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RESEARCH PAPER

Milling Qualities of Some Local Varieties of Paddy

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ABSTRACT

The milling studies provide important information for the research associated with rice breeding and post-harvest technology of paddy and rice. It reflects varietal character, harvesting conditions and effect of pre-processing treatments. The milling studies were conducted in the laboratory and the results obtained were compared with the data collected from the rice mill test. The objective was to determine the milling quality of paddy varieties locally grown; BPT 5204, BPT 1768, 2716, NLR 28523, NLR 9672.

HIGHLIGHTS

- Rice mill test results revealed that the degree of polish was more by 2 per cent for the varieties. BPT 1768 (SF), 2716 and by 4 per cent for the varieties NLR 28523, NLR 9672 than that from the laboratory test results also the percentage of brokens were 3 per cent more for varieties of BPT 5204, BPT 1768(SF), 2716 and 4 per cent more for varieties NLR 28523, NLR 9672 than that obtained from the laboratory results.
- The laboratory results showed that the total yield was more by 2-3 per cent than that obtained from rice mill test results.

Keywords: Rice, yield, milling process, parboiling, rice mill

Rice is one of the major staple foods in the world. Over half of worlds population and more than 90 per cent population of the tropical Asia eat rice. Paddy is the most important cereal crop in India. A record production of paddy in 2020-21 is 122.27 MT. Odisha. Even by moderate estimates, the yield of rice has to be increased by 25 to 30 per cent, If the country is to remain self sufficient by 2025. In order to increase the paddy production, every effort is being made by using high yielding and non-lodging varieties, better irrigation facilities, application of fertilizers and adopting modern agronomical practices.

Milling quality of paddy is the measure of its performance during the milling process. It is expressed through (1) total rice out-turn or total yield and (2) head rice out-turn or head yield. Total yield is the amount of milled rice obtained from a given amount of paddy and it is expressed as per cent weight of the paddy. Head yield or whole rice out-turn is the amount of whole rice obtained by processing a given amount of paddy and it is also expressed as the per cent weight of the paddy sample. The measurement of milling quality of paddy is not only important in the rice processing industry, but also equally important in the fields of research assosciated with post-harvest technology of paddy and rice. The milling of paddy also reflects varietal character, harvesting condition and effect of pre-processing treatments.

On the other hand, head yield of rice is affected by harvesting conditions and pre processing

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treatments given to rice along with the varietal differences. Therefore, total yield is an expression of the potential of a paddy sample to produce rice and head yield is an expression to produce better rice quality. This information is of great importance for rice breeders in developing new high yielding varieties with better milling potential and to rice millers or procurement agencies in fixing the price of a given lot depending upon the potential milling quality of that lot. Further, head yield of paddy reflects the effectiveness of any post-harvest treatment like soaking, parboiling etc., which is given to paddy before the actual milling. Hence, the measurement of milling quality of paddy provides a basis for measuring the effectiveness of new treatments given to paddy during production and processing. Measurement of milling quality by a standard laboratory method assists in determining the performance of paddy varieties and also processing equipments.

In view of the above discussion, there is no information pertaining to qualities of native paddy varieties. Hence, this project is taken up to assess the milling qualities of paddy varieties locally grown in Andhra Pradesh.

The objective was to determine the milling quality of paddy varieties locally grown; BPT 5204, BPT 1768, 2716, NLR 28523, NLR 9672.

REVIEW OF LITERATURE

This chapter deals with the review of literature on milling qualities of paddy and the factors responsible for head yield, brokens and total yield.

Araullo *et al.* (1976) have observed that modern mills have an overall increase in total rice out-turn averaging 2.5% over sheller type units and 6.6% over huller units with respect to raw paddy. The increase in head rice yield was 6 per cent on an average for raw paddy in the modern mills as compared with existing sheller mills and an increase of 15 per cent with huller mills. Apart from giving significantly higher out-turn of total edible rice and head rice, the modern mills yielded rice of superior quality with less brokens and a negligible incidence of foreign matter.

Samajpati *et al.* (1984) observed that due to over-drying of paddy stalks in the field, the panicles become brittle and cracking develops in the grains and fall in the field. On the other hand, if the paddy is immature when harvested, it results in higher amount of breakage during milling.

