

## The Milling of rice in the Madras Presidency.

---

Rice is the principal food of about one half of the earth's population. It is one of the most important articles of food in all tropical countries, three hundred million East Indians alone using it, as their staple diet, the importance of rice in Indian agriculture is evident from this fact. It is one of the most prolific of all crops. In the Madras Presidency nearly 30 per cent. of the cultivated land is under rice, the chief paddy growing districts being Ganjam, Vizagapatam, Kistna, Tanjore, Malabar and Godavari where its production is steadily expanding with the growth of the population. In connection with this crop, therefore, the problems of agricultural improvement mostly centre round increasing the yield, and by that means the local food supplies. Most of the rice produced in the Presidency is consumed locally, or exported by rail or by coasting steamers to other parts of India and to Ceylon.

The grain which is harvested much in the same way as wheat is removed from the stalk by some form of threshing, leaving each grain separate and covered by an outer husk. In this condition known as paddy, it is stored and in this form reaches the Rice Mill. There the processes of preparing and cleaning are carried out on a commercial scale by means of machinery. The rice grain varies greatly. A casual examination reveals that there is short round rice, long thin rice, powdered rice and clear rice. Again an examination of the paddy shows that there are many other points of difference such as, thickness and nature of the husk thickness and nature of the mealy covering which underlies the husk, and variations in the colour of the latter. The removal of the mealy covering of the grain is the most important part of the milling process.

The process of rice milling requires highly specialized machinery for the shelling, grading and polishing of the grain, and

owing to the wide variations in the character of the rice grown not only in different parts of India, but even within relatively narrow limits in the same territory, expert knowledge and experience are necessary for the selection of the most suitable design of machinery. A certain type of machine which may be successful in the Circars may not be suitable for Tanjore on account of the difference in the original grain. Again, the market for which the rice is destined must affect the machinery required for the milling, to some extent; and this should be considered when installing new machinery.

The essence of good rice milling is, generally, to obtain the maximum proportion of whole well cleaned white rice from the paddy supplied to the mill, together with the automatic separation, grading, and dressing of the broken rice and bye products obtained in the process.

The process of milling in a properly designed and constructed mill, as carried out at Rangoon, would consist of the following operations :—

- Preliminary cleaning of the grain from foreign matter.
- Shelling.
- Winnowing.
- Separating.
- Whitening and Polishing.
- Grading.
- Bagging.

The paddy is first separated from the stones, mud and other foreign matter, which it generally contains in more or less quantities according to locality. It is then elevated into shellers where the removal of the outer husk is effected. This machine essentially consists of two well balanced cast iron plates, the lower of which revolves while the upper is stationary; these plates are covered with a suitable composition of emery which is easily

removable at slight cost when required. The grain is fed through the eye of the upper disk and the husk is cracked off as it passes through the two rough faces. The removal of this outer husk is effected with comparative ease. In a good mill 80% of the grain passed through is shelled and the percentage of broken rice is small being usually about 1½% to 2%. The remaining 20% is composed of small grains, to shell which with large grains would necessitate the breaking of the latter. From the shellers the grain is conveyed by an elevator to a separator where the coarse bran and broken rice are separated and taken off. The grain which is still mixed with husk is then elevated and passed through winnowers which generally comprise a double machine having one or more fans placed one above the other, giving a gentle and gradual separation, the aim being to obtain the highest possible percentage of the raw grain as finished product and to prevent good grain being blown away with the husk. The husk blown off in the winnowers is collected and conveyed direct to hoppers placed over the husk burning furnaces attached to the boiler, where it is used as fuel for steam raising. The shelled and winnowed grain is known as "Five part," or "Cargo" rice from the fact that it usually contains about one unshelled grain in every five. These unshelled grains are removed by a rotary separator or paddy eliminator. The grain is then conveyed to the cone-huller where the mealy covering is removed from around the kernel of the rice grain. The rice is then passed through an aspirator which removes all trace of any remaining husk or loose bran, and is then conveyed to the polishing machine from which it emerges clean and white. Finally the clean and white rice is separated into the various grades of quality as required for the consuming markets.

Of the whole milling process the whitening of the shelled grain is the most important; certain grains in Southern India are of a deep red colour underneath the husk. This inner skin

adheres closely to the grain and is difficult to remove without breakage resulting. The degree of whiteness and finish and freedom from broken grain determine the commercial value of the rice.

In the large Rangoon mills, grading plays an important part; the rice and broken rice being separated into various degrees of classification, the smallest broken grain being ground for the production of rice flour.

The bran that lies between the husk and the grain, and which is given off during the polishing processes is a valuable animal food, and contains much of the nourishing properties of the whole grain.

