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Research Article
Impact of different seeding densities onyield of direct seeded fine rice

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Abstract

A field experiment was conducted to evalute effect of four different seeding densities viz: 22.5 Kg ha^{-1}, 30 Kg ha^{-1}, 37.5 Kg ha^{-1} and 45 Kg ha^{-1} on the yield and yield components of fine rice (cv. Super Basmati) under direct seeded conditions at farmers field of Adaptive Research Station, Sialkot during the kharif season 2010-2012 with randomized complete block design. The results revealed that seed rate 37.5 Kg ha^{-1} produced maximum yield during all the three years. The data of number of productive tillers m^{-2} was found significantly different during 2nd and 3rd years but found non-significant during 1st year. The maximum number of productive tillers m^{-2} were produced by seed rate 37.5 Kg ha^{-1} during 2nd and 3rd year. The data of plant height showed gradual increase in plant height with the increase of seed rate but it only significantly differed during 1st year. These results showed that 37.5 Kg ha^{-1} seed rate in case of direct seeded fine rice performed better than low and high seed rates.

Introduction

Rice is the second largest cereal crop in Pakistan after wheat (Chaudhary, 1994) and considered a staple food of the whole world. Basmati rice of our *Kalar* tract is well known all over the world due to its special aroma and good quality. It is also a source of foreign exchange earnings. Rice cultivation in *kalar* tract is mostly done through nursery transplantation technique. But this is very laborious and time consuming technique (Usman, 2009). In this method transplantation is done manually and in the peak season of rice transplantation mostly labour shortage problem is faced by the farmers. Ultimately the process of transplantation is delaye resulting in poor growth of crop, less number of tillers, reduction in grain yield and lowered grain quality (Ghosh and Singh, 1994). Similarly for transplanted rice, puddling is done which need a lot of water and high water requirements also adverse the sustainability of rice system (Toung and Mortimor, 2005). In this scenario of high demand of water, shortage & high labour cost and late transplanting which results in poor plant growth and yield, direct seeding seems to be an alternative technology for rice cultivation. It is an economical, time & labour saving approach and yields are also comparable if crop is properly managed (Sunil et al., 2002). There is another major drawback in transplantation that required plant population cannot be maintained due to scarcity of skilled labour and high cost of this operation. So again direct seeding approach seems to be an alternative technique to maintain optimum plant population in a field of rice crop. Seeding rate is one of the important factors which affect the yield and economic returns of rice production (Li, 2004). Now the fact is that how much seed rate of fine rice should be applied in a field of one hectare so that an optimum plant population is obtained. The present study, therefore, was conducted to evaluate the proper seed rate of basmati rice in direct seeded rice technique in Sialkot district.

Materials and Methods

A field experiment was carried out by Adaptive Research Station, Sialkot during 2010-2012 at farmer s field. The trial

was comprised of four different seeding densities i.e. 22.5, 30, 37.5 and 45 Kg ha^{-1}. All the treatments were arranged in a randomized complete block design with three replications. The plot size was 20m x 50m. The variety super basmati of rice was sown on 13th June, 19th June and 4th June in 1st, 2nd and 3rd year respectively. The crop was harvested on 9th November, 12th November and 2nd November respectively. Recommended fertilizer and irrigation was applied at appropriate time. The crop of rice in all three years was raised as per the recommended package of practices. At the harvesting of crop data regarding productive tillers m^{-2}, plant height and grain yield were recorded according to their standard procedure and practices. The data were statistically analyzed by using the technique of analysis of variance and means were compared using LSD test at 0.05 % level of probability (Steel et al., 1997).

Results and Discussion

Grain yield (t ha^{-1})

Grain yield is most important parameter of rice crop from farmer s point of view. It is the parameter on which farmers socio-economic status depends. The data regarding grain yield of 1st year (2010) were found significantly affected by different seed rates (Table-1). According to data maximum grain yield (2.91 t ha^{-1}) was recorded in case of seed rate 37.5 Kg ha^{-1}. It was followed by 30 and 45 Kg ha^{-1} where 2.75 and 2.62 t ha^{-1} grain yield was recorded respectively. The minimum grain yield (2.32 t ha^{-1}) was recorded in case of minimum seed rate of 22.5 Kg ha^{-1}. The data of grain yield of 2nd year (2011) were also found significantly affected by different seeding densities. The trend was same and maximum grain yield (3.11 t ha^{-1}) was recorded in case of seed rate 37.5 Kg ha^{-1}. It was followed by 30 and 45 Kg ha^{-1} seed rate where grain yield 2.85 and 2.78 t ha^{-1} was recorded. The grain yield of these two seed rates was statistically at par. Again minimum grain yield (2.73 t ha^{-1}) was again recorded where minimum seed rate 22.5 Kg ha^{-1} was used. Moreover the grain yield of minimum (22.5 Kg ha^{-1}) and maximum (45 Kg ha^{-1}) seed rate was also statistically at par. The data of grain yield of 3rd year (2012) again varied significantly by different seed rates and showed the trend of 2010. In 2012 again maximum yield (3.37 t ha^{-1}) was recorded by seed rate of 37.50 Kg ha^{-1}.

