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Possibility of Planting Rice in Semi-Cold Environment, (Case Study, Saman, Chaharmahal and Bakhtiari, Iran)

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ABSTRACT

In order to determine the best cold tolerant line of rice, Eight rice genotypes were compared in a randomized complete blocks design with three replicates in Saman town (one of the semi-cold places of Chaharmahal and Bakhtiari province) during 2012-2013. Results of combined analysis of variance showed significant differences among the genotypes for studied traits including; the number of days to the phenological stages (emerging 50% of panicles and 80% of maturity), plant height, the number of fertile and non-fertile tillers per plant, the number of fertile and non-fertile grains per panicle, weight of one thousand seeds and grain yield. Genotype code 14 (Stevela) with the highest number of fertile tillers per plant and the lowest number of no fertile grains per panicle produced the highest grain yield (6.640 t/ha) and was ranked higher than other genotypes. Three other genotypes (codes 1, 3 and 7) with an average yield of tons per hectare were in a class lower than code 14 but higher than control genotypes. Two control genotypes were Koohrang and local Champa, had an average yield of 4.625 t/ha.

***Keywords**:* Rice, Genotype, Yield, Cold tolerance.

INTRODUCTION

Rice with a cultivated area of about 150 million hectares and an average yield of 3.5 tons per hectare is the second important crop in the world after wheat. It alone is the main food for more than half of the world's people (Smith and Hamel, 2005). Since the low temperature is one of the

most limiting factors of rice production, therefore, cultivation of this crop will not be successful in the cold regions, unless using the cold tolerant cultivars (Maurice, 2000). Preliminary evaluation of 70 lines from landraces of Chaharmahal and Bakhtiari province led to the identification of 24 superior lines, and subsequent studies led to the introduction of Line 4 as the Koohrang cultivar (Nourbakhshian, 1999). In the another study, with the aim of increasing the rice cultivation area in semi-cold regions of Chaharmahal and Bakhtiari province, In this research, six selected lines from the preliminary study, along with control, were compared during two consecutive years (2011-2012) to identify the best line for semi-cold regions of the province.

MATERIALS AND METHODS

The study was conducted in Aliabad, Saman, Chaharmahal and Bakhtiari province, located on the shore of Zayandeh Rood river during 2012-2013. Eight rice genotypes were compared in a randomized complete blocks design with three replicates. This area is located in north-east of Shahrekord (30 km) with the high of 1860 meters above sea level. The long-term averages of the minimum and maximum annual temperatures are 4.02 and 23.14 °C, respectively and the average precipitation of the region is 324.4 mm (Anonymous, 2016). Six selected lines from the preliminary study of 2010 (Lido, 79014-IR14-1-1-2, Rosa-Manchatli, H270-85, Stevela and 12-310-1 which were specified as 1, 3, 7, 13, 14 and 18 codes, respectively) were compared with two common cultivars of the region (Koohrang and local Champa).

Seeds were cultivated in the open nursery after germination in warm and humid conditions. Transplantation was carried out at 4 to 5 leaves stage, (3 to 4 seedlings per hill and 20 cm distance between rows and plants on rows). The studied agronomic traits were: the number days to emerging 50% of panicles, the number days to 80% of maturity, average plant height, number of fertile and non-fertile stems per plant, number of filled and unfilled grains per panicle and weight of one thousand seeds. Different agronomic traits were measured during the growing season and after maturity. Obtained data were analyzed using SAS program (combined variance analysis). In case of significant difference among treatments, mean comparisons were done using LSD method (least significant difference).

RESULTS AND DISCUSSION

Results of combined variance analysis showed that there were significant differences ($p<0.01$) among the traits but the effect of year was significant on the number of fertile stems per plant, the number of filled and non- filled grains per panicle and paddy yield (Table 1).

Variance analysis of the number days to emerging 50% of panicles and 80% of maturity showed that there were significant differences among the studied genotypes. Result showed that genotype1 was the earliest genotype (122 days to 80% of maturity), whereas genotype18 was the latest (145 days) genotype (Table 2). Dorosti *et al.* (2004) and RahimSoroush *et al.* (2004) also

reported the high diversity in rice genotypes for traits such as the number of days to 50% of flowering and of maturity.

