Madras Agric. J. 91 (1-3) : 1-4 January-March 2004
https://doi.org/10.29321/MAJ.10.A00055

(107)

Studies on milling outturn of paddy varieties using rubber roll sheller

P. RAJKUMAR, N. VARADHARAJU AND V.V. SREENARAYANAN
Dept. of Agrl. Processing, Tamil Nadu Agrl. University, Coimbatore - 641 003, Tamil Nadu

Abstract: Paddy varieties namely ADT 41 and Basmati (extra long slender), CO 45 and ADT 38 (long slender), CO 43 and improved white ponni (medium slender) grains were dried under sun drying, shade drying and hot air drying at 30,40,50 and 60°C to the moisture content in the range of 12-14% w.b. They were shelled by using rubber roll sheller in order to increase the head rice recovery and milling outturn. The observations concluded that the time required for drying of extra long slender and long slender paddy varieties were comparatively lesser than medium slender varieties. The breakage was significantly higher in extra long and long slender varieties. From the milling results, it was found that the milling outturn and head rice recovery were significantly higher in shade dried paddy varieties. It was also observed that, as drying temperature was increased to 60°C the percentage of broken rice increased.

Key words : Rubber roll sheller, Milling, Head rice, Broken rice, Drying characteristics.

Introduction

The milling outturn of paddy depends on various factors such as variety, percentage of matured grains, moisture content, drying methods and milling techniques. The average outturn of rice for huller is 62-64% with 25-30% broken, resulting only 50% of the whole rice/head rice due to friction and heat developed by huller. But by using the rubber roll sheller, the milling out turn and percentage of head rice recovery can be increased (Adhikaranaike *et al.* 1988; Indudhar Swamy and Bhattacharya, 1979). Hence evaluating a suitable drying condition to reduce the breakage loss during milling of raw paddy varieties will be highly useful to increase the outturn and percentage of the head rice in milled rice.

Materials and Methods

Six varieties of paddy grains *viz.* 'ADT 41' and 'Basmati' (extra long slender), 'CO 45' and 'ADT 38' (long slender), 'CO 43' and improved 'white ponni' (medium slender) were dried under various drying methods *viz.* sun drying, shade drying and hot air drying at 30,40,50 and 60°C to the moisture content in the range of 12-14% w.b. (Sejwan and Kaplan, 1990; Kulshrestha *et al.* 1992). The dried grains were shelled by using a rubber roll sheller and polished in a lab model horizontal polisher. From the milled rice, the milling outturn and percentage of head rice and broken rice were statistically analyzed.

One kg of raw paddy in each variety was taken and dried under various drying methods as follows.

Sun drying : All the six varieties of paddy grains were dried under sun drying from 8.30 to 11.30 a.m. and 2.00 to 4.00 p.m. regularly. Then in the night, the grains were heaped for moisture equalization.

Shade drying of paddy varieties was carried out by drying in shade without heaping during the month of April to May.

Hot air drying of paddy grains was carried out by using mechanical cross flow drier. The drying air temperature was set as 30,40,50 and 60°C. Paddy grains were tempered for 12 hours when the moisture content reached in the range of 17-18%.

In all the above treatments drying was carried out till the moisture content of the grain reached in the range of 12-14% w.b (Lee and Son, 1989).

Table 1. Drying characteristics of extra long slender paddy varieties

Treatments	ADT 41			Basmati		
	Final weight (g)	Final moisture content % (wb)	Drying time h	Final weight (g)	Final moisture content % (wb)	Drying time h
T_1- Sun drying	904.0	12.94	9.0	899.6	13.01	9.0
T_2 - Shade drying	905.6	13.28	14.0	901.7	13.12	14.0
T_3 - Hot air drying at 30°C	906.4	13.17	9.0	899.6	13.51	10.0
T_4 - 40°C	904.0	12.94	7.0	900.4	13.09	8.0
T_5 - 50°C	903.2	12.86	5.0	903.2	13.36	5.0
T_6 - 60°C	905.2	12.61	4.0	902.8	13.32	4.0

Table 2. Drying characteristics of long slender paddy varieties

Treatments	CO 45			ADT 38		
	Final weight (g)	Final moisture content % (wb)	Drying time h	Final weight (g)	Final moisture content % (wb)	Drying time h
T_1- Sun drying	920.4	12.64	10.0	920.0	13.14	10.0
T_2 - Shade drying	920.0	12.6	12.0	921.2	13.26	12.0
T_3 - Hot air drying at 30°C	919.2	12.47	9.0	918.4	12.99	9.0
T_4 - 40°C	918.8	12.43	7.0	916.8	12.84	7.0
T_5 - 50°C	915.2	12.1	5.0	911.0	12.34	5.0
T_6 - 60°C	918.0	12.35	4.0	919.6	13.10	4.0

