Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
www.phytojournal.com
JPP 2020; 9(6): 349-351
Received: 22-09-2020
Accepted: 26-10-2020

Mahendra Pratap Singh
Ph.D. Scholar, Department of Agronomy, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

BN Singh
Assistant Professor, Department of Agronomy, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

RC Tiwari
Associate Professor, Department of Agronomy, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

Amit Kumar
Ph.D. Scholar, Department of Agronomy, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

Prashant Singh
Ph.D. Scholar, Department of Agronomy, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

Chandra Shekhar
Ph.D. Scholar, Department of Agronomy, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

Corresponding Author:
Mahendra Pratap Singh
Ph.D. Scholar, Department of Agronomy, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

Response of different moisture regimes and nutrient management on growth, yield and water use efficiency of hybrid rice (*Oryza sativa* L.)

Mahendra Pratap Singh, BN Singh, RC Tiwari, Amit Kumar, Prashant Singh and Chandra Shekhar

Abstract
A field experiment was conducted during 2017-18 and 2018-19 at Agronomy research farm of ANDUAT, Kumarganj, Ayodhya to study the effect of different moisture regime and integrated nutrients management on growth, yield and water use efficiency of hybrid rice. Result data revealed that 7 cm irrigation given at 1 day after disappearance of ponded water resulted significantly higher growth attributes *viz*., plant height, number of shoots per running meter, leaf area index and drymatter accumulation and yield *viz*., grain and straw yield and harvest index of hybrid rice. Maximum water use efficiency was recorded with 7cm irrigation given at 4 DADPW. Application of 75% NPK + 25% N through biocompost recorded significantly higher plant height, number of shoots per running meter, LAI, drymatter accumulation per plant, grain and straw yield, harvest index and water use efficiency of hybrid rice as compared to rest of the treatments.

Keywords: Days after disappearance of ponded water (DADPW), Growth attributes, harvest index, water use efficiency, conventional irrigation.

Introduction
Rice (*Oryza sativa* L.) plays a pivotal role in Indian agriculture, as it is the principal food crop more than 70 percent of the word population stress the need to increase the production and productivity of crop. In the immediate future hybrid rice is practically feasible and having acceptable technology for enhancement of production. To fully exploit the potential of hybrid rice proper water needs and nutrient management is of prime importance for achieving high crop yields. Efficient irrigation through timely application of water in desirable amount not only improves the crop yield, but also enhances water use. The proper use of available irrigation water and application of optimum dose of nutrients in respect to available soil moisture may play an important role in minimizing the present large gap between yield achieved and yield achievable. Therefore, the present experiment was conducted to study the response of different water regimes and integrated nutrients management on growth, yield and water use efficiency of hybrid rice (*Oryza sativa* L.).

Materials and methods
The present field investigation on response of different moisture regime and integrated nutrients management on growth, yield and water use efficiency of hybrid rice (*Oryza sativa* L.) was conducted during *kharif* season of two consecutive years of 2017-18 and 2018-19 at Agronomy Research Farm, Acharya Narendra Deva University of Agriculture & Technology, Narendra Nagar, (Kumarganj) Ayodhya. The treatment combinations comprised of four moisture regime *viz*. 7cm irrigation given at 1 DADPW, 7cm irrigation given at 4 DADPW, 7cm irrigation given at 7 DADPW and conventional irrigation and five integrated nutrients management *viz*.100% RDF of NPK (150:75:60 kg/ ha) through inorganic fertilizer, 75% NPK + 25% N through biocompost, 50% NPK + 50% N through biocompost, 75% NPK + 25% N through FYM, 50% NPK + 50% N through FYM were executed in split plot design with three replications. The soil of the experimental field was silt loam in texture with low in organic carbon (0.30-0.31%), available nitrogen (185.0-189.0 kg ha^{-1}) and phosphorus (16.0-16.2 kg ha^{-1}) and high in available potassium (282-284 kg ha^{-1}). The hybrid rice (Arize 6444) was transplanted on 8th July and 12th July 2017 and 2018 and harvested on 10th November and 14th November of 2017 and 2018 during first and second years of experimentation, respectively. The observations on growth and growth attributed at harvest stages of crop growth, yield and water use efficiency were taken after harvest of crop.