Pillaiyar (1988) has found that more than the type of mill, the pre-milling conditions mostly determine the milling quality. In appropriate conditions of drying, moisture content, chalkiness, infestation and temperature caused increased breakage in raw rice during milling. Irrigated crop gave significantly higher head and total milled rice for both sundried and mechanically dried samples. The breakage during polishing was much higher in the short grain than in the medium and slender grain varieties, and after light shelling than after complete shelling. The breakage increased with an increase in the degree of polish and pressure of milling.

Banaszek and Siebenmorgen (1990) reported that a decrease in head rice yield of more than 20 percentage was found in the lowest at an initial moisture content of 9 per cent (wb) rice samples subjected to the highest relative humidity of 90 per cent. Lower reductions in head rice yield were found in the higher initial moisture content samples and at the lower relative humidity of 70 per cent.

Dasaradhi Rao *et al.* (1995) reported that eight varieties of *rabi* paddy were collected from Agricultural research station, Maruteru and analysed for milling quality at a moisture content of 8.5 to 11.8% and found that a total rice recovery, head rice recovery and brokens were 71.5%, 66.2% and 12.6% respectively.

The adjustment of the shelling machine depends upon the paddy variety and moisture content. For this purpose, rubber roll sheller was used.

MATERIALS AND METHODS

Rubber Roll Sheller

It consists of a rubber roll and a metal roll rotating in opposite directions at different speeds. A feeder feeds paddy uniformity to the machine. Paddy is fed in between the rotating roll and metal roll by the feeder. One of the roll is fixed while the other is adjustable to obtain desired clearance between them. The rolls are driven mechanically and the adjustable roll normally runs about 25% slower than fixed one. Difference in peripheral speeds of the

rolls develop a compression and shearing force on grain surface resulting in the opening and breaking of husk. The clearance between roll is kept smaller than the thickness of paddy grain. This clearance should be about half the thickness of paddy grain and may be adjusted subsequently by judging the shelling efficiency. If the gap between rolls is properly adjusted, this equipment can shell upto 95% of paddy fed to it. At decreased gap excess pressure results which cause more breakage of grain and can also cause colouring of shelled rice.

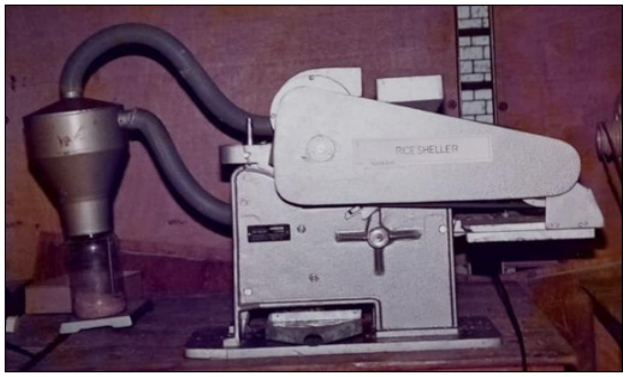

Plate 1: Rubber Roll Sheller (Lab Model)

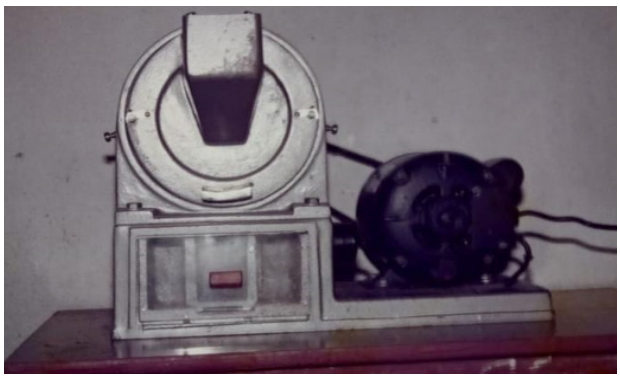

Plate 2: Polisher (Lab Model)

Plate 3: Rice Grader (Lab Model)

