PERFORMANCE AND WATER USE EFFICIENCY OF TRANSPLANTED RICE (*ORYZA SATIVA* L.) AS AFFECTED BY MOISTURE REGIMES & INTEGRATED NUTRIENT SUPPLY SYSTEMS

Vimal Pratap Pandey[*#], R.A. Singh[*] G.R. Singh[*] and Pradeep Sherawat[**]

** Narendra Deva University of Agriculture & Technology, Kumarganj, Faizabad-224229 (U.P.)*
*** S.V.B.P.U.A. & T. Meerut*
[#]E-mail : vimal2724@gmail.com*

Abstract : A field experiment was conducted at the Agronomy Research Farm, Narendra Deva University of Agriculture &Technology, Narendra Nagar (Kumarganj) Faizabad (U.P.) during *Kharif* season 2007-08. The experiment was laid out in split plot design with 4 replications comprising (3) three levels of moisture regime (7 cm irrigation 1, 3 and 5 DADPW) and 4 nutrient supply system (100 % NPK, 75 % NPK + 25 % N through FYM, 75% NPK + 25% N through biocompost and green manuring + 75% NPK). The soil of experimental plots was silty loam in texture with low available N, P and high K. The results indicated that 7 cm irrigation 1 DADPW was found significantly superior over 7 cm irrigation at 3 and 5 DADPW in respect to growth characters, *viz*., plant height, dry matter, LAI, number of shoots per hill, yield and its attributes. Nutrient management practices had also significant effect on growth parameters as well as yield and yield attributing characters. Application of recommended dose of NPK (120:60:40 kg ha^{-1}) through chemical fertilizers found superior over rest of the nutrient management practices, which was closely followed by green manuring supplemented with 75% recommended NPK, but significantly superior over rest of the integrated nutrient supply systems. Highest grain and straw yield was obtained under 100% NPK through chemical fertilizers which was significantly superior over FYM and biocompost + 75 % recommended NPK. The maximum water use efficiency was computed with 7 cm irrigation 1 DADPW, F_4 (green manuring + 75% NPK) nutrient supply system.

Keywords : Transplanted rice, Organic manure, IPNS, Integrated nutrient supply system, Nutrient removal, Nutrient uptake, Moisture regime, WUE, Yield

INTRODUCTION

Rice (*Oryza sativa* L.) is the major cereal crop in India. Cultivated on 40 m ha and contributing 96 million tones grain production (Govt. of India New Delhi-2008). It is an input intensive crop, grown on 40 per cent of the total gross cultivated area. its water requirement is quite high, which is met through rain, ground and canal water for its production, which leads to various problems of ground water depletion, salinization etc. Irrigation plays a pivotal role in increasing the productivity of rice. Though the efficiency and productivity of water are very low due to percolatation losses and higher water requirement. Nitrogen plays an important role in increasing the yield of rice but its efficiency is only 30-40% due to losses by run off, leaching, ammonia volatilization and denitrification (Prasad, 1998). The use of organic nitrogen substitution plays an important role in increasing N-use efficiency and soil health. Most of the Indian soils are low in N and to achieve a better yield. Farmers generally apply a large quantity of inorganic N. Keeping this aspect in consideration an experiment was carried out to study the effect of different moisture regimes and integrated nutrient supply system on growth, productivity, N uptake & water use by rice.

MATERIAL AND METHOD

The field experiment was conducted at Agronomy Research Farm (Main campus) Narendra Deva Univ. of Agriculture and Technology, Kumarganj, Faizabad (24.4^0-26.56^0 N and 82.12-83.98 E at 113 m above mean sea level) during rainy (*kharif*) season of 2008. The soil was silt loam having pH 7.8, electrical conductivity 0.27 ds/m, organic carbon 0.38% and available N, P and K of 188.60 kg, 13.1 kg and 255.10 kg/ha, respectively. The experiment was laid out in a split plot design with four (4) replications and a set of 12 treatments involving 3 moisture regimes 7 cm. irrigation 1 DADPW (Days after disappearance of ponded water), 7 cm. irrigation 3 DADPW and 7 cm. irrigation 5 DADPW) as main plot treatments and 4 levels of IPNS (*viz*., 100% NPK) (120:60:40 kg ha^{-1}), 75% NPK+25% N through FYM, 75% NPK+25% N through biocompost and green manuring + 75% NPK) as sub plot treatments. Transplanting of rice was done at 20 x 10 cm spacing on 16th July 2008. The crop was raised with recommended Agronomic practices and harvested on Oct. 2008. The total rainfall, mean maximum and minimum temperatures during the crop season were 836.7 mm, 34.5^0 and 19.1^0 respectively. Economics of the treatments were computed on the basis of the prevailing market price of the produce and agri-inputs.