Results and discussion

Effect of moisture regime

Significantly maximum number of shoots per running meter, plant height, leaf area index and dry matter accumulation of hybrid rice was recorded with 7 cm irrigation given at 1DADPW, which was significantly superior over 4 and 7 DADPW (Table 1). The growth attributes of hybrid rice might be highest due to maintenance of adequate water supply, which emphasized the rapid growth, good establishment of roots and different metabolic processes resulting higher nutrient metabolism and uptake through appropriate water supply contributed to rapid cell elongation, which resulted maximum plant height under the treatments. Minimum growth attributes of hybrid rice was recorded with 7 cm irrigation given at 7 DADPW due to poor growth caused by moisture deficit conditions. The increase in growth and growth attributes of hybrid rice due to increase in moisture availability have also been reported by several workers (Kumari, 2012; Shekara *et al*, 2011) [4, 10].

Significantly higher grain and straw yields of hybrid rice were recorded with 7 cm irrigation given at 1DADPW as compared to 7 cm irrigation given at 4 DADPW, conventional irrigation and 7 cm irrigation given at 7 DADPW, this might be due to adequate moisture availability, which contribute to better growth parameter and yield attributes (Table 2**)**. However, lowest grain and straw yields were recorded with 7 cm irrigation given at 7 DADPW which might be due to moisture deficit experienced by the crop. The lowest grain and straw yield was obtained with the decrease in irrigation frequency. This might be due to poor growth of plants, high weed infestation and also the water stress limits the supply of photosynthates resulting the poor yield attributes. The results confirm the findings of Maheshwari *et al* (2008) and Shekhara *et al* (2010) [6, 9].

Highest harvest index (46.27%) of hybrid rice was recorded with 7cm irrigation given at 1 days after disappearance of ponded water followed by 7 cm irrigation given at 4 day after disappearance of ponded water (46.17%), conventional irrigation (45.69%) and 7 cm irrigation given at 7 day after disappearance of ponded water (45.22%). The increase in harvest index of hybrid rice with increase in irrigation might be due to increase in grain and straw yield. Similar results have also been reported by Kumar *et al* (2000) and Shekara *et al* (2010) [2, 9].

The water use efficiency shown in Table 2 clearly indicatedes that the maximum water use efficiency (77.15 kg ha^{-1}) was computed with 7 cm irrigation given at 4 days after disappearance of ponded water followed by 7 cm irrigation given at 7 day after disappearance of ponded water (73.57 kg ha^{-1}) and 7 cm irrigation given at 1 days after disappearance of ponded water (62.12 kg ha-1. The minimum water use efficiency (49.99 kg ha^{-1}) of hybrid rice was recorded with conventional irrigation method. The lower water use efficiency with high irrigation regime might be due to consumption of more quantity of water. Similar results was also corroborated with the findings of Nayak *et al.* (2016) [8].

Effect of integrated nutrients management

Significantly higher number of shoots per running meter, plant height, leaf area index and drymatter accumulation of hybrid rice was produced in case of integrated nutrients management with the application of 75% NPK + 25% N through biocompost as compared to rest of the integrated nutrients management treatments (Table 1). This might be due to adequate integrated nutrients menagement increased plant height, produced more number of shoots and leaf area index. Application of 75% NPK + 25% through FYM also produced significantly more number of shoots per running meter, plant height, leaf area index and drymatter accumulation of hybrid rice as compared to 50% NPK + 50% N either through biocompost or FYM. Growth attributes was increased mainly due to adequate nutrient supply to the plants resulting rapid growth by bigger establishment of roots and various metabolic process which enhanced the mobilization of synthesized carbohydrate into amino acids and proteins which stimulated the rapid cell division and cell elongation and there by faster plants growth. The lowest growth attributes was recorded with 50% NPK through inorganic fertilizers + 50% N through FYM at all growth stages due to nutrient deficit condition caused poor growth and nutrient mobilization. These results are in close accordance of those obtained by Ali *et al, (*2017) and Singh *et al*, (2018) [1, 11].

