressed in the *dubandi* is rich in crystallizable sugar and is, therefore, separately collected. It is brown and more palatable. It commands a good price and is purchased by sweetmeat sellers. When molasses cease to ooze the *bojha* is left over night so that the *rab* contents of the bags may become more rarefied.

Ordinarily it takes about a day of 10 to 12 hours to press a *bojha* of 12 to 14 bags of *rab*. Next morning these bags are re-opened and their brown sugar contents, called *potli* or *potri* are transferred to the *khanchi*.



***Khanchi***  
refining.

There are two types *khanchis*, viz. one of masonry work and the other of bamboo and reed work. They are made in rooms. For permanent purposes a *pucca khanchi* is made. It consists of brick walls  $4\frac{1}{2}$  inches to 9 inches thick raised against the walls of the room in which it is made. On the other hand a temporarily made *khanchi* consists of vertically stuck rows of bamboos, 4 feet high above the floor level and running parallel to the four walls of the rooms interlaced with a net work of bamboo strips, reeds, grass, etc. The dimensions of a good *khanchi* should be  $15' \times 10' \times 12'$ . Such a size facilitates an easy and even flow of molasses at the floor. The floor always slopes towards the door of the room and is interspread with pieces of bricks which are overlaid with a bed of bamboos, sticks, cotton and *arhar* stalks, etc. The cost of this for the above sized *khanchi* is Re.1. The inner surface of the four walls of the *khanchi* are then covered with mattresses and ordinary *desi* coarse cloth, both costing Rs.5 to fit the above dimensions. Three average sized *khanchis* consume the *potri* prepared on two *aras* during a season. Thus, an ordinary *khanchi khandsal* has seven to eight such *khanchis*.

Every morning the *karigar* lightly spreads the *potri* into the *khanchi*. He commences spreading it from the farther end, and as this is stuffed up, he proceeds further anteriorly till the whole *khanchi* is filled up. Then the *karigar* smears a little *ghee* on the bottom of a *phool ki thali* (a metallic flat-bottomed plate) and levels the *potli* of the *khanchi* with the same. This part of the business is finished by the end of January (*Pus*) and further treatment consists in curing and bleaching the product.

The *potli* thereafter is treated with water weeds known as *sewar*. Fresh layers of *sewar* are changed on alternate days for the first 15 days and subsequently after every third or fourth day. Two *banhgis* of *sewar*—each *banhgi* containing one maund of wet *sewar*—are required to make a layer for an average *khanchi*. Every time a fresh layer is spread the previous layer is rolled over it. In this way about 60 *banhgis* of *sewar* per season are used in a *khanchi*. The village ponds, *tals*, *jhils*, tanks and river beds give free supplies of these weeds. Every morning the *Dhinwars* (a low caste labourers) bring the *sewar* in the required amounts. They are the servants of the *khandsalis* and take only *chabena* and some molasses for bringing the water weeds. But with its growing scarcity this weed is also now fetching a price which is sometimes 8 annas per *banhgi* near the towns and cities. Three

varieties of *sewar*, viz. *launchhi*, *patera* and *jaria* are used for bleaching the *khanchi khand*. The first of these three varieties is supposed to be good for the first one or two layers. It produces much heat and is, consequently, also employed when the bleaching process is imperfect or unduly delayed.

After about 15 to 20 days, when some 6 or 7 layers of *sewar* have been changed, the *khanchi* becomes ready for further treatment. The *sewar* layer is removed and a man sweeps the bleached *khand* with a broomstick and collects the *mail* (dirt), chips of *kalsis*, and pieces of *sewar* retained in the *khanchi*. These sweepings are called *chotta*. The *chotta* is reboiled into *rab* which is said to be of particularly good taste. A layer of refined *khand* 4 to 5 inches deep is then scraped with *khurpis* or *karchhulas* about two of which are required in a *khanchi* and cost 3 annas each. A thin layer of cured sugar is always left unremoved every time the sugar is scraped. At each scraping about 5 to 6 maunds of wet sugar known as *pachni* is obtained. This is dried in the sun as described in the foregoing pages. It takes one whole day to dry a charge of *pachni*.

After each scraping of sugar a fresh layer of *sewar* is spread over the *khanchi* and on every third day a new layer of *pachni* is scraped. Each subsequent layer of the sugar scraped is darker than the previous one. The first scraping is very white and supposed to be the best of all the subsequent ones. It is technically known as *phool*. The subsequent scrapings are known as *darmyani* or *doyam*; and the last one, which is the darkest of all, is called the *tarauncha*, *tarauta*, or *tarayal*. The last three *mandias* of molasses, escaping from the *khanchi* are very rich in making sweetmeats, *garawat*, etc. It takes about three months to cure the *khand* in an average sized *khanchi*. From the months of January and February new *khanchi* sugar begins to come in the market.

When the *khanchi* is exhausted its *pallis*, *pals* (cloth pieces) mattresses, etc. are removed, and washed. This washing is boiled and turned into *boorq* (a variety of sugar). The *chotta* is also boiled into sugar. The *khanchi* itself is washed and the washing is used for making vinegar (*sirka*).

When sugar centrifugals were introduced for the first time, some *khandsalis*, in order to avoid the trouble of erecting *aras* for pugging the *rab*, used to treat the *rab* in the centrifugal machine first, and when the massequite was semi-centrifuged the *potli* was treated in the *khanchi* for further refining. But due to the lengthy process involved in

refining *khand* even in this manner this system has lost its popularity and has been replaced by full centrifugal curing.

Working  
results and  
cost.

The following figures show the working results of a *khanchi khandsal* in Bareilly :

Number of <i>Kalsis</i> of <i>rab</i> refined	Number of <i>aras</i> or <i>bojhas</i>	Total yield of sugar in maunds	Total yield of molasses in <i>naps</i>
6,772	578	Mds. 1,379½	4,286

Particulars	Amount Rs.
Total cost of 6,772 <i>kalsis</i> = 3,386 maunds of <i>rab</i> at Rs.30 per maund	10,158
Total working expenses of the <i>khanchi khandsal</i>	2,013
Total cost of production	12,171
Price realized for the I sugar at Rs.10 per maund approximately	13,795
Value of molasses (1,600 maunds) at 9 annas per maund approximately	943
Total value of I sugar and molasses	14,738
Deduct total cost of production	12,171
Profit	2,667

The cost of production of *khand* from *rab* comes to Re.1-7 per maund of *khand* or 9 annas per maund of *rab*.

Molasses  
boiling.

The molasses which is purged out by machining the I *rab* is not generally sold. It contains a large amount of crystallizable sugar and is used either for the manufacture of II *rab* (*garawat ki rab*) or *lauta* (*shire ka gur*).

Molasses boiling business is taken up in April and May (*Chait* and *Baisakh*), and is carried on in a separate *bel* consisting of only three boiling pans—the smallest one, which is fixed just above the fire, being known as the *parcha*. Before boiling the molasses is diluted to 65° to 70° brix by the addition of washings of pug mill, centrifugal, *kalsis*, tins, etc. The consistency of molasses becomes thin and sugar crystals are dissolved. This facilitates the defecation process. Wood fuel is used for boiling molasses. The dilute molasses is stored in the *hauz*, boiled and clarified in the *nikhar* and concentrated in the *parcha*. The defecants

ordinarily used are lime water and *sajji* solution. Within about 20 minutes after lighting the fire the *bel* comes into working order. The temperature of the concentrated strike is about 110°C. The finished product is ladled into earthen cooling vessels, stirred, and finally removed into masonry tanks, big metallic vessels or lower halves of *kalsis* (*kallhis*) where it is allowed to cool and crystallize. The *II rab* and it is machined during the monsoon months of July and August.

One hundred maunds of molasses yield 80 to 85 maunds of *II rab*; and this when machined yields 10 to 11 *pallas* of *II sugar* (each *palla* is equal to 3 maunds 25 seers by Imperial weight). One *lati* or *nap* (a unit of measure) of *shira* of 37½ maunds, when boiled, gives 30 to 32 maunds of *II rab* and this, when machined, yields 8 to 10 maunds of *II sugar*. The cost of boiling 1 maund of *II rab* varies between 4 and 4½ annas. One hundred maunds of molasses is boiled in three working days (of 10 hours each) at an average consumption of Rs.9 to Rs.10 worth of wood fuel. The cost of boiling 100 maunds of molasses apart from fuel expenses comes to Rs.18. A molasses boiling *bel* employs five labourers of which one is the *karigar* (molasses boiler).

The machining of *II rab* is rather tedious. It is gunmy and stringy, as it contains a high percentage of molasses. The molasses is very often so sticky that sometimes it is neither purged nor easily passed through perforated lining of the centrifugal. The machine has, therefore, to be stopped in the middle to drain off the molasses through the hole at the bottom of the "drum." On an average it takes about half an hour for a charge to be properly centrifuged. The *II sugar* is always inferior to the *I*. It is yellowish or brown in colour and commands a lower price than that fetched by the *I sugar*. The *II molasses* is not generally boiled, but is sold to tobacco curers. Occasionally, however, some *khandsalis* add one part of the *I molasses* to 4 parts of *II molasses* and convert the mixture into *lauta* (*shira ka gur*).