Table 3. Drying characteristics of medium slender paddy varieties

Treatments	CO 43			Improved White Ponni		
	Final weight (g)	Final moisture content % (wb)	Drying time h	Final weight (g)	Final moisture content % (wb)	Drying time h
T_1- Sun drying	960.8	12.61	9.0	916.9	13.0	8.0
T_2 - Shade drying	906.4	12.6	13.5	917.6	12.81	13.0
T_3 - Hot air drying at 30°C	907.2	12.79	9.0	917.2	12.77	9.5
T_4 - 40°C	906.4	12.6	7.0	914.4	12.5	8.0
T_5 - 50°C	904.8	12.46	5.00	914.8	12.54	5.0
T_6 - 60°C	902.4	12.23	4.0	916.4	12.7	4.0

From the dried paddy grains, under each treatment, three samples of 250 g each were taken for milling with lab model rubber roll sheller. While shelling the gap between the rollers was adjusted based on the thickness of paddy varieties (BIS, 1990). The total milling consisted of two operations *viz.* dehusking and polishing. The unshelled paddy was manuall separated from brown rice after dehusking. Th samples of clean brown rice were then polishe (3-5%) in a horizontal rice polisher. The millin outturn was the total milled rice obtained wit respect to cleaned paddy, whereas the hea rice outturn was the amount of full rice obtaine

Table 4. Milling outturn of paddy varieties (%)

Treatments	Variety						T-mean
	ADT 41	Basmati	CO 45	ADT 38	CO 43	White Ponni	
T_1 - Sun drying	70.0	70.2	70.4	70.5	71.0	71.2	70.55
T_2 - Shade drying	70.3	70.5	70.9	71.0	71.3	71.25	70.87
T_3 - Hot air drying at 30°C	70.15	70.6	70.9	71.17	71.5	71.5	70.97
T_4 - 40°C	70.12	70.4	70.3	71.1	71.4	71.2	70.75
T_5 - 50°C	70.10	70.1	70.3	71.12	71.3	71.0	70.65
T_6 - 60°C	70.0	70.1	70.1	70.9	71.1	71.0	70.50
V mean	70.1	70.3	70.48	70.96	71.26	71.19	70.71
Treatment CD 5% = 0.200	Variety CD 5% = 0.200			CD 1% = 0.227			CD 1% = 0.227

Table 5. Percentage of head rice recovery in milled rice

Treatments	Variety						T-mean
	ADT 41	Basmati	CO 45	ADT 38	CO 43	White Ponni	
T_1 - Sun drying	81.2	81.3	82.7	82.5	84.13	84.3	82.68
T_2 - Shade drying	83.2	83.4	85.5	85.7	86.5	86.3	85.10
T_3 - Hot air drying at 30°C	83.93	83.80	85.7	85.9	86.77	86.7	85.46
T_4 - 40°C	83.33	83.1	85.03	85.23	85.5	86.23	84.73
T_5 - 50°C	82.8	82.9	83.6	83.8	86.07	86.03	84.20
T_6 - 60°C	79.7	79.9	81.03	81.13	83.13	83.33	81.37
V mean	82.36	82.4	83.92	84.04	85.35	85.48	83.92
Treatment CD 5% = 0.186	Variety CD 5% = 0.186			CD 1% = 0.258			CD 1% = 0.258

by milling with respect to total milled rice and expressed in percentage. The percentage of head rice was determined manually and reported.

Results and Discussion

Drying characteristics of extra long slender varieties

The initial moisture content of 'ADT 41' and 'Basmati' grains was found as 21.3 and 21.8 per cent, respectively. The time taken for drying of 'ADT 41' and 'Basmati' under sun drying was 9 h, in shade drying - 14 h, hot air drying at 30°C-9 h and 10 h, at 40°C-7 h and 8 h, respectively. Then these varieties were also dried at 50°C and 60°C for 5 h and 4 hours, respectively to reach the moisture content in the range of 12-14 per cent. The results are shown in Table 1.

Drying characteristics of long slender varieties

The initial moisture content of 'CO 45' and 'ADT 38' grains were found as 20.2 per cent and 20.1 per cent, respectively. The time taken for drying of long slender paddy varieties under sun drying, shade drying, hot air drying at 30°C, 40°C, 50°C and 60°C was 10 h, 12 h, 9 h, 7 h, 5 h, and 4 hours, respectively for both 'CO 45' and 'ADT 38' paddy varieties shown in Table 2.

