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Ratooning Parameters of Two Rice Cultivar in Modified Planting Systems

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Abstract: In order to evaluation of quantity yield, harvest index and phonological traits of ratooning crop in two rice under agro systems at the north of Iran, an experiment was carried out as split plot in randomized complete blocks design based four replications at Neka, Mazandaran, Iran in 2011 and 2012. Planting systems were chosen as main plots (Conventional, Improved and SRI or System of Rice Intensification) and genotypes as sub plots (Tall plant: Sang Tarom and Hashemi Tarom; Short plant: Neda and Shiroodi). The minimum days number to physiological maturity was observed in SRI and improved system but the highest grain yield and harvest index had produced in SRI and improved system. Grain yield in var. Tarom Hashemi was in ratio 7.53% more than var. Sang Tarom. But harvest index for var. Tarom Hashemi more than var. Sang Tarom. At interaction of year×cropping system was notice that the most grain yield was produced at interaction of first year in SRI and improved system. At interaction of year×cultivar observed maximum grain yield was obtained at interaction of first and second year×var. Tarom Hashemi. Therfore, SRI was the soutable for ratooning harvesting in this location.

Key words: Cropping system, grain yield, growth period, ratooning, rice

INTRODUCTION

Rice continuous cultivation in the north of Iran has recently decreased rice production and farmers for increasing yield used nitrogen application resulting in coast increasing and production decreasing duo to highland sensitive to disease especially blast and lodging, where disease and lodging have caused major yield losses. Rice production in much of the world increasingly focuses on optimizing grain yield, reducing production costs and minimizing pollution risks to the environment (Koutroubas and Ntanos, 2003)http://agron.scijournals.org/cgi/content/full/98/1/168?maxtoshow=&HITS=10&hits=10&RESULTFORMAT=&andorexactfulltext=and&searchid=1&FIRSTINDEX=0&sortspec=relevance&volume=98&firstpage=168&resourcetype=HWCIT-BIB11. Rice is one the most important crops in developing countries and a main food stuff for about 35% of the whole world population (Becker and Asch, 2005). Customary and conventional rice cultivation is faced with many problems because the lack of proper understanding of rice requirements. Inappropriate use of the water, fertilizers and chemical pesticides increased production costs, reduced yield and destroyed resources and environment in the long term. The System of Rice Intensification (SRI) is a method of increasing the yield of rice and decrease of water using in farming. It was developed in 1983 by the French Jesuit Father Henri de Laulanie in Madagascar. Planting with wider spacing in a square pattern, rather than randomly or in rows, followed as did controlling weed growth by use of a soil-aerating push-weeder (Uphoff, 2005). The ability to provide nutrients and their absorption in the SRI system is more common methods of planting. The use of compost and organic fertilizers for gradual and steady share of nutrients, especially during the grain filling period associated with the increased volume of roots and soil to absorb more nutrients due to periodic irrigation increased grain yield. The use of compost and periodic irrigation under SRI system increased 3 tons per hectare yield compared to the conventional system of planting and this was for increase of panicle number per m^2 and filled spikelet per panicle (Barison, 2003). SRI system increased grain yield because of additive effects, periodic irrigation management, use of 3-3.5 leaves seedling, use of one seedling per hill with more space, square planting pattern and fertilization with the use of organic sources (Uphoff, 2005). Therefor, the aim of this research was evaluation of quantity yield, harvest index and phonological traits of ratooning crop in two rice cultivar under agro systems at the north of Iran.

MATERIAL AND METHODS

In order to investigate of quantity yield, harvest index and phonological traits of ratooning crop in two rice cultivar under agro systems at the north of Iran, an experiment was carried out as split plot in randomized complete blocks design based four replications at Neka,

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Table 1: Selected soil properties for composite samples at experimental site in 2011.