The manufacture of white sugar by the *khandsari* system is wasteful. A large sum of money is annually lost in erecting and dismantling *bels*. The cane crushers commonly used extract a low percentage of available juice; and a considerable quantity of sugar is burnt along with the bagasse. The method of boiling is unsatisfactory and a large amount of sugar is inverted and charred. The juice boilers are not trained people and an inferiority of the product turned out is always attributed to the quality of juice used. The practice of potting the *rab* into earthen *kalsis* is itself open to

Drawbacks  
of the  
*khandsari*  
system.

serious objections. Nor is the centrifuging of sugar satisfactorily done—the work being entrusted to ordinary untrained workers who acquire some practice by merely working as assistants for some time. All these causes are responsible for such a low recovery of sugar as 4 to 5 per cent. against 9 per cent. in a modern cane sugar factory. The Tariff Board on Sugar Industry estimated that out of 3,800,000 tons of cane consumed under the *bel* process only 200,000 tons of sugar was produced while all the Indian sugar factories put together produced 100,000 tons of sugar out of only 750,000 tons of cane.

While it is true that serious losses are taking place in the indigenous system of sugar manufacture, it by no means follows that the industry should be scraped and supplanted by factory industry. Referring to the limitations of the *khandsari* process, Mr. R. L. Sethi, Incharge Government Sugarcane Research Station, Shahjahanpur, observes, "These facts prove one thing that the general complaint of getting very low percentage of sugar in the Rohilkhand *bel* (4 to 5 per cent. on cane) is not solely due to inherent defects of the *bel* but to various extraneous causes such as the use of cheap pans, manufactured out of thin iron sheeting, bad management, slovenly night working, unskilled workmen, unfavourable situation with regard to provision of labour, raw material and marketing of produce, etc. etc. If some of these defects which are remediable are removed there is no reason why the *bel* should not give about 7 per cent. recovery of good sugar which has been obtained on the Farm."<sup>(1)</sup>

Importance  
of *khandsari*  
industry.

Manufacture of sugar by the *khandsari* system is primarily a cottage industry. In point of size also the industry is of considerable dimensions. With the extension and development of cheap hydel power there are hopeful possibilities of its further expansion. The *khandsari* industry annually consumes about 3,800,000 tons of cane, affords employment to thousands of agriculturists as labourers in *bels* and *khandsals* and to a considerable number of villagers as carters and machine repairers. Its importance in the rural economy of the country has attracted the attention of government and public alike and several experiments have been conducted by the United Provinces Department of Agriculture and the Imperial Council of Agricultural Research to effect improvement in the existing processes. According to Khan Bahadur Saiyid Mohammad Hadi, the ex-Director of Agriculture,

(1) United Provinces Agricultural Development Bulletin no. 63, pp. 62-66.

Bhopal State, 7 to 9·5 per cent. of marketable sugar on cane can be recovered by the indigenous system suitably improved, as against 4 per cent. recovery under the primitive *khanchi* system, 5·6 per cent. recovered by Mr. Hulme, and 9·5 per cent. extraction in an average Indian sugar factory. The Tariff Board also maintained that during the transitional period of development of the Indian sugar industry, *khandsari* factories are essential. This industry provides an economical outlet for surplus cane. The cost of manufacture too is low and the capital cost is from 6 to 7 annas per maund of cane crushed against rupee one per maund in central factories.

Cane juice, in its natural state, concentrated to solidifying point without having been clarified, is known as *gur*. <sup>Manufacture of Gur.</sup> According to the estimates of Mr. R. C. Srivastava, Sugar Technologist, Imperial Council of Agricultural Research, 82½ per cent. of the total cane crop of India is converted into *gur*(<sup>1</sup>). Our annual production of *gur* today stands at about 5,000,000 tons.

The manufacture of *gur* is mainly a cottage industry. Cane, either carted or carried on the head from the fields, is crushed in the ordinary two or three roller iron mills erected near the boiling-house. The average extraction of juice in these mills varies from 50 to 60 per cent. on cane. Only one open shallow pan 5 feet in diameter and 1 foot in depth is used for boiling the juice. The megass serves as fuel and no defecants are employed for purifying the juice—the scum only, as it rises upon the surface of the boiling juice, being removed. The juice is thoroughly boiled and concentrated. As the strike assumes the required consistency it is ladled into an earthen cistern known as *chak* (costing about 6 to 7 annas each) and briskly stirred by a wooden stirrer, called *chatua* (costing 1 anna each), till it becomes a semi-solid mass when it is left to cool. The *gur* is then transferred from the *chak* into baskets or *kunras* (made of baked earth), covered with cloth; and when it becomes solid it is taken out in the form of *bhelis* (round blocks).

That a considerable wastage of sugar actually present in the cane occurs in the existing processes of *gur* manufacture, is a well-known fact. The crushing mills used are generally worked by cattle power and can give only 50 to 60 per cent. extraction; actually due to the inadequacy of the strength of the cattle used to turn a properly adjusted mill and the little care bestowed on the mills by the peasant, the extraction

(<sup>1</sup>) Memorandum submitted to the Indian Tariff Board by Mr. R. C. Srivastava.

is still lower. The method of juice boiling is also very defective. Generally the bagasse produced by the crushing mills is not sufficient to feed the furnace, and it has to be supplemented with wood fuel. The fire and heat produced are not steady and due to the lading of the charge every time it is ready considerable charring in the pan takes place. Of 34 to 57 per cent. of the combined loss of sugar which occurs during milling and boiling, 16 to 23 per cent., according to the late Dr. Barnes, occurs during milling, and 3 to 14 per cent. during boiling, the remainder being lost in handling the juice and *gur*. According to Mr. Clarke one-fifth of the sucrose in the juice is destroyed or inverted during boiling. In *gur* manufacture the extraction of sucrose is only 52.4 per cent. against 86 to 90 per cent. obtained in a modern sugar factory. For 1933-34 the production of *gur* has been estimated at over 5,000,000 tons. Taking the average figure of 9 per cent. recovery of *gur* on cane the quantity of cane required to produce this amount of *gur* must be more than 55,000,000 tons. Under the present system of *gur* manufacture only 6 per cent. sucrose on cane is recovered against the average recovery of about 9 per cent. in our cane factories—the total availability being 12 per cent. Therefore, out of 55,000,000 tons of cane utilized for the manufacture of *gur*, only 3,300,000 tons are obtained in the form of sucrose by the present crude methods against 49,950,000 tons obtainable in an average factory, involving a total loss, including inversion, of about 1,650,000 tons of sucrose.

Though the manufacture of *gur* under present methods is wasteful, it does not follow that the industry should be extinguished. Considering its dimensions, nature and importance in the rural economy of the country, it should be improved. The development of the *gur* industry should proceed on two main lines. The Indian Sugar Committee in this connection stated: "The first is the introduction of power crushing on a relatively small scale by mills of better design than the present 3-roller mill. Such mills would be driven either by oil or steam, and we consider that the most convenient unit would be a mill crushing one or two tons of cane an hour. The second is the introduction of an improved furnace which will so economize the use of fuel by securing more complete combustion and absorption of heat that the juice extracted by the power mill can be converted into *gur* by means of megasse alone."<sup>(1)</sup>

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(<sup>1</sup>) Report of the Indian Sugar Committee, 1920, p. 280.

## CHAPTER VI

## LARGE-SCALE PRODUCTION IN ROHILKHAND

THE development of the factory sugar industry in Rohilkhand is of comparatively recent date. Of the ten factories working today in this revenue division, the Rosa Sugar Works and Distillery is the oldest. Next to it comes the old sugar factory of Pilibhit; while the other eight have only recently been established, and most of them are having their third or fourth crushing seasons. Before the establishment of these newer factories large-scale production in Rohilkhand was far eclipsed by the size and importance of the *khandsari* industry. The average annual production of factory sugar in Rohilkhand is about 60,000 tons.

Size and importance of factory sugar industry.

Every sugar factory has a Managing, an Engineering and a Manufacturing Department. The function of the Managing Department is to arrange for the supply of cane, stores, fuel, etc., to recruit labour, to arrange for the disposal of sugar, to conduct correspondence and office work, to settle accounts and make payments; and to exercise general supervision over all processes and functions. The Department is put under the charge of a General Manager who is helped by a number of assistants.

Organization of sugar factory.

The Engineering Department is responsible for the proper working of the whole plant and in cases of break-downs it has to locate and rectify the mistakes. This department is put under the charge of a Chief Engineer who is assisted by two or three assistant engineers and a number of mechanics and trained technical men.

The Manufacturing Department is concerned with the whole process of manufacture, beginning from the intake of the raw material at the cane carrier to the discharge of the finished product from the sugar drier. It carries on extensive experiments and minute analysis of the products at different stages of manufacture so as to spot any defect or leakage. The Manufacturing Department is put under a Chief Chemist who is helped by two or three Assistant Chemists.

