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Effect of age of seedling, spacing and fertilizer frequencies on extra early rice variety: Pradhyumna (JGL- 17004) under late season condition in northern Telangana agroclimatic zone of Telangana state India

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Abstract
India is second largest (103.5 m t) producer after china (145.7 mt) (USDA, 2016). Delay in the release of canal water for irrigation due to late onset of monsoon is a common phenomena Northern Telangana agroclimatic zone of Telangana state. Agronomic practices such as transplanting age, plant spacing, and fertilizer frequencing in irrigated paddy production can have a significant impact towards the performance in rice growth and yield. A study was conducted during kharif season of 2013 and 2014 to investigate the optimum transplanting age, spacing and fertilizer frequency for extra early rice variety Pradhyumna (JGL-17004), under late season condition. The study treatments adopted were three main treatments representing age of transplanting viz., 15,20 and 30 days old seedlings, sub plots three spacing viz., 15X15, 15X10 and 10X10 cm and in sub - sub plots two fertilizer frequencies viz., and two slits – basal and panicle initiation or three splits - basal-maximum tillering and panicle initiation, replicated 4 times each. Results of the experiment depicted that transplanting seedlings at the age of 20 days at a spacing of 15 X10 or 10X10 cm and split application of fertilizer either in 2 splits (basal and panicle initiation) or 3 splits (basal, maximum tillering and panicle initiation) is most suitable for obtaining optimum grain yield in extra early rice variety (JGL – 17004) under late season condition at Northern Telangana Agro climatic zone of Telangana state, India.

Keywords: Rice, pradhyumna (JGL-17004) and seedling age

Introduction
Rice is the staple food of more than half of the world's population. In the World, rice is the staple food of half of the population in the world and grown in an area of 158.5 m ha with a production of 470.6 m t and productivity of 4.43 t ha^{-1}. India is second largest (103.5 m t) producer after china (145.7 mt) (USDA, 2016) [9]. Agronomic practices such as transplanting age, plant spacing, and fertilizer frequencing in irrigated paddy production can have a significant impact towards the performance in rice growth and yield. A study was conducted to investigate the optimum transplanting age, plant spacing and fertilizer frequency for extra early rice variety pradhyumna (JGL-17004), under late season condition at northern Telangana agroclimatic zone of Telangana state in India. The study treatments adopted were three main treatments representing age of transplanting viz., 15,20 and 30 days old seedlings, sub plots three spacing viz., 15X15, 15X10 and 10X10 cm^2 and in sub - sub plots two fertilizer frequencies viz., three splits - basal-maximum tillering and panicle initiation and two slits – basal and panicle initiation, replicated 4 times each. The experiment was set in double-split plot design.

Materials and methods
The field experiment was conducted at Regional Agricultural Research Station, Jagtial, Karim nagar district of Telangana state in India. The farm is geographically situated at 780 45'E to 79 0 0'E Longitude and 180 45' N to 190 0' N Latitude. The climate of polasa, Jagtial was classified as subtropical. The southwest monsoon usually sets in during June-October second week giving 40-50 rainy days per year (IMD, 1978). Winter was generally milder at Jagtial and temperature begins to rise from January and reach it peak by May. Weather data were recorded at the meteorological observatory located at Regional Agricultural Research Station (RARS), Jagtial, Karim nagar district, Telangana The experimental site was a typical clayey soil, (8.22 pH) in reaction, non-saline (0.47 dS m^{-1}) in nature and medium in organic carbon (0.79 g kg^{-1}).

The soil under study was low in available nitrogen (107.6 kg N ha^{-1}), medium in available phosphorus (19.6 kg P_2O_5 ha^{-1}) and high in available potassium (364 kg K_2O ha^{-1}) at the initiation.

