RESEARCH ARTICLE

INFLUENCE OF CROP MANAGEMENT PRACTICES ON YIELD, YIELD ATTRIBUTES AND ECONOMICS OF HIGH ZINC RICE

M. Kumar*, H.L. Sonboir and Manish Kumar Singh

Department of Agronomy, College of Agriculture, IGKV, Raipur-492006 Chhattisgarh,India; Email: maheshkumarmargiya12@gmail.com

Received-15.11.2015, Revised-27.04.2016

Abstract: An experiment to evaluate influence of crop management practices on yield and economics of high zinc ricewas conducted at Research cum Instructional farm, I.G.K.V., Raipur, during *kharif*season of 2013. The experiment was laid out in factorial randomized block design with four replications. Treatment comprised of three spacing *viz.,*10cm x 10cm, 15cm x 10cm and 20cm x 10cm and three levels of nutrient *viz.*, 50%, 100% and 150% RDF. The result revealed thatspacing of 20cm x 10cm recorded higher panicle length, panicle weight, number of total grains/panicle, number of filled grains/panicle, test weight, grain yield, harvest index,gross return, net return and B:C ratio as compared to15cm x 10cm and 10cm x 10cm spacing.While higher number of panicle/m^2 and straw yield were recorded under 10cm x 10cm spacing. Among the different nutrient levels, application of 150 per cent RDF produced the highest number of panicle/m^2, panicle length, panicle weight, number of total grains/panicle, number of filled grains/panicle, test weight, grain yield, straw yield and harvest index. Nutrient levels were not found significant with respect to B:C ratio.

Keywords: Planting geometry, Nutrient levels, Economic, Yield attributes, High zinc rice

INTRODUCTION

Rice is most important staplefood crop for half of the world population. High zinc rice contains more than 24 ppm zinc.Efforts arerequired to increase low yield of high zinc rice per unit area to meetenough zinc to eliminate "hidden hunger," and food requirements of over growing population of the world. The most common reason for high Zn deficiency in humans is inadequate dietary zinc intake, particularly in the regions where cereal based foods are the major source of calories (Virk*et al.*, 2007). Zinc deficiency in human body causes undesirable consequences including growth retardation, dermatitis, impaired immune functioning, hypogonadism, delayed wound healing and poor mental development (WHO, 2002). Thus, growing of high zinc rice can make the difference between illness and a healthy life for millions of people around the world, and productive life.

The yield of rice can be increased through improved agronomic manipulations such as proper spacingand judicious use of fertilizer (BARI, 1995). The optimum spacing ensures the plant to grow in their both aerial and underground parts through efficient utilization of solar radiation and nutrients (Miah*et al.*, 1990). The plant to plant and row to row distance determines the plant population unit-^{1} area which has direct effect on yield. Closer spacing hampers intercultural operations, more competition arises among the plants for nutrient, air and light as a result plants become weaker and thinnerand consequently, and yield is reduced. So, it is most importance to determine optimum spacing for maximizing the yield of high zinc rice. Rice is one of the least fertilizer use efficient crop. Results of several studies have indicated that application of fertilizers increasegrain yield of rice by increasing the magnitude of its yield attributes(Panda*et al.*, 1995). Increase in yield attributing characters is associated with better nutrition and increased nutrient uptake which result in better and healthy plant growth and development (Kumar and Rao, 1992) leading to greater dry matter production and its translocation to the sink. Grain yieldof high zinc rice increased due to increased N,P and K uptake in responseto external supply of N,P and K fertilizers. Therefore, present investigation was carried out to find out effect of spacing and nutrient levels on grain yield, yield attributes and economics of high zinc rice.