Under the Managing Department there is the Cane Department, the General Stores Department, the Sugar Department and the Office. The Cane Department is put under the charge



of a Cane Superintendent who is assisted by three Cane Supervisors, a Head Clerk and some office assistants. A Store-keeper is the Officer-in-charge of the General Stores Department and he is helped by three or four assistants. Similarly in the Sugar Department there is a Store-keeper and three or four assistants. In the Office there is a Head Clerk and some clerical staff.

Factory  
labour and  
office staff.

No special system of recruitment of labour is followed in this industry. Practically all the factories in Rohilkhand are located in rural parts, and a large part of their labour supply is drawn from the surrounding villages. As the crushing season coincides with the time intervening between the sowing and the harvesting of the *rabi* crop—a time when agricultural operations are comparatively slack—the supply of labour is plenty and cheap.

An average sugar factory employs 200 to 300 men during the off-season and 1,000 to 1,200 workers during actual working days. Office staff and skilled factory workers are retained on half or one-third pay during off-seasons.

Members of the office staff and skilled factory hands are paid on a monthly basis, while unskilled labourers are recruited on daily wages. A certain kind of work, e.g. wagon shunting, loading and unloading, sugar bagging, etc. is done on contract.

The hours of factory work extend for all the 24 hours, and three shifts of eight hours each are employed. Over-time work is only casually taken and it is paid according to the scheduled rates fixed by the Indian Factories Act. All important festivals like *Holi*, *Id*, etc. are observed as holidays. Some factories allow casual and privilege leaves up to a certain limit to their monthly-paid regular employees. Absenteeism is not common as leave without pay is given in almost all cases when necessary. Strikes and lock-outs are unknown.

Some factories give housing facilities to their employees in the shape of bungalows and family quarters for superior staff and single room quarters for unskilled factory hands. Since most of the unskilled factory labourers belong to the neighbouring villages, they go away to their homes after finishing their work in the factory. A good water supply is available in the factory quarters at Rosa. Provident Fund benefit is also given in many factories. In Rosa Sugar Works all monthly-paid permanent employees contribute 5 per cent. of their salaries towards this fund and a similar sum is contributed by the factory to which interest is added. Some factories make

advances of money to their employees under certain rules. The L. H. Sugar Factories; Pilibhit, distribute bonus among all the regular employees on a certain scale when the profits exceed a specified limit. Practically all the factories in Rohilkhand provide medical facilities in some form or other. A dispensary, under the charge of some whole time or part-time physician is generally attached to each sugar factory and treatment and medicines are given gratis to the employees. The Rosa Factory has got an excellent dispensary, with a very good stock of medicines, open for all the 24 hours to the factory servants. It is placed under the charge of a qualified assistant surgeon. This factory provides free education to the children of its employees in a local factory school.

The salary of the office staff and factory hands is ordinarily paid in the first week of every month, but in certain cases the payment is delayed for two or three weeks. In Rosa Factory, salary bills are regularly paid on the 6th of every month.

The following table shows the designation of the employees of a sugar factory in Rohilkhand together with the number of each designatory employed and the salary paid to him :

*Engineering Department*

Designation	Number employed	Average salary per month in rupees.
Chief Engineer .. .. .	1	700
Assistant Engineer .. . . .	3	160
Clerk .. .. .	1	30
Supervisor .. .. .	2	60
Mill supervisor .. .. .	2	50
Boiler supervisor .. .. .	3	50
Head mistri .. .. .	1	225
Mistri .. .. .	5	55
Fitter .. .. .	21	50
Electrician .. .. .	3	55
Turner .. .. .	5	65

*Engineering Department—(concluded)*

Designation	Number employed	Average salary per month in rupees
Moulder .. .. .	2	50
Boiler maker .. .. .	3	50
Hoister .. .. .	2	35
Blacksmith .. .. .	4	35
Hammerman .. .. .	7	17
Renter .. .. .	1	16
Mason .. .. .	2	37
Carpenter.. .. .	3	40
Mochi .. .. .	2	34
Tinner .. .. .	1	15
Driver .. .. .	70	30
Oiler .. .. .	108	14
Fireman .. .. .	18	35
Handlemen .. .. .	6	17

*Managing and Manufacturing Department*

Designation	Number employed	Average salary per month in rupees
Manager .. .. .	1	350
Chief Chemist .. .. .	1	500
Assistant Chemist .. .. .	3	120
Overseer .. .. .	1	75
Peon .. .. .	10	12
Medical Officer .. .. .	1	60
Station supervisor .. .. .	3	30
Railway weighing clerk .. .. .	2	25

*Managing and Manufacturing Department—  
(continued)*

Designation	Number employed	Average salary per month in rupees
Checking clerk .. .. .	3	25
Weighing clerk .. .. .	14	20
Gate munshi .. .. .	5	15
Tak peon .. .. .	15	10
Cane <i>chatta</i> chaukidar .. .. .	12	12
Head clerk .. .. .	1	75
Cashier .. .. .	1	35
Accountant .. .. .	2	75
Clerk .. .. .	6	45
Railway clerk .. .. .	4	30
Bill clerk .. .. .	1	25
Time-keeper .. .. .	3	25
Store-keeper .. .. .	4	30
Sugar store-keeper .. .. .	5	35
Assistant cashier .. .. .	1	30
Fuel clerk .. .. .	1	20
Car driver .. .. .	1	40
Lorry driver .. .. .	1	35
Manager's servant .. .. .	2	13
Gardener .. .. .	1	10
Gate-keeper .. .. .	10	10
Fuel-keeper .. .. .	2	10
Store cooly .. .. .	10	10
Palledar .. .. .	101	14
Mate .. .. .	1	18
Grinding mill cooly .. .. .	56	11
Grinding mill mate .. .. .	7	11

*Managing and Manufacturing Department—  
(concluded)*

Designation	Number employed	Average salary per month in rupees
Driver cooly .. .. .	12	11
Carpenter .. .. .	11	25
Mason .. .. .	6	23
Beldar .. .. .	12	13
Spare cooly .. .. .	144	10

Supply of cane.

The Cane Department makes arrangement for the purchase of cane. Cane is either purchased through agents or contractors or directly from the growers. Part of it is purchased on forward contracts and a part for cash. In forward dealings the factories advance small sums of money to the cultivators either without any interest or at a nominal rate of interest. The ready rate is always higher than the forward rate. Cane is bought deliverable either at the factory wayside station or yard.

A 500-ton factory requires between 5,000 and 6,000 acres of cane to feed it during a season of about 120 days. The amount of cane crushed during a particular season depends upon the quantity and continuity of its supply. For the last two or three years these districts have become centres of acute competition for the purchase of sugarcane. (It is not uncommon to find the huts and weigh-bridges of three, four or even more factories at the same station. This results in an endless over-bidding and cheating, and each factory tries to entice as many cane growers as possible long before the actual crushing work commences. This keen competition is mainly responsible for forcing up the price of cane towards the close of the season when the price touches 13 annas to 1 rupee per maund of cane. Those factories which are favourably situated with regard to the supply of raw material get their cane at a comparatively cheaper rate. The following table shows the amount of cane crushed in four different factories during the season 1933-34 :

Factory	A District Bareilly	B District Bareilly	C District Pilibhit	D District Shahjahanpur
Amount of cane crushed in maunds during the season 1933-34 ..	1,800,000	2,700,000	4,300,000	1,700,000

Out of 27 lakh maunds of cane crushed by a sugar factory about 12 lakh maunds was purchased locally. Of 1,519,100 maunds of cane purchased for Rs.4,03,900 at outstations, the factory received only 1,486,500 maunds at its yard. About 32,600 maunds of cane was lost on account of driage, pilferage and shortage. On these outstation purchases the factory paid Rs.21,000 by way of commission, Rs.1,15,600 by way of freight and Rs.4,000 by way of tips to railway men. Supplies of cane were drawn from about 36 outstations, and the expenses under huts and weigh-bridges came to Rs.1,000 and Rs.1,500 respectively. The highest price per maund of cane was Re.1-4 as against Re.0-4-4, the lowest price. The average price at the factory of cane purchased at outstations works out at Re. 0-5-11 per maund. The unloading charges of cane came to 3 pies per maund, and the cost of removing it to the crushers plus cane office expenses amounted to 3 pies per maund.

There are difficulties in getting an adequate and continuous supply of raw material. A long double string of bullock carts loaded with cane and standing occasionally for as many as four days is a common sight at the gates of some of the sugar factories in Rohilkhand. The cultivators do not definitely know the time when they have to bring their cane. Nor are they kept well informed with regard to this. The result is that sometimes there is an over supply when the factories do not want much cane, and when they actually need it the supply falls short. Considering the nature of this raw material and the deterioration which it undergoes with the lapse of every hour after it has been harvested, the loss and inconvenience are caused both to the growers and to the factory owners owing to this lack of organization.