Soil texture	K (ppm)	P (ppm)	N (%)	OM (%)	pH	EC (μmohs/cm)	Depth (cm)
Clay-loam	220	12	0.18	1.58	7.81	0.22	0-30

Table 2: Selected soil properties for composite samples at experimental site in 2012

Soil texture	K (ppm)	P (ppm)	N (%)	OM (%)	pH	EC (μmohs/cm)	Depth (cm)
Clay-loam	216	11.42	0.22	1.61	7.52	0.68	0-30

Mazandaran, Iran in 2011 and 2012. The experimental farm is geographically situated at 43°, 36 N latitude and 13°, 53 E longitude at an altitude of 15 m above mean sea level. The soil was analysed and the soil of field was clay-loam (Table 1 and 2). This experiment was conducted as split plot in randomized complete blocks design based four replications. Planting system was chosen as main plots (Conventional system, improved system and SRI or System of Rice Intensification) and genotypes as sub plots (Tall plant: Sang Tarom and Hashemi Tarom; Short plant: Neda and Shiroodi).

Conventional system: conventional planting (rill and stack), mature seedling (35 days after sowing), <3 seedlings per hill, random planting arrangement, permanent flooding and keep water in all vegetation period in field, without drainage, use of chemical fertilizers (200 kg h^{-1} N, 100 kg h^{-1} P and 100 kg h^{-1} K) which P and K fertilizers were applied before transplanting and 75% N was used before transplanting and the rest of that was used 30 day after transplanting as top dressing fertilizer. Weeds control had done 28 and 40 day after transplanting by hand.

Improved system: Planting (rill and stack), semi mature seedling (25 days after sowing), two seedlings per hill with 20×20 cm^2 planting arrangement, permanent flooding and keep water in all vegetation period in field except one time drainage in tillering time, use of chemical fertilizers (200 kg h^{-1} N, 100 kg h^{-1} P and 100 kg h^{-1} K) which P fertilizer was applied before transplanting and 25% N and 50% K were used before transplanting and 25% N and 50% K were used 30 day after transplanting as top dressing fertilizers and the rest of N fertilizer was applied in heading time. Weeds control had done one time by herbicide and three times (28, 40 and 50 day) after transplanting by hand.

System of Rice Intensification (SRI): Young seedling (20 day after sowing), one seedling per hill with 10×30 cm^2 planting arrangement, two weeks use flooding system then periodic irrigation system, use of 10 ton h^{-1} compost (cow and sheep manures) before transplanting and nitrogen fertilizer application (46 kg h^{-1}) was applied 50 % before transplanting and the rest of that was in heading time. Weeds control had done by rotary weeder (two to four times) and be used within two to seven days. During the growth time, following characteristics was measured randomly from each plot. Grain yield was harvested from 4 m^2 from the middle of the sub plots with 12 % humidity. Data analyzed by SAS statistical software and averages comparison were calculated by Duncan's multiple range tests in a 5% probability level.

RESULTS AND DISCUSSION

Results in Table 3 showed that day number to initial heading and biological yield were significant in 5% level on cropping system and 1% level in cultivar treatment and day number to 50% flowering, day number to physiological maturity, grain yield and harvest index were significant in 1% in cropping system and cultivar treatment. Biological yield was significant in 5% level on interaction of year×cropping system. As, harvest index was significant in 5% on interaction of year×cultivar and cropping system×cultivar. Only day number to physiological maturity was significant in 5% level at triple interaction of year×cropping system×cultivar. Grain yield was significant in 5% level at interaction of year cropping system and year×cultivar (Table 3). The most number of days to initial heading (31.94 day), days number to 50% flowering (43.81 day) and days number to physiological (75.75 days) were observed in conventional system, that because of these results the least grain yield 1552 kg ha^{-1} and harvest index 29.95% had produced in conventional system. The least days number to initial heading 29.13 day, days number to 50% flowering 40.5 day were obtained in SRI. The minimum days number to physiological maturity (65.63 and 67.5 day) was observed in SRI and improved system but the highest grain yield equivalent to 1810 and 1774 kg ha^{-1} and harvest index 35.61 and 35.69% had produced in SRI and improved system. The maximum days number to initial flowering (31.1 day), days number to 50% flowering (43.33 day) and days number to physiological maturity (70.96 day) was observed for var. Sang Tarom and the minimum days to initial heading (29.52 day), days number to 50% flowering (40.58 day) and days number to physiological maturity (68.29 day) was obtained for var. Tarom Hashemi. Grain yield in var. Tarom Hashemi (1774.04 kg ha^{-1}) was in ratio 7.53% more than var. Sang Tarom (1649.88 kg ha^{-1}) (Table 4). Also, biological yield in var. Sang Tarom (5272.42 kg ha^{-1}) more than var. Tarom

