The Journal of Rural and Agricultural Research Vol. 19 No. 2, 28-31 (2019)
Received August 2019; Acceptance November 2019

Response of timely sown wheat varieties under limited irrigation conditions in western U.P.

HARISH KUMAR[1], RAJVIR SINGH AND SANT BAHADUR SINGH
Department of Agronomy R.B.S. College, Bichpuri Agra- 283105 (U.P)
Corresponing Author- drrajjcb@gmail.com

Abstract

A field experiment was carried out during Rabi season of 2018-19 at RBS Collage Agricultural Research Farm, Bichpuri, Agra. The experimental work was conducted in split-plot design with four replications. Three different levels of irrigation based on crop growth stages viz., no irrigation (I_0), one irrigation at CRI (I_1) and two irrigations at CRI and Boot leaf stage (I_2) were randomly allotted to main-plots, while nine wheat varieties were allocated randomly to sub-plots. More value of growth parameter and yield attributes registered with the (I_2) and it was statistically better to other main plots treatments. Amongst various varieties NIAW-3170 (V_9) registered taller shoots and other yield attributes viz. higher number of ear head/m^2, number of grains spike^{-1}, more weight of grains spike^{-1} and test weight and was significantly better to other set of treatments. Application of irrigation water at CRI and boot leaf stage (I_2), gave significantly more grain (43.05 q/ha) and straw (58.43 q/ha) yield compared to other treatments under study. Observation related to various varieties revealed that, NIAW-3170 (V_9) recorded significantly more grain (43.60 q/ha) and straw (57.34 q/ha) yield. Economics revealed that, highest net return (Rs.75870.4) and benefit cost ratio (3.42) was observed with I_2 while, highest net return (Rs.79159.2) and B:C ratio (3.77) were observed with varieties NIAW-3170 (V_9). So, it is concluded that under agro climatic conditions of western U.P. varieties NIAW-3170 (V_9) with two irrigation at CRI and boot leaf stage found to be economical to the farmers.

Keywords: Economics, varieties, irrigation level, yield, wheat

Introduction

Wheat (*Triticum aestivum* L.) is the most important staple food crop of the world and emerged as the backbone of India's food security. It is grown all over the world for its wider adaptability and high nutritive value. It is an important winter cereal contributing about 35 per cent of the total food grain production in India. Wheat straw is an important source of fodder for a large animal population in India. In India, wheat is the second most important cereal crop after rice covering an area of 29.58 million hectares. Total annual production of wheat in India was 99.70 million tonnes with the productivity of 33.71 tonnes per hectare during 2017-18. India is the second largest wheat producer (approximately 12 per cent world's wheat production) and consumer after China. In Uttar Pradesh, wheat is an important *Rabi* crop and is grown almost throughout the state with 9.75 million hectares' area under cultivation, total production of 31.88 million tonnes and an average yield of 3.27 tonnes per hectare during 2017-18 (Agricultural Statistics at Glance,2018).

Among the various factors influencing grain yield, availability of water and varieties are of supreme importance. In India, the demand for water resources is exceeding the supply and the competition for this scarce water among the various sector like domestic, industrial and agricultural use is becoming intense. Water is the key input for all recommended agronomic practices and therefore efficient utilization of irrigation water is essential for wheat and other crops (Rathore *et al*., 2014). Wheat require appreciable amount of water on its different physiological stages of crop growth and development to expose higher potentials of yield of super quality. In wheat, irrigation scheduling is followed depending on the availability of water.

[1]P.G. Scholar, Department of Agronmy, R.B.S. College, Bichpuri Agra

Considerable area (86%) sown under wheat has an access to irrigation, however, crop sown in about 14-15 per cent of the area, which amounts approximately to 4 million hectares, depends on rain. Hence, failure of monsoon followed by absence of winter rains largely reduces area as well as productivity (Sharma et al., 2013).However, there is a need to quantify the irrigation need of the crop. Number and time of irrigation play crucial role in crop productivity and farmer's net return as a whole (Mukherjee, 2016).