The Rosa Sugar Works deserve credit for evolving an excellent system of regulating their supply of cane. They provide every cane supplier with a small "Daily Supply Book" containing six pages. Each of these pages is of a distinct colour and is meant for delivery of cane on a certain day in the week. The cultivator finds out the amount of cane he has to supply on a particular day by referring to the page of that day. About two weeks in advance of the due dates of delivery of cane from a particular grower this book is filled in and issued to him. He, therefore, knows the various amounts of cane he has to supply on different days of the week. The factory issues these books to the growers in accordance with its own requirements of cane. Thus, the factory gets a regular and unbroken supply of the requisite amount of fresh cane, and the grower is also spared the loss, trouble and inconvenience consequent on waiting at the factory gate to deliver cane. The

following is a facsimile of a page of this "Daily Supply Book":

SATTAR NO.	CARTS
MONDAY	
Date	From _____
	To _____

Each book contains six pages in six distinct colours as follows :

- 1st page for Monday is blue.
- 2nd " " Tuesday " yellow.
- 3rd " " Wednesday " red.
- 4th " " Thursday " green.
- 5th " " Friday " orange.
- 6th " " Saturday " white.

Further, the accounts of the growers are not satisfactorily kept by most of the factories. At the Rosa Sugar Factory, however, when the cane supplier brings his cart-load of cane, he hands over his "Daily Supply Book" to the clerk at the weigh-bridge who makes the necessary entries in his books. The cart is weighed at the weigh-bridge and its gross weight is automatically impressed by a mechanical device on a "Card Ticket". The cultivator takes his cart and discharges the cane at the cane carrier. The empty cart is reweighed at the weigh-bridge and its tare weight is similarly noted on the "Card Ticket" just below the gross weight. The following is a facsimile of one such "Card Ticket":

3	5	0
2	0	0

The cultivator then takes this card and the "Daily Supply Book" to the Cane Office where the particular page of this book is torn off and retained with the "Card Ticket"—the "Daily Supply Book" being returned to the cane supplier. The Cane Office makes the necessary entries in the books of the factory as also in the "Cultivators' Pass Book" and "Foil"

with which every cane supplier is provided. The following are illustrations of the "Cultivators' Pass Book" and "Foil":

*Specimen of the Cultivators' Pass-book"*  
Season—193

Date	Account no.	Ticket no.	Maunds	Total maunds	Tare	Rs.	A.	Total		Date	Advance							
								R	a.		Rs.	a.	Rs.	a.				

*Specimen of the "Foil"*

Date	Ticket no.	Maunds	Total maunds	Tare	Date	Ticket no.	Maunds	Total maunds	Tare

The sugar factories in Rohilkhand purchase a great part of their cane requirements through agents and contractors, who enter into cut-throat competition with each other for cane which ends in over-bidding and cheating. Occasionally the raw material has to be drawn from a distance of 100 miles or more. In such cases the railway freight on cane mounts up to a very high figure and the cane deteriorates in quality due to the long time taken in its transport. The Rosa Sugar Works get most of their supplies deliverable at the factory yard itself. They also, however, make outstation purchases through *zamindars* whom they pay a commission of  $\frac{1}{2}$  annas to 1 anna per maund of cane. In short, those who supply cane to them are satisfied and refer them to other purchasers. This mainly accounts for the fact that the factory gets practically the whole of its cane requirements within a radius of about 15 miles.



**Process of  
white sugar  
manufacture  
in factories.**

The sheaves of cane as they come in cart-loads, are untied and put on an endless carrier whence they are conveyed to the crushing plant house and fed into the crushers and mills which are fitted with a series of revolving steel rollers varying in size, shape and number. The cane is first sliced into convenient lengths by revolving knives and then it is crushed in a 2 roller crusher. It then goes into a mill fitted with 3 rollers. The expressed juice received on the bed frame below is utilized in soaking the bagasse escaping from this mill which is again passed through a second 3-roller mill and the bagasse coming from this mill is re-soaked with water and passed through a third 3-roller mill. The mixed juice expressed by the third mill is received in the bed frame to which the raw juice expression of the second mills is added and the whole thing is filtered and passed into a raw juice storage tank. The spent cane coming from the crushing plant house is used for feeding the boilers for generating steam.

The acidity of the raw juice is neutralized by the addition of sufficient lime of 12° to 20° Be. The juice is then heated and boiled in defecators at a temperature of 60° F. and allowed to settle in the settling tanks from which the clear juice is drawn off and the impurities in the form of scum are further treated in filter presses.

The alkalinity of the juice due to the addition of lime is neutralized by sulphitation process. The defecated juice is passed through sulphurous vapour in the sulphitation tanks, tested by B. T. B. (Bormo Tymol Blue) Paper, heated and boiled in the eliminators and passed into the settling tanks. In some factories the juice is sulphitated before liming.

The clarified juice from the clarified juice storage tanks is boiled and concentrated to 50° to 60° Brix by exhaust steam in the multiple vacuum evaporators, carried into the syrup storage tanks and further concentrated into a series of vacuum pans (generally of calandria type) till the consistency of massecuite is attained.

The massecuite is discharged into crystallizers where it is kept in continuous motion and gradually cooled until separation of sugar can be proceeded with.

From the crystallizers the massecuite is taken into the centrifugals where it is machined and washed and the molasses are separated—the wet sugar from the centrifugals passing on to the sugar driers in the sugar drying house where it is dried with a current of hot air passing through it.

The molasses escaping from the centrifugals is drained into the molasses storage tanks, reboiled twice and centrifuged to recover a second and third grade sugar.

The sugar when it has been manufactured is ground into the required standards of crystals in the sugar grinding mill house, bagged and disposed off through selling agents.

Most of the factories in Rohilkhand start working some time in the first half of November, and close towards the middle of April, thus having an actual working season of about 120 to 130 days, after allowing for holidays and stoppages. In the 1933-34 season one of the sugar factories in Pilibhit and another in Bareilly closed their crushing operations at the end of the first week of May—the Pilibhit factory having 140 and the Bareilly factory 159 actual working days. Length of crushing season in Rohilkhand.

The following table shows the working results of a sugar factory in Bareilly :

*Season 1933-34*

Amount of sugar-cane crushed during the season	Amount of sugar manufactured during the season	Amount of molasses obtained during the season	Percentage recovery on cane	
			Of sugar	Of molasses
Tons	Tons	Tons		
80,355	6,788	4,098	8 48	5·1

Another factory in Pilibhit crushed 43 lakh maunds of cane and manufactured 4 lakh maunds of sugar giving an average recovery of 9·3 per cent. on cane. The percentage of molasses on cane in the same factory was 4·5.

The estimated capital cost of a 500 ton sugar plant is Rs.13 lakhs and other fixed assets for a sugar factory cost about Rs.4 lakhs. The working expenses come to about Rs.3 lakhs. The following figures show the approximate manufacturing cost per maund of sugar, under classified heads, in an average Indian sugar factory : Cost account.

Particulars	Cost per maund of sugar	
	Rs. a. p.	
1. Cane at 6 annas a maund .. .. .	..	4 0 0
2. Other raw materials .. .. .	..	0 2 0
3. Labour .. .. .	..	0 7 0
4. Fuel .. .. .	..	0 1 0
5. Supervision, office charges and establishment expenses	..	0 11 0
6. Current repairs .. .. .	..	0 6 7
7. Packing .. .. .	..	0 2 9
8. Miscellaneous (excluding interest) .. .. .	..	0 10 0
Total	..	6 8 4

In Java the cost price of sugar does not exceed Rs.2-12 a maund and the quality of product is incomparably better than any produced in India.<sup>(1)</sup>

Problems  
facing the  
factory  
sugar  
industry.

Indian sugar factories are both small and inefficient. One of the most important drawbacks is the difficulty of obtaining an adequate and continuous supply of cane. The unique position of Java in this respect is primarily due to the possession by the factories of a complete control over the lands, under a system of leases, which supply them with cane. Excepting some individual cases, where the factory owners are landlords and *zamindars*, no cane estate in Rohilkhand is owned or leased by sugar factories. The position of the sugar industry with regard to the intake of raw material is peculiar in so far as the sugar factories have to depend on their immediate neighbourhood for the supply of cane, because cane cannot be transferred to large distances except by paying prohibitive freight charges and undergoing considerable deterioration. It follows, therefore, that the more compact the area on which a factory depends for its cane, the greater the economy in its working.

Further, the manufacturers do not take any interest in the agricultural side of the industry. They are averse to spend any money on agricultural improvements.