RESULT AND DISCUSSION

Maximum plant height was observed with 7 cm. irrigation 1 DADPW which was significantly superior over 3&5 DADPW (Table-1). No. of shoots per hill, Dry matter accumulation, Leaf area index were increasing till 90 DAT and recorded maximum at 7 cm irrigation 1DADPW. No. of effective shoots

was found maximum at 7 cm. irrigation 1 DADPW. Regarding yield attributes no. of panicles per hill, length of panicle & no. of grains per panicle were recorded maximum with the application of 7 cm irrigation 1 DADPW which was significantly superior over rest of the treatments. There was no significant effect of these treatments on test weight of rice.

Highest grain yield was observed with the 7 cm irrigation 1 DADPW which was 22% & 28% more than 3 & 5 DADPW. Maximum water use efficiency had been worked out 51.66 kg ha^{-1} cm. under 7 cm. irrigation 1 DADPW with 96.5 cm total water applied and 58.5 cm. effective rainfalls.

In case of nutrient supply system the growth characters, yield attributes, water studies as well nutrient uptake (NPK) was found maximum under 100% NPK (120:60:40 kg ha^{-1}) through chemical fertilizers which was found at par with green manuring + 75% NPK through chemical fertilizers. Total nutrient removal (NPK uptake) was also recorded maximum with the application of 100% NPK (120:60:40 kg ha^{-1}) with chemical fertilizers, which was found at par with green manuring + 75% NPK. However maximum net return was also recorded with the application of 100% NPK (120:60:40 kg ha^{-1}) with chemical fertilizers.

Table 1 : Growth and productivity of rice as influenced by the moisture regimes and integrated nutrient supply systems.

Treatment	Plant height (cm)	Leaf area index	Dry matter accumulation (g)	Number of shoots $hill^{-1}$	Number of panicles $plant^{-1}$	Length of panicle (cm)	Number of grain $panicle^{-1}$	Test weight (g)	Grain yield (q ha^{-1})
Moisture regimes									
7 cm irrigation 1 DADPW*	122.10	4.96	16.65	14.21	12.64	21.37	177.05	24.17	49.86
7 cm irrigation 3 DADPW	114.03	4.19	13.90	11.92	10.73	19.34	167.99	23.75	41.74
7 cm irrigation 5 DADPW	106.08	3.92	11.77	10.21	9.23	17.34	145.86	23.11	36.72
SEm±	3.15	0.13	0.40	0.34	0.292	0.52	4.39	0.63	1.15
CD 5%	10.91	0.45	1.37	1.18	1.009	1.79	15.20	NS	3.96
Integrated nutrient supply systems									
100% NPK (120:60:40 kg ha^{-1})	121.01	4.62	14.97	12.86	11.53	20.53	173.62	24.56	45.40
75% NPK + 25% N through FYM	107.52	4.11	13.30	11.42	10.24	18.24	154.24	22.90	40.32
75% NPK + 25% N through Biocompost	111.32	4.25	13.76	11.82	10.60	18.88	159.67	23.40	41.73
Green manuring + 75% NPK	116.43	4.44	14.39	12.36	11.09	19.75	166.99	23.85	43.64
SEm±	2.90	0.13	0.36	0.31	0.261	0.46	3.91	0.57	1.03
CD 5%	8.42	0.37	1.04	0.89	0.757	1.34	11.34	NS	2.98

*DADPW-Days after disappearance of ponded water.

Table 2 : Influence of moisture regimes and integrated nutrient supply system on grain yield and NPK uptake of transplanted rice.

