International Journal of Agricultural Sciences
Volume **10** | Issue 1| January, 2014 | 298-301

RESEARCH PAPER

Effect of moisture regime and integrated nutrient supply on yield and economics of transplanted rice (*Oryza sativa* L.)

SANTOSH KUMAR*, RAVI SHANKER SINGH[1] AND LALJI YADAV
Department of Agronomy, N.D. University of Agriculture and Technology, Kumarganj, FAIZABAD (U.P.) INDIA
(Email : santoshagro.nd@gmail.com)

Abstract : A field experiment was conducted at Agronomy Research Farm, Narendra Deva University of Agriculture and Technology, Narendra Nagar (Kumarganj) Faizabad (U.P.) on effect of moisture regime and integrated nutrient supply on growth and yield of transplanted rice during *Kharif* 2010-12.The experiment was laid out in Split Plot Design consisted of twelve treatment combinations with four replication. The results indicated that 7 cm irrigation 1 DADPW was found significantly superior over the 7cm irrigation at 3 and 5 DADPW on yield attributes and yield character. The maximum yield attributes and yield were recorded with full dose of NPK 120:60:40 kg ha^{-1} which was found at par with green manuring + 75% NPK through inorganic fertilizers which was significantly superior over rest treatments. The maximum total cost of cultivation was computed with the application of 7 cm irrigation 1 DADPW + 75% NPK + green manuring (I_1S_4) followed by 7 cm irrigation 1 DADPW + full dose of NPK 120:60:40 kg ha^{-1} (I_1S_1) through inorganic fertilizer. The maximum gross income, net profit and B: C ratio was recorded with the application of 7 cm irrigation 1 DADPW + full dose of NPK 120:60:40 kg ha^{-1} (I_1S_1) through inorganic fertilizer.

Key Words : Moisture regime, Yield, Biocompost, Green manuring

View Point Article : Kumar, Santosh, Singh, Ravi Shanker and Yadav, Lalji (2014). Effect of moisture regime and integrated nutrient supply on yield and economics of transplanted rice (*Oryza sativa* L.). *Internat. J. agric. Sci.*, **10** (1): 298-301.

Article History : Received : 07.08.2013**; Revised :** 24.10.2013**; Accepted :** 22.11.2013

INTRODUCTION

Rice (*Oryza sativa* L.) is the premier food crop not only in India but world also. In India, rice plays a vital role in our national food security and a means livelihood for millions of rural household. Further decline/stagnation in rice production has been observed. Yield decline under intensive rice-wheat cropping system in the Indo-Gangetic plain region is associated with the imbalanced application of NPK and emerging deficiency of micronutrients. Chemical fertilizer indeed boots up crop production initially, however, it causes several problems related to soil health and grains quality. Integration of chemical fertilizers with organic manures has been found to be quite promising not only in maintaining higher productivity but also in providing greater stability in crop production (Nambiar and Abrol, 1992). Gupta and Sharma (2010) at Jabalpur (M.P.) evaluated the sustainable productivity on rice on long term basis and observed application of chemical fertilizer with organic fertilizers. It is well known fact that water management is one of the major factor responsible for achieving better harvest in crop production. In general farmers use to keep paddy field submerged throughout the growth period on the basis of assumption in their mind that higher grain yield of rice can be achieved only by doing this practice. However, now it has been proved that intermittent drainage increases the growth as well as grain yield of rice. Dwivedi (2008) reported that the higher grain of rice was recorded with the application of 7cm irrigation at 1 DADPW over the 3 and 5 DADPW. Thus, the judicious use of available irrigation water and application of integrated nutrient supply in respect to available soil moisture may play an important role in minimizing the present large gap between yield achieved and yield achievable.

