Int.J.Curr.Microbiol.App.Sci (2018) *7*(2): 59-66

International Journal of Current Microbiology and Applied Sciences
***ISSN: 2319-7706* Volume 7 Number 03 (2018)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2018.703.007

Effect of Moisture Regime and Nutrient Management System on Yield and Economics of Wheat (*Triticum aestivum* L.)

Ajit Kumar, Sanjay Kumar*, Anil Kumar Singh, Dinesh Kumar, Harikesh, Tarun Gopal, Deepak Pandey and Vinay Kumar Pandey

Department of Agronomy, NDUAT Kumarganj, Faizabad-224 229, UP, India

**Corresponding author*

Keywords

Wheat, Moisture regime, Nutrient, Varieties, Growth, Economics, Yield

Article Info

Accepted:
04 February 2018
Available Online:
10 March 2018

A B S T R A C T

The field experiment was conducted at Agronomy Research Farm of Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad (U.P.) during *Rabi* season of 2014-15 and 2015-16. Sixteen treatments comprised of four levels of moisture regime (a) I1; 0.6 IW/CPE ratio (b) I2; 0.8 IW/CPE ratio (c) I3; 1.0 IW/CPE ratio and (c) I4; 1.2 IW/CPE ratio and four levels of fertilizers ((a) 100% RDF through inorganic fertilizers (120:60:40 kg NPK ha-1) (b) 75% NPK+ 25% N through FYM (90:45:30 kg NPK ha-1) (c) 50% NPK+ 50% N through FYM (60:30:20 kg NPK ha-1) (d) 25% NPK+75% N through FYM (30:15:10 kg NPK ha-1) were tested in a split plot design with three replications. The growth attributes *viz.*, number of shoots, plant height, dry matter accumulation and yield attributing characters *viz.*, number of grains spike^{-1}, number of spike m^{2}, length of spike, test weight, grain and straw yield, harvest index, nutrients uptake by crop was significantly increased 75% RDF (90:45:30 kg NPK/ha +25% N through FYM along with I4; 1.2 IW/CPE ratio moisture regime which was at par with 100% RDF(120:60:40 kg NPK/ha)along with I4; 1.2 IW/CPE ratio moisture regime and significantly higher over rest of the treatment as well as economics of various treatments were recorded. Moisture regime of 1.0 IW/CPE ratio (5-6irrigations) was found suitable for achieving higher yield of wheat with 75% RDF (90:45:30 kg NPK/ha +25% N through FYM followed by 100% RDF (120:60:40 kg NPK/ha) was found suitable higher growth and yield of wheat crop. On the basis of results obtained, application of 75% RDF (90:45:30 kg NPK/ha +25% N through FYM, nutrient supply system and I4; 1.2 IW/CPE ratio moisture regime found to be more suitable for higher yield of wheat variety Malviya 234.Wheat cultivar Malviya 234accrued the maximum net return with B:C ratio of 2.76 under 1.0 IW/CPE moisture regime (I3) with 100% RDF through inorganic fertilizers (120:60:40 kg NPK ha-1).

Introduction

Wheat (*Triticum aestivum* L.) is a staple food of the world and falls under Poaceae family. It is primarily grown in temperate regions and also at higher altitude under tropical climatic areas in winter season. It is the single most important cereal crop that has been considered as integral component of the food security system of the several nations Wheat is the single, most important cereal crop that has been considered as integral component of the

food security system of the several nations. It ranks first in the world among the cereals both in area with 225.43 mha and production with 708.0 mt. In India, total area under wheat is 29.90 mha with the production and productivity of 93.90 mt and 3.14 t ha-1 respectively (Anonymous, 2014).

