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Effect of Seedling Age and Planting Space on Yield and Yield Components of Rice (Neda Variety)

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Abstract: In order to study the effects of seedling age and planting spaces on yield and yield components of rice (Neda Variety) a field experiment was carried out in field of Ghaemshahr Azad University. Experimental design was arranged in split plot in basis of Randomized Completely Block design with four replication. Some agronomical traits such as total tiller number, fertile tiller number, panicle number per m^2, total spikelet per panicle, total strile spikelet per panicle, 1000 grains weight and grain yield were measured. Results showed that the effect of seedling age on total tiller number and panicle number per m^2 was significant at 0.01 probability level. Also seedling age had a significant effect on fertile tiller number at 0.05 probability levels. Planting spaces had a significant effect on total tiller, fertile tiller, panicle per m^2, total spikelet per panicle and grain yield. when the age of seedling is less than optimum, the tender seedlings may die in greater number due to high temperature and ultimately the plant population is reduced. For this variety transplanting in seedling age at 25 day and 15×15 cm planting space for the best performance of yield attributes were recommended.

Key words: Neda variety, yield and yield components, agronomical traits, rice

INTRODUCTION

Rice is the most important crop at the global level, as it used as a staple food in the most countries of the world (Dowling *et al*., 1998). Rice is the principle food crop of Iran feeding almost hundred percent of its population. Rice scientists are engaged in developing new high yielding varieties and management practices to increase the productivity per unit land area per unit time. Achieving a sustainable increase in rice production can improve global food security and contribute to poverty alleviation. The reason for such low yield mainly associated with cultural technologies. Among cultural technology application of best planting space is the important ones (Barari, 2005). The growth of rice plant is greatly affected both qualitatively and quantitatively by planting density (Hoseini, 2004). Transplanting of healthy seedlings of optimum age ensures better rice yield. When seedling are transplanted at right time, tillering and growth proceed normally. However when seedling stay longer in seed nursery bed, primary tiller buds on the lower nodes of the main culm often degenerate. Primary tiller buds of 4th to 7th nodes are held inside when seedling are planted at 7th leaf age (Matsuo and Hoshikawa, 1993). Age of seedling at the time of transplanting is an important factor for uniform stand establishment of rice (Paddalia, 1981). On the other hand, if the age of seedlings is more than optimum, the seedlings produce less tillers due to reduce vegetative period and thereby results in poor yield. Thus, to improve yield and quality of fine rice, optimum age of seedling for transplanting needs investigations. Selection of suitable planting density and seedling age are the most important factors for maximizing rice production.

MATERIALS AND METHODS

The experiment was conducted at field of Ghaemshahr Azad University in north of Iran. This experiment was laid out in split plot in basis of Randomized Completely Block design with four replications. The plot size was 15 m^2. main factor was seedling age in three levels (25, 35, 45 day) and minor factor was planting space (including 15×15 cm, 20×20 cm, 25×25 cm, 30×30 cm). All plots received 100 kg P_2O_5 ha^{-1} and 100 kg K_2O ha^{-1} before transplanting. The nitrogen fertilizer in the form of urea was applied at the rate of 132 kg N ha^{-1} in two split doses. Half of nitrogen fertilizer was applied before transplanting while the remaining quantity applied as top dressing in the maximum tillering

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stage, standards cultural practices were carried out until the plant was matured. Four hills (excluding border hills) were randomly selected from each plot for measuring total tiller number. Six hills (excluding border hills) were randomly selected from each plot prior to harvest for measure yield components. Grain yield was determined from harvest area of 6 m^2 adjusting to 14% moisture content. All statistical tests were done using the Statically Analysis System (SAS, Institute, 1996) and mean values were compared by Duncan Multiple Range Test (DMRT).

RESULTS AND DISCUSSION

Effect of seedling age: The seedling age had a significant effect on total tiller number and panicle number per m^2 at 0.01 probability level also seedling age had significant effect on fertile tiller number at 0.05 probability level (Table 1). The highest tiller number (18.67), highest fertile tiller number (17.55) and highest panicle number per m^2 (354.6) were obtained in seedling age at 45 day (Table 2). Seeding age had not significant effect on total spikelet per panicle, sterile spikelet per panicle, 1000 grains weight and grain yield. These findings are in conformity with those of Shahani *et al.* (1984), Chandra and Manna (1988), Ali and Rahman (1992) and Paul (1994), who stated that the seedling age had non significant effect on grain yield. The highest spikelet number per panicle (171.6) was obtained in 25 day seedling age. The highest grain yield (1018 g m^{-2}) was obtained in transplanting at 35 day seedling age. Alam *et al.* (2002) showed that the least tiller number was produced in seedling age at 21 day. In this research the least total tiller number was obtained in seedling age at 25 day.