Table. 1: Impact of different seeding densities on grain yield of direct seeded rice

Seed Rates (Kg ha^{-1})	1st YEAR (2010) Grain Yield (t ha^{-1})	2nd YEAR (2011) Grain Yield (t ha^{-1})	3rd YEAR (2012) Grain Yield (t ha^{-1})
22.50	2.32 D	2.73 C	2.62 D
30.00	2.75 B	2.85 B	2.97 B
37.50	2.91 A	3.11 A	3.37 A
45.00	2.62 C	2.78 BC	2.82 C
LSD	0.075	0.102	0.052

These results revealed that increase in seed rate increased grain yield upto certain limit but beyond this limit addition in seed rate lower the grain yield. The reason of these results might be that the addition in seed rate results in more plant population which develops a nutrient competition among plants and less light penetration and aeration occurred due to dense plant population which affected the photosynthesis process of plants. These results are in line with Bhattacharjee (1978) who reported that increasing seed rate increase paddy yield but upto a certain level. Similar results were reported by Akbar and Ehsanullah (2004).

Plant Height (cm):

Vegetative growth behavior of crop depends on plant height because it reflects the response of the inputs applied to plants. Data pertaining to plant height are represented in Table-2. It indicates that the plant height was increased with the increase of seeding density. The data of plant height of 1st year (2010) was found significantly different. The maximum plant height (85cm) was recorded for seed rate 45 Kg ha^{-1} while for seed rate of 37.5 Kg ha^{-1} the plant height was reported 82.33 cm. Both of these seed rates were statistically at par. In case of seed rate 30 Kg ha^{-1} plant height was recorded 81.67 cm and minimum plant height (80.33 cm) was reported in case of 22.5 Kg ha^{-1}. The results showed that 37.5, 30 and 22.5 Kg ha^{-1} were statistically at par. This increment in height might be due to crop competition which was developed due to increasing seed rate. Similar results were reported by Sharma (1992) who revealed that increase in seed rate increase the plant height. The data regarding plant height of 2nd and 3rd year (2011 and 2012 respectively) were found non significant. Similar results were reported by Akbar and Ehsanullah (2004) who stated that there was no significant effect of different seeding rates on the plant height.

Table 2: Impact of different seeding densities on plant height of direct seeded rice

Seed Rates (Kg ha^{-1})	1st YEAR (2010) Plant Height (cm)	2nd YEAR (2011) Plant Height (cm)	3rd YEAR (2012) Plant Height (cm)
22.50	80.33 B	79.00	83.00
30.00	81.66 B	80.67	78.67
37.50	82.33 AB	81.33	85.67
45.00	85.00 A	81.00	86.00
LSD	2.745	NS	NS

Number of Productive Tillers per m^2:

Number of productive tillers is one of major contributor in grain yield of cereal crops. The data of 1st year (2010) were found non-significant. The maximum number of tillers were observed in case of 37.5 Kg ha^{-1}while minimum number of tillers were observed in case of minimum seed rate (22.5 Kg ha^{-1}). The data regarding number of tillers of 2nd year (2011) revealed that there is a significant difference in number of tillers per m^2 due to different seeding densities. The maximum number of tillers (301) were recorded in case of seed rate 37.5 Kg ha^{-1}. It was followed by maximum seed rate i.e. 45 Kg ha^{-1} where 286 number of tillers were recorded. While 284 number of tillers were recorded by seed rate 30 Kg ha^{-1}. The minimum number of productive tillers (271) were recorded in minimum seed rate (22.5 Kg Kg ha^{-1}). The reason of more number of tillers in seeding density 37.5 Kg ha^{-1} might be due to the optimum plant population while in case of those treatments where seed rate was below than 37.5 Kg ha^{-1} produced less plant population but in case of increased seed rate, competition might be developed among plant which may result less productive tillers per unit area. Similar results were reported by Akbar and Ehsanullah (2004) and Shukla (1974). They stated that plant density above optimum level, decreased the number of effective tillers per unit area.

Table 3: Impact of different seeding densities on number of productive tillers

Seed Rates (Kg ha^{-1})	1st YEAR (2010) Number of tillers/ m^2	2nd YEAR (2011) Number of tillers/ m^2	3rd YEAR (2012) Number of tillers/ m^2
22.50	250.00	271.00 D	242.00 B
30.00	260.67	284.00 C	242.33 B
37.50	264.67	301.00 A	259.00 A
45.00	264.00	286.00 B	243.67 B
LSD	NS	0.998	11.801

The data of 3rd year (2012) differed statistically significant. The maximum number of tillers (259) were reported again in case of 37.5 Kg ha^{-1}. The remaining three seed rates i.e. 22.5, 30 and 45 Kg Kg ha^{-1} produced 242, 242.33 and 243.67 productive tillers per m which were found statistically at par with each other. Similar results were reported by Akbar and Ehsanullah (2004).

Conclusion

It is concluded from the experiment that 37.5 Kg ha^{-1} seed rate is the best suited for fine rice under direct seeded culture in Sialkot district. The low seed rate than 37.5 Kg ha^{-1} produced less productive tillers and less yield. Also higher seed rate than 37.5 Kg ha^{-1} may not contribute in the yield of fine rice due to poor growth and development because of inter plant competition.

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