Grain and straw yield were affected significantly due to various integrated nutrients management. Significantly higher grain (73.25 q ha^{-1}) and straw (84.90 q ha^{-1}) yield of hybrid rice was obtained with the application of 75% NPK + 25% N through biocompost as compared to rest of treatments (Table 2). Higher grain and straw yield under this treatment of integrated nutrients management was due to sufficient integrated nutrients availability to the plants which contributed to increased dry matter production. The better vegetative growth coupled with higher yield attributes resulted in higher grain and straw of rice. Lowest grain (63.06 q ha^{-1}) and straw (75.06 q ha^{-1}) yield were recorded with the application of 50% NPK + 50% N through FYM this was due to poor growth metabolic process and lesser number of grains per panicle. The increase is grain and straw yield due to integrated nutrients management have also been reported by Kumar *et al*, (2013) and Singh *et al*, (2015) [3, 12].

Highest harvest index (46.59%) of hybrid rice was obtained with the application of 75% NPK + 25% N through biocompost followed by 75% NPK + 25% N through FYM (46.56%), 100% RDF of NPK (100:75:60 kg ha^{-1}) through inorganic fertilizer (46.53%), 50% NPK + 50% N through biocompost (45.79%) and 50% NPK + 50% N through FYM (45.66%) It might be due to proportionately increased grains yield over straw by and large these poor harvest index is indicated the fact that most of the energy of the plant is retained in vegetative parts and less translocated to fruiting organs. The significant enhancement in harvest index of rice with the application of organic and inorganic sources of plant nutrients was also observed by Manjunath *et al*, (2016) and Naorem *et al*, (2018) [7, 5].

Maximum water use efficiency (69.53kg ha^{-1} cm) was obtained with the application of 75% NPK + 25% N through biocompost followed by 75% NPK +25% N through FYM (65.52 kg ha^{-1} cm), 100% RDF of NPK (100:75:60 kg ha^{-1}) through inorganic fertilizers (64.36 kg ha^{-1} cm), 50% NPK + 50% N through biocompost (61.11 kg ha^{-1} cm) and 50% NPK + 50% N through FYM (59.86 kg ha^{-1} cm). The similar results ware also reported by the scientists in their studies.

Table 1: Grwoth and growth attributes of hybrid rice as affected by different moisture regime and integrated nutrients manegement (pooled of 2 years)

Treatments	Plant height (cm)	Number of shoots per running meter	Leaf area index	Dry matter accumulation (g hill^{-1})
Moisture regime				
7cm irrigation given at 1 DADPW	119.42	141.06	5.00	22.68
7cm irrigation given at 4 DADPW	111.96	116.91	4.12	18.67
7cm irrigation given at 7 DADPW	103.40	106.03	3.71	16.18
Conventional irrigation	105.29	109.40	3.74	16.59
SEm±	2.02	2.52	0.08	0.30
CD at 5%	4.96	6.18	0.19	0.73
Integrated nutrients management				
100% RDF of NPK(150:75:60 Kg/ ha) through inorganic fertilizers	110.49	119.89	4.10	18.11
75% NPK + 25% N through Biocompost	119.96	134.07	4.55	21.57
50% NPK + 50% N through Biocompost	106.81	112.52	3.96	17.42
75% NPK + 25% N through FYM	112.58	122.37	4.22	18.80
50% NPK + 50% N through FYM	104.22	105.40	3.65	16.73
SEm±	2.32	2.49	0.09	0.40
CD at 5%	6.69	7.20	0.25	1.17

Table 2: Grain and straw yield and harvest index of hybrid rice as affected by different moisture regime and integrated nutrients manegement (pooled of 2 years)