Selection of suitable varieties plays a vital role in crop production. The choice of right varieties of wheat helps to augment crop productivity by about 20-25 per cent. Thus, the value of stable and high yielding varieties has been universally recognized as an important factor for boosting crop production.

Keeping in view the aforesaid facts, the present study is being undertaken to evaluate the performance and adaptability of new wheat varieties to restricted irrigation conditions under agro-ecosystem of Agra region of western Uttar Pradesh.

Materials and Methods

A field experiment was conducted on sandy loam soil at RBS Collage Agricultural Research Farm, Bichpuri, Agra to study the Response of timely sown wheat varieties under limit irrigation conditions in western U.P during *Rabi* season of 2018-19. The experiment comprising of three levels of irrigations (I_0- no irrigation, I_1- One irrigation at CRI and I_2- Two irrigations at CRI and Boot leaf stage) and nine varieties of wheat. Thus, in all 27 treatment combinations were compared in a 'split pilot design' having level of irrigation in main plots and varieties in sub-plots with four replications. The soil was deficient in available nitrogen (183.00 kg ha^{-1}) and medium in available phosphorus (28.30 kg P_2O_5 ha^{-1}) and available potash (292.00 kg K_2O ha^{-1}).

The wheat varieties were sown with seed rate of 100 kg ha^{-1}, with spacing of 20.0 cm in between two rows. Full dose of NPK (90:60:40) was applied as basal in I_1 (no irrigation) while in treatment I_2 and I_3 full doses of phosphorus (60 kg P_2O_5 ha^{-1}) and potash (40 kg K_2O ha^{-1}) were supplied through DAP and MOP, respectively as basal dose at sowing time along with one-third of the recommended dose of nitrogen and rest 2/3rd nitrogen was applied at first node stage (35-40 DAS) by top dressing of urea. The irrigation was applied as per treatment on different growth stages and other management practices were adopted as per recommendations. The growth and yield parameters as well as yield were recorded at harvest

Results and Discussion

The plant height significantly improved with every increase in level of irrigation. Amongst various sub-plot treatments, varieties NIAW-3170 (V_9) produced appreciably taller plants as compared to rest of the varieties except WH-1080 (V_2) at all the stages of crop growth. Increased number of irrigations resulted in higher vegetative growth of the plant thereby increasing the shoot height. Further with various main plot treatments, no. of ear head per square meter increased significantly with every increase in level of irrigation. Varieties NIAW-3170 (V_9) produced significantly more number of ear head per square meter as compared to all other varieties which were statistically at par among themselves and could not cross the level of significance. The number of grains $spike^{-1}$ were increased significantly with increasing number of irrigations from no irrigation to two irrigations. The increase in number of grains $spike^{-1}$ with one and two irrigations was 15.22 and 24.05 per cent, respectively over no irrigation. The lesser competition and greater availability of water and nutrients with I_3 resulted in more number of grains $spike^{-1}$. With different Varieties NIAW-3170 (V_9) gave maximum number of grain $spike^{-1}$ and the difference in number of grains per $spike^{-1}$ with varieties NIAW-3170 (V_9) and WH-1080 (V_2) was 6.99 to 22.84 and 9.15 to 14.81 per cent, respectively over all other varieties. Grain weight $spike^{-1}$ increased significantly with every increase in the level of irrigation. The increase in grain weight per spike with one and two irrigations was to the tune of 22.81 and 40.35 per cent, respectively over the no irrigation. Varieties NIAW-3170 (V_9) gave significantly higher grain weight spike-1 as compared to all other varieties except WH-1080 (V_2) which also had significantly higher grain weight $spike^{-1}$ over rest of the varieties. Two irrigations applied at CRI and boot leaf stages produced significantly higher 1000 grain weight over one irrigation. Highest test weight registered with NIAW-3170 (V_9) varieties and this was significantly better to all other allotted subplots treatments. One irrigation at CRI stage and two irrigations applied at CRI and boot leaf stages required significantly more days to 75 per cent spike emergence and days to maturity over no irrigation. However, days to 75 per cent spike emergence and days to maturity failed to produce any statistical