Although the commercial milling of rice has within recent years made great progress in Burmah and other parts of the World, little advance has been made in the scientific milling of rice in this Presidency. The process has apparently remained stationary for many years without any noticeable improvements having been made, but apart from the actual design of the plant, the construction of the mills and the installation of the machinery often leave a great deal to be desired. The mills are not erected in accordance with any standard plan or design and are almost invariably constructed in a most haphazard way, the result being that alterations and reconstruction are often necessary after completion. Even allowing for the fact that the Rangoon Mills manufacture principally for export whilst the factories of the Madras Presidency chiefly produce rice for local consumption, there is a great scope for improvement in the latter mills.

Both raw and par boiled rice are produced in this Presidency, although the latter is produced to a much larger extent than raw rice which is principally produced for immediate local consumption. In the Northern Circars all the largest mills produce boiled rice which, in normal times, is exported to the Malabar Coast



Coimbatore, Colombo and Mauritius. Unfortunately, facilities for transport to these places appear to be practically non-existent at the present time owing to the unprecedented shortage of rolling stock and of coasting steamers both large and small. The factories are in consequence unable to dispose of their produce with the result that most of them are closed down and the stocks of rice are large. There are also a number of smaller factories in the Circars which produce raw rice for local requirements and also for export. In normal times the chief markets for the raw rice of the Circars are the Bombay Presidency, the Nizam's Dominions, Bellary and Madras whilst a small amount is sent to Bangalore. In the Tanjore district par boiled rice is chiefly produced. It is chiefly exported to Colombo and the Malabar Coast.

Most of the par boiled rice factories of the Circars work on a modification of the Rangoon system, The paddy is first cleaned and separated from foreign matter and is then conveyed into a sheller which removes the outer husk. But as the husk still remains mixed with bran it is conveyed by a second elevator to a separator where the coarse bran and broken rice is taken off. From the separator the paddy is conveyed to the aspirating fans where the husk is blown off. It is then passed to another separator where the hulled grains are sifted and returned to the sheller for retreatment. The rice is then conveyed to the scouring and polishing cones from where the best bran is obtained, and is finally conveyed to a sifter which removes particles of meal and dust and any broken grain.

The raw rice factories work on a somewhat similar system, the main difference being that Engelberg Hullers are usually substituted for cones in the polishing operation, although the reason for this is not apparent, cones being equally suitable for raw or boiled rice.

The shellers, cones and separators on the whole are generally manufactured by Madras foundries and the remaining machines

which are principally constructed of wood are manufactured by local maistries. The construction of these machines often leave a good deal to be desired, the shellers for instance are often unevenly turned on the surface with the result that the shelling is uneven and the percentage of broken rice high. Two types of shellers are in general use, the Rangoon in which the lower plate revolves and the American in which the lower plates remain stationary the upper plate revolving. The former is generally preferred as the diameter of the plates is less and the balance is better maintained.

The process of par boiling consists in steeping the raw paddy for a period varying from 20 to 36 hours, the time varying according to quality, in masonry tanks, after which the grain is placed in drums where it is subjected to live steam for a further period of 12 to 15 minutes. From the pans the grain is taken out and spread over a brick or an earth floor where it is exposed to the direct rays of the sun for about 24 hours, being raked over until dry. Par boiled rice is not liable to deterioration on storage to the same extent as raw rice.

The steaming pans consist of wrought iron cylindrical vessels of a capacity of 25 to 50 bags, having a coned bottom connected with the main cylinder by a sliding cover. A vertical pipe is fitted to the centre of the pan having a number of perforated branch pipes issuing in all directions and extending to within an inch or two of the sides of the vessel. The main steam pipe from the boiler is connected to the vertical pipe, and the steam flows through the perforated branches percolating through the paddy which fills the vessel.

The mills in the Circars which have an output of from 700 to 800 bags of finished rice per day, are generally driven by a 35 N. H. P. simple non-condensing steam engine and a 24' x 6'6" Lancashire boiler. The boiler is fired by the husks produced in

the milling process, a specially designed furnace with stepped grate being used for the purpose. In these mills, however, the production of husk is only about 320 bags per day whilst the daily requirements of the furnace are 500 bags. The deficiency is made good either by obtaining additional husk from the oil engine driven mills, or using wood or coal fuel.

In addition to the mills referred to previously, which have outputs ranging from 150 to 800 bags of finished rice per day there are a number of smaller mills in the Circars consisting of an Oil Engine driving one, two or three pairs of Engelberg Hullers without the addition of any winnowing, separating or cleaning machinery. Attached to these mills are a number of hand mills where the paddy is husked and the resulting "cargo rice" conveyed to the huller which completes the hulling operation, the polishing being generally effected in a separate huller. There are about 75 of these hullers working in the Bezwada district. The hand shellers are manufactured at Guntur and cost about Rs. 90 each. A number of these hand mills are also in use in the villages—the partly shelled rice being conveyed to the milling centres to be hulled and polished. It follows that the appearance and finish of the rice produced by these small mills is distinctly inferior to that of the more elaborate factories operating on a modification of the Rangoon system.