MATERIAL AND METHOD

The proposed investigation was conducted to study the performance of crop management practices on yield, yield attributes and economics of high zinc rice. The experiment laid out at Research cum Instructional farm, I.G.K.V., Raipur, during *kharif* season of 2013. This site is located at 21^0 4' North latitude and 81^0 35' East longitude with an altitude of 290.2 meters above the mean sea level. The experimental soil was vertisols, neutral in reaction, low in available nitrogen and medium in available phosphorus and potassium content. Climate of this region is sub-humid with an average annual rain fall of about 1200-1400 mm and the crop received 1413.6 mm of the total rainfall during its crop growth. The weekly average maximum and minimum temperature varied in between 27.9^{0}C to 33^{0}C and 16.6^{0}C to 25.3^{0}C, respectively. The treatments consisted oftwo factors included in the experiment were as follows: Plant spacing-3 (i) 10cm × 10cm (S 1) (ii) 15cm × 10cm (S2), (iii) 20cm × 10cm (S3), nutrient levels-3 (i) 50%RDF (F1), (ii)

*Corresponding Author

100%RDF (F2), (iii)150%RDF(F3). The experiment was laid out in factorial randomized blockdesign with four replications. The test variety was R-RHZ-1 which was short duration. Recommended level of nutrient was 80:50:30 kg NPK/ha. Nutrients were applied as per the treatments of the investigation. The entire amount of Phosphorus and Potash and half dose of Nitrogen were applied as basal and remaining half dose of Nitrogen was applied in two equal splits viz. 25 per cent at active tillering and 25 per cent at panicle initiation stage. The Nitrogen, Phosphorus and Potash were applied in the form of urea, single super phosphate and muriate of potash, respectively. Transplanting of two or three seedlings/hill was done at the spacing of 10cm x 10cm, 15cm x 10cm and 20cm x 10cm spacing, respectively as per treatment. Crop was transplanted on 27.07.2013 and harvested on 20.10.2013. Normal cultural practices weregiven to all the treatments equally.Five plants in each treatment wererandomly selected for observation. The pre-harvest observation such as, plant height, number of tillers/m^2, dry matter accumulation and post-harvest observations such as, number of effective tillers/m^2 , panicle length, panicle weight, number of spikelets/panicle, number of filled grains/ panicle, test weight , grain yield, straw yield and harvest index were recorded and analyzed statistically.

RESULT AND DISCUSSION

Yield attributes

The yield attributing characters significantly varied due to different spacing. The highest panicle length (24.9), panicle weight (4.22), number of total grains/panicle (176),number of filled grains/panicle (139)and test weight(26.04) was noticed with the 20 cm x 10cm spacing which might be due to fact that wider spacing provide efficient use of nutrient and available resources with less competition(Kandil*et al.*2010and Pol*et al.* 2005). While 10cm x10cm spacing gave significantly the highest number of panicle/m^2 (356) only which might be due to higher plant population per unit area.Similar results have been reported by Siddiqui*et al*. (1999) and Gorgy (2010). Spacing of 15cm x10cm produced intermediate number of panicles/m^2 and number of total grains/panicle with significant difference. The lowest value of yield attributing characters except number of panicles/m^2 was obtained under10cm x10cm spacing.

The application of 150 per cent RDF produced significantly the highest number of panicle/m^2, panicle length and panicle weight. Number of panicle/m^2 and panicle weight was found at par with that of 100 per cent RDF. The lowest value of panicle/m^2,panicle weight and panicle length was observed under the 50 per cent RDF. Number of total grains/panicle, number of filled grains/panicle and test weight were recorded the highest under 150 per cent RDF might have helped in improving the nutrient availability for a prolonged period resulting more translocation of photosynthates during crop growth and development stages, ultimately it influenced the reproductive stage and resulted in more yield attributing characters(Pandey*et al.*2009). The lowest value of number of total grains/ panicle, number of filled grains/panicle and test weight were recorded under 50 per cent RDF which was found at par with that of 100 per cent RDF.