Treatment	Grain yield (q ha^{-1})	Total removal		
		N uptake	P uptake	K uptake
Moisture regimes				
7 cm irrigation 1 DADPW*	49.86	82.39	37.57	97.22
7 cm irrigation 3 DADPW	41.74	69.63	31.28	80.32
7 cm irrigation 5 DADPW	36.72	60.59	27.00	69.15
SEm±	1.14	1.893	0.850	2.182
CD 5%	3.96	6.552	2.943	7.550
Integrated nutrient supply systems				
100% NPK (120:60:40 kg ha^{-1})	45.40	79.04	35.64	95.59
75% NPK + 25% N through FYM	40.30	64.02	28.39	71.21
75% NPK + 25% N through Biocompost	41.73	67.22	30.41	76.00
Green manuring + 75% NPK	43.64	73.19	33.36	86.12
SEm±	1.03	1.717	0.858	2.814
CD 5%	2.98	4.981	2.489	5.843

*DADPW-Days after disappearance of ponded water.

Table 3 : Effect of moisture regime and integrated nutrient supply system on grain yield and economics of rice crop

Treatment combinations	Grain yield (q/ha)	Gross return (Rs./ha)	Net return (Rs./ha)	Benefit cost ratio
I_1S_1	53.41	49245.00	26459.74	1.16
I_1S_2	47.04	43239.50	20454.24	0.89
I_1S_3	48.51	44583.00	22073.00	0.98
I_1S_4	50.47	46540.50	23705.50	1.03
I_2S_1	44.28	40834.00	18498.74	0.82
I_2S_2	39.36	36278.00	13942.74	0.62
I_2S_3	40.69	37521.50	15461.24	0.70
I_2S_4	42.64	39188.00	16802.74	0.75
I_3S_1	38.52	35640.50	13955.24	0.64
I_3S_2	34.56	31868.00	10182.74	0.46
I_3S_3	36.00	33090.00	11679.74	0.54
I_3S_4	37.80	34834.50	13099.24	0.60

CONCLUSION

The maximum grain yield and WUE were obtained with the application of 7 cm. irrigation 1 DADPW which was significantly superior over 3 & 5 DADPW. The highest gross & net monetary return was also obtained with the 7 cm irrigation 1 DADPW & 100% NPK (120:60:40: kg ha^{-1}). Application of water 1 days after disappearance of ponded water not only increase grain yield, WUE, NPK uptake, but also recorded substantially higher gross & net returns and benefit: cost ratio.

REFERENCES

Dwivedi, P.N. (2008). Water management technologies for sustainable crop production in sharda sahayak command area. Training manual Water Management for sustainable agriculture production in canal commands, held at Water Technology Centre for Eastern Region, Bhubaneswar during 18-23 Feb., pp. 6-9.

Ganesh, H.V. (2000). Effect of various irrigation schedules on yield and water use in transplanted paddy. *Mysore J. of Agricultural Science*, **34** (3): 222-226.

Kumar, Suresh; Katiyar, T.P.S. and Singh, M.M. (2008). Impact of improved water management practices on performance of rice- wheat cropping

system in sharda sahayak command. *Annals of Plant and Soil Research*, **10** (1): 98-99.

Mahapatra, B. S. and Sharma, G. L. (1996). Contribution of *Sesbania species* to yield and nitrogen nutrition in lowland rice (*Oryza sativa* L.). *Indian J. Agron.* **41**(2):226-229.

Shaik, Dawood, A.; Budhar, M.N. and Chandrasekaran (1990). Study of irrigation and nitrogen for lowland rice. *Indian J. Agron.*, **35** (4): 380-383.

Tripathi, H.P.; Maurya, A.K. and Kumar Alok (2007). Effect of integrated nutrient management on rice-wheat cropping system in eastern plain zone of U.P. *Farming system Research & Development*, **13** (2): 198-203.

Zaidi, S.F.A.; Tripathi, H.P.; Singh, R. and Singh, B. (2006). Effect of long term integrate nutrient management in rice-wheat cropping system. *In* 2nd International Rice Congress-2006, New Delhi October 9-13 (pp. 349).