RESEARCH ARTICLE

INFLUENCE OF DIFFERENT DATE OF PLANTING OF RICE ON YIELD AND CROP PRODUCTIVITY IN VERTISOLS

Rahul Kumar*, Anurag, Ritesh Kumar Singh and R.N. Singh

[1]*College of Agriculture, Bharatpur*
[2,3,4]*College of Agriculture, I.G.K.V, Raipur 492012, India*
Email: rahulsoiligkv@gmail.com

Received-05.04.2021, Revised-18.04.2021, Accepted-27.04.2021

Abstract: The nutrient management practices were also influenced due to variable climatic conditions during the crop growth period and nutrients availability was influenced through soil plant atmosphere continuum which in turn resulted in higher rice yields due to variable treatments. The nutrient management practices influenced the growth and yield of rice and highest grain yield of rice (38.78 q/ha) was recorded with T5 (100%NPK+ Zn+ S +GM @6 t/ha+ FYM @3 t/ha +Straw@3 t/ha as mulch +1% Fe + 0.2% B spray) treatment. The major and micronutrient content in grain and straw was also influenced significantly due to application of organics and fertilizers and higher contents were recorded T5 (100%NPK+Zn+S+GM @6 t/ha+ FYM @3 t/ha +Straw@3 t/ha as mulch +1% Fe + 0.2% B spray) and, T4 (150% NPK + Zn + S + 1% Fe + 0.2% B spray) treatments.

Keywords: Crop, Growth, Yield, Productivity, Rice

INTRODUCTION

Rice (*Oryza sativa* L.) is one of the leading cereal crop of the world. Chhattisgarh is known as "Rice Bowl of India" occupies by 3.61million hectares with the production of 6.36 million tones and productivity 1800 kg/ha (2011-12).Which is less than national average? In rice cultivation, the farmers are giving much attention only to N fertilization and very often P and K applications are carried out at minimal level, mostly missing K fertilization. Many factors are responsible for increasing yield and quality of crop. Among these proper and balanced application of fertilizers is one of the most important factor contributing towards higher productivity, and good health of the soil. The organic manures improve the soil health and thereby enhance the crop yield per unit of applied nutrient. Application of organic manures along with rock phosphate helps in its dissolution and increases the availability of P.

Crop removal efficiency (removal of nutrient in harvested crop as % of nutrient applied) is also commonly used to explain nutrient efficiency. The efficiency with which the N absorbed in the rice crop is utilized towards grain production and other production parameters are important component of overall utilization efficiency. The N absorption efficiency is defined in terms of producing unit of grain yield per unit of N. Nitrogen, fertility is a major factor for rice production and most of the nitrogen is taken up by rice originates from rapidly and easily decomposable organic nitrogen (*Pandey et al.,2001*)**.** Integrated use of organic manures and inorganic fertilizers can contribute to increase in the N content of rice soil as well as to increase in long term productivity. Nitrogen Supply can influence grain yield by increasing the number of spikelet'spanicle, grain weight and panicle length (Gupta and O' Tool 1986). As N supply increases there is an increase in the proportion of total dry matter distributed to the grain.

Increase in availability of phosphorus in soil as well as its concentration and uptake in rice plant as influenced by single super phosphate (SSP) blended with cow dung has been established. The crop planted on July 15 recorded significantly higher grain yield, number of panicles m^{-2}, panicle weight then that planted on July 25, irrespective of the variety and N level. A 10 days delay in planting reduced their grain yield by 3.46 kg day^{-1}. These Findings are in conformity with Samrathal *et al.* (2003) claimed that grain and straw yields of rice crop were increased significantly owing to potash fertilization to the level of 62.5 Kg ha when applied in two equal splits. Which is due to efficient potash uptake, increase grain yield, better growth and development? Application of nitrogen and phosphorus fertilizer increases the grain yield of rice by increasing the magnitude, and its yield attributing characters, increased dry matter production including grain yield of rice was due to increased N and P uptake in response to external supply of both N and P fertilizers. Therefore, this field experiment was conducted to investigate the effects of applied N and P fertilizer of different doses on yield and yield components and to establish the optimum levels of N and P required for improved grain yield and production of flooded rice.