The normal time for sowing of dwarf wheat in irrigated tracts starts in the beginning of November. Medium to long duration varieties taking 135-145 days to mature should be sown in the first fortnight of November while, short duration varieties (120-125 days) may be sown in the second fortnight of November (Singh *et al.,* 1984 and Shaktawat, 1986). The productivity of wheat in eastern U.P. is very low (25 q ha^{-1}) and it might be due to adoption of cereal-cereal (Rice-Wheat) cropping system, poor management in balanced fertilization, etc. Increasing level of production can be achieved by increasing level of fertilizer, but continuous use of chemical fertilizers alone may lead diminishable yield even with the recommended dose of fertilizer application. Besides chemical fertilizer alone may also lead to same detrimental effect on physical and chemical properties of soil and may not be so remunerable unless the fertility of soil is maintained at sustainable level by application of organic manures. Therefore to maintain fertility and productivity of soil at sustainable level for long duration, there is a need to adopt the concept of integrated nutrient management. Organic manures such as farmyard manure are to be considered and integral component and may help to recover soil health in cropping system (Ranwa and Singh, 1999) as they improve soil fertility and physical properties. Organic matters in soil improve physical condition of soil for better performance of microorganism and physical status at soil (Kumar and Tripathi, 1990).

Irrigation water is a major constraint for assumed crop production. Evapo-transpiration by a full crop cover is closely associated with the evaporation from an open pan. At present irrigation is very costly input so will be used very judiciously. Parihar *et al.,* (2003) suggested a relatively more practical meteorological approach of IW/CPE, the ratio between a fixed amount of irrigation water (IW) and Cumulative Pan Evaporation, as a basis for irrigation scheduling to crops. IW/CPE approach merits special consideration on account of its simplicity of operation. IW/CPE is taken for applying water to wheat and for comparative study treatments at critical growth stages, Patel and Upadhya, (1993) reported that the higher grain yield with IW: CPE ratio 1.2 of 6cm irrigation, resulted in improved yield attributes, viz. effective tiller per meter row length, spikelets per spike, number of grains per spike, grain weight per spike and 1000-grain weight.

Materials and Methods

A field experiment was conducted at Main Research Farm, Department of Agronomy of Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad (U.P.) India. The farm is located 42 km away from Faizabad city on Faizabad- Raebareily road at 26.47˚ N latitude and 82.12˚ E longitude and about 113 metres above the mean sea level. Sixteen treatments comprised of four levels of moisture regime (a) I1; 0.6 IW/CPE ratio (b) I2; 0.8 IW/CPE ratio (c) I3; 1.0 IW/CPE ratio and (c) I4; 1.2 IW/CPE ratio and four levels of fertilizers (a) 100% RDF through inorganic fertilizers (120:60:40 kg NPK ha^{-1}) (b) 75% NPK+ 25% N through FYM (90:45:30 kg NPK ha^{-1}) (c) 50% NPK+ 50% N through FYM (60:30:20 kg NPK ha^{-1}) (d) 25% NPK+75% N through FYM (30:15:10 kg NPK ha^{-1}) were tested in a split plot design with three replications. The wheat variety Malviya 234 was sown in 20 cm row to row distance on 16 Nov., during both years. Fertilization was doneby using inorganic fertilizers and

FYM as per treatments (level of inorganic fertilizers; 100%, 75%, 50% and 25%) and was added at time of sowing while full dose N was applied as basal and rest half nitrogen was top dressed in two splits after first irrigation and second 45 DAS were done as when required during 2014-15 and 2015-16.Whereas first irrigation of all treatments done at CRI stage (21DAS) after that as per IW/CPE ratio treatments. From the individual plot the crop of net plot area was harvested for taking observation. The final seed weight was recorded in kg per plot and converted into q/ha.

Results and Discussion

The data pertaining to different moisture regimes and varieties, plant growth and yield given in Table 1 reveal that the growth and yield of wheat was affected by moisture regimes.

Effect on crop growth

Data on progressive plant height at the successive stages of crop growth as influenced by various nutrient supply system and moisture have been summarized in Table 1. In general, plant height increased successfully up to 90 DAS stage. There after the rate of increased in plant height was nominal at harvest stage of the crop.