Table 1: Growth parameters and yield attributes of wheat varieties under various levels of irrigation

Treatments	Shoot height (cm)	No. of ear head/m^2	No. of grains spike^{-1}	Weight of grains spike^{-1}(g)	Test weight (g)	Days to 75% spike emergence	Days to maturity
Irrigation levels							
I_0	66.60	261.61	30.69	1.14	30.85	88.72	121.1
I_1	89.28	267.00	35.36	1.40	37.76	93.53	125.99
I_2	95.45	272.33	38.07	1.60	38.60	97.03	130.99
SEm ±	1.57	1.43	0.69	0.05	0.24	1.01	1.34
CD at 5%	5.42	4.94	2.38	0.18	0.82	3.48	4.64
Varieties							
BRW-3806 (V_1)	82.5	267.17	33.96	1.43	36.40	92.83	124.67
WH-1080 (V_2)	92.85	268.08	37.20	1.48	38.18	93.85	125.67
HD3043 (V_3)	73.36	260.17	32.40	1.22	32.48	91.87	124.33
HI-1620 (V_4)	80.76	266.67	33.60	1.35	34.64	92.92	125.00
HD-3237 (V_5)	85.69	267.58	34.08	1.35	36.53	92.70	125.67
WH-1142 (V_6)	75.78	265.67	32.90	1.29	33.40	92.42	126.67
PBW-644 (V_7)	78.98	266.33	33.20	1.30	34.18	92.67	127.00
HI-1628 (V_8)	87.38	267.83	35.40	1.40	36.98	94.54	127.21
NIAW-3170 (V_9)	96.69	273.33	39.80	1.62	39.84	94.04	128.00
SEm ±	2.01	1.86	0.89	0.08	0.28	1.16	1.42
CD at 5%	5.63	5.21	2.48	0.21	0.78	NS	NS

response with various varieties. These findings are in close proximity with the findings of Aradwade*t al.* (2008) and Aslam, *et al.* (2014).

Irrigation had a significant influence on biological, grain and straw yields of wheat (Table 2). Application of irrigation water at Two irrigations at CRI and boot leaf stages (I_2), gave significantly more biological yield (101.48 q/ha) compared to other allotted main plots treatments. Almost similar results were obtained by Bankar *et al.* (2008). The grain yield also increased with every increase in the number of irrigations and the increase with two irrigations at CRI and boot leaf stages was to the tune of 8.49 and 45.05 per cent, over one irrigation at CRI stage and no irrigation, respectively. From the table 2 it is crystal clear that increase in irrigation frequency drastically improves wheat yield and productivity. The increased growth along with better expression of yield attributes might have led to increase in grain yield. Higher irrigation frequency increased the availability of nutrients and thus enhanced the meristematic activities and size of cell and formation and functioning of protoplasm which consistently improved the crop growth and yield. Behera and Panda (2009), Khokhar, *et al.* (2013) and Mukherjee (2016) have also reported similar results. Observations related to various varieties revealed that Varieties NIAW-3170 (V_9) resulted in significantly higher grain yield by 6.71 to 33.17 per cent over rest of the varieties. However, least grain yield observed with HD-3043 (V_3) (32.74 q/ha).More straw yield was recorded with two irrigations applied at CRI and boot leaf stages (I_2) which was found significantly superior to no irrigation (I_0) and one irrigation at CRI stage (I_1). The increase in straw yield with one and two irrigations was to the tune of 8.59 and 24.61 per cent, respectively, over no irrigation. Better plant growth might be held responsible for higher straw yield ha^{-1} with two irrigations. This corroborate with the findings of Khokhar, *et al.* (2013), Mitra and Das (2015) and Mukherjee (2016). Amongst various varieties, (V_9) produced significantly higher straw yield by 2.72 to 12.04 per cent as compared to all other varieties. Harvest index also influenced significantly due to irrigation levels. One irrigation applied at CRI stages increased significantly harvest index over no irrigation and two irrigations at CRI and boot leaf stages. Amongst various varieties more HI registered with the NIAW-3170 (V_9) and statistically better to all other sub plot treatments. Economics revealed that, more net return observed with I_2 (Rs.75870.4) with the highest benefit cost ratio of 3.42. Amongst various varieties, highest net return observed with NIAW-3170