Table 3: Mean square of planting system on ratooning phonological traits and grain yield in rice cultivar.

SOV	df	Days No. to initial heading	Days No. to 50% flowering	Days No. to physiological maturity	Grain yield (kg ha^{-1})
Year	1	17.52	2.08	3.00	5764.08
RY	6	9.70	7.47	25.88	8960.69
System (A)	2	33.94*	45.77**	464.25**	311301.08**
Y×A	2	17.52	1.02	18.25	44447.58*
Error	12	9.47	12.95	7.42	16396.19
Genotype (B)	1	30.08**	90.75**	85.33**	185008.33**
Y×B	1	2.08	14.08	10.08	57685.33*
A×B	2	1.33	15.25	10.08	18389.58
Y×A×B	2	2.08	14.08	13.08*	18931.08
Error	18	0.278	6.14	4.85	14711.83
CV (%)	-	5.07	5.91	3.16	7.09

**, *respectively significant in 1 and 5% level

Table 4. Mean comparison of planting system on ratooning phonological traits and grain yield in rice genotypes.

Treatment	Days No. to initial heading	Days No. to 50% flowering	Days No. to physiological maturity	Grain yield (kg ha^{-1})
Cropping system				
SRI	29.13^{b}	40.50^{b}	65.63^{b}	1810^{a}
Improved	29.88^{ab}	41.56^{ab}	69.50^{b}	1774^{a}
Conventional	31.94^{a}	43.81^{a}	75.75^{a}	1552^{b}
Cultivar				
Sang Tarom	31.10^{a}	43.33^{a}	70.96^{a}	1650^{b}
Tarom Hashemi	29.52^{b}	40.58^{b}	68.29^{b}	1774^{a}

^{ab}Values within a column followed by same letter are not significantly different at Duncan ($p \leq 0.05$)

Hashemi 4927.04 kg ha^{-1} (Fig. 1). But, harvest index for var. Tarom Hashemi (36%) more than var. Sang Tarom equivalent to 31.5% (Table 4). SRI increased grain yield because of additive effects, periodic irrigation management, use of 3-3.5 leaves seedling, use of one seedling per hill with more space, square planting pattern and fertilization with the use of organic sources (Uphoff, 2005).

At triple interaction of year×cropping system cultivar was showed that the most number of days to physiological maturity (80.75 days) was observed at interaction of first year in conventional system for var. Sang Tarom and the least number of days to physiological maturity equivalent to 65.25 and 64.25 days was obtained at interaction of first and second year in SRI for var. Tarom Hashemi (Fig. 1). At interaction of year cropping system was notice that the most grain yield was produced at interaction of first year in SRI and improved system (1836 and 1786 kg ha^{-1}) and second year×improved system (1784 kg ha^{-1}) and the least grain yield (1481 kg ha^{-1}) was observed at interaction of first year×conventional system (Figure 2). As, the most biological yield was produced at interaction of first year×improved system (5383 kg ha^{-1}) and second year×conventional system (5359 kg ha^{-1}) and the least biological yield 4843 kg ha^{-1} was observed at interaction of second year×improved system (Fig. 3).