MATERIALS AND METHODS

The field experiment was conducted at the research farm, Indira Gandhi KrishiVishwavidyalaya, Raipur (Chhattisgarh) during *kharif* 2012-2013.Raipur comes under agro-climatic plain Zone of Chhattisgarh State and lie at $21^0 16'$ N latitude and

*Corresponding Author

$81^{0}26$' East longitude with an altitude of 289.56 m above the mean sea level. The soil was clay loam having 184.50,18.33,339.62 available N, P, K, with pH 7.6. The experiment were laid out in Twenty one treatment combinations involving three dates of crop establishment (early, optimum and late sowing) as main plot with seven sub treatments related to nutrient management were tried in split plot design with four replications. Nitrogen content in plant Sample was determined by using micro-Kjeldahl method as described by Chapman and Pratt (1961).Phosphorus content was determined by Vanadomolybdo-phosphoric acid yellow color method using blue filter as described by Jackson (1958).Potassium content was determined by flame photometer method as described by Chapman and Pratt (1961).The growth and yield of rice crop depend upon all growth parameters.viz Number of total and effective tillers, Plant height, Panicle length, Number of grains/panicle, 1000 grain weight etc.

RESULTS AND DISCUSSION

The data recorded on various growth and yield parameters, yield, major and micro- nutrients content and their uptake, nutrient status (chemical and biological) and nutrient use efficiency were analyzed and the results and discussion of the experiment are briefly described in this chapter under following heads and sub heads:

These meteorological observations affected photosynthesis rate and growth of rice plants, which intern resulted in influencing the grain and straw yield of rice (Table 1). The optimum date of sowing observed conducive environment for the growth and development of rice plants which intern resulted into higher grain yield of rice (39.55 q ha^{-1}).

Among nutrient management practices, the climatic condition also affected the growth and development of plant because temperature, humidity, and sun shine hours are directly related in enhancing the plant nutrient availability and their absorption by plants. The maximum grain yield was recorded in treatment T5 [100% NPK+ Zn + S STCR based +GM @6 t/ha+ FYM @3 t/ha +Straw@3 t/ha as mulch +1% Fe + 0.2% B spray (38.78 q ha^{-1})] followed by T4 [(150% NPK+Zn+SSTCR based +1%Fe+0.2 % B spray) (38.22 q ha^{-1})]. And minimum was recorded in T1 control plot (29.17 q ha^{-1}). The higher yields in various treatments may be attributed due to maximum available nutrients in these treatments. Favorable climate influenced the availability and uptake of nutrients. These finding were also supported by Murali *et al.* (2001), Rahman (2008) ,LinX. Q. *et al*. (2009) and Sharma *et al*. (2012). The data presented in Table 2 indicated that dates of early sowing of rice had no significant difference in height (69.6 cm) which was followed by optimum date of sowing. However, late sowing of rice had less height (68.4 cm) as compared with both of the sowing dates. The nutrient management practices had also significantly influenced the plant height with maximum plant height in T4 (150% NPKSTCR based +Zn+S+1%Fe+0.2% B spray) which was at par with rest of the nutrient management treatments except in T1 (control plot). This may be ascribed to ease in availability of nitrogen responsible for vegetative growth. The interaction of dates of planting and nutrient management practices was also found to be significant and more crop height was recorded in optimum and early dates of sowing with T4(150%NPKSTCR based +Zn+S+1%Fe+0.2% B spray). These finding were also in agreement with Sharma *et al*. (2012).The data presented in table 2 indicated that early sowing of rice had significantly more number of tillers (303 m^{-2}) followed by optimum date of sowing (296 m^{-2}).However, late sowing of rice had significantly less number of tillers (203 m^{-2}) as compared with both of the sowing dates. The maximum number of tillers at early sowing date may be attributed to the more favorable weather conditions.