Effect of planting space: Planting spaces had significant effect on total tiller number, fertile tiller number, panicle number per m^2, total spikelet per panicle and grain yield at 0.01 probability level. The highest tiller number (23.5), fertile tiller number (22.49) were obtained at 30×30 cm

Table 1: Mean squares of agronomical traits of Neda variety

Source of variation	df	Total tiller	Fertile tiller	Panicle m^{-2}	Spikelet per panicle	Sterile spikelet per panicle	1000 grains weight	Grain yield
Rep	3	2.101ns	2.156ns	2936.11ns	775.741ns	30.35ns	1.72ns	32308.91ns
Seedling age	2	31.541**	21.669*	16498.08**	198.136ns	28.49ns	3.05ns	4779.08ns
Error (a)	6	1.18	2.116	1102.278	159.03	57.39	0.961	5385.47
Planting spaces	3	342.29**	326.662**	71784.167**	1084.419**	49.63ns	2.318ns	119224.18**
Sa×Ps♣	6	2.93ns	1.916ns	1084.167ns	169.755ns	23.02ns	1.177ns	12458.25ns
Error (b)	27	3.486	2.527	623.333	207.177	18.58	1.108	11703.56
CV		10.87	9.72	7.78	8.57	22.82	3.45	10.78

♣ = Seedling age × Planting space, ns = Non significant, *, ** significant at 0.05 and 0.01 probability level

Table 2: Mean comparision of agronomical traits of Neda variety

Treatment		Total tiller No.	Fertile tiller No.	Panicle m^{-2}	Total spikelet	Sterile spikelet	1000 grains weight (g)	1000 grains weight (g m^{-2})
	25 day	15.88c	15.23b	29.06b	171.6a	18.03a	31.04a	1008.0a
Seedling age	35 day	16.98b	16.29b	318.0b	164.5a	18.21a	30.30a	1018.0a
	45 day	18.67a	17.55a	354.6a	168.0a	20.42a	30.26a	984.3a
	15×15 cm	11.07d	10.38d	427.3a	157.4c	21.93a	30.57ab	1129.0a
Planting spaces	20×20 cm	15.04c	14.25c	328.0b	163.2bc	17.79b	31.02a	1038.0ab
	25×25 cm	19.10b	18.31b	275.3c	178.6a	17.79b	29.95a	934.6b
	30×30 cm	23.5a	22.49	253.8d	172.9ab	18.03b	30.60ab	912.9b

Means with similar letter(s) in each column are not significantly different at the 0.05 probability level according to Duncan's Multiple Rang Test

Table 3: Interaction effect of seedling age and planting spaces on agronomical traits of Neda variety

Seedling age (day)	Planting space (cm)	Total tiller No.	Fertile tiller No.	Filled spikelet (%)	Panicle number m^{-2}	1000 grains weight (g)	Grain yield (g m^{-2})
25	15×15	25.4a	24.08a	90.88a	468.8a	31.5a	1149.0a
	20×20	24.15b	23.13a	90.85a	433.3a	31.35a	1125.0a
	25×25	20.98c	20.35b	90.18ab	379.8b	31.05a	1111ab
	30×30	20.30c	19.35bc	90.18ab	365.8b	30.85a	1053a-c
35	15×15	18.63d	18.00bcd	89.63ab	313.0c	30.80ab	1051a-c
	20×20	18.37d	17.58cd	89.58ab	309.8c	30.6ab	1010a-d
	25×25	17.1e	15.8de	88.58a-c	308.5c	30.5ab	998.8a-d
	30×30	14.18f	13.73ef	87.65a-c	271.01d	30.5ab	997.5a-d
45	15×15	13.85f	13.23fg	87.55a-c	268.5d	30.35ab	935.0b-d
	20×20	11.93g	10.98gh	86.72bc	261.8d	30.00ab	880.0cd
	25×25	11.00gh	10.40h	86.30bc	251.3de	29.85ab	871.3d
	30×30	10.35h	9.77h	85.33c	221.8e	29.05b	860.0d

Means with similar letter(s) in each column are not significantly different at the 0.05 probability level according to Duncan's Multiple Rang Test

planting spaces. The greatest panicle number per m^2 (427.3) and the highest grain yield were obtained in 15×15 cm planting space. Barari (2005) got almost the similar results which showed that in low planting spaces, grain yield was increased. Total spikelet per panicle (178.6) was produced at 25×25 cm planting space. The least grain yield was obtained at 30×30 cm planting space. Planting spaces had not significant effect on sterile spikelet number and 1000 grains weight. Paul *et al*. (2002) reported that high density reduced total tiller number per hill but fertile tiller number was improved by high density. Between 30, 45, 60 and 75 day seedling age, the highest grain yield was obtained at 45 day seedling age and increase in seedling case reduce in grain yield (Table 2).

Interaction of seedling age and planting space: The highest grain yield (1149 g m^{-2}) was observed in first seedling age in case of 15×15 cm planting space. The least grain yield (860 g m^{-2}) was produced in third seedling age with 30×30 cm planting space (Table 3).

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