American-Eurasian J. Agric. & Environ. Sci., 11 (1): 129-132, 2011
ISSN 1818-6769
© IDOSI Publications, 2011

Effect of Harvesting Time and Plant Residual on Agronomic Traits of Rice Ratoon

Davood Barari Tari

Department of Agronomy,
Ayatollah Amoli Branch, Islamic Azad University, Amol, Iran

Abstract: A field experiment was carried out in 2010 to investigate the effect of harvesting time and main plant residual on yield and yield components of rice. A split-split plot arrangement fitted into a Randomized Completely Block Design with three replications was used. Main factor was 3 harvesting times (T_1 : harvesting plant crop at physiological maturity T_2 : harvesting at 7 days after physiological maturity . T_3 : harvesting at 14 days after physiological maturity). Sub-factor was 3 varieties (Traditional Tarom , Langerodi Tarom , Hashemi Tarom) and with plant residual in three levels (cutting from soil surface, lodging method, control (no treatment on residual) as a Sub-sub factor. Results showed that plant height, total tillers , fertile tiller, filled spikeletes percentage , and ratoon grain yield were decreased with delaying harvesting time. The highest ratoon grain yield was obtained in traditional Tarom variety. Most and least ratoon grain yields were produced in laying method and control, respectively. The interaction effect between harvesting time , variety and main plant residual had no significant effect on rice ratooning characterisrics. Rice ratooning grain yield had positive and significant correlation with total tillers and panicles number per m^2.

Key words: Rice · harvesting time · Plant residual · Ratoon · yield

INTRODUATION

Ratooning is a technique for increase rice production and hence increase farmers income rice ratoon crop has short growth duration and its maturity take 35% to 65% of time for plant crop maturity [1, 2]. Ratoon crop is characterised by short height and less fertile tillers than plant crop [3]. Some results showed that 1000 grains weight in ratoon crop was less than that of plant crop 1000 grains [4]. It is critical to increase rice yield and decrease production inputs to offset the decrease in value.Therefore, a cultural practice that many producers have adopted as a result is the ratooning technique [5]. However, researchers need to discuss ongoing research to evaluate new and current varieties and hybrids under growing condition with emphasis on management practices to improve ratoon crop yield . Ratoon crop contributes significantly to the rice producer's income [6]. Increase in world population and key role of rice in people diet neccesitate development in rice cropping systems. Ratooning technique has positive characteristics such as high cooking quality, high taste, short growth duration and less production cost [7]. Ratoon grain yield is nonetheless affected by some factors such as. Main plant harvesting time, Climate condition, Water and fertilizer management in the ratoon. Temperature at ratoon reproductive stage, cutting plant crop height and growth regulators [8]. It has been opined plant crop should be harvested immediately when matured grains are at maximum and their stems are physiologically alive. Delaying in harvesting time cause low ratoon grain yield [9]. If ratoon growth encounter with low temperature, growth duration would be increased. In this case, the flowering stage encounter to fall cooling and strile spikeletes per panicle would be increased. In some varieties only upper or lower nodules have ability to produce germinate for producing ratoon [10]. Treating with plant residuals cause many different actions on yield because of carbohydrates amount in stems . Results showed many differences in this case that can be the results of differences between varieties in ratooning ability and environmental conditions. For this reason new techniques for treat with plant residuals could decrease this diffrences and increase ratoon yield.

Corresponding Authors: Davood Barari Tari, Department of Agronomy, Ayatollah Amoli Branch, Islamic Azad University, Amol, Iran. Tel: +98-9111187008.

