SHORT COMMUNICATION

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Effect of moisture regime and integrated nutrient supply on growth, yield and economics of transplanted rice

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ABSTRACT

A field experiment was conducted at Narendra Deva University of Agriculture and Technology, Faizabad (U.P.) on effect of moisture regime and integrated nutrient supply on growth, yield and economics of transplanted rice during wet season 2010. The results indicated that 7 cm irrigation one day after disappearance of ponded water (DADPW) was found significantly superior to 7 cm irrigation at 3 and 5 cm days DADPW in respect to growth and yield characters. Nutrient management practices also had significant effect on growth parameters as well as yield attributing characters and yield. Application of recommended dose of NPK (120:60:40 kg ha^{-1}) through inorganic fertilizers recorded significantly higher growth and yield and green manuring + 75% NPK was at par with recommended dose of NPK (120:60:40 kg ha^{-1}) through inorganic fertilizers but significantly superior to rest of the integrated nutrient supply systems in respect of growth, yield attributing characters and yield.

Key words: *rice, moisture regime, yield, biocompost, economics*

Water management is one of the major factors responsible for achieving better harvest in crop production. Dwivedi (2008) reported that the higher grain yield of rice was recorded under 7cm irrigation one day after disappearance of ponded water (DADPW) over 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. Therefore, a study was undertaken to find out the effect of irrigation schedules and integrated nutrient supply on rice production.

The experiment was conducted at Narendra Deva University of Agriculture and Technology, Faizabad (U.P) during the wet season of 2010-11. 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 comprised three moisture regimes in main plots 7cm irrigation 1 day after disappearance of ponded water, 3 DADPW and 5 DADPW with four integrated nutrient supply as sub-plots 100% NPK (120:60:40 Kg ha^{-1}) through inorganic fertilizer, 75% NPK + 25% N through FYM, 75% NPK + 25% N through biocompost and 75% NPK + green manuring. Split plot design was followed with four replications. Irrigation treatments based on days after disappearance of ponded water was started just after transplanting. Twenty-five days old seedlings were transplanted with Sarjoo-52 variety in the field at 20 x 10 cm spacing. The data were recorded randomly from five places in each plot on growth characters and yield attributing factors and yield. The water use efficiency (WUE) has been expressed as the ratio of grain yield to water requirement of crop.

Significantly marked differences were observed in morphological parameters viz., plant height, number of shoot m^{-1}, leaf area index (LAI) and dry matter production of rice crop up to harvest with application of various moisture regime and integrated nutrient supply. The highest plant height (125.17cm), number of tillers m^{-1} (145.96) , leaf area index (5.20)

Table1. Effect of moisture regime and integrated nutrient supply system on growth characters, yield attributes, water use efficiency and economics of rice

Treatments	Plant height (cm)	Tillers m^{-1}	LAI at 90 DAT	Dry matter accumulation (g $hill^{-1}$)	No. of effective tillers m^{-1}	Length of panicle (cm)	No. of grains panicle	Weight of grains $panicle^{-1}$	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Total water applied (cm)	WUE (kgha^{-1} cm^{-1})	Benefit: Cost ratio
Moisture regime													
I_1	125.17	145.96	5.20	17.54	121.54	22.00	180.14	4.34	5.44	7.67	97.57	55.80	1.35
I_2	116.08	130.06	4.44	14.60	113.82	20.01	168.18	3.84	4.85	6.84	90.57	53.54	1.11
I_3	113.39	113.61	4.16	12.65	101.39	18.64	160.67	3.18	4.67	6.70	83.57	55.95	1.07
CD (p=0.05)	7.54	8.23	0.29	0.93	7.24	1.30	10.91	0.24	0.32	0.46	-	-	-
Nutrient supply system													
S_1	123.30	138.67	4.84	15.45	118.94	21.14	174.33	4.11	5.20	7.45	90.57	57.49	1.25
S_2	11.70	120.34	4.23	14.19	102.17	19.05	163.17	3.31	4.74	6.64	90.57	52.39	1.03
S_3	116.43	125.28	4.51	14.68	109.50	19.72	167.48	3.64	4.91	6.88	90.57	54.27	1.04
S_4	121.41	135.21	4.82	15.39	118.38	20.95	173.68	4.08	5.09	7.31	90.57	56.23	1.21
CD (p=0.05)	7.57	8.65	0.31	0.98	7.61	1.36	11.76	0.25	0.34	0.48	-	-	-