At interaction of year×cultivar observed The maximum grain yield equivalent to 1798 and 1750 kg ha^{-1} was obtained at interaction of first and second year×var. Tarom Hashemi and the minimum grain yield

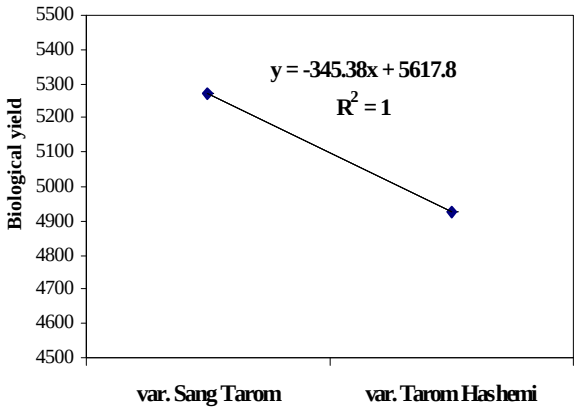

Fig. 1: Mean comparison of cultivar on biological yield per hectare

(1604 kg ha^{-1}) was produced at interaction of first year×var. Sang Tarom (Fig. 4). Also, the highest harvest index equivalent to 36.24 and 35.75% was obtained at interaction of first and second year with var. Tarom Hashemi and the least harvest index (30.17%) was obsetved at interaction of first year×var. Sang Tarom (Fig. 5). At interaction of cropping system×cultivar found that the maximum harvest index equivalent to 36.85 and 38.20% was produced at interaction of SRI and improved system with var. Tarom Hashemi and the minimum harvest index 26.95% had found at interaction of conventional system var. Sang Tarom (Fig. 6). The ability to provide nutrients and their absorption in the SRI system is more common methods of planting. The use of compost and

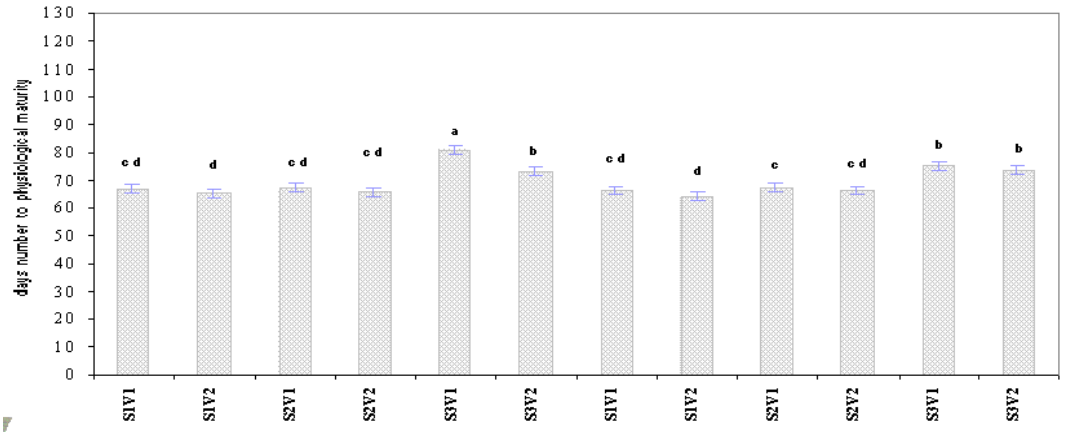

Fig. 2: Triple interaction of year × cropping system×cultivar on number of days to physiological maturity. S1, S2 and S3: SRI, improved and conventional system, respectively. V1 and V2: Sang Tarom and Tarom Hashemi cultivars, respectively