MATERIALS AND METHODS

This experiment was carried out in 2010 at Research Filed located in Amol-Babol road (52°22' N, 36°28' E, altitude 28 m). A split-split plot arrangement fitted into a Randomized complete Block Design with three replications was used. The main factor was 3 harvesting times (T_1: harvesting time of main crop at physiological maturity statge . T_2: harvesting 7 days after physiological maturity stage T_3: harvesting 14 days after physiologicl maturity stage), sub-factor was 3 varieties (Traditional Tarom, Langerodi Tarom , Hashemi Tarom) and sub-sub factor was (cutting from soil surface, lodging method and control {no treatment on residual }). Plant crop transplanting was done in May at a spacing of 25cm×25cm. Before transplanting 150 kg P/ha and 100 kg K/ha were used in each plots. Nitrogen fertilizer were used in three split doeses, 70 kg N/hec before transplanting, 100 kg N/ha in early tillering stage and 30 kg N/ha in early panicle initiation stage for each plot. Standard cultural practices such as irrigation, weeding and fertilization were carried out until the crop matured. Time and methods of harvesting plant crop were done in each treatment. After harvesting, 100 kg N/ha used to each plot. After ratoon matured, 10 hills were selected from each plot for measure some characteristics such as height, total tiller and fertile tiller. Ten panicles were selected from each plot for measurement of panicle length, total spikeletes and fertile spikelets percentage. Grain yield was determined from harvest area of 5 m^2 adjusting to 14% moisture content Statistical analysis was done using the Statistically Analysis System [11] and mean values were compared by Duncan Multiple Rang Test (DMRT).

RESULTS AND DISCUSSION

Effect of Harvesting Time: Results showed that harvesting time had significant effect on height and grain yield ($P<0.01$) (Table 1). Also harvesting time had significant effect on total tillers and filled spikelets at ($P<0.05$) (Table 1). The tallest plant was 65.48cm, total tillers was 12.51 and filled spikelets percentage was 87.27% and were produced in first harvesting time (harvesting plant crop in physiological maturity) (Table 2). The highest grain yield (1420.1 kg/ha) and the least grain yield (1066.8 Kg/ha) were produced in first harvesting time (harvesting plant crop in physiological maturity) and third harvesting time (harvesting in 14 days after physiological maturity), respectively (Table 2). With delaying in harvesting time ratoon yield was decreased. The best time for harvesting plant crop for maximum ratoon yield is when stems are alive [12]. Delay in plant crop planting time and harvesting time caused decrease in growth duration and grain yield. Results of some experiment showed that in Abrill variety, IR841-63-5 line and IR889-55-4-6 line, the best ratoon grain yields were produced in planting date done in September [13]. With delaying in planting date, the plant crop grain yield was decreased, while ratoon grain yield was increased [14].

Effect of Variety: Total tiller and panicle numbers per m^2 were influenced significantly by variety ($P<0.05$) (Table 1). Traditional tarom had the highest total tillers (12.71) and panicles per m^2 (159.8), while the least were obtained from Hashemi Tarom (Table 2). The highest ratoon grain yield was obtained in traditional tarom (1470 kg/ha) ,while the least grain yield was produced in Hashemih tarom

Table 1: Mean square of rice ratoon morphologicl characteristics in different treatments

S.O.V	df	Plant height	Panicle length	Fertile tillers	Total tillers	Panicle per m^2	Filled spikelets (%)	Total spikelets	1000 grains weight	Grain yield	Harvest index
Rep	2	0.101ns	11.80 ns	0.656 ns	1.768 ns	123.6 ns	2.205 ns	43.281ns	0.684ns	1221.88ns	6.278ns
HTψ	2	452.22**	0.476 ns	1.065 ns	13.589*	141.91 ns	11.45 *	28.93 ns	0.377ns	797984.46**	5.901ns
Error (a)	4	4.12	0.654	0.430	1.316	124.90	1.213	40.88	0.310	3934.92	7.824
variety	2	1.75 ns	0.831 ns	1.189 ns	7.459*	878.8*	15.63 ns	2.105 ns	0.108ns	11567.32ns	3.737ns
HT×Variety	4	28.12 ns	1.327 ns	0.126 ns	0.232*	37.67*	18.24 ns	4.70ns	1.123ns	22084.72*	5.223ns
Error (b)	12	28.34	0.398	0.615	0.978	20.19	14.07	10.97	0.684	5442.64	3.013
TPRψψ	2	0.20	1.379 ns	3.819**	2.245*	27.84 ns	24.52 *	41.29*	0.594ns	104641.15**	4.322ns
HT×TPR	4	16.05 ns	1.876 ns	0.588 ns	0.374 ns	11.81 ns	5.63 ns	2.60ns	1.097ns	13337.55ns	3.231ns
Variety×TPR	4	9.08 ns	1.250 ns	0.216 ns	0.131 ns	16.31 ns	1.46 ns	5.21ns	0713ns	10654.91ns	11.653ns
HT×variety ×TPR	8	4.01 ns	0.213 ns	0.790 ns	0.244 ns	14.17 ns	2.49 ns	5.130ns	0.751ns	9075.45ns	9.151ns
Error	36	8.72	0.478	0.659	0.465	13.13	4.05	9.58	1.540	3906.7	6.781
CV		3.73	4.74	5.19	4.34	4.75	2.23	9.90	5.20	5.26	9.59

