DOI: 10.15740/HAS/AU/15.3/188-192
Agriculture Update
Volume **15** | Issue 3 | August, 2020 | 188-192
Visit us : *www.researchjournal.co.in*
ISSN-0973-1520

RESEARCH ARTICLE :

Effect of date of harvesting on yield and quality of different rice varieties

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ARTICLE CHRONICLE :
Received :
21.02.2020;
Revised:
09.06.2020;
Accepted :
10.07.2020

KEY WORDS :
Harvesting time, Rice, Hulling, Milling, Head rice recovery

SUMMARY : Greater attention should be paid for increasing the yield per unit area by growing modern varieties of rice through improved cultivation practices. An experiment was conducted for investigating the effect of variety and date of harvesting on yield performance of modern rice varieties during *Kharif,* 2012 at Agricultural Research Station, Bapatla. The experiment was laid out in a split-plot design with three replications. Main treatments comprised of four rice varieties namely, BPT 5204, BPT 2270, BPT 2231, NLR 34449, NLR 28523 and MTU 1010 and sub treatments comprised of three time of harvesting *viz*., 25, 30 and 35 days after flowering. Plant growth, yield attributes, yield and quality of rice varieties were significantly influenced by different dates of harvesting. BPT 2270 was found significantly superior to all other varieties in respect of effective tillers, grains panicle^{-1}, grain yield, straw yield and hulling per cent, milling per cent and head rice recovery. Among three harvesting times, the highest grain yield (6250 kg ha^{-1}) and straw yield (7314 kg ha^{-1}) were obtained when the crop was harvested at 30 days after flowering. The interaction effect of variety and date of harvesting was significant in respect of grain and straw yield. The highest grain yield (7771 kg ha^{-1}) was observed in BPT 2270 when harvested at 30 days after flowering. Therefore, optimum date of harvesting for higher grain yield may be 30 days after flowering for avoiding immature stage as well as shattering loss.

How to cite this article : Mrudhula, K. Anny and Veni, B. Krishna (2020). Effect of date of harvesting on yield and quality of different rice varieties. *Agric. Update*, **15**(3): 188-192; **DOI : 10.15740/HAS/AU/15.3/188-192.**

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BACKGROUND AND OBJECTIVES

Rice is the main food of the largest population of the World. About 90 per cent rice in the world is grown and consumed by the population of the Asian countries which constitute 58 per cent population of the World. In India, it occupies an area of 43.75 m ha with a production of 85.3 million tonnes. The average productivity of rice is 2.13 t/ha in India, which is far below the world's average of 3.7 t/ha (Jagtap *et al.,* 2012). In India, the demand for rice will increase because of population growth and an expected diet change. The country has to produce about 130 million tonnes of rice by 2025 to feed the ever growing population. The majority of this population rise is expected to be attributed mainly from developing countries, several of which are already facing issues of hunger and food insecurity. The yield of rice is much below compared to that of other rice growing countries. The per hectare yield of rice of

those countries is higher due to their adoption of improved varieties, modern farming technology and sophisticated cultural practices. Therefore, India has a tremendous scope of increasing her total production by augmenting per hectare yield through the use of modern technology. Moreover, Seed is a vital input of riceproduction which largely determines both the quantityand quality. Improvement of rice production can be achieved through different agronomic practices and treatments. Seed maturity has critical implications for seed quality in terms of their germinability and vigor. In timely harvesting of rice ensures good quality with higher yield (Ali *et al*., 1990). Grain yield and its quality depend on the right judgment at harvesting. Farmers usually harvest transplant rice at or beyond the full maturity stage and keep it in the field quite along time. This risk is more acute especially at the harvesting time of rice in *Kharif* season. Some times natural disaster and its area can be predicted before several days of its attacking. If the information about seed quality in relation to degree of seed maturity is available, seed crop can also be harvested at the reasonable time to overcome certain contingent situation. Hence, present study was under taken to evaluate the performance of rice varieties through different harvesting times to get quality seed with high yield. Harvesting time of rice crop is very important in respect of yield and yield contributing characters. If rice is harvested at proper time and stored in a proper way, 10-15 per cent more production will be obtained (CDP, 1995). Early or immature harvest may lead to low yield. Delayed harvesting results in high shattering, lodging, broken rice, decline yield of head rice (Bhatti *et al*., 1983). In the light of the above information the present study was undertaken to evaluate the varietal effect on yield and yield attributes under various dates of harvesting.