Grain yield, straw yield and harvest index

The grain yield and harvest index of rice increased with the increasing the spacing. The spacing of 20cm x 10cm produced significantly higher grain yield and harvest index as compared to closer spacing which was found at par with that of 15cm x 10cm spacing, while straw yield was registered higher under10cm x 10cm spacing which was also found at par with15cm x 10cm spacing. The lowest grain yield (40.0 q/ha) and harvest index was recorded under 10cm x 10cm spacing which was again found at par with that of 15cm x 10cm spacing. The negative effect of 10cm x 10cm spacing on grain yield could be mainly due to poor translocation of food materials from source to sink.

Grain yield and straw yield of rice was influenced with increasing nutrient levels from 50 per cent to 150 per cent of RDF whereas harvest index was not affected by it. Among the different nutrient levels, application of 150 per cent RDF recorded significantly the highestgrain yield (43.50 q/ha) and straw yield (62.89q/ha). Application of 100 per cent RDF produced intermediate grain and straw yield with significant difference compared to those of 150 per cent and 50 per cent RDF.This may be due to the luxury consumption along with continuous supply of nutrients in the treatments receiving higher dose of nutrients. Similar trend was also observed by GanajaxiMah (2008) and Priyanka*et al*. (2013). The lowest grain yield (38.56 q/ha), straw yield (55.60q/ha) and harvest index was obtained with the application of 50 per cent RDF.

Economics

The highest gross return,(Rs 59386/ha) net return (Rs.31763/ha) and B:C ratio (2.08) were obtained with the spacing of 20 cm x 10cm . Net return was however, at par with that of 15cmx10cm spacing (Rs. 29881/ha).The lowest gross return, net return (Rs. 25784 /ha) and B:C ratio (1.84) was obtained with the spacing of 10cm x 10cm. The highest B:C ratio under the spacing of20 cm x 10cm is due to comparatively lower cost of cultivation, increased straw yield and higher net return. The lowest B:C ratio (1.84) with the spacing of 10cm x 10cm mainly due to comparatively lower grain yield of rice.

The highest gross return (Rs.62284/ha) and net return (Rs.31225/ha was observed with the application of 150 per cent RDF. The lowest Gross return (Rs

54842/ha)andnet return (Rs. 27322 /ha)was recorded with 50 per cent RDF which was however, at par with that of 100 per cent RDF. The more grossand net return was obtained in these treatments were mainly due to higher grain and straw yield and comparatively less cost of cultivation. Nutrient levels were not found significant with respect to B: C ratio.

Table 1. Yield attributes of high zinc rice as influenced by spacing and nutrient levels.

Treatment	No of panicles /m^2	Panicle length (cm)	Panicle weight (g)	Total no. of grains /panicle	No. of filled grains/ panicle	1,000 grain weight (g)
Spacing						
S_1 (10cm x 10cm)	356	24.1	3.77	163	130	25.81
S_2 (15cm x 10cm)	272	24.5	3.90	169	132	25.83
S_3 (20cm x 10cm)	241	24.9	4.22	176	139	26.04
SEm±	**6.18**	**0.20**	**0.08**	**1.49**	**2.36**	**0.15**
CD (P=0.05)	**18**	**0.6**	**0.24**	**4**	**7**	**NS**
Nutrient levels						
N_1 (50% RDF)	273	23.9	3.81	165	125	25.68
N_2 (100% RDF)	287	24.6	3.97	169	132	25.78
N_3 (150% RDF)	308	25.3	4.11	175	142	26.22
SEm±	**6.18**	**0.20**	**0.08**	**1.49**	**2.36**	**0.15**
CD (P=0.05)	**18**	**0.6**	**0.24**	**4**	**7**	**0.43**

Table 2. Grain yield, straw yield and harvest index of high zinc rice as influenced by spacing and fertility levels.