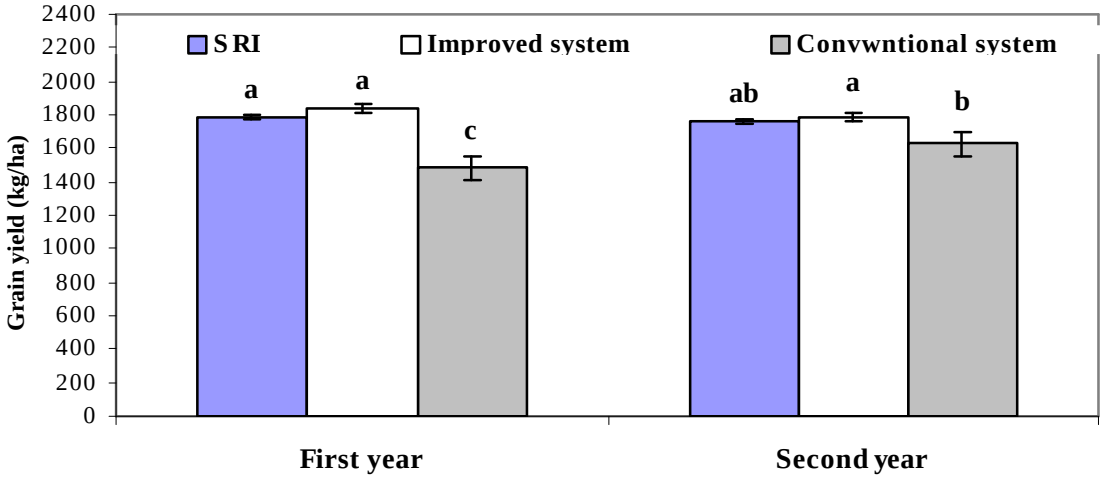

Fig. 3: Interaction of year×cropping system on grain yield

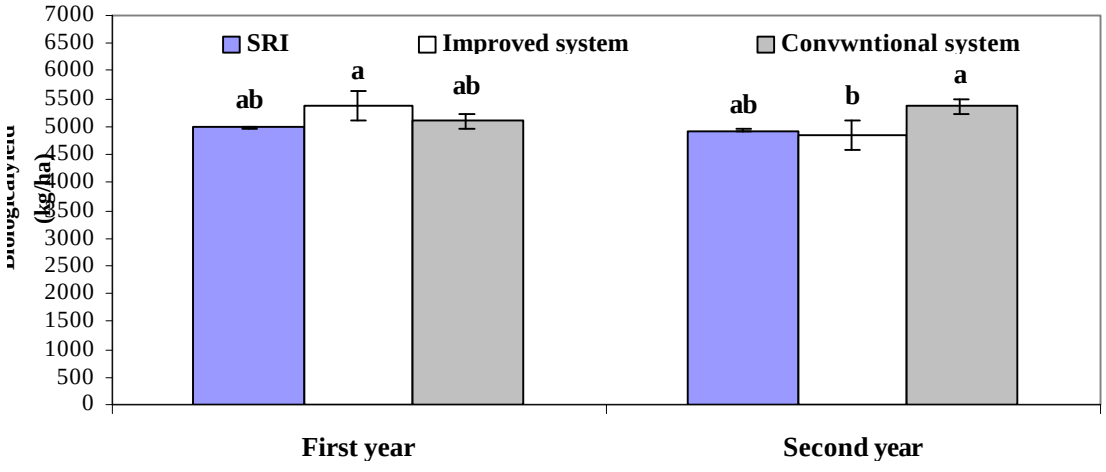

Fig. 4: Interaction of year × cropping system on biological yield

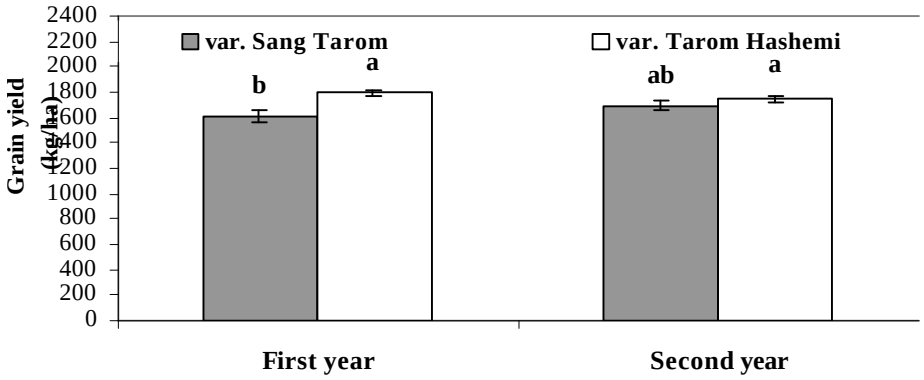

Fig. 5: Interaction of year × cultivar on grain yield

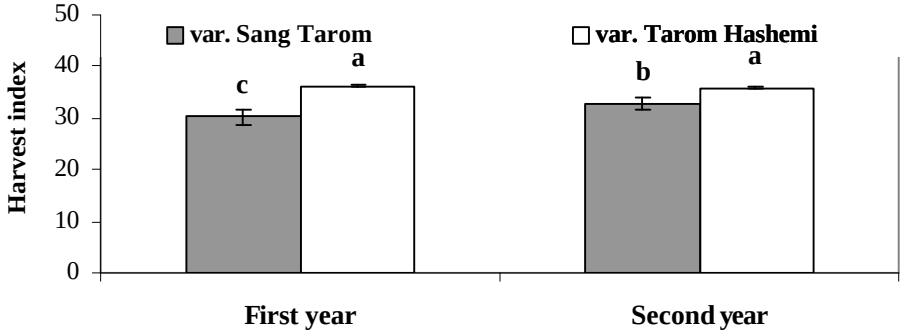

Fig. 6: Interaction of year × cultivar on grain yield

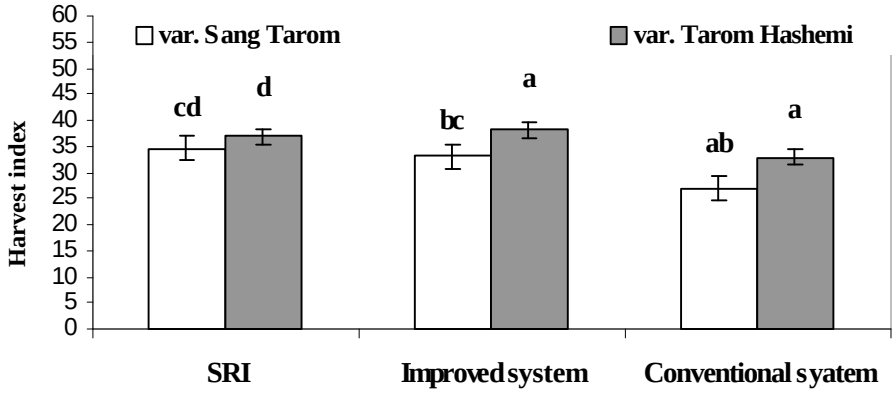

Fig. 7: Interaction of cropping system and genotype on harvest index

organic fertilizers for gradual and steady share of nutrients, especially during the grain filling period associated with the increased volume of roots and soil to absorb more nutrients due to periodic irrigation increased grain yield. The use of compost and periodic irrigation under SRI system increased 3 tons per hectare yield compared to the conventional system of planting and this was for increase of panicle number per m^2 and filled spikelet per panicle (Barison, 2003). SRI system increased grain yield because of additive effects, periodic irrigation management, use of 3-3.5 leaves seedling, use of one seedling per hill with more space, square planting pattern and fertilization with the use of organic sources (Uphoff, 2005).

CONCLUSION

The results showed that the least days number to initial heading, days number to 50% flowering 40.5 day were obtained in SRI.

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