Drying characteristics of medium slender varieties

The initial moisture content of 'CO 43' and improved 'white ponni' was found as 20.8 per cent and 20.5 per cent, respectively. The time taken for drying of 'CO 43' and improved 'white ponni' under sun drying was 9 h and 8 h, shade drying 13.5 h and 13 h, hot air drying at 30°C-9 h and 9.5 h and at 40°C-7 h and 8 h, respectively. The time taken at 50°C and 60°C for both 'CO 43' and 'white ponni' paddy varieties is shown in Table 3.

From the drying rate, it was observed that, the time taken for drying medium slender

varieties were higher than long and extra long slender varieties. But the time taken for drying at 50°C and 60°C was 5 hours and 4 hours, respectively irrespective of the paddy varieties.

Milling outturn of paddy varieties

Milling outturn of paddy varieties was analyzed using Randomized Block Design (RBD) and shown in Table 4. From the analysis, it was observed that, among the treatments the milling outturn was significantly higher in hot air dried paddy varieties at 30°C followed by shade drying and drying under hot air drying at 40°C. But the variations in the milling outturn were found insignificant by drying at 50°C, 60°C and sun drying (Suresh Prasad, 1988).

Among the paddy varieties, the milling outturn was significantly higher for the medium slender (CO 43-71.26% and white ponni-71.19%) compared to long slender (CO 45-70.48% and ADT 38-70.96%) and extra long slender (ADT 41-70.1% and Basmati-70.3%) paddy varieties. Between long slender varieties the milling outturn was significantly higher in 'ADT 38' and also between extra long slender varieties the milling outturn was significantly higher in 'Basmati' compared to 'ADT 41'. These milling outturn values are comparable with the average values reported by Adhikaranayake *et al.* (1988).

Percentage of head rice and broken rice in milled rice

From the milled rice, percentage of head rice and broken rice was arrived and analysed using RBD. The results are shown in Table 5. From the table, it was observed that, the percentage of head rice was significantly higher in hot air dried paddy at 30°C and shade dried paddy varieties. It was followed by drying at 40°C and 50°C, respectively. It was also observed that, the percentage of broken increased as drying temperature was increased to 60°C (Suresh Prasad, 1988). The breakage of rice at this temperature may be due more moisture evaporation from the surface than the moisture migration from centre to the surface.

Among the parboiled paddy varieties, the percentage of head rice was significantly lower (percentage of broken rice was higher) in extra long slender varieties (ADT 41-82.36% and Basmati-82.4%) compared to long slender (CO 45-83.92% and ADT 38-84.04%) and medium slender (CO 43-85.35% and white ponni-85.48%), varieties.

Conclusions

From the results of the study, it was concluded that, the percentage of head rice was significantly higher in medium slender (CO 43-85.35% and white ponni-85.48%) than in long slender (CO 45-83.92% and ADT 38-84.04%) and extra long slender varieties (ADT 41-82.36% and Basmati-82.4%) paddy varieties. Hot air drying at 30°C and shade drying are better than other methods for paddy grains to get significantly higher milling outturn and head rice using rubber roll sheller.

References

Adhikaranayake, K., Palpane, K.B. and Gunathilake, J. (1988). Shelling performances of rubber roll sheller and disc sheller. *Trop. Post Harvest Tech.* **1**: 39-46.

Bureau of Indian Standards (1990). Agriculture produce milling machinery-paddy dehusker-rubber roll type test code. IS 9049, New Delhi.

Indudhar Swamy and Bhattacharya (1979). Breakage of rice during milling. *J. Food Process Engg.* **3**: 43-47.

Kulshrestha, J.K., Mishra, D.P. and Chauhan, G.G. (1992). Physical and chemical characteristics of grains. *J. Food Sci. Technol.* **29**: 284-286.

Lee, B.Y. and Son, J.K. (1989). Studies on milling properties to moisture content of rice. *Farm Products Utilization and Mycology*, **3**: 1-4.

Sejwan, K.S. and Kaplan, D.I. (1990). Influence of post harvest operations in the milling quality of rice. International *J. Trop. Agric.* **8**: 304-309.

Suresh Prasad (1988). Studies on stress crack from drying in paddy. *J. Agrl. Engg.* **25**: 57-62.

(Received: September 2002; Revised: December 2003)