Treatment

There were three sets of treatments in the experiment, viz. age of the seedling at transplanting, spacing, fertilizer frequencies, three different seedling ages, i.e., 15 days, 20days and 25 days and transplanted at three different spacings viz., 15X15cm, 15X10 cm and 10X10 cm and two different fertilizer frequencies three split application (basal, Maximum tillering & Panical initiation), two split applications (basal & Panicle initiation) in the experimental plot.

Experimental design and lay out

In the experiment, double split design was followed with four replications. Treatment combinations were assigned at random within a block. Each plot size was 4.0 m x 2.5 m; total numbers of plots were 72; and the individual plot and the block were separated for irrigation and drainage by 0.5 m and 1.0 m channel, respectively.

Land preparation and other activities

The experimental plot was well prepared for seedling transplantation using modern technology. Fertilizers were applied in the form of urea, single super phosphate, muriate of potash, gypsum, and zinc sulphate, respectively, at the time of land preparation and different stages of plant growth. Seedlings at 15, 20, and 25 days old were transplanted in the well puddled experimental plots properly. Harvest and post-harvest operations were performed accordingly.

Data collection

Average plant height was recorded from 10 randomly selected plants in each plot. The plant height was measured from the base of the plant to the tip of the uppermost spikelet of the panicle of the same plant. To get the total tillers per hill, whole tillers were counted from each sample and then average of 10 hills was taken and presented as tillers per square meter. The rice grain and straw yield of net plots area was recorded. It was sun dried up to a constant weight. Then the grain was weighed and the grain weight $plot^{-1}$ on the sun dry basis was determined. The yield of straw in kg $plot^{-1}$ was converted into kg ha^{-1}. Length of panicle was measured from each panicle in cm from the first node to the tip of panicle and then averaged. Ten panicles were randomly selected from each harvested hill.

Statistical analysis

The collected data were statistically analyzed using ANOVA technique with the help of computer package program OPSTAT (1998).

Results ad discussion

Effect of age of transplanting on yield and yield attributing characters

Agronomic practices such as transplanting age, plant spacing, and water application regimes in irrigated paddy production can have a significant impact towards the performance in rice growth and yield. Under late season condition in both the years (2013 and 2014) the variety pradhyumna performed better when transplanted with 20 days old seedling than 15 or 30 days old seedlings which had higher number of effective tillers per square meter and the longer panicle length. Mahmud *et al* 2017 [8] reported that higher grain yield was obtained from early transplanted rice than late. He observed significant yield decrease by delay in transplanting. Paul Reuben *et al* 2016 [10] studied the Influence of transplanting age on paddy yield under the system of rice intensification and reported that transplanting rice seedling at younger age of 8 to 12 days was has shown to be more potential in terms of higher number of tillers per hill over 15 days seedlings.

Effect of spacing on yield and yield attributing characters

Table 1: Pant height (cm) and effective tillers (No.m^2) of rice as influenced by the treatments during 2013 and 2014 under late season condition

Treatment		Plant height (cm)		Effective tillers (No.m^2)	
		2013	2014	2013	2014
Age of transplanting	15DAS	88	80	308	310
	20DAS	76	76	292	290
	30DAS	64	63	270	265
	CD (P=0.05)	10	4.7	4.9	13.08
Spacing between rows and hill	15X15	74	73	242	240
	15X10	78	77	298	285
	10X10	81	80	329	320
	CD (P=0.05)	4	4	4.9	22.66
Fertilizer application frequencies	B, MT, PI	78	76	283	282
	B &PI	74	72	302	298
	CD (P=0.05)	NS	NS	NS	NS

Pradhyumna an extra early duration variety under late season condition performed better at a spacing of 10X10 cm and a spacing of 15X10 cm was comparable with it. Chandrakar and Khan (1981) [3] studied the effect of spacing of 10 x 10 cm, 15 x 10 cm and 20 x 10 cm on the grain yields on early, medium and late duration tall growing indica rice varieties and found that the spacing of 20 x 10 cm2 gave the highest yields for medium and late varieties, while the spacing of 10 x 10 cm gave higher yield in case of early maturing varieties.