Treatment	Grain yield (q/ha)	Straw yield (q/ha)	Harvest index (%)
Spacing			
S_1 (10cm x 10cm)	40.00	60.42	39.87
S_2 (15cm x 10cm)	40.80	59.44	40.76
S_3 (20cm x 10cm)	41.75	58.46	41.65
SEm±	**0.44**	**0.39**	**0.33**
CD (P=0.05)	**1.29**	**1.13**	**0.97**
Nutrient levels			
N_1 (50% RDF)	38.56	55.60	40.94
N_2 (100% RDF)	40.62	59.82	40.43
N_3 (150% RDF)	43.50	62.89	40.88
SEm±	**0.44**	**0.39**	**0.33**
CD (P=0.05)	**1.29**	**1.13**	**NS**

Table 3. Economics of high zinc rice as influenced by spacing and nutrient level.

Treatment	Cost of cultivation (Rs/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	B: C Ratio
Spacing				
S_1 (10cm x 10cm)	31244	57332	25784	1.84
S_2 (15cm x 10cm)	29809	58579	29881	1.97
S_3 (20cm x 10cm)	28659	59386	31763	2.08
SEm±	**-**	**979**	**736**	**0.03**
CD (P=0.05)	**-**	**NS**	**2149**	**0.10**
Nutrient level				
N_1 (50% RDF)	27664	54842	27322	1.99
N_2 (100% RDF)	29705	58171	28881	1.96
N_3 (150% RDF)	32342	62284	31225	1.93
SEm±	-	**979**	**736**	**0.03**
CD (P=0.05)	-	**2859**	**2149**	**NS**

REFERENCES

Kumar, K. and Rao, K. V. P. (1992). Nitrogen and phosphorus requirement of upland rice in Manipur; *Oryza*; 29:306–309.

Panda, S. C., Panda, P. C. and Nanda, S. S. (1995). Effect of levels of N and P on yield and nutrient uptake of rice; *Oryza*; 32:18–20.

Ganjaxi and Math, K.K. (2008). Effect of organic and inorganic fertilizer on yield and aroma of scented rice in low land situation. *International Journal of Agricultural Sciences* **4**(1): 79-80.

Kandil, A. A. El-Kalla1, S.E. Badawi, A.T. andOmnia M. (2010). Effect of hill spacing, nitrogen levels and harvest date on rice productivity and grain quality.*Crop &environment*, **1**(1):22-26.

Pandey, A.K. Kumar V. and Kumar, R. (2009). Effect of long-term organic and inorganic nutrients on transplanted rice under rice-wheat cropping system.*Oryza* **46**(3): 209-212.

Pol, P.P., Dixit, A.J.andThorat,S.T. (2005). Effect of integrated nutrient management and plant densities on yield attributes and yield of Sahyadri hybrid rice.*Journal of Maharashtra Agricultural Universities.***30**(3): 360-361.

Priyanka, G. Sharma G.D., Rana R. and Lal B. (2013). Effect of integrated nutrient management and spacing on growth parameters, nutrient content and productivity of rice under system of rice intensification.*International Journal of Research in BioSciences.***2**(3):53-59

Siddiqui, M. R. H.; Lakpale, R.; Tripathi, R. S. (1999). Effect of spacing and fertilizer on medium duration rice (Oryza sativa) varieties.*Indian Journal of Agronomy*; 1999.**44**(2): 310-312.

Gorgy, R.N. (2010). Effect of transplanting spacings and nitrogen levels on growth, yield and nitrogen use efficiency of some promising rice varieties. Journal of Agriculture.Research.Kafer El-Shiekh Univ., 36(2): 123.

Miah MHN, Karim MA. Rahman MS. and Islam MS. (1990). Performance of Nitrogen nutrients under different row spacing.*Bangladesh J. Train. Dev***3**(2), 31-34.

BRRI (Bangladesh Rice Research Institute) (1995). AdunikDhanerChash. *Bangladesh Rice Res. Inst., Joydebpur, Gazipur, Bangladesh*,34.

BRRI (Bangladesh Rice Research Institute) (1995). AdunikDhanerChash. Bangladesh Rice Res. Inst., Joydebpur, Gazipur, Bangladesh,34.

WHO (2002) The world health report 2002. Reducing risks, promoting healthy life. World HealthOrganization, Geneva Switzerland.