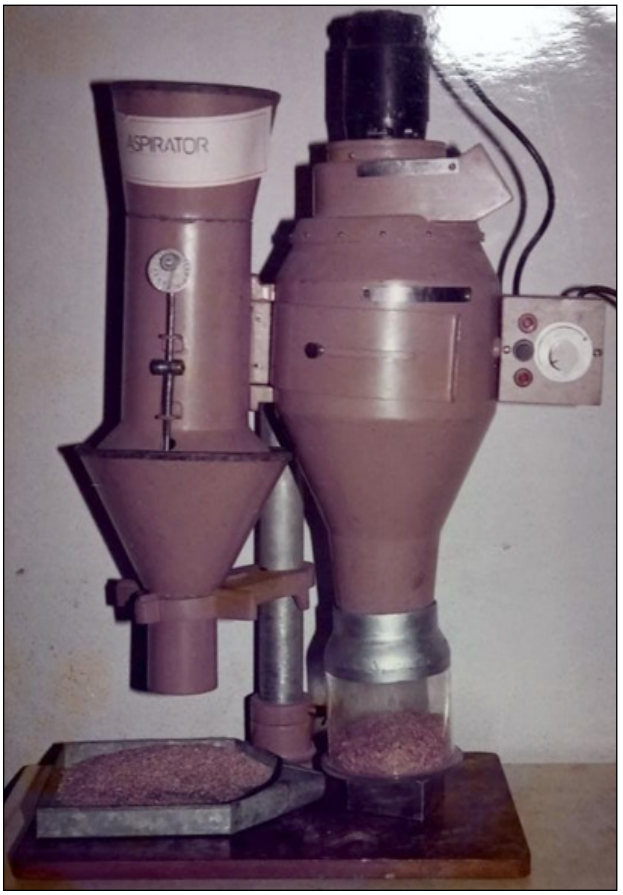

Plate 4: Aspirator (Lab Model)

Experimental Plan

Some locally available paddy varieties were selected and obtained from nearby rice mills and farmer. The varieties are BPT 5204, BPT 1768(SF), 2716, NLR 28523, NLR 9672.

Experimental Procedure

Paddy samples were drawn from various spots in the selected variety of paddy lot and thoroughly mixed to give a composite sample of 2kg. From the composite sample, 20 gms of paddy was taken for the measurement of moisture content of the paddy. Two hundred fifty grams of clean paddy was collected for the milling test. This paddy sample was shelled in a laboratory rubber roll sheller. The unshelled paddy was separated by hand and shelled again in the same machine. Weights of the shelled rice and husk are recorded to determine the per cent husk.

$$Per\ cent\ husk\ content = \frac{Wt.\ of\ husk}{Wt.\ of\ paddy\ shelled} \times 100$$

Brown rice was then polished in a sateke – Binni type rice polishes of laboratory model. The polished rice was then aspirated at low velocity of air flow to remove bran which may be adhering to the surface of the rice kernels. The bran was weighed separately. Degree of polish given to the rice was then calculated from the ratio of weight of bran to the weight of brown rice originally taken for polishing i.e.,

$$Per\ cent\ polish = \frac{Wt.\ of\ bran}{Wt.\ of\ brown\ rice} \times 100$$

The total yield of rice as defined earlier is calculated as follows:

$$Per\ cent\ total\ yield = \frac{Wt.\ of\ polished\ rice}{Wt.\ of\ paddy\ sample} \times 100$$

The percentage of head rice from the original paddy sample by weight is known as head yield, i.e.,

$$Per\ cent\ head\ yield = \frac{Wt.\ of\ head\ rice}{Wt.\ of\ paddy\ sample} \times 100$$

RESULTS AND DISCUSSION

Measurement of Moisture Content

The moisture content of the paddy samples were determined by hot-air oven method in which 20g of paddy samples were dried at 105°C for 24h. The moisture content of the different paddy varieties obtained from milling tests were shown in Table 1. There was no significant variation in the moisture content of different samples. Pre milling procedure, i.e., harvesting, drying and duration of storage, etc., were similar for all the samples and only cleaned and matured grains were selected for the experiments.

The milling quality of paddy was expressed in terms of the total milled rice and total head rice. The degree of polish, percentage husk, total yield, percentage brokens and head yield of the five varieties were discussed in detailed in the below sections.