In the Tanjore district the rice milling industry has shown remarkable progress during the last five years, but it is questionable whether the development has been on the right lines, consisting as it has of the construction of a vast number of single huller mills. There are a small number of mills in this district working on the Rangoon system, but the great majority consist of single hullers of the Engelberg type driven by oil engines. These small mills would have been of some economic value if they had paved the way for the establishment of large central factories but

this has not been the case and this system of milling regarded as an end in itself is devoid of advantage, and has probably had the effect of tending to arrest real development. A number of these small mills are situated in the most unsuitable places as regards proximity of raw materials and transport facilities.

Only boiled rice is produced in any quantity in the Tanjore district as the quality of the paddy is said to be unsuitable for the production of raw rice. The par boiled rice is exported to Colombo and the Malabar Coast.

These hullers have a capacity of about 50 bags of finished rice per day of 12 hours and are supposed to husk, clean and polish the grain at one operation. They require about 14 to 16 B. H. P. to drive, and are almost invariably driven by oil engines. They consist of two cylinders, one a small hulling cylinder above, and the other a large polishing cylinder below. The paddy is fed into a hopper and passes into the hulling cylinder, where it is retarded by a stripper plate against the grooves on the cylinder. This produces rubbing between the plate and the cylinder, and so the hulls are removed, the hull falling through the screen out of the way. The rice is carried on to the polisher, which is made of wood and has leather straps attached. This revolves inside a screen which receives the hulled grain at one end and delivers the polished rice at the other end. In Tanjore this polishing cylinder is seldom used the paddy being passed twice through the hulling cylinder.

For reasons that are not apparent shellers are very little used in the Tanjore district, although even moderately good results cannot be attained without their use. The method extensively followed in Tanjore of passing the paddy twice through the huller is open to objection as it not only considerably increases the cost of renewals but decreases productive capacity. Moreover by the use of a sheller the breakage of rice is considerably reduced.

The small rice milling plant just referred to has many disadvantages when compared with mills operating on the Rangoon system or even a self contained Engelberg plant consisting of a sheller, huller, aspirator and grader. The percentage of finished rice obtained is poor, the cost of renewals excessive, and the husk is often wasted. Further the breakage of grain is considerable and the appearance and finish of the rice distinctly inferior. Also, owing to the absence of any means of cleaning or separating the grain, the husk and bran obtained from these mills are combined together, and consequently, fetch a very low price for cattle fodder, as the husk is generally considered to be injurious; the fuel value of this mixed bye-product is also low and it is often thrown away the demand being small. The pure bran obtained from the mills operating on the Rangoon system commands a high price and considerably swells the receipt of a factory. Prior to the war a considerable amount of good quality bran was exported to Liverpool and elsewhere. These small mills are proving anything but a paying proposition for a number of their owners, and the efforts of the Department will be exerted towards restricting any further development on the present lines, and to encourage the creation in the Tanjore district of a larger number of mills operating on the Rangoon system or a modification thereof.

The country method of par boiling is extensively employed in the Tanjore district. Square wrought iron pans of a capacity of 15 bags of paddy are used. A wire gauze is fitted inside the pan, the space between the floor of the pan and the gauze containing water and the paddy resting on the gauze. Husk or wood fuel is used to heat the water and generate at atmospheric pressure the steam required to boil the paddy. This system of par boiling is primitive and inefficient, for not only does the boiling extend over a long interval of time, but the lower portion of the paddy boils much quicker than the upper layers, and in consequence the quality and value of the rice varies.

Modern rice mills of whatever kind employ relatively little labour, as the whole milling operation is automatic from the time the paddy is brought into the mill from the fields until it is bagged and stored. The cost of actual milling labour is low, but in connection with the sowing, harvesting and threshing of the grain employment is found for a large population. The handling and storing of the paddy and milled rice, and the collecting of the dried par boiled paddy from the drying grounds attached to the mills also give employment to a large body of native labour.