The yield of cane per acre in India is 13 tons against 50 tons in Java. Similarly the sugar percentage on cane is 12 (i.e. 6 tons of sugar per acre) in Java, and only 8½ (i.e. only one ton of sugar per acre) in India. The following table shows the result of a recent analysis of various qualities of cane grown in the western districts of the United Provinces.<sup>(2)</sup>

Quality	Extraction	Brix	Sucrose	Purity	Availability
Co. 312 ..	66·88	15·60	12·23	78·39	6·66
Co. 300 ..	66·15	14·45	10·74	74·32	5·46
Co. 290 ..	65·66	13·36	7·76	73·05	4·82
Co. 244 ..	65·53	13·85	9·92	71·62	4·79
Co. 213 ..	66·43	13·80	9·95	72·10	4·88

The organization of the supply of cane is likewise very defective. It is of the utmost importance for the efficiency of

(1) Article on 'Dangers of Indian Sugar Industry' by "An Expert" published in the *Pioneer*, dated January 16, 1935.

(2) The *Leader*, dated December 14, 1934.

a sugar factory that cane should be available continuously. The existing organization does not properly adjust the demand with the supply so that there is an over supply of cane when the factories are adequately provided, but when they actually need this raw material the supply runs short. These factors mainly account for the fact that most of the sugar factories do not work up to their full capacity throughout the crushing season.

The welfare of the sugar industry is closely bound up with the question of transport, both of raw materials and of finished products. In the sugar industry, particularly, the importance of cheap and quick transport is very great. Sugarcane should be supplied to the factories with the utmost expedition at the lowest possible cost in order that its supplies may be drawn from a fairly wide zone at a moderate over-all-cost without deteriorating the quality, so as to obtain the maximum amount of sugar from it. Likewise, sugar and molasses can bear only a certain amount of freight which can enable the factories to supply these products economically to the various consuming centres. At present 12 per cent. of the price of cane has to be paid in its transportation over the railways to a distance of about 25 to 30 miles. Similarly "the present average rates for carrying sugar from manufacturing centres in India to important consuming areas like Karachi, Bombay and Madras (distance about 800 to 1,000 miles) amount to Rs.1-8 per maund, or more than 15 per cent. of the cost of production, the ocean freight charged on the transport from Java to Karachi, Bombay and Madras is about 4 to 5 annas per maund only." (1) The existing rates of freight on molasses also, as compared with its present price, are beyond the capacity of the traffic to bear. It has been estimated that if the freight on sugar to distant ports is brought on a level with that to Calcutta, the railways would gain about Rs.30 lakhs per annum. The East Indian Railway has extended various facilities in the shape of reduction of freight on cane, supply of requisite type of wagons and reduction of freight on sugar over long distances.

Most manufacturers do not realize the importance of the place of chemistry in the factories. The manufacture of sugar from the beginning to the end is a complicated organic chemical process which has to be guided throughout its entire course by competent chemists. Most of our sugarcane varieties contain 11.5 per cent. of sugar and some as much as 14.

(1) Gandhi, M. P., Sugar Industry and the Problems of Transport, p. 2.

per cent. " Yet there is scarcely an Indian sugar factory which can extract more than 8 per cent. out of it, and sometimes even this low figure is manipulated by under weighing the cane. The majority of the factories can really extract only 6.5 to 7 per cent. and some as low as 4 to 5 per cent. In other words even in well managed sugar factories 27 to 33 per cent. of the sugar contained in the cane is lost for ever as compared to only 15 per cent. in Java and 14.5 per cent. in Cuba, whereas in many others the loss often exceeds 50 per cent.<sup>1</sup>

The Tariff Board assumed that a price of Rs.1-8 to Rs.2 per maund would be realized for molasses; but today molasses has become a liability to the manufacturer rather than an asset.

In face of all these disadvantages the competition between the Indian sugar factories have increased to such an extent that it amounts to sheer rivalry, underselling and price cutting, which represents an annual loss of Rs.2 crores to the industry.<sup>2</sup>

The Indian Sugar Committee of 1920 reported that the average recovery of sugar in Indian factories was 6.85 per cent. Taking the average sugar content of cane in India at 12 per cent. they concluded that in a thoroughly efficient factory 9.5 per cent. of the marketable sugar could be obtained against 9.75 per cent. in Java. The last decade has witnessed a phenomenal improvement in the process of sugar manufacture; and the average recovery of sugar factories in the United Provinces touched 9 per cent. in 1929-30—the average recovery for India in the same year being 9.07. The sucrose content of the cane in Java is 13 to 14 per cent. against 11.5 per cent. in Northern India; and allowing for this difference, 9 per cent. recovery represents an extraction of 78 per cent. sucrose against an average of 85 per cent. in Java. An " efficiency beyond this, though it may be reached in individual factories, could not safely be assumed for the average Indian factory."<sup>3</sup> This represents a great advance in the technique and process of manufacture as compared with the indigenous methods of making *khand* and *gur*. Further, in an efficient sugar factory losses due to inversion are very small, but in the open pan boiling, inversion is inevitable and constitutes one of the most important source of loss of sucrose. The following table shows the average figures of comparative losses of sugar at various stages of its manufacture and probable receipts in different plants:<sup>4</sup>

<sup>1</sup> Dr. S. Dutt's article on " Indian Sugar Industry " published in the *Leader* of August 5, 1934.

<sup>2</sup> Gandhi, M. P. : Single Sugar Selling Organization (A Central Marketing Board), p. 2.

<sup>3</sup> Report of the Indian Tariff Board on the Sugar Industry, p. 65.

<sup>4</sup> Obtained from the Government Sugarcane Research Station, Shah-jahanpur.

<sup>3</sup> Report of the Indian Tariff Board on the Sugar Industry, p. 65.

<sup>4</sup> Obtained from the Government Sugarcane Research Station, Shah-jahanpur.

The difficulties of obtaining an adequate regular supply of cane for the factories could be obviated by concentrating the area round about them on which they could draw for their cane. This could be brought about either by the factories purchasing land in compact blocks from the existing *zamindars*, or by the grant of Crown waste lands by the State, or by compulsory acquisition by Government of cane lands for factories. No single measure can fully solve the question. The problem should be tackled from all sides.

Lines of  
improvements.

The agricultural side of the sugar industry is as important, as the manufacture itself. Factory owners should invest some money in agricultural improvement by opening experimental and demonstration farms and offering credit facilities for the purchase of improved seedlings, manure implements and live stock.

Old and out-of-date plants are not infrequently installed for cheapness. This is false economy and it should be given up. Again the place of chemistry in the process of manufacture should be duly recognized and the position of the factory chemists should be made more secure.

The railways should extend adequate transport facilities in the shape of reduction of freights and provision of suitable tank wagons for carriage of molasses. The existing competition among the Indian sugar factories has become too acute to be healthy. A single sugar selling organization on the model of NIVAS of Java will perhaps ease the situation.

An important side problem of great magnitude which faces the Indian sugar industry today is that of the utilization of by-products, such as molasses, bagasse, filter-press-mud-cakes, bagasse ashes, etc. At present in most of the sugar factories in India molasses run to waste. The market provided for molasses by the tobacco curing industry is very limited, and unless some suitable outlet for it is found, the waste which is going on today will increase as the sugar industry develops. Molasses may be used for the manufacture of alcohol for industrial purposes. Again it is a suitable ingredient of fuel for internal combustion engines. The cost of extraction of alcohol at the place of manufacture has been estimated to 6 annas per gallon. It may also be used for the manufacture of vinegar. The Rosa Sugar Works and Distillery carry on the distillation of molasses on a large scale and produce rum, rectified and other types of spirits. Under the existing excise policy of the State, however, it is not possible to encourage molasses distillation to any great extent. Molasses are used

as fuel in sugar factories in Queensland and Philippines. It is also sometimes used as manure. In America dry ice (solid carbon dioxide) is manufactured out of molasses. When mixed with some fodder, molasses can be used as cattle food.

Spent cane may be utilized for the manufacture of cellulose, paper, woodless wood, artificial silk, insulating materials, etc. Filter-press-mud-cakes, bagasse ashes and sugar factory refuse are all good fertilizers.



## CHAPTER VII

## MARKETING

*Rab marketing.*

GENERALLY the *khandsalis* are also the manufacturers of *rab* and, therefore, all the *rab* annually produced is not marketed, but a part of it is consumed in the *khandsals* of the producers. The rest of the *rab* is sold in the village markets or brought to the bigger markets in the towns and cities for sale. *Khandsalis* usually purchase a large amount of this *rab* in the open market.

Three varieties of *rab* are dealt with in markets in these districts. The *bel rab* is produced in the *rab* boiling workshops of the *khandsalis* and is supposed to be the best type. Next in order comes the *sairi rab*. It is boiled from juice on a single open pan in the cottages of the cultivators. As it is not clarified it is darker and more sticky. The *garawat ki rab* is boiled from molasses and is deficient in the percentage of recoverable sugar. The *bel rab* is generally marketed in new *kalsis* (earthen pots), the *sairi rab* in old ones and the *garawat ki rab* in the lower halves of used *kalsis*. The *rab* which is meant for carriage to distant places is potted in metallic vessels like tins and drums.

Varieties of *rab* dealt with in the markets.