Milling Test Results of BPT 5204 Variety

Milling test was carried out at a moisture content of 13.81 per cent. The results showed that the average value of total yield and head yield recoveries were 68.89 per cent and 63.89 per cent respectively. The percentage husk was 22.75 per cent. The degree of polish and percentage of brokens were 8.27 per cent and 7.27 per cent respectively. The results are shown in Table 2.

Milling Test Results of BPT 1768 (Superfine) Variety

Milling test was carried out at a moisture content of 15.21 per cent. The results showed that the average value of total yield and head yield recoveries were 69.34 per cent and 62.96 per cent respectively. The percentage husk was 23.53 per cent. The degree of polish and percentage of brokens were 8.4 per cent and 9.2 per cent respectively. The results are shown in Table 2.

Milling Test Results of 2716 Variety

Milling test was carried out at a moisture content of 13.12 per cent. The results showed that the average value of total yield and head yield recoveries were 71.54 per cent and 68.05 per cent respectively. The percentage husk was 22.15 per cent. The degree of polish and percentage of brokens were 8.37 per cent and 4.86 per cent respectively. The results are shown in Table 2.

Table 1: Moisture content of different paddy varieties selected for rice milling studies

Sl. No.	Name of Variety	Wt. of Sample (g)	Moisture Content, %(wb)			Avg.
			Rep.1	Rep.2	Rep.3	m.c % (wb)
1.	BPT 5208	20	15.89	13.83	13.70	13.81
2.	BPT 1768 (SF)	20	15.6	15.0	15.0	15.21
3.	2716	20	13.1	13.1	13.0	13.12
4.	NLR 28523	20	13.6	13.0	13.7	13.48
5.	NLR 9672	20	12.3	12.4	12.4	12.42

Table 2: Milling quality of some varieties of paddy analyzed by laboratory equipment

Variety	Wt. of Sample (g)	Wt. of brown rice (g)	Husk Content		Wt. of polished rice (g)	Total yield (%)	Wt. of bran (g)	Degree of polish (%)	Brokens		Wt. of whole rice (g)	Head Yield (%)
			Wt. of Husk (g)	Percentage Husk (%)					Wt. of Brokens (g)	Percentage brokens (%)		
BPT 5204												
R1	250	182.6	58.0	23.20	165.98	66.39	16.62	9.1	12.95	7.80	153.03	61.21
R2	250	191.2	55.6	22.24	175.52	70.21	15.68	8.2	12.11	6.90	163.41	65.26
R3	250	189.4	57.0	22.80	175.20	70.08	14.21	7.5	12.44	7.10	162.76	65.10
BPT 1768 (SF)												
R1	250	190.0	58.0	23.20	172.52	69.01	17.48	9.2	16.91	9.80	155.61	62.25
R2	250	188.0	60.3	24.12	172.40	68.96	15.60	8.3	15.69	9.10	156.71	62.68
R3	250	189.7	58.2	23.28	175.09	70.04	14.61	7.7	15.23	8.70	159.86	63.94
2716												
R1	250	197.5	53.1	21.24	180.71	72.29	16.79	8.5	8.67	4.80	172.04	68.81
R2	250	190.1	59.0	23.60	176.22	70.49	13.88	7.3	8.14	4.62	168.08	67.23
R3	250	198.0	54.0	21.60	179.59	71.83	18.41	9.3	9.28	5.17	170.31	68.12
NLR 28523												
R1	250	193.8	56.4	22.56	176.55	70.62	17.25	8.9	17.58	9.96	158.97	63.59
R2	250	194.0	56.7	22.68	180.03	72.01	13.97	7.2	18.35	10.19	161.68	64.67
R3	250	195.3	56.9	22.78	180.07	72.03	15.23	7.8	17.66	9.81	162.41	64.96
NLR 9672												
R1	250	190.0	58.0	23.20	172.71	69.08	17.29	9.1	18.26	10.57	154.45	61.78
R2	250	192.1	56.4	22.60	177.50	71.00	14.60	7.6	19.76	11.13	157.74	63.10
R3	250	188.8	59.8	23.92	173.32	69.33	15.48	8.2	17.09	9.86	156.23	62.49

Milling Test Results of NLR 28523 Variety

Milling test was carried out at a moisture content of 13.48 per cent. The results showed that the average value of total yield and head yield recoveries were 71.55 per cent and 64.41 per cent respectively. The percentage husk was 22.67 per cent. The degree of polish and percentage of brokens were 7.97 per cent and 9.99 per cent respectively. The results are shown in Table 2.