Reverting to the question of power to which reference was made earlier in this paper there are practically only two classes of prime movers in use at present in driving rice mills, the non-condensing steam engine and Lancashire boiler for the large mills, and the liquid fuel burning oil engine for the small mills. The latter class of mill owner has hitherto relied almost exclusively on the oil engine to furnish power at a reasonable rate but the price of liquid fuel has advanced considerably in the last two years, and in view of the increasing world wide demand for this oil it is unlikely that the price will ever fall to its pre-war level. The oil engine while therefore retaining the advantages of the simplicity and low initial cost, is in a very different position as regards economical generation of power to what it was a few years ago. Reference has already been made to the steam engines and boilers in general use, the great majority of the boilers are fitted with reasonably efficient husk burning furnaces, but the burning of waste materials for direct steam raising must always be a wasteful and objectionable method of generating power and it is probable that the great majority of rice mills will ultimately be driven by suction gas plants in which case almost all the drawbacks incidental to the burning of husk in a boiler furnace will be overcome. There are two great disadvantages attached to the burning of husks for direct steam raising, one

that the production of husk is often insufficient for the requirements of the mill, and the other the objectionable smoke and dangerous sparks which result therefrom. Several of the Municipalities in the Circars are considering measures to compel the husk burning steam mills to go outside the Municipal limits. The exhaust of a gas engine resembles that of an oil engine, and is consequently in no way objectionable, whilst no chimney is required.

As given quantity of husk will raise from four to five times the power when gasified than when burned under a steam boiler, and this is an important consideration in these mills where the amount of husk available is small and often insufficient for the power requirements. One of these plants, the first in this Presidency, has already been installed at Gudivada in Bezwada district, whilst a number are in successful operation in the Bombay Presidency. The consumption of rice husks in the Gudivada plant is only about 3lbs. per B. H. P. per hour.

To summarise the conclusions arrived at from an examination of many of the rice mills of this Presidency, it may be said that as regards the number of factories, the rice milling industry has developed rapidly in the last few years, but that broadly speaking, it cannot be said to have developed on lines that are altogether desirable. In the chief milling districts the industry has been detrimentally affected owing to the competition arising from an excessive number of mills. The result of this over production is that few are operated continuously at their maximum capacity; and that in consequence, capital which might have been diverted into other forms of industry with great economic benefit, is not being used to the best advantage. In the Circars for instance the crushing of cotton seed, and the manufacture of cement are natural industries which might profitably have been developed. Rice milling cannot be satisfactorily run as a small industry.

It should be taken up by large capitalists who are in close touch with the markets, who can buy up the raw materials at the most favourable time of the year, and who can therefore be expected to construct good mills.

It is the intention of the Department of Industries to undertake a systematic survey of the rice milling industry of the Presidency, and the deputation of an officer to study the latest methods of rice milling practised in Rangoon is under consideration. It has been suggested that the condition of the industry in the different districts should be studied, an examination made of the different markets, the transit facilities connected therewith, and of the disposal of the bye-products. It is also proposed to investigate the merits of the different classes of machinery having regard to the percentage of finished rice obtained, the appearance and finish of the rice, the quality of the bye-products obtained, and the cost of renewals. An investigation of the industry on these lines is greatly needed, and should be productive of much good.

L. B. Green.

**Discussion :—**

Mr. D. Balakrishnamurthi said that he had found the small rice milling plants, crowded so closely together between Cocanada and Rajahmundry, to be on the whole a success. In these parts the husk is a universal cattle-food, and the supply frequently not adequate to meet the demand. The mill ashes are frequently used in the reclamation of saline land and fetches as much as Rs. 3 per cart load.

Mr. Unnikrishna Menon said that, in Sholayandan, Madura district, the ryots were frequently handicapped by shortage of labour in the milling and pounding of paddy and that occasionally even males took part in such operations (Laughter).



Rai Sahib A. Rama Rao, chronicled his personal experiences of visits paid to rice milling factories for a series of years. In the earlier days he used to find about the mills hillocks of paddy husk which later gave place to smaller hillocks of ashes—the husk being used as fuel. Of recent years even these ash heaps were disappearing owing to a growing demand for this stuff as manure. He would very much welcome a small mill to be driven by cattle power as it would be within the means of even the ordinary ryot to purchase. The discussion was becoming quite interesting but the President was reluctantly constrained to stop it as the hour was late and one more paper was on the Agenda.

---

### **How to spread Agricultural Education among the Masses.**

---

The subject of agricultural education is engaging the prominent attention of the Government of India at present. The gigantic War that is being waged in Europe, has among other things, exposed the inadequacy of food production in the British Empire and awakened the statesmen and politicians who control its destinies to a sense of the necessity of improving and developing agriculture in different parts of the Empire so as to make it self-contained in the matter of food and other requirements of the Empire. India which is an essential component of the mighty British Empire is an Empire in itself with incalculable resources which, if but fully developed, will enable her to bear a large portion of the burden of the Empire in the different branches of its activities. It is but natural, therefore, that at a time when the resources of the Empire are being taxed to the utmost the Government of India, following in the foot-steps of the Imperial Government, should set its heart on the development of the agricultural, industrial and commercial possibilities of India. Not that this question was altogether neglected in the past; but a fresh impetus has been given to its solution in consequence of the revelations made by the War, though financially this is a time most unsuited for tackling