RESOURCES AND METHODS

The experiment was conducted during *Kharif*, 2012 at Agricultural Research Station, Bapatla during *Kharif*, 2012. The experiment was laid out in a split-plot design. The main treatments were rice varieties *viz.,* BPT 5204, BPT 2270, BPT 2231, NLR 34449, NLR 28523 and MTU 1010. The sub treatments were date of harvestings *viz*., 25 days after flowering (DAF), 30 DAF and 35 DAF. The unit plot size was 6.0 m × 5.4 m. Variety was randomly placed in the main plot and date of harvesting in sub plot. Each treatment was replicated thrice. Space between replications and between plots were 1.0 m and 0.5 m, respectively. Planting space was 20 cm × 15 cm between the rows and plants. Nitrogen was applied as per the treatments in three equal splits in the form of urea. First split of nitrogen was applied as basal dose at the time of planting of the crop remaining two equal splits of nitrogen was broadcasted at maximum tillering and panicle initiation stages. Phosphorus was applied at the rate of 60 kg P_2 O_5 ha^{-1} in the form of single super phosphate as basal and potassium 40 kg K_2O ha^{-1} in the form of muriate of potash was applied in two equal splits as basal dose at the time of transplanting and panicle initiation stage. Gap filling, weeding, irrigation and other necessary intercultural operations were done in proper time. Harvesting was done plot wise at 25, 30 and 350 DAF. Five hills were selected randomly from each unit plot for taking yield component data at harvest. One m^2 area from each plot was selected from the central portion and was cut manually from the ground level to take grain and straw yields. The harvested crop of each plot was separately bundled, properly tagged and then brought to the threshing floor. The harvested crops were threshed manually. The grain was cleaned and dried to a moisture content of 14 per cent. Straws were sun dried properly. Data recorded for yield parameters were compiled and tabulated in proper form for statistical analysis (Gomez and Gomez 1984).

OBSERVATIONS AND ANALYSIS

The findings of the present study as well as relevant discussion have been summerized under following heads:

Effect of variety :

The effect of variety was found to be significant in respect of all the yield and yield contributing characters. Results of the experiment revealed that significantly the highest plant height (128.6 cm) was recorded with NLR 28523 and the lowest plant height (80.6 cm) was found in NLR 34449 variety. The maximum number of effective tillers $hill^{-1}$ was observed in BPT 2270 (13) variety followed by BPT 2231 variety (12) which was significantly superior to NLR 28523. Significantly the highest panicle length (24.4 cm) was observed with BPT 2270 variety and the lowest panicle length (20.5 cm) was recorded with NLR 34449 variety. BPT 2270 produced the highest

number of filled grains panicle^{-1} (237) followed by BPT 2231 variety and the lowest number of filled grains panicle^{-1} (145) was produced by MTU 1010. The results expressed that the highest test weight (20.4 g) was obtained in MTU 1010 and the lowest weight was (14.4 g) in BPT 5204. The variation in 1000-grain weight might be due to differences of length and breadth of the grain that were partially controlled by genetic make-up of the varieties under study. The highest grain yield (6846 kg ha^{-1}) in BPT 2270 was mostly due to its more number of effective tillers, longest panicle length and more number of grains panicle^{-1} (Table 1). The lowest yield (4804 kg ha^{-1}) was found in MTU 1010 because of its lower effective tiller hill^{-1} and lower number of grains penicle^{-1}. The highest straw yield was found in BPT 2270 (7100 kg ha^{-1}) and the lowest was in NLR 34449 (5761 kg ha^{-1}) in Table 2. BPT 2270 produced significantly the highest hulling per cent (73.2 %) milling per cent (65.2 %) and head rice recovery (57.1 %) and the lowest hulling per cent (70.0 %), milling per cent (60.3 %) and head rice recovery (54.4 %) with NLR 34449 variety.

Effect of date of harvesting:

The effect of different dates of harvesting showed that significant effect on panicle length, number of grains per panicle, test weight and grain yield at 30 DAF but there is no significant effect on plant height, total effective tillers hill^{-1}. The effect of harvesting date was significant in respect of yield and all yield contributing characters. Significantly the highest panicle length (23.9 cm), maximum number of filled grains panicle^{-1} (210), highest test weight (18.5 g), highest grain yield (6250 kg ha^{-1}) and highest straw yield (7314 kg ha^{-1}) when the crop was harvested at 30 DAF. Grain yield per panicle and germination (%) were found high under 30 DAF reported by Baktiar *et al.* (2013). Similar conclusions were reported by Kady *et al*. (1992); Surek *et al*. (1996) and Asano *et al*. (1999). The lowest panicle length (22.7 cm), minimum number of filled grains panicle^{-1} (198), lowest test weight (17.6 g), lowest grain yield (5257 kg ha^{-1}) and straw yield (6143 kg ha^{-1}) were recorded when the crop was harvested at 25 DAF (Table 2). The lowest yield was obtained for harvesting at 25 DAF due to immaturity of spikelet. All of the above parameters

Table 1: Effect of dates of harvesting schedules on growth and yield attributes of different rice varieties