The data presented table 2. Indicated that effective number of tillers/m^2 had more or less similar trend as total number of tillers. The nutrient management practices had also significantly influenced the number of tillers and the highest number of tillers was recorded in T4 (150% NPKSTCR based+Zn+S+1%Fe+0.2% B spray) treatment as compared to all other treatments. The maximum number of tillers was obtained in T4 (150%NPKSTCR based +Zn+S+1%Fe+0.2% B spray) (300 m^2) treatment followed by T3(100% NPK+ Zn+SSTCR based +1%Fe+0.2%B spray), T5(100% NPK +Zn +S STCR based +GM @6 t/ha+ FYM @3 t/ha +Straw@3 t/ha as mulch +1% Fe + 0.2% B spray), T7(Organic management equivalent to 100% NPK Levels STCR based GM, FYM and rice straw) (286 m^2) and minimum number of tillers were recorded in control (148 m^2).This may be due to maximum easy in availability of nitrogen responsible for vegetative growth. The interaction of date of planting and nutrient management practices was also found to be significant and maximum number of tillers were recorded in early date of planting with T4 (150% NPK STCR based +Zn+S+1%Fe+0.2% B spray treatment) (338 m^2) and the minimum were recorded in late sowing date under T1 (Control) (141 m^2).These results were also supported by the Jha (2001) and Pandey *et al.* (2001). The data presented in table 1 indicated that date of planting of rice had no significant difference in panicle length, number of grain and test weight .The maximum panicle length (18.9 cm) and test weight (24.7 g/1000 seed) was found in early date of planting, however, number of grain/panicle was found maximum in optimum date of sowing and minimum in later sown rice.

Table 1. Effect of time of crop establishment and nutrient management practices on yield and yield attribute characters of rice (q ha^{-1})

	Treatments	Grain yield (q ha^{-1})	Straw yield (q ha^{-1})	Panicle length (cm)	Number of grains /panicle	Test weight(g/ 1000 seed)
	Time of crop establishment					
	Early sowing	35.00^{b}	46.49^{ab}	18.9	92.6	24.7
	Optimum sowing	39.55^{a}	53.25^{a}	18.8	93.4	24.40
	Late sowing	35.37^{b}	42.84^{a}	18.8	92.2	24.0
	SEm±	**0.83**	**1.08**			
	CD (0.05%)	**3.25**	**7.08**	**NS**	**NS**	**NS**
	Nutrient management					
T1	Control	29.17^{c}	39.17^{c}	14.8^{b}	65.5^{c}	22.7^{b}
T2	100% (NPK+Zn+S)	35.29^{a}	60.09^{a}	19.6^{a}	93.4^{ab}	24.8^{a}
T3	100% NPK+Zn+S +1%Fe+0.2%B spray	36.68^{a}	55.78^{a}	19.8^{a}	98.9^{a}	24.6^{a}
T4	150% NPK+Zn+S+1%Fe+0.2% B spray	38.22^{a}	55.04^{a}	19.5^{a}	98.0^{a}	24.5^{a}
T5	100% NPK+ Zn +S +GM @6 t/ha+ FYM @3 t/ha +Straw@3 t/ha as mulch +1% Fe + 0.2% B spray	38.78^{a}	52.55^{a}	19.9^{a}	105.9^{a}	24.8^{a}
T6	INM -75%N +100% PK+ Zn S+GM @ 5 t/ha +FYM 3 t/ha+ rice straw @ 3 t/ha as mulch+1%Fe+0.2% B spray	34.66^{ab}	45.22^{ab}	19.5^{a}	91.7^{ab}	24.5^{a}
T7	Organic management equivalent to 100% NPK Levels GM, FYM and rice straw	33.92^{ab}	41.87^{ab}	18.8^{a}	95.6^{ab}	24.6^{a}
	Nutrient management SEm±	**1.22**	**3.24**	**0.41**	**3.32**	**1.35**
	Nutrient management CD (0.05%)	**3.56**	**9.45**	**1.21**	**9.7**	**5.42**
	(Interaction) TxN	**NS**	**NS**	**NS**	**NS**	**NS**