*, **, ns: significant at 5% and 1% probability levels and nonsignificant respectively

Table 2: Mean comparision of rice ratoon characteristics in different treatments

	Plant height (cm)	Panicle length (cm)	No of fertile tillers	No of total tillers	No of panicles per m^2	Filled spikelets (%)	Total spike-letes per panicle	1000 grains weight (g)	Grain yield (Kg/hec)	Harvest index (%)
HT										
T_1	65.48a	14.23a	11.34a	12.51a	137.1a	87.27a	27.99a	23.39a	1420.1a	45.49a
T_2	58.39b	14.22a	11.03a	11.53b	132.2a	85.11a	28.10a	23.40a	1229.2b	46.12a
T_3	57.87b	14. a	9.97a	10.10b	122.7b	82.7b	27.44a	23.62a	1066.8c	45.12a
Variety										
Traditional tarom	61.65a	14.77a	12.7a	12.71a	159.8a	85.56a	27.93a	23.57a	1470a	45.11a
Langerodi tarom	58.86a	14.03a	11.08a	11.74a	129.5b	87.06a	28.07a	23.50a	1314ab	46.56a
Hashemi tarom	60.23a	13.99 a	7.90b	8.13b	128.6b	86.84a	27.5a	24.9a	1132.1b	45.07a
TPR										
Lodging	60.52b	14.74a	11.56a	12.03a	131.2a	90.62a	28.97a	23.63a	1401.1a	41.28a
Cutting from soil surface	60.53b	14.39a	11.08a	11.53a	129.5a	87.04ab	27.93a	23.44a	1248.3ab	45.37a
Control	65.9a	15.08a	9.28a	10.17b	129.3a	83.8b	24.53b	23.34a	1067.6b	45.09a

Mean with similar letter(s) in each column are not significantly different at the 0.05 probability level to DMRT

Table 3: Correlation between morphological characteristics of rice

	Grain yield	Total tillers	Fertile tillers	Panicle numbers	Total spikelets	Filled spikelets	1000 grains weight
Grain Yield	1						
Totl tillers	0.460**	1					
Fertile tillers	0.259 ns	0.268 ns	1				
Panicle numbers	0.590**	0.473*	0.140 ns	1			
Total spikeletes	0.067 ns	0.080 ns	0.161 ns	0.091 ns	1		
Filled spikeletes	0.092 ns	0.008 ns	0.042 ns	0.094 ns	0.070 ns	1	
1000 grain weight	-0.062 ns	-0.016 ns	-0.089 ns	-0.015 ns	-0.051 ns	-0.028 ns	1

*, **, ns: significant at 5% and 1% probability levels and nonsignificant respectively

(1132 kg/ha). Plant height, panicle length, total spikelets per panicle, filled spikelets percentage,1000 grains weight, fertile tillers and harvest index were not influenced significantly by variety (Table 1) . Ratooning ability is result of the interaction between the genetical, climate and management variables [14]. Ratooning ability is an important and potential characteristics of rice varieties [15]., Japonica varieties had better ratooning ability than indica varieties. Some results showed some differences between varieties ratooning ability [15]. Some rice varieties like genetical ability to produce ratoon tiller, delay in leaf scenescence and root vegetation ability had effect on variety ratoon ability [16].