It is evident from the data that the effect of nutrient supply system was not visible at 30 DAS stage, after this, it exhibited significant effect on plant height at 60, 90 DAS stage and at harvest stage. At all the stages of growth, the tallest plants were recorded with an irrigation practice of I_4 (IW/CPE of 1.2) which was at par with I_3 (IW/CPE of 1.0) and the shortest plants with I_1 (IW/CPE of 0.6) and I_2 (0.8 IW/CPE ratio). The higher plant height were counted it could be attributed to the fact that due to proper combinations of inorganic and organic source of nutrient in F_2 (75% NPK+ 25% N through FYM) would certainly increased the amount of availability to the individual plant and hence resulted in taller plants while the plants were shortest stature with F4 (25% NPK+ 75% N through FYM). These findings were in close conformity with those of Zhong *et al.,* (2015), Mohsin *et al.,* (2014), Singh *et al.,* (2012), Naser *et al.,* (2000), Khola *et al.,* (1989).

Higher dry matter production was due more plant height and increased LAI together produced higher dry matter production. Dry matter production of wheat tended to increase progressively with advance in the age of the crop. The total dry matter production of I_3 (1.2 IW/CPE Ratio) was higher with the crop nutrient level of F_2 (75% NPK+ 25% N through FYM) which was at par with F1 and significant over with F3 and F4 which resulted in the lowest dry matter accumulation.

These findings were in agreement with Zhong *et al.,* (2015), Mohsin *et al.,* (2014), Singh *et al.,* (2012), Naser *et al.,* (2000), Khola *et al.,* (1989).

Effect on yield and yield attributing parameter

The yield attributes character like number of spike, length of spike and number of grain per spike was recorded with the highest level of irrigation tried i.e., IW/CPE ratio of 1.2 (I4) which was at par with IW/CPE ratio of 1.0 while significantly higher than with IW/CPE ratio of 0.6 (I1) and 0.8 IW/CPE ratio, among the nutrient management tried, the yield attributes was recorded with F_2 (75% NPK+ 25% N through FYM), which was at par with F1. This might be due to better growth of individual plant in F_2 and F_1 which resulted in utilization of accumulated photosynthates and influenced the growth and development of yield attributes.

Table.1 Growth parameter and yield and yield attributing parameter as influenced by Moisture regime and Nutrients supply system on wheat crop

Treatment	Plant height (cm)				Dry matter accumulation (g m^{-2})				Number of spike/m^2	Length of spike (cm)	Grain $spike^{-1}$	Grain yield (q/ha)	Straw yield (q/ha)	Test weight (g)
	30 DAS	60 DAS	90 DAS	At harvest	30 DAS	60 DAS	90 DAS	At harvest						
Nutrients supply system														
F_1	23.73	49.75	79.95	80.75	67.92	458.02	767.20	971.85	279.95	7.92	35.53	29.95	39.75	36.17
F_2	25.50	53.49	86.02	86.87	73.08	492.50	825.00	1045.02	301.02	8.52	30.22	32.22	41.27	36.93
F_3	26.00	54.62	87.70	88.58	74.50	502.38	841.48	1065.90	307.03	8.67	38.97	32.85	41.19	37.20
F_4	26.73	56.20	90.30	91.18	76.75	517.13	866.23	1097.25	316.05	8.93	40.12	33.81	42.84	37.50
SEm±	0.67	1.04	2.27	2.28	1.87	11.06	21.152	22.49	7.78	0.19	1.07	0.68	4.11	0.92
C.D. (P=0.05)	1.97	3.05	6.68	6.69	5.48	32.44	62.03	65.97	22.83	0.56	3.14	2.00	1.06	NS
Seed rate (kg ha^{-1})														
S_1	24.20	50.85	81.68	82.50	69.44	467.89	783.71	992.75	285.96	8.09	36.29	30.95	39.63	36.65
S_2	25.78	54.05	86.86	87.74	73.75	497.43	833.24	1055.48	304.01	8.59	38.59	32.54	41.90	37.15
S_3	26.50	55.64	89.44	90.30	76.00	512.21	857.99	1086.79	313.06	8.85	39.75	33.49	42.26	37.05
SEm±	0.58	0.90	1.97	1.97	1.62	9.58	18.31	19.48	6.74	0.16	0.92	0.59	0.92	0.80
C.D. (P=0.05)	1.71	2.64	5.78	5.79	4.75	28.098	53.72	57.13	19.77	0.48	2.72	1.73	2.71	NS