Genotypes were different in terms of average plant height. Control genotypes (Koohrang and local Champa) with the average plant heights of 111 cm and genotype code 3 with the height of 76 cm were the tallest and shortest genotypes, respectively. Since the height of all studied lines, except line 18, were lower than the control genotypes, these lines are expected to be favorable genetic resources for lodging resistance.

Results of this study indicated that genotypes had significant differences in the number of fertile and non-fertile stems per plant, as well as number of filled and unfilled grains per panicle. Genotype14 had the highest number of fertile stems and the lowest number of infertile stems per plant and also the least unfilled grains per panicle while genotype 18 had the highest number of infertile stems per plant and the highest unfilled grains. The weight of one thousand seeds was affected by genotype so that genotype1 produced the highest weight, whereas the lowest was belonging to control. Mean comparison of genotypes' yield during two years of experiment showed that genotype 14 with the average paddy yield of 6.64 ton/ha had the highest yield and was statistically different from control genotypes.

As mentioned earlier, Genotype14 had the highest number of fertile stems and the lowest number of non-fertile stems per plant and also the least unfilled grains per panicle which can be mentioned as the most important factors in justifying the higher yield of this genotype. Line 18 with the lowest number of fertile stems per plant, the lowest number of filled grains per panicle, the highest infertile stem per plant and the highest number of filled grains per panicle produced the lowest paddy yield per unit area (3.t3 tons/ha). Three other genotypes with codes of 1, 3 and 7 were ranked lower than genotype14 (with average paddy yields of 6.125, 6.212, and 6.227 tons/ha, respectively) but higher than control genotypes. Meanwhile, the average paddy yield of control genotypes (Koohrang and Champa) was 4.625 tons/ha. According to the two year results of this experiment, line14 which has entered the country by name of Stevela, is recommended as the best genotype for semi-cold regions of the province.

Table 1. Combined variance analysis of some studied traits

Source of Variation	Degrees of Freedom	Mean squares								
		Days to 80% of maturity	Days to 50% of panicles emergence	Plant height	The number of fertile panicles per plant	The number of infertile panicles per plant	The number of unfilled grains per panicle	The number of unfilled grains per panicle	1000-seeds weight	paddy yield
Year	1	52.08	72.52	132.04	22.41**	0.33	1399.03**	246.34**	0.062	4.148**
Rep(year)	4	6.27	15.40	5.22	1.83	0.06	79.48	10.12	0.002	0.114
Genotype	7	193.23**	445.16**	1036.81**	15.26**	9.13**	928.72**	242.74**	0.718**	6.395**
Year∗ Gen.	7	2.94	1.28	33.95	1.45	0.47	124.37*	10.98	0.011	0.307**
Error	28	3.41	3.28	8.18	0.64	0.39	24.25	18.86	0.005	0.025

* and ** indicate and ns indicate significant differences at 5% and 1% probability levels and no significant difference, respectively

Table 2. Mean comparison results of some studied traits

Genotype	Days to 80% of maturity	Days to 50% of panicles emergence	Plant Height (cm)	The number of fertile panicles per plant	The number of infertile panicles per plant	The number of unfilled grains per panicle	The number of unfilled grains per panicle	100 seeds weight (g)	paddy yield (tons/ha)
Code1	89.8d	122.e	84.08c	12.38ab	1.68cd	73.56d	19.97ab	2.75a	6.125b
Code3	94.7c	125.0d	76.02e	10.27d	1.13d	78.08d	13.76bcd	2.55c	6.212b
Code7	98.7b	124.7de	82.53cd	11.30bc	2.32bc	90.08c	18.61bc	2.63bc	6.227b
Code13	93.2c	132.2c	86.72c	10.67cd	2.60b	70.45d	18.26bc	2.70ab	4.740c
Code14	87.3d	127.2d	79.27de	13.62a	1.18d	94.59bc	6.07e	2.69ab	6.640a
Code18	105.0a	144.5a	93.97b	8.30e	4.72a	79.28d	25.68a	2.58bc	3.732d
Koohrang	98.2b	141.5b	112.02a	10.17d	1.03d	110.05a	8.95de	1.88d	4.733c
Local mass	99.8b	138.8b	110.47a	11.60bc	1.40cd	98.48b	12.77cde	1.97d	4.518c

there is no significant difference between means of each column with at least one common letter, according to LSD test

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