I_1-irrigation 1 day after disappearance of ponded water (DADPW), I_2-3 DADPW, I_3-5 DADPW with four integrated nutrient supply as sub-plots , S_1-100% NPK (120:60:40 Kg ha^{-1}) through inorganic fertilizer, S_2-75% NPK + 25% N through FYM, S_3-75% NPK + 25% N through biocompost , S_4-75% NPK + green manuring, LAI - leaf area index

and dry matter accumulation (17.54g) was obtained with 7 cm irrigation 1 DADPW which was found significantly superior to 7 cm irrigation 3 and 5 DADPW at harvest stage except LAI at 90 DAT (Table 1). It could be due to rapid growth by maintenance of adequate water supply to crop which maintained good establishment of roots and various metabolic processes that perform better nutrient mobilization , which resulted in maximum plant height under the treatments. This is in harmony with the observations of Singh and Ingran (1995).

The application of full dose of NPK through inorganic fertilizer recorded significantly higher plant height (123.30cm), number of tillers m^{-1} (138.67) leaf area index (4.84) and dry matter accumulation (15.45g) which was found at par with 75% NPK + green manuring applied through inorganic fertilizer at harvest stage and significantly superior over rest of treatments. These results are in agreement with those of Parihar *et al.* (1995).

The higher number of effective tillers m^{-1} (121.54), Length of panicle (22cm), no. of grains $panicle^{-1}$(180.14), weight of grains $panicle^{-1}$ (4.34 g), grain yield (5.44 tha^{-1}) and straw yield (7.67 tha^{-1}) was recorded under 7 cm irrigation 1 DADPW which was significantly superior over the 7 cm irrigation 3 and 5 DADPW. Grain yield was higher by 10.92%, 14.12% in 7 cm irrigation 1 DADPW as compared to 7 cm irrigation 3 and 5 DADPW, respectively. This might be due to adequate moisture availability which contributed to increased dry matter accumulation. The yield increased under 7 cm irrigation 1 DADPW due to the fact that rice plant possessed superior yield attributes like panicle m^{-2}, number of filled grains $panicle^{-1}$ and weight of grains $panicle^{-1}$. 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. Similar observations were reported by Singh *et al.* (1991) and Singh *et al.* (1995).

Application of full dose of NPK through inorganic fertilizers significantly recorded the highest number of effective tillers m^{-1} (118.94), length of panicle (21.14 cm), no. of grains $panicle^{-1}$(174.33), weight of grains $panicle^{-1}$ (4.11g), grain (5.20 tha^{-1}) and straw yield (7.45 tha^{-1}), which was at par with green manuring + 75% NPK applied through inorganic fertilizers. The grain yield was higher by 5%, 8.8% under full dose of

NPK (120:60:40 kg ha^{-1}) through inorganic fertilizers as compared to 75% NPK + 25% N thought farm yard manure and 75% NPK + 25 % N thought bio-compost, respectively. This might be due to more profuse growth of yield attributes under higher level of nutrients soil. Similar results were reported by Pal *et al.* (2005).

Irrigation requirement was the highest under irrigation schedule of 7 cm irrigation 1 DADPW followed by 7 cm irrigation 3 and 5 DADPW. Therefore, maximum water use efficiency was observed under 7 cm irrigation 5 DADPW (55.80 kg ha^{-1} cm^{-1}) due to higher utilizing water by the crop but grain yield was also reduced substantially as compared to both the irrigation. The data recorded under different treatment of integrated nutrient supply in respect to water use efficiency was highest (57.49 kg ha^{-1} cm^{-1}) with the application of full dose of NPK followed by green manuring + 75% NPK through inorganic fertilizers (Table 1). Similar result were reported by Parihar *et al.* (1995).

The data recorded under different components of economics reveal that gross return increased with increasing grain + straw yield of rice obtained under different treatments. Maximum gross return (₹ 64674 ha^{-1}), net return (₹ 37169.0 ha^{-1}) and B:C ratio (1.35) was calculated under 7 cm irrigation 1 DADPW with full dose of NPK through inorganic fertilizers followed by 7 cm irrigation 1 DADPW with 75% NPK + green manuring through inorganic fertilizers. This is due to higher production of grain and straw and higher increase in output in comparison to input, also reported by Singh and Singh (2007).

Application of 7 cm irrigation 1DADPW and full dose of NPK through inorganic fertilizers significantly increased the growth, yield attributes and yield and B: C ratio of the crop.

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