* Author for correspondence

MATERIAL AND METHODS

The study was carried out at Agronomy Research Farm, Narendra Deva University of Agriculture and Technology, (Kumarganj), Faizabad (U.P) during the *Kharif* season of 2010 to study the effect of moisture regime and integrated nutrient supply on yield and economics of transplanted rice. The soil samples were collected randomly from 10 places of the experimental field with the help of soil auger and analyzed. The soil of experimental field was silt loam in texture having pH 7.8, EC 0.28 dSm^{-1}, organic carbon 0.39 % and medium in nitrogen (189.2 kg ha^{-1}), low in phosphorus (13.15 kg ha^{-1}), and high in potassium (255.73kg ha^{-1}). The experiment was laid out in a Split Plot Design with four replications. The experiment comprised of three moisture regime in main plots *viz*., 7cm irrigation 1 DADPW (I_1), 7cm irrigation 3 DADPW (I_2) and 7cm irrigation 5 DADPW (I_3). The four integrated nutrient supply were applied as sub-plots *viz.*,100% NPK 120:60:40 kg ha^{-1} (S_1), 25% N through FYM +75% NPK (S_2), 25% N through biocompost +75% NPK (S_3) and green manuring +75% NPK (S_4) applied through inorganic fertilizers. Irrigation treatments based on days after disappearance of ponded water (DADPW) was started just after transplanting with 7 cm depth of water in each irrigation as per treatment. Farm yard manure, biocompost and green manuring was incorporated 15 days before transplanting to facilitate the complete decomposition of FYM, biocompost and green manuring. Full dose of phosphorus, potassium and zinc along with half dose of nitrogen was applied as basal while remaining half amount of nitrogen was applied in two splits at tillering and panicle initiation stages, respectively. Twenty-five days old age seedlings were transplanted in the field. The Sarjoo-52 variety was planted at 20 x 10 cm spacing .The data were recorded randomly from five places in each plot on yield attributing and yield. The different components of economics were calculated as treatment wise. The data recorded in respect to different observations were analysed as per standard statistical procedure.

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Effect on yield attributing and yield character:

Effect of moisture regime:

Various moisture regimes affected significantly the yield attributing characters of the crop. The maximum number of effective shoots running $meter^{-1}$ (121.54), length of panicles (22.00), number of grains $panicles^{-1}$(180.14), and weight of grains $panicles^{-1}$ (4.34 g) were found with application of 7 cm irrigation 1 day disappearance of ponded water (DADPW) which was significantly superior over the 7 cm irrigation 3 and 5 DADPW (Table 1). Lowest yield attributes were recorded under 7 cm irrigation 5 DADPW as growing plants suffered most due to moisture stress, hence, plants were unable to extract more water and nutrients from deep in soil under moisture deficit conditions which ultimately led to poor growth and yield attributes. Similar results were reported by Luikham and Anal (2008).

The grain and straw yield of rice was influenced significantly due to the effect of moisture regimes. The highest grain yield (54.45 qha^{-1}) and straw yield (76.79 qha^{-1}), was recorded under 7 cm irrigation 1 DADPW (I_1) which was significant superior over the 7 cm irrigation 3 and 5 DADPW. The lowest grain (46.76 qha^{-1}) and straw yield (67.0 qha^{-1}) was recorded in 7 cm irrigation 5 DADPW. This might be due to adequate moisture availability which contributed to increased dry matter accumulation. As the results of best

Table 1 : Yield attributes and yield of rice as influenced by moisture regime and integrated nutrient supply system

Treatments	No. of effective shoots running $meter^{-1}$	Length of panicle(cm)	No. of grains $panicles^{-1}$	Weight of grains $panicles^{-1}$	Test weight(g)	Grain yield (qha^{-1})	Straw yield (qha^{-1})	Harvest index (%)
Moisture regime								
I_1	121.54	22.00	180.14	4.34	24.44	54.45	76.79	41.51
I_2	113.82	20.01	168.18	3.84	23.71	48.50	68.46	41.48
I_3	101.39	18.64	160.67	3.18	23.11	46.76	67.02	41.11
S.E.±	2.26	0.41	3.41	0.08	0.48	1.01	1.46	0.20
C.D. (P=0.05)	7.24	1.30	10.91	0.24	NS	3.24	4.66	NS
Nutrient supply system								
S_1	118.94	21.14	174.33	4.11	24.35	52.07	74.51	41.12
S_2	102.17	19.05	163.17	3.31	23.07	47.45	66.43	41.65
S_3	109.50	19.72	167.48	3.64	23.65	49.16	68.89	41.66
S_4	118.38	20.95	173.68	4.08	23.94	50.93	73.19	41.03
S.E.±	2.42	0.47	3.93	0.09	0.55	1.17	1.68	0.18
C.D. (P=0.05)	7.61	1.36	11.76	0.25	NS	3.41	4.89	NS