Transactions for the purchase and sale of *rab* are put through the *arhtis* (a class of commission agents) and *dalals*(<sup>1</sup>). *Kalsis* or tins of *rab* meant for sale are brought in cart-loads from villages to the *arhats* (the business place of the *arhtis*) in the town or city *gunj* (market), where *khandsalis* and *beoparis* come with their *dalals* to buy the same. The *arhtis* also export *rab* to outstation *beoparis* on receipt of their orders. Shamatanj, Alamgiriganj, and Kila, in Bareilly; Sahukara, Purananganj, and Chauk, in Pilibhit and Bahadurganj, Keruganj, Bholaganj, Biriaganj, and Ganeshganj in Shahjahanpur are the leading *rab* markets in these districts. An octroi duty has to be paid on all *rab* entering these three cities.

Role of *arhtis* and *dalal*.

The cartage of *kalsis* of *rab* depends upon the distance from the village to the *arhat* and is calculated on 100 *kalsis*. The cartage from a village *bel* about 10 miles away from the Bahadurganj market in Shahjahanpur is Rs.2 per 100 *kalsis*.

Cartage of *rab*.

(<sup>1</sup>) Brokers.

Higgling  
and  
bargaining  
at the  
*arhat*.

Carts carrying *kalsis* are stationed before the *arhat* of the commission agent through whom they are to be sold. In practice each prospective seller of *rab* has his own favourite *arhti* through whom he generally deals. Good-will between the two parties is firmly established after a few years' dealings. The seller of *rab* gives the approximate rate to the *arhti* at which he intends to sell his product. The *khandsalis* or *beoparis* or their agents come to the *gunj* (market) and roam about with *dalals* from *arhat* to *arhat*. The *dalal* shows samples of *rab* to the prospective purchaser by scratching some *rab* with an iron *suja* from the *kalsis* at various *arhats*. Next starts the higgling and bargaining. No rates are communicated directly either to the purchaser or to the *arhti* on behalf of the seller. The purchaser and the *dalal* hide their hands in an *angaucha* (piece of cloth); and by touching each other's fingers a rate is communicated by the former to the latter. The *dalal* does the same thing with the *arhti* and thus the higgling goes on. If a rate is struck which is agreeable to both the purchaser as well as the seller, the transfer is put through. No written agreement is however made. Nor is any earnest money paid.

**Weighment.** When the rate is settled the *kalsis* are weighed and the total amount of money payable by the buyer arrived at. Generally all the *kalsis* are not weighed. The commonest practice is that the purchaser samples the two smallest and the seller the two biggest *kalsis*. These are then broken and their *rab* contents separated from their broken chips. The *rab* and the pieces of *kalsis* are weighed separately and averaged. The mean tare weight of the *kalsi* and the net weight of the *rab* per *kalsi* having been thus found, the value of the total amount of *rab* is calculated. Occasionally the average weight is arrived at simply by higgling. The local maund of *rab* is equal to  $40\frac{1}{2}$  seers in Bareilly and 49 seers in Shahjahanpur. The *kalsis* of *rab*, having been sold, are next carted to the godown of the purchaser at the expense of the seller.

Export of  
*rab*.

A considerable amount of *rab* is also exported to *beoparis* at distant places in Rajputana, Mewar, Deccan, Punjab, Central Provinces, Kasganj, Agra, Bengal, etc. The *arhtis* occasionally demand some earnest money, in advance from such *beoparis* but when they have had constant dealings with each other no such advance is taken.

The *arhtis* make the following market charges from the Local market purchasers of *rab* : deductions.

Items	Shahjahanpur	Bareilly
<i>Tulai</i> .. .. .	2 annas per maund	
<i>Dalali</i> .. .. .	½ anna per maund..	8 annas per every transaction of Rs.100.
<i>Ramlila</i> .. .. .	1 anna on every transaction of Rs.100.	
<i>Arhat</i> .. .. .	.. .. .	1 anna per maund.
<i>Karda</i> .. .. .	.. .. .	½ seer per maund.

From the sellers the *arhtis* take the following :

Items	Shahjahanpur	Bareilly
<i>Dalali</i> .. .. .	½ anna per maund	8 annas per every transaction of Rs.100.
<i>Arhat</i> .. .. .	Rs.1 per every transaction of Rs.100.	Rs.2 per every transaction of Rs.100.
Cartage to the purchaser's godown (varies with distance).	.. .. .	

In the Pilibhit markets *rab* weight is taken at 40½ seers for each maund. If the *rab* which has been sold is subsequently found to be inferior in quality the *dalal* intervenes and settles a *batta* (allowance) which is binding on both the purchaser as well as the seller. The payment is either made on the same day or on the third day when the *dalal* produces the *parcha* (bill) to the purchaser from the *arhti*. The market rate of *rab* is liable to frequent and wide fluctuations, depending mainly on the trends of *khand* and molasses markets. No standardization and specification has so far been introduced in the *rab* markets. Stiff *rab* of lighter colour is supposed to be of superior quality and rich in sugar. On the other hand the loose variety of darker colour contains a higher percentage of molasses and inverted sugar. Nawabganj (Bareilly district) *rab* is reputed for its quality. During the season 1933-34 the market of *rab* opened from a low level and towards the close it reached the peak. *Galawat ki rab* was sold at Rs.2 per maund and the *bel ki rab* at Rs.3-8 to Rs.5 per maund.

Sometimes the producers of *rab* take advances of money from the *arhtis* on an implied understanding that they will dispose off their *rab* through them.

#### Marketing of *khand*

Unlike *rab*, *khand* is sold at the place of its manufacture. The sale agreement is put through the *arhtis* and *dalals*. In smaller towns there is another class of middlemen known as the *kachcha arhtias* who serve as a connecting link between the *khandsalis* (sellers) and the *pucca arhtias*. But in city markets the services of the *kachcha arhtias* are dispensed with. Occasionally the *pucca arhtias* accommodate the *kachcha arhtias* in towns and the latter finance the village *khandsalis*. The money is lent either for the season at a nominal rate of interest or without any interest when a current account is running between the borrower and the lender. In every case there is an implied understanding that the debtor will dispose of his produce to his financier. The *pucca arhtias* act as commission agents for the *beoparis* or wholesale dealers in big cities.

Important  
*khand*  
markets.

Bareilly, Shahjahanpur and Pilibhit are important centres of *khand* business. Shamatganj and Alamgiriganj in Bareilly; Bahadurganj, Bholaganj, Biriaganj and Ganeshganj in Shahjahanpur and Direpanganj in Pilibhit are the leading sugar marts (*ganjs*) in these districts. Most of the substantial *arhtis* carry on their business (*arhat*) in these marts. There are about 10 important *arhtis* and 20 *dalals* in Pilibhit and 30 *arhtis* and 60 *dalals* in Bareilly and Shahjahanpur each.

The number of *khandsalis* during the year 1933-34 in five out of the six districts of Rohilkhand was as follows: (1)

Bareilly	..	..	..	..	470
Shahjahanpur	..	..	..	..	490
Pilibhit	..	..	..	..	380
Bijnor	..	..	..	..	534
Moradabad	..	..	..	..	353

Role of  
*arhti, dalal*  
and *beopari*.

The *beoparis* who live near about come personally to the *arhtis* to make purchases of sugar. Others generally send orders direct to their commission agents specifying the quality and approximate price of the product to be purchased. Only in rare cases are samples actually sent. Generally no advance of money is demanded with the orders, but occasionally a sum equal to 10 per cent. to 25 per cent. of the total value of the order is insisted upon from new *beoparis* specially when the market is very unsteady. Occasionally too the *beoparis*,

(1) Figures obtained from the Bureau of Statistics and Economic Research, United Provinces.

*arhtis* and *dalals* go personally to the *khansalis* to purchase *khand*, but ordinarily the business of putting through the agreement is left to the *dalals* who are experts in this business.

The *dalals* keep a number of *purias* or packets (small quantities of various specimens of sugar wrapped in paper wrappers) of *bangis* (samples) of sugar which were marketed on the previous day with their rates duly marked on each *puria*. They roam about from one *khandsal* to another taking fresh samples of sugar available with any *khandsali*. They put a specimen of the *khand* from a *khandsal*, intended to be sold, on a piece of small wooden board, painted black, and technically known as *patti*, and display against this their own samples for the sake of comparison. They then ask for the rate of the *khand* from the *khandsali* and go with the sample to their *arhtia* to communicate the rate to him. After some amount of higgling if a rate is struck upon which is acceptable to the *arhti* as well as the *khandsali* in question the agreement is concluded and both the parties are informed. No written agreement is made. In Shahjahanpur markets Re.1 is generally paid as earnest money to the *khandsali* and entered in the books both of the *khandsali* and the *arhti*.