Treatments	Grain yield (qha^{-1})	Straw yield (qha^{-1})	Harvest index (%)	WUE kg ha^{-1} cm
Moisture regime				
7cm irrigation given at 1 DADPW	73.05	84.90	46.27	62.12
7cm irrigation given at 4 DADPW	69.12	80.58	46.17	77.15
7cm irrigation given at 7 DADPW	60.76	73.62	45.22	73.57
Conventional irrigation	65.78	78.20	45.69	49.99
SEm±	1.30	1.56	-	-
CD at 5%	3.19	4.18	-	-
Integrated nutrients management				
100% RDF of NPK(150:75:60 Kg/ ha) through inorganic fertilizers	67.80	77.92	46.53	64.36
75% NPK + 25% N through Biocompost	73.25	83.99	46.59	69.53
50% NPK + 50% N through Biocompost	64.38	76.21	45.79	61.11
75% NPK + 25% N through FYM	69.02	79.22	46.56	65.52
50% NPK + 50% N through FYM	63.06	75.06	45.66	59.86
SEm±	1.40	1.63	-	-
CD at 5%	4.02	4.72	-	-

References

1. Ali Naiyar Md., Izhar Tajwar. Performance of SRI principles on growth, yield and profitability of rice (*Oryza sativa* L.) Journal of Pharmacognosy and Phytochemistry 2017;6(5):1355-1358.
2. Kumar R, Singh G, Walia SS. Long term effect of manures and fertilizers on rice yield and soil fertility status in rice-wheat system. Environment and Eco 2000;18(3):546-549.
3. Kumari Niru, Singh CS, Prashad J, Singh MK, Kumar R. Influence of organic nutrient sources on productivity of rice (*Oryza sativa*) based cropping system in Jharkhand. Indian Journal of Agronomy 2013;58(3):277-281.
4. Kumari P. Effect of soil moisture regimes and levels of nitrogen on growth and yield of aerobic rice (*Oryza Sativa* L). M. Sc. (Ag.) Thesis. RAU, Pusa, Bihar 2012.
5. Naorem LC. Effect of Organic Manures and Chemical Fertilizers on the Yield of Rice Seed "Lalat*"* Int. J Curr. Microbiol. App. Science 2018;7(10):2161-2166.
6. Maheswari J, Bose J, Sangeetha SP, Sanjutha S, Sathyapriya R. Irrigation regimes and N levels influence chlorophyll, leaf area index, proline and soluble protein content of aerobic rice. International Journal of Agricultural Research 2008;3(4):307-309.
7. Manjunath BL, Mahajan Gopal R, Ramesh R, Singh NP. Effect of improved nutrient management on grain yield of rice (*Oryza sativa*) and soil health under organic management. Indian Journal of Agronomy 2016;61(1):25-32.
8. Nayak BR, Pramanik K, Khanda CM, Panigrahy N, Samant PK, Mohapatra S, Mohanty AK, Dash AK, Panda N, Swain SK. Response of aerobic rice (*Oryza sativa*) to different irrigation regimes and nitrogen level in western Odisha. Indian Journal of Agronomy 2016;61(3):321-325.
9. Shekara BG, Sharnappa KN. Effect of irrigation schedule on growth and yield of aerobic rice (*Oryza Sativa*) to soil moisture regime and weed control. Indian Journal of Agronomy 2010;43(1):82-86.
10. Shekara BG, Venkatesh M, Govindappa M, Thimmarayappa M, Krishnappa MR. Water use efficiency, economics and grain yield of aerobic rice (*Oryza sativa* L.) as influenced by irrigation schedule. Environment and Ecology 2011;28(3B):2117-2119.
11. Singh C, Zaidi SFA, Kumar M, Singh R, Singh V, Singh MK. Effect of INM Modules and Different Cultural Practices on Properties of Silty Clay Loam Soil. International Journal of Current Microbiology and Applied Science 2018;7(1):653-658.
12. Singh SK, Thakur R, Singh MK, Singh CS, Pal SK. Effect of fertilizer level and seaweed sap on productivity and profitability of rice (*Oryza sativa*). Indian Journal of Agronomy 2015;60(3):420-425.