Plate 5: Laboratory test results of BPT 1768 (Superfine) variety

Milling Test Results of NLR 9672 Variety

Milling test was carried out at a moisture content of 12.42 per cent. The results showed that the average value of total yield and head yield recoveries were 69.8 per cent and 62.46 per cent respectively. The percentage husk was 23.24 per cent. The degree of polish and percentage of brokens were 8.3 per cent and 10.52 per cent respectively. The results are shown in Table 2.

With the test results obtained, a comparative study was made for all the varieties used. Fig. 1 showed that the total yield recovery of both the varieties 2716 and NLR 28523 was found to be same, i.e., 71.5 per cent and was more than the other varieties. Fig. 1 showed that the head yield recovery of 2716 variety was more than other varieties and was 68.05 per cent. Fig. 1 showed that the broken percentage was more in the NLR 9672 variety and was less in 2716 variety. Though all the varieties were milled for the same time, Fig. 1 showed that the degree of polish for the variety BPT 1768 (SF) was more than that of the other varieties.

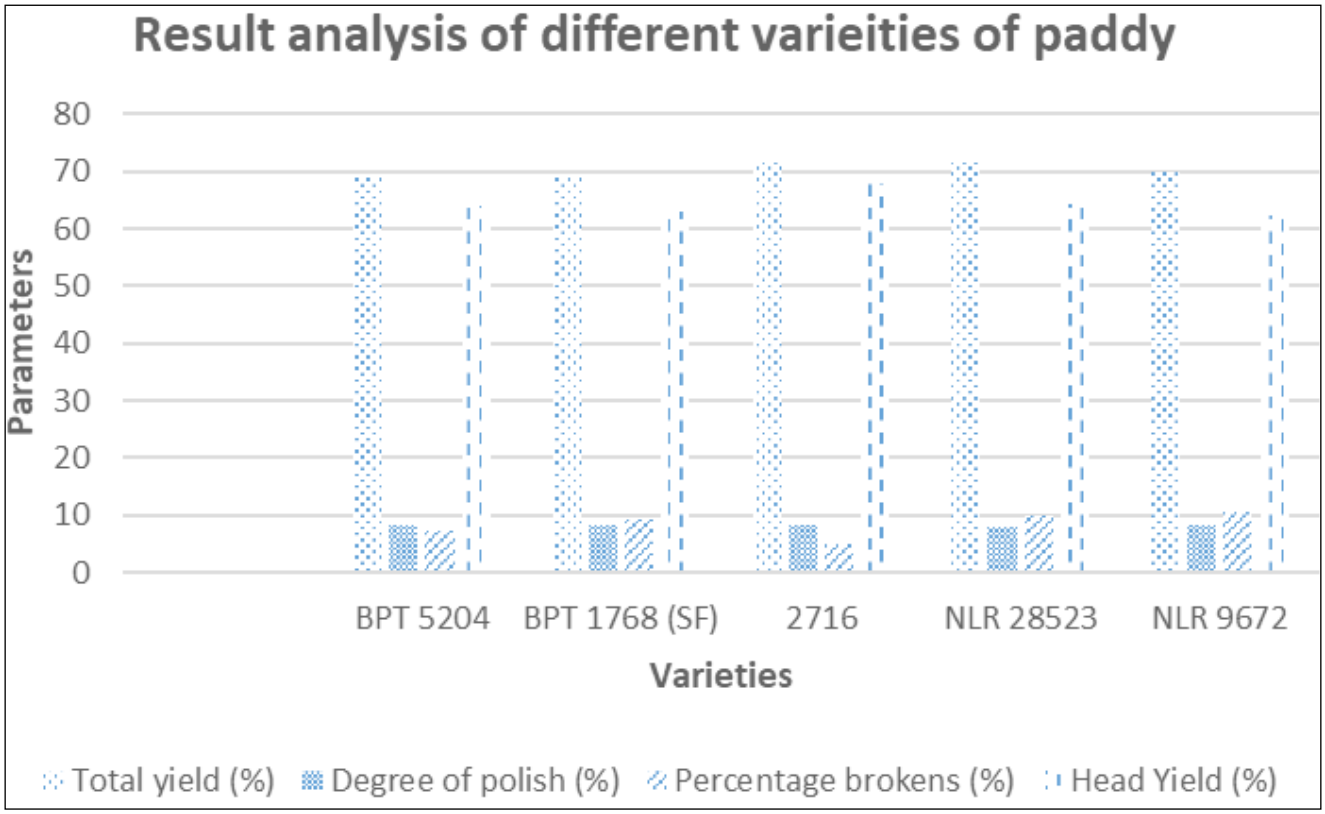

Fig. 1: Total yield, Head yield, Broken contents & Degree of polish of rice from different varieties of paddy

To make a comparative study of the milling quality of the paddy processed in the laboratory and that in the rice mill, data was collected from the rice mill, processing the test varieties.

Comparative study of the laboratory test results and rice mill test results was made. The results of the laboratory test showed that the percentage of husk of all varieties on an average was 2 per cent more than that obtained from the rice mill test. Rice mill test results also revealed that the degree of polish was more by 72 per cent for the varieties BPT 1768 (SF), 2716 and by 4 per cent for the varieties NLR 28523, NLR 9672, than that obtained from the laboratory test results. But there was only 0.5 per cent difference in the degree of polish for the variety BPT 5204. The percentage of brokens was 3 per centmore for varieties BPT 5204, BPT 1768 (SF), 2716 and 4 per cent more for varieties NLR 28523, NLR 9672 in rice mill test. The laboratory result showed that the total yield was more by 2 to 3 per cent than that obtained from tha rice mill test. The laboratory test results also showed that the head yield was more by 6 per cent for the variety, NLR 28523 and 4 per cent for the other varieties than the rice mill test. The comparative study revealed that the results of the paddy varieties processed in the laboratory were better than that the rice mill.