The agreement having been made, the *dalal* writes a note on the *puria* of the *bangi* (sample) of the *khand* to be sold and hands over the same to the *morhia* (a servant) of the *arhti* who goes in company with 15 to 20 *palledars* and *taulas*. *Taulas* and *palledars* are ordinary porters who are hired for ordinary wages in the market. Sometimes they are also in the employ of the *arhti* and receive a specified amount of *khand* from the *khandsali* on each maund of sugar weighed by them and for which the latter is paid by the *arhti*. The *morhia* is some reliable man of the *arhti* under whose supervision the sugar is weighed and bagged. He compares the bulk with the sample from time to time, and if he detects any difference prejudicial to the interests of the *arhti* he suspends further weighment and reports the matter to his master. The *arhti* then comes in company with the *dalal* through whom the sale agreement was effected. If a marked difference is noted the *dalal* settles the *batta* (allowance) payable to the *arhti* and this is binding on both the parties, viz. the *khandsali* as well as the *arhti*. The *batta* is charged on the total amount of sugar contracted for—whether weighed or not. The *khandsali*, therefore, takes special precautions to thoroughly mix the various charges of sugar from the centrifugal so as to minimize the chances of disputes. This mixing of sugar is known as *khall karna*. It is left to both the purchaser as well as the seller to stop further weighment of *khand* any time. The

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Weighment  
of *khand*.

*khand* which has been weighed, is carried away to the *arhat* either in *gatthis* of cloth on the shoulders of the *palledars* or it is stuffed in gunny bags. A *gatthi* contains about  $1\frac{1}{2}$  maund (Imperial weight) and a bag  $2\frac{1}{2}$  maunds (Imperial weight) of *khand*. The bags are supplied by the *beopari* and cost 5 annas each or Rs.25 per 100. When the first *palledar* goes to the *arhat* he takes with him a formal note from the *khandsali* to the *arhti*. This note contains particulars of agreements, rate of *khand*, name of the parties concerned, viz. the *arhti*, the *khandsali* and the *datal*, etc. This note is compared with the *parcha* or bill when it is presented to the *arhti* by the *khandsali* for the payment of his sale-proceeds. It is only occasionally that the *khand* is brought to the *arhat*. More generally it is bagged and kept for some time in the *khandsal* itself from where it is carted to the railway station for carriage to *desawar* (outstations).

Market  
customs and  
usages.

In Shahjahanpur markets the practice is that when the agreed amount of *khand* has been weighed and bagged the *arhti* comes with his own *kanta* and *bant* (scales and weights) to the *khandsal* to test the weights of a few bags. Generally the *arhti* selects the two smallest and the *khandsali* the two biggest bags. All these are weighed and the mean weight of the bags is found on the basis of which the weight of all the bags is computed. If an excess or deficiency of  $\frac{1}{2}$  seers or less on the weight per bag is revealed on this test it is ignored; but if the deficiency is more than this the *arhti* charges double the difference on each bag. This is known as *du chandi katna*. On the other hand if there is an excess only the actual difference is paid on each *bori* (bag).

Bagging, sewing and carting charges fall upon the *arhti*.

If due to unfavourable weather conditions or some other reasons the *arhti* cannot remove his sugar from the *khandsal* he pays no rent and the *khand* lies in the *khandsal* at the care and risk of the *khandsali*. When the bags have been filled and sewn the *arhti* sends his cart for their removal to the railway station for despatch to the *beopari* in *desawar* (outstations). The *arhti* pays all the expenses of the despatch and charges the same from the *beopari*.

Market  
deductions.

The *arhti* makes the following market charges from the *khandsali* :

Items	Bareilly	Shahjahanpur	Pilibhit
<i>Dane</i> ..	..	..	$\frac{1}{2}$ chhatak per maund of sugar.



Items	Bareilly	Shahjahanpur	Pilibhit
<i>Dalati</i> ..	1 anna per <i>palla</i>	1 anna per <i>palla</i>	1 anna per <i>palla</i> .
<i>Sharbat sadabari</i>	..	3 annas per transaction of Rs.100.	..
<i>Dharamshala</i> ..	$\frac{1}{2}$ anna per transaction of Rs.100.	..	..
<i>Khand kharach</i> ..	$\frac{1}{2}$ seer per 12 $\frac{1}{2}$ maunds of sugar.	1 seer per <i>palla</i> of sugar.	1 chhatak per <i>palla</i> of sugar.
<i>Dharmada</i> ..	$\frac{1}{2}$ anna per transaction of Rs.100.	1 anna per transaction of Rs.100.	1 anna per transaction of Rs.100.
<i>Palledari</i> ..	1 anna per <i>palla</i>	$\frac{1}{2}$ anna per bag or 1 anna per <i>palla</i> .	$\frac{1}{2}$ anna per bag.
<i>Morhia ki khand</i> (ganesi morhia ki khand, punn khate ki).	3 $\frac{1}{2}$ pao per <i>dhari</i>	..	..
<i>Morhia ki khand</i> (charhai ki, gau-shala, pathshala, shafakhana, dharamshala.	$\frac{1}{2}$ seer per <i>dhari</i> or 5 pice per transaction of Rs.100.	..	$\frac{1}{2}$ anna per <i>palla</i> or 1 anna per transaction of Rs.100.
<i>Dana batta</i> ..	13 $\frac{1}{2}$ annas per transaction of Rs.100.	No <i>mili</i> system prevails.	8 annas per transaction of Rs.100.
<i>Khand to arhti</i> ..	..	..	1 chhatak per <i>palla</i> of <i>khand</i> .
Do. <i>dalal</i> ..	$\frac{1}{2}$ seer of sugar	$\frac{1}{2}$ seer of sugar	1 seer of sugar.
Do. <i>taula</i>	$\frac{1}{2}$ to 1 seer per 100 <i>dhari</i> s of sugar.	..	..
Do. <i>charhaiya</i>	..	..	1 chhatak per <i>palla</i> of sugar.
<i>Khand to palledar</i>	..	..	Ditto.

N.B.—These market charges vary very widely from *arhat* to *arhit*. No uniformity prevails even in different *arhats* in the same market. In Bareilly some *arhtis* charge 1 anna per 5 maunds of sugar from the *beopari* and give the same to the *khandsali* for allowance to the *taulas* when the latter are not in the regular employ of the *arhti*. The *palledars* and *taulas* are sometimes paid in terms of sugar by the *khandsali* who recoups himself from the *arhti*.

Out of 1 anna per bag as *palledari* the *arhtis* in Pilibhit pay only 3 pice per bag to the *palledars* and retain 1 pice per bag for themselves. In Pilibhit the *kachcha arhti* charges Re.1 per transaction of Rs.100 as his *arhat* from the *khandasali* over and above all other charges. In Pilibhit markets 40½ seers of sugar is weighed for every maund.

The *arhti* recoups himself for all the expenses he incurs from the *beopari*. He makes the following charges from the *beopari* over and above the value of the *khand* sold :

Items	Bareilly	Shahjahanpur	Pilibhit
<i>Bharai, silai</i> ..	1 anna per bag	1 anna to 1½ anna per bag.	½ anna per bag.
<i>Dalali</i> ..	1 anna per <i>palla</i> .	1 anna per <i>palla</i> .	1 anna per <i>palla</i> .
<i>Arhat</i> ..	Re.1 per transaction of Rs.100.	8 to 12 annas per transaction of Rs.100.	12 annas to Re.1 per transaction of Re.100.
<i>Gaushala</i> ..	..	2½ annas per transaction of Rs.100.	..
<i>Dharma'ta</i> ..	..	1 anna per transaction of Rs.100.	½ pice per <i>palla</i> .
<i>Tulai</i> ..	1 anna per 5 maunds.	4 annas per <i>palla</i>	..
<i>Palledari</i> ..	1 anna per <i>palla</i>	1 anna per <i>palla</i>	1 anna per <i>palla</i> .
<i>Bora dhulai</i> (cart- age of bags to station).	1 anna per bag	1 anna per bag	1 anna per bag.
<i>Babu kharch</i> (or tips to railway men per wagon).	4 to 5 rupees..	4 to 5 rupees ..	4 to 5 rupees.
<i>Billi kharch</i> ..	8 anna per 100 bags.	8 annas per 100 bags.	8 anna per 100 bags.
<i>Ladwai</i> (loading charges at the station). <sup>a</sup>	3 pice per bag	3 pice per bag	3 pice per bag.
Freight ..	Depending	on	distance.
Interest at Re.1 p.m. per cent. on unpaid bal- ance.	..	..	

N.B.—Local variations are prominent in every market. In the markets of Pilibhit on every Re.1 of *dalali* charged from the *beopari* the *arhti* intercepts 4 annas and gives only 12 annas to the *dalal*.

On every transaction of *khand* some money is charged either from the purchaser or the seller or from both the parties for charitable purposes in the name of *dharmada*, *gaushala*, *Ramlila*, *shafukhana*, *pathshala*, *dharamshala*, etc. This money is set aside and utilized for some religious or charitable purpose. In the Chandausi (district Moradabad) market a very systematic custom of collecting and managing this charitable fund prevails. A *Gaushala* Committee is formed from among some of the leading *arhtis* of the market. The committee keeps and sells *gaushala* stamps with which every payment on every market transaction is chargeable. The *khandsali*, before he can obtain payment for his *khand*, has to stamp the *parcha* (bill for payment) with the *gaushala* stamps and signs and dates the same. Each stamp is impressed with the mark of the *gaushala* committee. The local stamp duty at the following scale is charged on all sugar sold in Chandausi markets :

Up to Rs.10 worth of sugar	..	..	No stamp.
From Rs.10 to 30 of sugar	..	..	1 pice.
.. Rs.30 to 50 of sugar	..	..	2 pice.
.. Rs.50 to 80 of sugar	..	..	3 pice.
.. Rs.80 to 100 of sugar	..	..	1 anna.
On every additional Rs.100	..	..	1 anna.