Main Plant Residual Effect: Fertile tillers and grain yield were influenced significantly (P<0.01) by main plant residual treatments and total tillers, filled spikeletes per panicle and total spikelets influenced significantly at %5 probability level by main plant residual treatments (Table 1). Higher total tillers (12.03) and filled spikelets (90.62%) and total spikelets (28.97) were obtained in lodging method (Table 2). The most and least filled spikelets percentage were obtained in lodging (90.62%) and control method (83 %) respectively. Also, the highest ratoon grain yield was obtained in the lodging method (1401.1 kg/ha) and the least ratoon grain yield were produced in control (1067.6 kg/ha) . Therefore, for increasing ratoon grain yield, high harvest height would be better. Results recommended 40 cm to 60 cm harvest height for high ratoon grain yield [10]. The best ratoon yield were produced in lodging method compare to cutting from soil surface method and control because of increase in total tiller, fertile tiller and total spikelets per panicle [6]. Correlations between yield and yield components showed that ratoon grain yield had positive and high correlation with total tiller and panicle number per m^2 at 1% probability level (Table 3).

ACKNOWLEDGEMENT

Financial support by Ayatollah Amoli Islamic Azad University is highly appreciated.

REFERENCES

1. Karunakran, K., N. Rajappan and C.A. Rosamma, 1998. Rice ratooning and ratoon-based system in Kerala. In: Rice Ratooning.p: 227-231. International Rice Research Institute. Los Banos, Philippines.
2. Jones, D.B., 1993. Rice ratoon response to main crop harvest cutting height. Agronomy J., 85: 1139-1142.
3. Mahadevappa, M., 1988. Rice ratooning practices in India. In: rice ratooning. p: 69-78. International Rice Research Institute. Los banos, Philippines.
4. Sutaryo, B. and B. Supriharto, 1993. Ratoon crop performance in some rice hybrids. International Rice Research Notes., 18: 18-19.
5. Turner, F.T. and M.F. Jund, 1993. Rice ratoon crop yield linked to main crop stem carbonhydrates. Crop Sci., 33(1): 150-153.
6. Esmaeili, M., 2006. Investigation treat with plant residual, Azolla and duck in weed controlling and rice ratooning characteristics. M.S. Thesis. Research and Science Islamic Azad University of Tehran. pp: 115.
7. Karbalaei, M.N., R. Sharafi Erfani and G. Nematzadeh, 1998. Harvesting ratoon. Iran Rice Research Institute, Newspaper, pp: 1-5.
8. Bollich, C.N., B.D. Web and J.E. Scott, 1988. Breeding and testing for superior ratooning ability of rice in Texas. In: rice ratooning. International Rice Research Institute. Manila, Philippines, pp: 47-54.
9. Bahar, F.A. and S.K. De Data, 1977. Prospects of increasing tropical rice production through ratooning. Agron. J., 69(4): 536-540.
10. Web, B.D., C.N. Bollich and J.E. Scott, 2002. Comparative quality characteristics of rice from frist and ratoon crops. Texas Agriculture Expriment Station Progress Report, 3324c. 12.
11. SAS Institute, 1996. SAS/STAT Users Guide, Version 6.12. SAS Institute, Cary, NC. Murata, Y.1997. Photosynthetic characteristics of rice plants and its culture significance . Bull. Nat. Inst. Agric. Sci. Japan Ser., D.9.
12. Hong, K.P., G.M. Shon, J.Y.K.B. Choi, Y.S. Lee and Z.R. Choe, 1991. Productivity of herbage yield of ratoon in rice plants in the southern region. Research Reports of the Rural Development Administration. Rice., 33(1): 74-78.
13. Krishnamorty, K., 1988. Rice ratooning as an alternative to double cropping in tropical Asia. In: Rice Ratooning . International Rice Research Institute. Manila, Philippines, pp: 3-16.
14. Jones, D.B. and G.H. Snyder, 1987. Seeding rate and row spacing effects on yield and yield components of ratoon rice. Agronomy J., 79: 627-629.
15. Naydo. B.S., 2004. Annual Rice Research Report. Regional Research Station University of Agriculture Science V.C. Farm Manrya Karnatake.
16. Vergara, B.S., F.S.S. Lopez and J.S. Chauhan, 2003. Morphology and physiology of ratoon rice. In: Rice ratooning. Pp: 31-40. International Rice Research Institute. Los Banos, Philippines.