Main treatments	Plant height (cm)	No. of productive tillers/plant	Panicle length (cm)	No. of filled grains/panicle	Test weight (g)
Varieties					
MTU 1010	90.8	10	22.6	145	20.4
NLR 34449	80.6	10	20.5	162	15.4
BPT 5204	88.3	9	21.9	171	14.4
BPT 2231	101.8	12	22.7	228	18.3
NLR 28523	128.6	8	22.0	168	19.1
BPT 2270	104.7	13	24.4	237	15.5
S.E. ±	2.4	1.1	0.6	13.3	0.1
C.D.(P=0.05)	6.8	3.2	1.7	38.5	0.4
CV (%)	5.1	5.3	5.3	15.3	11.9
Sub treatments					
25 days after flowering	98.2	13	22.7	207	17.6
30 days after flowering	101.4	11	23.9	210	18.5
35 days after flowering	94.6	11	22.9	198	17.9
S.E. ±	2.2	1.7	0.2	2.4	0.04
C.D.(P=0.05)	NS	NS	0.9	7.2	0.13
CV (%)	6.8	6.7	5.8	9.6	4.7
Interaction					
S.E. ±	14.0	3.0	1.5	13.1	0.2
C.D.(P=0.05)	NS	NS	NS	36.3	0.5

NS= Non-significant

Table 2: Effect of dates of harvesting schedules on yield and quality of different rice varieties

Main treatments	Grain yield (kg/ha)	Straw yield (kg/ha)	Hulling %	Milling %	Head rice recovery %
Varieties					
MTU 1010	4804	5864	71.3	67.6	61.4
NLR 34449	5064	5761	70.0	60.3	54.4
BPT 5204	5854	6911	72.4	63.2	54.8
BPT 2231	5980	7005	72.9	63.0	55.3
NLR 28523	5772	6788	71.6	61.0	54.4
BPT 2270	6846	7100	73.2	65.2	57.1
S.E. ±	427	435	1.4	2.0	1.2
C.D. (P=0.05)	1232	1305	4.1	5.9	3.5
CV (%)	12.8	14.1	4.2	6.9	4.7
Sub treatments					
25 days after flowering	5257	6143	66.7	60.4	51.4
30 days after flowering	6250	7314	73.6	63.0	54.8
35 days after flowering	5654	6458	72.8	62.1	54.4
S.E. ±	187	276	0.8	0.3	0.6
C.D. (P=0.05)	564	830	3.1	1.2	1.9
CV (%)	9.7	14.2	3.3	1.5	3.8
Interaction					
C.D. (P=0.05)	739	926	2.5	3.5	2.5
CV (%)	NS	NS	NS	NS	NS

NS= Non-significant

Table 3: Effect of dates of harvesting schedules on grain yield of different rice varieties

Harvesting schedules	Varieties						
	MTU 1010	NLR 34449	BPT 5204	BPT 2231	NLR 28523	BPT 2270	Mean
25 days after flowering	3977	4633	6254	5500	5067	6100	5257
30 days after flowering	5597	5517	5833	6383	6400	7771	6250
35 days after flowering	4840	5033	5433	5476	6059	5851	5654
Mean	4804	5064	5854	5980	5772	6846	
	S.E. ±	C.D. (P=0.05)	CV (%)				
Harvesting schedules	427	1232	12.8				
Varieties	187	564	9.7				
Interaction	520	1561	10.4				

gradually increase upto full heading and thereafter decreased due to shattering and low moisture content of seeds. Significantly the highest hulling per cent (73.6 %) milling per cent (63.0 %) and head rice recovery (54.8 %) was recorded when crop was harvested at 30 days after flowering and the lowest hulling per cent (66.7 %) milling per cent (60.4 %) and head rice recovery (51.4 %) was obtained when crop was harvested at 25 days after flowering.

Interaction effect of variety and date of harvesting:

Interaction of variety and date of harvesting was significant in respect of filled grains per panicle, test weight and grain yield. The highest grain yield was recorded with BPT 2270 variety at 30 days after flowering (7771 kg ha^{-1}) and the lowest grain yield was obtained with MTU 1010 variety at 25 DAF (3977 kg ha^{-1}) in Table 3.

Conclusion:

From the results and discussion it has been found that the highest grain yield (6846 kg ha^{-1}) was obtained by BPT 2270 when it was harvested at 30 DAF. Therefore, it can be concluded that BPT 2270 has a great

potentiality to produce higher yield than other varieties and it should be harvested at 30 DAF for avoiding immature stage as well as shattering loss. Finally, it may be concluded that harvesting at 30 to 35 days after flowering (DAF) was found to be suitable for all of the grain characters of the tested varieties. These times are suitable for quality of seed. Maturity period and harvesting time is a so much important for quality seed production and escape from contingent situation.

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