The proceeds of sale of these tickets go to make up the *gaushala* fund which at the close of the year is allocated as follows :

- (i) 25 per cent. to Vaish Charitable Dispensary.
- (ii) 12½ per cent. to Vaish Ramlila Committee.
- (iii) 12½ per cent. to Brahman Ramlila Committee.
- (iv) 50 per cent. for the upkeep and maintenance of cows and other cattle.

In the evening the *khandsali* sends a *parcha* (or bill) either on the same or on the 3rd day to receive his payment. This is known as *parcha ka bhugtan*. Interest at Re.1 per cent. per mensem is charged for late payments. In Bareilly and Pilibhit there is a *miti* (trade discount) system but it does not prevail in Shahjahanpur. The charges for *dana batta* are nothing but trade discount for payments within the customary period.

A large amount of *khand* is annually exported to Rohtak, Agra, Muttra, Delhi, Meerut, Muzaffarnagar, Miyani, Jhansi, Etawah, Auraiya, Hathras, etc. About 1,000 *boris* in Pilibhit, and 4,000 in Bareilly and Shahjahanpur markets each are

Chandausi  
markets.

Settlement  
of purchase  
considera-  
tion.

Market  
charac-  
teristics.

dealt with daily during the full swing of the season. There is an association of *arhtis* in Shahjahanpur and of *khandsalis* in Bareilly and Pilibhit.

The quality of sugar is not standardized in these markets. This is a great defect which has to be removed before really good *khand* markets can be established. At present there is much room for adulteration of sugar and no control is practicable. Centrifugal machine-made sugar is recognized by various local names such as *awwal*, *doyam*, *seyam*, *dabiz*, *naram*, *dabti*, *pili*, *ghatia*, etc. *Khanchi* made sugar is characterized by terms like *phool*, *melu*, *darmiyani*, *akhri*, *tarauncha*, etc. The market price of *khand* varies widely from season to season and from month to month within the same year. It generally starts from a moderate level, followed by a downward trend, reaching the peak at the middle of the season and falling down to a low level towards the close but again shooting up at the termination. The market rate of *khand* rises and falls in sympathy with market fluctuations elsewhere as also with the price of second and third grade factory sugar and the market trends of *rab*, *gur* and molasses. *Khanchi* sugar always commands a price of 4 to 6 rupees per *palla* higher than that fetched by machine-made sugar, and machine first *khand* is always dearer than machine made 2nd *khand*. The average market price of first, second and third classes of machine-made *khand* during the last season ranged between Rs.32 and Rs.40, Rs.28 and Rs.30 and Rs.18 and Rs.25 per *palla* respectively.

#### Marketing of Factory Sugar

Disposal of  
factory  
sugar  
through  
selling  
agents.

Central factory sugar is sold through the selling agents of the factories. Factory sugar, being graded and standardized, is sold by specification of grades. A commission of 14 annas to Re.1 per 100 maunds of sugar sold is paid to the selling agents. The agents procure orders and forward the same to the factory for execution. The factory despatches the sugar to the consignee with the railway receipt and discounts the bill with its bankers who collect the bill and credit the account of the factory with the proceeds.

Example of  
Java.

The existing Single Selling Organization of sugar in Java has an interesting history behind it. Before the war Java factories sold their produce as Indian factories do at present. After 1917, however, there arose a cut-throat competition. Prices were cut down. A huge stock was accumulated and demoralization began to reign. The United Java Sugar

Producers' Association (V. I. S. P.) was formed at this juncture and the crisis was averted. The Association worked satisfactorily and proved very useful till 1932. By the end of 1932 the V. I. S. P. was dissolved.

With the development of political and economic conditions in British India and China difficulties began to increase. Government intervention became inevitable and the Governor General promulgated the Associated Sugar Ordinance which came into force on 1st January, 1933, by which was founded the Netherlands Indian Association for the sale of sugar (NIVAS). With the establishment of the NIVAS "the Java sugar industry has entered upon a period in which all producers, whilst setting aside their special group interests, have combined under the supervision and with the co-operation of the Netherlands Indian Government, by means of a prudent sales policy to avert the crisis now prevailing, with the minimum sacrifice and losses, in the interests of the industry and people as whole." (1)

India has an obvious lesson to learn from Java. In order that the fullest use of protection may be made it is essential that a fully representative sales organization should be started. It is true that many difficulties have to be surmounted in the case of an Indian organization but the necessity cannot be too much emphasized.

A central marketing board for India.

The sugar millowners at their two conferences recently held discussed the problem of bringing into existence a Central Marketing Board with the following objects :

- (1) Avoidance of wasteful internal competition by a scientific and well-planned scheme of distribution of sugar.
- (2) Elimination of imports of foreign sugar as far as possible so as to keep the Indian market for Indian sugar.
- (3) Standardization of grades of sugar.

#### Marketing of Gur

Like *rab* and *khand*, *gur* is also marketed through the medium of the *dalals* and *arhtis*. The *kachcha arhti* purchases *gur* in village and small town markets and sends it to a *pucca arhti* in the city market (or *gunj*). Shahjahanpur is the leading *gur* market in Rohilkhand.

Marketing of gur.

The *arhtis* in Shahjahanpur market levy the following market charges on the sellers of *gur* :

*Dalali*—2 annas per *palla* or  $12\frac{1}{2}$  annas per transaction of Rs.100.

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(1) Gandhi, M. P. *Single Sugar Selling Organization—(A Central Marketing Board)*, p. 13.

*Sharbat sadabart*— $2\frac{1}{2}$  annas per transaction of Rs.100.

*Chatti*—9 *chlatak* per *palla* of *gur*.

*Kanta*— $\frac{1}{4}$  seer per maund.

The *arhti* pays  $6\frac{1}{2}$  annas per Rs.100 worth of transaction to the seller as *karigari*.

The market of *gur* depends on the market of juice, *rab* and molasses. Various qualities of *gur*, viz. *sairi lauta*, etc. are sold. During the 1933 season the average market rate of *lauta gur* was Rs.5 to Rs.10 per *palla* (4 maunds). *Sairi gur* was marketed at Rs.3 to Rs.5 per maund.

The *arhti* charges the *beopari* with the following on the sale of *sairi gur* :

*Dalali*— $9\frac{1}{2}$  annas per Rs.100 worth of transaction.

*Marhvai*— $6\frac{1}{2}$  annas per Rs.100 worth of transaction.

*Chatti tat*—Rs.10 to 12 per Rs.100 of transaction.

*Chatti*—Sawa *paua* per maund.

*Cartage to station*—Re.1-9 per 100 *bheli*.

*Railway receipt charges*—

*Tips to railwaymen*—1 pice per *bheli*.

*Loading charges*—1 pice per *bheli*.

On *lauta gur* the *arhti* makes the following charges from the *beopari* :

*Dalali*—1 anna per *palla*.

*Kharch*— $2\frac{1}{2}$  annas per transaction of Rs.100.

*Arhat*—8 to 13 annas per transaction of Rs.100.

*Dharmada*— $\frac{1}{2}$  anna per transaction of Rs.100.

*Gaushala*— $\frac{1}{2}$  anna per transaction of Rs.100.

From Shahjahanpur market *gur* is exported to Gwalior, Agra, Gujrat, Jai'pur, Jodhpur, etc.

#### *Disposal of shira or molasses*

Disposal of molasses.

The unit of sale of molasses is 100 *nap* (as in Bareilly and Pilibhit) or 100 *lati* (as in Shahjahanpur). *Lati* or *nap* is an earthen vessel used for measuring the molasses and marked with its capacity in seers. An average *nap* or *lati* contains 15 seers and the molasses maund is taken at 20 seers in Shahjahanpur.

Molasses is sold through the *dalals*. The purchaser goes with the *dalal* to the *khandsal* of the seller; and when the agreement is settled Re.1 is sometimes paid as earnest money to the seller. Fifty per cent. of the price is paid at the time

of measuring the molasses, and the balance is settled afterwards. The purchaser charges from the seller 4 annas per Rs.100 worth of molasses purchased as *katauti* and the *dalal* takes 4 annas per transaction of Rs.100 from each party.

For the last few years the *khandsalis* have been losing considerably on molasses and it practically used to go to waste. During the last season the market rate of molasses ranged from Rs.10 to Rs.50 per 100 *nap* in Bareilly and Pilibhit and Rs.19 to Rs.65 per 100 *lati* in Shahjahanpur. This was really a phenomenal increase and brought unexpected profits to the sellers of molasses.