Table 2: Panicle length (cm), filled grains (No.) and grain yield of rice as influenced by the treatments during 2013 and 2014 under late season condition.

Treatment		Panicle length (cm)		Filled grains Per panicle (No.)		Grain Yield (kg/ha)	
		2013	2014	2013	2014	2013	2014
Age of transplanting	15DAS	19.4	19.6	110	127	3103	3165
	20DAS	20.5	20.3	120	147	3886	3397
	30DAS	16.2	15.8	91	103	3206	2604
	CD (P=0.05)	1.04	1.1	3.7	9	167	434.8
Spacing between rows and hill	15X15	19.2	19.0	92	128	3134	2829
	15X10	18.0	18.1	104	127	3464	3052
	10X10	18.2	18.6	115	124	3602	3285
	CD (P=0.05)	NS	NS	NS	NS	167	423
Fertilizer application frequencies	B,MT,PI	19.2	19.4	105	127	3391	3047
	B &PI	18.5	18.1	95	126	3405	3006
	CD (P=0.05)	NS	NS	NS	NS	NS	NS

Shahi *et al*. (1976) [11] studied effect of spacing 20 x 20 cm and 15 x 15 cm on the paddy yield, of dwarf rice variety Jaya. Although they did not find significant differences in the yields, yet the yields in case of 20 x 20 cm spacing, tended to be higher than that of the other spacings. Singh *et al*. (1983) [13] studied the effect of row spacing in combination with nutrient supply on grain yield of semi-dwarf upland rice variety Narendra 1 (IET 2232). The crop was grown by direct seeding in rows at three spacings of 15, 20 and 25 cm. The grain yield was more with 20 cm spacing as compared to other spacings. Bari *et al*. (1984) [2] studied the effect of plant density of 15 x 15 cm and 25x 25 cm between hill and rows and compared for their effect on grain yield and yield components of two standard varieties IR6 and IR8 and two mutant strains of rice Shadab and Shua-92. The plant density at spacing of 20 x 20 cm was more effective and gave significantly higher grain yield per plot than the other two plant densities at other spacings and was, therefore, most suitable for obtaining maximum yields. The grain yield per unit area depends evidently on the performance of individual plants, panicle density as well as the total number of plants grown on the area. In the present study the plant spacing at either at 15X10 or 10 X10 cm performed better in both the years (3602 kg $ha^{-1}$and 3285 kg ha^{-1} respectively)

Effect of fertilizer frequencies on yield and yield attributing characters

Adequate and balance supply of nitrogen promotes vigorous vegetative growth and deep green colour of the crop, application of nitrogen either in two splits (as basal and panicle initiation) or three splits (basal, maximum tillering and panicle initiation) resulted in similar growth and yield attributes. These results are supported by Ha and Suh (1993) [4], who reported more plant height by applying nitrogen in splits and lower plant height by applying whole nitrogen in one dose. Plant height reflexes the vegetative growth of crop plant in response to applied inputs. Plant height of rice crop was significantly affected by split application of nitrogen. Maske *et al*. (1997) [5] who reported higher number of total tillers per meter square with increased number of split application of nitrogen and minimum with applying full nitrogen during puddling. Greater the number of productive tillers per meter square greater will be number of panicles per meter square and ultimately higher grain yield results. Higher number of tillers per hill, more fertile tillers per meter square, more number of spikelets per panicle and higher 1000-grain weight. Similar results are also obtained by Mathew *et al*. (1990) [6]. They reported increased grain yield by applying nitrogen in splits.

Conclusion

In the present study on the basis of results, it is concluded that transplanting at 20 days old seedling with a spacing of 10X10 or 15X10 cm between rows and hills and fertilizer frequencing either in 2 splits (Basal and Panical initiation) or 3 splits (Basal, maximum tillering and Panical initiation) is most suitable for obtaining optimum grain yield in extra early rice variety (JGL – 17004) under late season condition at Northern Telangana Agro climatic zone of Telangana state, India.

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