performance of growth character recorded, this contributed to highest yield attributes through increased photosynthetic activity of leaves. Besides translocation of photosynthesis from source to sink might have also increased under adequate moisture conditions through higher uptake of nutrients which led to better yield attributes. It indicates higher crop productivity, better vegetative growth coupled with higher yield attributes resulted in higher grain and straw yield. The lowest grain and straw yield was recorded under 7 cm irrigation 5 DADPW due to water scarcity during both vegetative and reproductive phase of growth, water stress during critical stages hampered the source and sink ratio to the large extent which reduced yield. The similar results were reported by Singh and Prasad (1991), Singh and Ingram (1995) and Dwivedi (2008).

Effect of integrated nutrient supply:

The various integrated nutrient supply affected significantly the yield attributing and yield characters of the crop. The highest number of effective shoots running meter^{-1} (118.94), length of panicles (21.14), number of grains panicles^{-1} (174.33), and weight of grains panicles^{-1} (4.11g) were recorded with the application of 100% NPK 120:60:40 kg ha^{-1}(S_1) which was at par with green manuring + 75% NPK (S_4) applied through inorganic fertilizers which was found significantly superior over the rest treatments (Table 1).

The maximum grain yield (52.07 qha^{-1}) and straw yield (74.51 qha^{-1}) was obtained with the application of 100% NPK 120:60:40 kg ha^{-1} ((S_1)) which was at par with green manuring + 75% NPK (S_4) which was found significantly superior over the rest of treatment applied through inorganic fertilizers. The minimum grain yield (47.45 qha^{-1}) and straw yield (66.43 qha^{-1}) was obtained with the application of 25 % N through FYM +75% NPK (S_2) through inorganic fertilizers. This was due to fact that better vegetative growth and development of plant received adequate nutrients during entire period of growth, ultimately it increased yield attributing character. Under higher level of nutrient soil, plants were able to absorb larger quantities of nutrients through their well developed root system. Hence, plants synthesized more photosynthates which helped to increase the crop production. The causes of poor yield mainly due to poor growth metabolic processes lesser number of panicles, number of grains panicle^{-1} and length of panicle. In respect to above the similar findings were reported by Pal *et al.* (2005), Zaidi *et al.* (2006) and Pandey *et al.* (2007).

Economics:

Data pertaining to different components of economics are given in Table 2. The maximum total cost of cultivation (Rs. 27594 ha^{-1}) was calculated under 7 cm irrigation 1 DADPW with green manuring + 75% NPK (I_1S_4), followed by 7 cm irrigation 1 DADPW + full dose of NPK (120:60:40) applied through inorganic fertilizers. The cost of cultivation varied mainly due to wide differences in the cost of irrigation and cost of integrated nutrient supply under the various treatment combinations. The maximum gross return (Rs. 64674 ha^{-1}), net returns (Rs. 37169 ha^{-1}) and B: C ratio (1.35) was calculated under 7 cm irrigation 1 DADPW with full dose of NPK 120:60:40 kg ha^{-1} (I_1S_1) followed by 7 cm irrigation 1 DADPW with green manuring + 75% NPK (I_1S_4) applied through inorganic fertilizers. The minimum data was calculated under 7 cm irrigation 5 DADPW with 75% NPK + 25%N (I_3S_2) through farm yard manure applied through inorganic fertilizer. The data recorded under different component of economics reveal that gross return increased with increasing grain + straw yield of rice obtained under different treatments. The net returns were much influenced due to differential cost incurred and yield obtained under various treatments. The similar result has also been reported by Yadav *et al.* (2008) and Gupta and Sharma (2010).