(Note: I_1:6 cm irrigation at 0.6 IW/CPE;I_2:6 cm irrigation at 0.8 IW/CPE; I_3:6 cm irrigation at 1.0 IW/CPE; I_4:6 cm irrigation at 1.2 IW/CPE); (F_1: 100% RDF through inorganic fertilizers (120:60:40 kg NPK ha^{-1}); F_2: 75% NPK+ 25% N through FYM (90:45:30 kg NPK ha^{-1}); F_3: 50% NPK+ 50% N through FYM (60:30:20 kg NPK ha^{-1}); F_4: 25% NPK+ 75% N through FYM (30:15:10 kg NPK ha^{-1})

Table.2 Economics as influenced by Moisture regime and Nutrients supply system on wheat crop

Treatment	Total cost of cultivation	grain yield (q/ha)	Straw yield (q/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	Rs/return (B:C ratio)
I_1F_1	33644	38.83	57.67	96645	63001	1.87
I_1F_2	34057	38.42	56.67	95328	61271	1.80
I_1F_3	34470	39.45	58.67	98242	63773	1.85
I_1F_4	34883	37.02	52.67	90403	55520	1.59
I_2F_1	34644	46.18	67.00	113752	79109	2.28
I_2F_2	35057	40.74	60.67	101521	66464	1.90
I_2F_3	35470	46.75	68.00	115285	79815	2.25
I_2F_4	35883	39.47	57.00	97019	61136	1.70
I_3F_1	35644	53.63	80.33	133986	98342	2.76
I_3F_2	36057	43.79	63.33	107705	71648	1.99
I_3F_3	36470	54.83	80.67	135894	99424	2.73
I_3F_4	36883	41.89	58.67	101604	64721	1.75
I_4F_1	36644	55.34	80.00	136089	99446	2.71
I_4F_2	37057	47.98	72.33	120227	83170	2.24
I_4F_3	37470	56.01	81.33	138011	100541	2.68
I_4F_4	37883	46.28	65.33	112628	74745	1.97

(Note: I_1:6 cm irrigation at 0.6 IW/CPE;I_2:6 cm irrigation at 0.8 IW/CPE; I_3:6 cm irrigation at 1.0 IW/CPE; I_4:6 cm irrigation at 1.2 IW/CPE); (F_1: 100% RDF through inorganic fertilizers (120:60:40 kg NPK ha^{-1}); F_2: 75% NPK+ 25% N through FYM (90:45:30 kg NPK ha^{-1}); F_3: 50% NPK+ 50% N through FYM (60:30:20 kg NPK ha^{-1}); F_4: 25% NPK+ 75% N through FYM (30:15:10 kg NPK ha^{-1})

This might be due to more vigorous and luxuriant vegetative growth, which in turn favoured a better partitioning of, assimilates from source to sink. Similar results were obtained by Pal *et al.,* (2001), Singh *et al.,* (2007), Das and Guha (1998) and Khiriya and Singh (2003).

Higher thousand grain weight was recorded with IW/CPE ratio of 1.2 (I4) which was at par with IW/CPE ratio of 1.0and 0.8 IW/CPE ratio (I2) while significantly higher than IW/CPE ratio of 0.6 (I1) and 0.8 ratio, which has resulted in lower grain weight. With F_2 (75% NPK+ 25% N through FYM) as regards the nutrient management practices, the higher no of grain per spike of wheat was recorded with the nutrient management of F_2 which was at par with F_1.This was followed by F_3, which was comparable with lowest no of grain per spike F_4.which produced the lowest hundred seed weight. Better growth of individual plant in F_2 result in better utilization of accumulated photosynthates which influenced the growth and development of yield attributes. This finding was in conformity with the work of Pal *et al.,* (2001), Singh *et al.,* (2007), Pradhan *et al.,* (2013), and Khiriya and Singh (2003).