Table 2. Effect of time of crop establishment and nutrient management practices on plant height(cm)and number of effective tillers/m^2

	Treatments	**Time of crop establishment**				**Time of crop establishment**			
		Early sowing	Optimum sowing	Late sowing	Mean	Early Sowing	Optimum sowing	Late sowing	Mean
	Nutrient management	**Plant height (cm)**				**Number of effective tillers/m^2**			
T1	Control	59.6^{b}	56.9^{ab}	63.4^{b}	60.0^{b}	59.6^{b}	150^{c}	138^{b}	145^{c}
T2	100% NPK +Zn+ S	71.9 a	72.2^{a}	69.4^{b}	71.1^{a}	71.9 a	325^{a}	193^{ab}	278^{b}
T3	100% NPK+Zn +S +1%Fe+0.2%B spray	71.9^{a}	71.0^{a}	68.7^{a}	70.5^{a}	71.9^{a}	320^{ab}	216^{a}	286^{b}
T4	150% NPK+Zn+S+1%Fe+0.2% B spray	73.5^{a}	73.5^{a}	70.1^{a}	72.3^{a}	73.5^{a}	334^{a}	224^{a}	298^{a}
T5	100%NPK+Zn + S +GM @6 t/ha+ FYM @3 t/ha +Straw@3 t/ha as mulch +1% Fe + 0.2% B spray	70.8^{a}	68.2^{a}	67.1^{a}	68.7^{ab}	70.8^{a}	313^{ab}	212^{a}	284^{ab}
T6	INM -75% N +100% PK + Zn+ S+GM @ 5 t/ha +FYM 3 t/ha+ rice straw @ 3 t/ha as mulch+1%Fe+0.2% B spray	71.8^{a}	68.0^{a}	69.4^{a}	69.7^{a}	71.8^{a}	312^{b}	218^{a}	283^{b}
T7	Organic management equivalent to 100% NPK Levels GM, FYM and rice straw	68.0^{a}	69.5^{a}	70.8^{a}	69.4^{a}	68.0^{a}	312^{b}	204^{ab}	282^{a}
	Mean	69.6	68.5	68.4		69.6	295^{a}	201^{b}	
		SEm±	**CD (0.05%)**			**SEm±**	**CD (0.05%)**		
	Time of crop establishment (T)	**NS**	**NS**			**1.15**	**4.54**		
	Nutrient management (N)	**0.79**	**2.32**			**2.46**	**7.18**		
	Interaction (TXN)	**1.38**	**4.03**			**4.26**	**12.45**		

The nutrient management practices influenced panicle length significantly (Table 1) and maximum panicle length (19.9 cm) was observed in T5 (100% NPK Zn+ S STCR based +GM @6 t/ha+ FYM @3 t/ha +Straw@3 t/ha as mulch +1% Fe + 0.2% B spray), which was at par with rest of nutrient management treatments except in T1(control plot). Interaction of nutrient management and time of crop establishment was found no significant in case of panicle length.Number of grains/panicle was also found significant and maximum number of grains/ panicle was found in T5 (100% NPKSTCR based Zn+ S +GM @6 t/ha+ FYM @3 t/ha +Straw@3 t/ha as mulch +1% Fe + 0.2% B spray) (105.9 grains/panicle) followed by T3 (100% NPK+ Zn+ SSTCR based +1%Fe+0.2%B spray) (98.9 grains/ panicle) T4 (150% NPKSTCR based +Zn+S+1%Fe+0.2% B spray) (98.0 grain/panicle) and minimum(65.5 grains /panicle)was found in T1 (control).Nutrient management practices significantly influenced test weight and maximum test weight (24.8 g/1000 seed) was recorded in two treatments i.e. T5 (100% NPK+ Zn+ S STCR based +GM @6 t/ha+ FYM @3 t/ha +Straw@3 t/ha as mulch +1% Fe + 0.2% B spray), and T2 (100% NPK+Zn+SSTCR based), followed by T3 (100% NPK+Zn+SSTCR based +1%Fe+0.2%B spray) (24.6 g/1000 seed). Significantly lower test weight (22.7g/ 1000 seed) was found in T1 (control)). Interaction of time of crop establishment and nutrient management practices was found non significant. This study was also supported by Sharma *et al.* (2012).