Table 2 : Economics of various treatment combinations of rice as influenced by various combinations of moisture regime and nutrient supply system

Treatment combinations	Cost of cultivation (Rs.ha^{-1})	Gross return (Rs.ha^{-1})	Net return (Rs.ha^{-1})	B: C ratio
I_1S_1	27505	64674	37169	1.35
I_1S_2	27314	60028	32714	1.19
I_1S_3	2694	60816	33822	1.25
I_1S_4	27594	61161	33567	1.21
I_1S_1	27005	58051	31046	1.14
I_2S_2	26864	52941	26077	0.97
I_2S_3	26544	54019	27475	1.03
I_2S_4	27144	56383	29239	1.07
I_2S_1	26405	55848	29443	1.11
I_3S_2	26414	49321	22907	0.86
I_3S_3	26094	53301	27207	1.04
I_3S_4	26694	55366	28672	1.07

Thus, it may be concluded that the maximum yield attributing characters, higher yield and component of economics were recorded under 7cm irrigation 1DADPW with 100% NPK 120:60:40 Kg ha^{-1} (I_1S_1) which was at par with green manuring + 75% NPK (I_1S_4) through inorganic fertilizer. Hence, both treatments I_1 S_1 and I_1 S_4 may be recommended to achieve higher yield but in fertility point of view I_1 S_4 treatment is best in irrigated area, it contributes some organic matter in soil which helps to improve soil fertility and sustain the rice production.

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.

Gupta, Vikas and Sharma, R.S. (2010). Effect on integrated nutrient management on yield, nutrient uptake and economics of rice (*Oryza sativa* L.) under wheat based cropping system, conducted at Jabalpur (M.P.). *Res. Crops,* **11** (2): 239-243.

Luikham, E. and Anal, P.S.M. (2008). Effect of irrigation regimes and nitrogen management practices on uptake of nutrients and grain yield in hybrid rice (*Oryza sativa* L.). *Environ. & Ecol.,* **26**: (3) 1146-1148.

Nambiar, K.K.M. and Abrol, I.P. (1992). Long term fertilizer experiments in India. An overview. *Ferti. News,* **34** (4): 11-26

Pal, S.K., Chowdhary, A. and Gunri, S.K. (2005). Effect of integrated nitrogen management on yield and nitrogen balance rice under lowland situation. *Oryza,* **42** (1): 41-47.

Pandey, N., Verma, A.K. Anurag and Tripathi, R.S. (2007). Integrated nutrient management in transplanted hybrid rice (*Oryza sativa*). *Indian J. Agron.,* **52** : (1) : 40-42.

Singh, H. and Ingram, K.T. (1995). Sensitivity of rice to water deficit at different growth stages, *Philippines J. Crop Sci.,* **16** (1): 511.

Singh, R.D. and Prasad, V.K. (1991). Water use and yield response in cropping system based on rice (*Oryza sativa* L.). In abstr. International symposium on Natural Resource Management for Sustainable Agriculture, 6-10th Feb. 1990 New Delhi (INDIA).

Yadav, O.M., Dahiphale, V.V. and Godhawale, G.V. (2008). Effect of integrated nutrient management on product and economic efficiency of rice (*Oryza sativa* L.) under upland drilled condition. *Dryland Agric. Res. & Development,* **23** (1) : 13-18.

Zaidi, S.F.A., Tripathi, H.P., Singh, R. and Singh, B. (2006). Effect of long term integrated nutrient management in rice-wheat cropping system. In 2nd international Rice Congress- 2006 New Delhi, October 9-13. 395pp.

10th Year
★★★★★ of Excellence ★★★★★