The higher seed yield was recorded with the highest level of irrigation tried i.e., IW/CPE ratio of 1.2 (I4), which was however comparable with 0.8 IW/CPE ratio (I3) and 0.6(I1), which has resulted in lower seed yield. Higher seed yield due to irrigation might be accounted to their favourable influence on the crop growth and yield attributes. As regards the nutrient management practices, highest seed yield was recorded with a nutrient management of F2, which was at par with F1 followed by F3 and F4with significant difference between them, which produced the lowest seed yield. The same was obvious through the findings of Pal *et al.,* (2001), Saren *et al.,* (2004), Singh *et al.,* (2007), Pradhan *et al.,* (2013), Kakar *et al.,* (2015), Zagonel *et al.,* (2002) Talashikar *et al.,* (1999).

Among the irrigation levels tried, IW/CPE ratio of 1.2 (I_4) recorded the higher straw yield which was however, comparable with 0.8 IW/CPE ratio (I_3). The lowest straw yield was recorded with IW/CPE ratio of 0.6(I_1). Increased straw yield might be due to better vegetative growth and higher dry matter production. Higher straw yield was recorded with F_2, which was at par with F_1. F_3 and F_4 produced the lowest straw yield. This is due to increased number of plants per unit area and increased growth of plants i.e, plant height, leaf area, dry matter production in F_2. Similar results were obtained by by Pal *et al.,* (2001), Sheoran *et al.,* (2015), Zagonel *et al.,* (2002) Talashikar *et al.,* (1999).

Effect on economics

Data presenting to cost of cultivation in table 2. Obviously reveal that it varied with variation in the nutrient management and moisture regime. The maximum cost of cultivation of Rs.37057 ha^{-1} was recorded with I_4 F_2 while the minimum cost of cultivation of Rs.33644 ha^{-1} was recorded with I_1 F_1.

Gross return increased with increase in grain yield and straw yield of wheat. The maximum Gross return of Rs.138011 ha^{-1} were recorded with I_4 F_3, the minimum of Gross return Rs.90403 ha^{-1} were recorded with I_1 F_4.and also the maximum Net returns of Rs.100541 ha^{-1} was recorded with I_4 F_3, the minimum Net returns of Rs. 58496 ha^{-1} were recorded with I_1 F_4. Increased net returns were recorded with increase in level of irrigation and nutrient management.

This was due to higher magnitude of increase in yield though the cost of irrigation and inorganic fertilizer was higher.

The maximum Net return per rupee invested of 2.76 was recorded with I_3 F_1, the minimum Net return per rupee invested 1.59 was recorded with I_1 F_4. I_1 F_3 has high Net return per rupee invested due to higher yields and less no of irrigations.

Nutrient management system with 100% RDF (120:60:40 kg NPK/ha followed by 75% RDF (90:45:30 kg NPK/ha +25% N through FYM) was found suitable higher growth and yield of wheat crop. Moisture regime of 1.0 IW/CPE ratio (5-6 irrigations) was found suitable for achieving higher yield of wheat. Interaction between moisture regime and nutrient management was found significant on dry accumulated 90 at DAS,120 DAS, at harvest; No. of spikes; grain yield; straw yield; nutrient uptake (NPK) and water use efficiency during both the year of investigation.

References

Das, K. and Guha, B. (1998). Response of rainfed wheat to Boron, FYM and fertilizers level in Assam. *Ann. Agric. Res*., 19(2): 217-218.

Kakar, K. M., Muhammad, A.S. and Iqbal, A. (2015).Effect of irrigation levels and planting methods on phenology, growth, biomass and harvest index of spring wheat under semiarid condition. *Pure and Applied Biology*, 4(3):375-383.

Khiriya, K. D. and Singh, B. P. (2003).Effect of phosphorus and FYM on yield, yield attributes and N, P and K uptake of fenugreek. *Indian J. Agron*., 498(1): 62-65.