REFERENCES

Ashrof, M., Mahamood, S., Munsif, M. and Yousuf, M. (1989). Relationship of transplanting and grain yield of Basmati 385. Int Rice Res News **l**.15:8

Ail, A., Zia, M.S., Hussain, F., Salim, M., Mahmood, I.A. and Shahzad, A. (2005). Efficacy of different methods of potassium fertilizer application on paddy yield, K uptake and agronomic efficiency.Pakistan J. Agri. Sci.**42**(1-2):27-32.

Chapman, L. and Pratt, E. (1961). Soil chemical analysis Prentice hall of India Private limited . New delhi.

Gupta, P.C. and O' Tool, J.C. (1986). Upland Rice A Global Perspectives .International Rice Research Institute,LosBanos , Laguna, Philippines.

Jackson, M. L. (1958). Soil and Chemistry Analysis, 1st Indian edn, pp. 32-38. Asia Publising House, Delhi.New

Jha, Kumar Santosh (2001). Effect of Integrated nutrient management practices on nutrient use Efficiency, yield ,nutrient uptake and quality of sented rice (*Oryza sativa* L.) M.Sc.(Ag.) *Thesis, Indira GandhiKrishiVishwavidyalaya, Raipur.pp – 83-84.*

Murali, M.K. and Setty, R.A. (2001). Growth, yield and nutrient uptake of scented rice (*Oryzasativa L.)* as influenced by levels of NPK, vermicompost and triacontanol. *J. Agri.Sci. **35(**1):1-4* .

Pandey, N., Upadhyay, S.K., Joshi, B.S. and Tripathi, R.S. (2001). Integrated use of organic manures and inorganic N fertilizers for the cultivation of low land rice in vertisol. *Indian J. Agric. Res.,* **35** *(2) : 112 – 114*

Qi-Chun, Zhang and Gaung-huowang (2005). Studies on nutrient uptake of rice and characteristics of soil microorganisms in a long-term fertilization experiments for irrigated *riceJ Zhejiang UnivSci B.**6**(2): 147–154*

Rahman, M. M., Amano, T. and Shiraiwa, T. (2009). Nitrogen use efficiency and recovery from N fertilizer under rice-based cropping systems. *Australian Journal of Crop Science* **3**(6):336-351.

Rahman, M., Rahman, T., Jahiruddin, M., Humauan, M. R., Alam, M. J. and A.khan, A. (2008). Effect of sulphur and zinc on growth, yield and nutrient uptake of Boro rice (cv. Brridhan 29)*J.Soil.Nature. **2**(3):10-15*.

Rehman, S.U., Hussain, N., Tariq, M., Hussain, M., Nasir, M. and Ayaz, M. (2012). response of wheat to exogenous boron supply at various growth stages *Sarhad J. Agric.* ***28***.(3) 411-413.

Ravi, K. and Rao, K. Rama (1992). Studies on levels and times of application of potassium for kharif rice (Oryza sativa L). The *Andhra Agri. J.* **30** (1-2):74-76.

Sharma, Dinesh, Sagwal, Pardeep Kumar, Singh, Ishwer and Sangwan, **Ajit** (2012). Influence of different nitrogen and phosphorus levels on profitability, plant nutrient content, yield and quality in basmati cultivars.*I.J.I.E.A.S.R***1**, No. 1,1-4.

Samrathal, M., Surendra, S. and Shivay, Y.S. (2003). Response of hybrid rice (Oryza Sativa) to nitrogen and potassium application in sandy clay-loam soils. *Indian J Agri.Sci*.**73** (1):8-11.