The rice mill test results showed that the percentage of brokens were 3 per cent more for varieties of BPT 5204, BPT 1768(SF), 2716 and 4 per cent more for varieties NLR 28523, NLR 9672 than that obtained from the laboratory results.

SUMMARY AND CONCLUSION

Paddy is the most important cereal crop in India. The total production of paddy was 84.74 million tonnes during the year 1998-99. The economic value of rice is affected by per cent head yield. The economic value of brokens is almost 50 per cent less than that of the head rice. The milling studies provide important information for the research associated with rice breeding and post-harvest technology of paddy and rice. It reflects varietal character, harvesting conditions and effect of pre-processing treatments. The information related to the milling characteristics of locally grown paddy varieties was not adequate. Therefore, this project was taken up to make an attempt to assess the qualities of paddy varieties before commercial milling process. and the following conclusions were drawn:

1. The total yield recovery of both the varieties 2716 and NLR 28523 was found to be same i.e., 71.5 per cent in lab test results.
2. The head yield recovery of 2716 variety was more than other varieties and was 68.05 per cent in lab test results.
3. The broken percentage was more in the NLR 9672 variety and was less in 2716 variety in lab test results.
4. Though all the varieties were milled for the same duration, the degree of polish for the variety BPT 1768 (SF) was found to be more than that of the other varieties in lab test results. The milling studies were conducted in the laboratory and the results obtained were compared with the data collected from the rice mill test.
5. The per cent husk of all varieties obtained by laboratory test was 2 per cent more than that obtained from rice mill test results.
6. Rice mill test results revealed that the degree of polish was more by 2 per cent for the varieties. BPT 1768 (SF), 2716 and by 4 per cent for the varieties NLR 28523, NLR 9672 than that from the laboratory test results.
7. The rice mill test results showed that the percentage of brokens were 3 per cent more for varieties of BPT 5204, BPT 1768(SF), 2716 and 4 per cent more for varieties NLR 28523, NLR 9672 than that obtained from the laboratory results.
8. The laboratory results showed that the total yield was more by 2-3 per cent than that obtained from rice mill test results.
6. The laboratory results also showed that the head yield was more by 6 per cent for the variety NLR 28523 and 4 per cent more for the other varieties than that obtained from rice mill test results.

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