Khola, O.P.S., Rao, D.S., Ram Mohan; Singh, H. and Faroda, A.S. (1989). Response of late sown dwarf wheat to irrigation and fertility levels. *Indian J. Agron.* 34 (1): 114-116.

Kumar, A. and Tripathi, R.P. (1990).Effect of continuous use of manure and fertilizer on physical properties of soil under paddy-wheat-cowpea cropping system. *Crop Res*., 3(1): 7-13.

Mohsin, M., Ahmad, A., Maqsood, M., Ahmad, T., Salim, M. N. and Hassan, M. (2014). Grain yield, dry matter accumulation and root development in winter wheat as affected by irrigation levels and phosphorus fertilizer. *International Journal of Biology and Biotechnology;* 11(2/3):327-332.

Naser, H. M., Idris, M. and Hashem, M. A. (2000). Effects of time and frequency of irrigation on N, P, K and S concentration and uptake by wheat. *Bangladesh Journal of Training and Development*; 13(1/2):243-248.

Pal, S.K., Verma, U.N., Singh, M.K., Upasani, R.R. and Thakur, R. (2001).Growth and yield of late sown wheat (*T. aestivum* L.) under different irrigation schedules. *Indian J. Agric. Sci.* 71 (10):664-667.

Parihar, S.S. and Tiwari, R.B. (2003). Effect of irrigation and nitrogen levels on yield, nutrient uptake and water use of late sown wheat (*Triticum aestivum* L.). *Indian J.Agron*. 48 (2), 103-107.

Patel R M and Upadhya P N (1993). Response of wheat (*Triticum aestivum*) to irrigation under varying levels of nitrogen and phosphorus. *Indian J Agron* 40(2): 290.

Pradhan, S., Bandyopadhyay, K. K., Sahoo, R. N., Sehgal, V. K.Singh, R., Joshi, D. K. and Gupta, V. K. (2013). Prediction of wheat (*Triticum aestivum*) grain and biomass yield under different irrigation and nitrogen management practices using canopy reflectance spectra model. *Indian Journal of Agricultural Sciences*; 83(11): 1136-1143.

Ranwa, R.S. and Singh, K.P. (1999). Effect of integrated nutrient management on prevalent cropping systems. *Indian J. Agron*.44: 554-559

Saren, B. K., Dey, S. and Mandal, D. (2004). Effect of irrigation and sulphur on yield attributes productivity, consumptive use, and consumptive use efficiency of wheat (*Triticum aestivum* L.). *Indian Journal of Agricultural Sciences*. 74(5), 257-261.

Singh, M., Singh, G. R., Singh, V. P. and Singh, D. K. (2012). Effect of moisture regimes and nitrogen levels on production potential water use efficiency and economics of bed planting wheat. *New Agriculturist*; 23(2):139-143.

Singh, R. K., Singh, S. K. and Singh, L. B. 2007. Integrated nitrogen management in wheat (*Triticum aestivum*). Indian Journal of Agronomy 52(3): 124-126.

Talshikar, S. C. and Mehta, V. B. (1999).Effect of compost and FYM with urea on rice. J. of Maharashtra Agric. Univ., 23(3): 305-306.

Zagonel, J., Venancio, W. S and Kunz, R.P. (2002). Effect of growth regulator on wheat crop under different nitrogen rates and plant densities. *Planta Daninha*, 20(3): 471-476.

Zhong, W. W., Liu, J. Q., Zhou, X. B., Chen, Y. H. and Bi, J. J. (2015). Row spacing and irrigation effect on radiation use efficiency of winter wheat. JAPS, *Journal of Animal and Plant Sciences;* 25(2): 448-455.

How to cite this article:

Ajit Kumar, Sanjay Kumar, Anil Kumar Singh, Dinesh Kumar, Harikesh, Tarun Gopal, Deepak Pandey and Vinay Kumar Pandey. 2018. Effect of Moisture Regime and Nutrient Management System on Yield and Economics of Wheat (*Triticum aestivum* L.). *Int.J.Curr.Microbiol.App.Sci.* 7(03): 59-66. doi: https://doi.org/10.20546/ijcmas.2018.703.007