Table 2: Biological, Grain, Straw yields and Harvest index of wheat varieties under various levels of irrigation

Treatments	Biological yield (q ha^{-1})	Grain yield (q ha^{-1})	Straw yield (q ha^{-1})	Harvest index (%)	Net return (Rs. ha^{-1})	B:C ratio
Irrigation levels						
I_0	76.57	29.68	46.89	38.76	48530.4	2.70
I_1	90.60	39.68	50.92	43.80	67464.8	3.25
I_2	101.48	43.05	58.43	42.42	75870.4	3.42
SEm ±	1.21	0.78	0.52	0.39	-	-
CD at 5%	4.20	2.70	1.80	1.36	-	-
Varieties						
BRW-3806 (V_1)	92.14	37.19	54.95	40.36	66217.6	3.32
WH-1080 (V_2)	96.68	40.86	55.82	42.26	73388.0	3.57
HD3043 (V_3)	83.92	32.74	51.18	39.01	56220.0	2.97
HI-1620 (V_4)	89.42	36.04	53.38	40.30	63348.0	3.22
HD-3237 (V_5)	93.27	38.93	54.34	41.74	69126.4	3.42
WH-1142 (V_6)	85.10	32.95	52.15	38.72	57072.0	3.00
PBW-644 (V_7)	87.35	34.61	52.74	39.62	60409.6	3.11
HI-1628 (V_8)	95.14	40.04	55.10	42.09	71533.6	3.50
NIAW-3170 (V_9)	100.94	43.60	57.34	43.19	79159.2	3.77
SEm ±	1.51	0.97	0.54	0.33	-	-
CD at 5%	4.24	2.72	1.51	0.92	-	-

(V_9) (Rs.79159.2), and this give highest B:C ratio (3.77).

References

Agricultural Statistics at a Glance (2018). Government of India, Ministry of Agriculture & Farmers Welfare, Department of Agriculture, Cooperation & Farmers Welfare, Directorate of Economics & Statistics.

Aradwad, P. D.; Bavalgave, V. G.; Waghmare, M. S. and Thete, N. M. (2008). Effect of nitrogen and irrigation levels on growth and yield of durum wheat, *Asian Journal of Soil Science*. 3(2):297-298.

Aslam, H.; Ansari, M. A.; Baloch, S. K.; Baloch, S.U. and Baloch, A.S. (2015) effect of irrigation scheduling on the growth and harvest index of wheat (Triticum aestivum L.) Verities. *Persian Gulf Crop Protection*, 3(2):15-29.

Bahera, S. K. and Panda, R. K. (2009). Integrated management of irrigation water and fertilizers for wheat crop using field experiments and simulation modeling. *Agricultural Water Management.* 96(11):1532-1540.

Bankar, K. B.; Gosavi, S. V. and Balsane, V. K. (2008) 'Effect of different irrigation treatment on growth and yield of wheat crop varieties. *International Journal of Agricultural Sciences.* 4(1): 114-118.

Khokhar, Badaruddin; Hussain, Imtiaz and Khokhar, Zafar (2013). Effect of different irrigation frequencies on growth and yield of different wheat varieties in Sindh. *Pakistan J. Agric. Res*., 23(3-4):108-112.

Mitra, S. and Das, S. (2015). Economization of irrigation schedule in wheat (Triticum aestivum L.) cultivation under sub-Himalayan plains of West Bengal, *Journal Crop and Weed*, 11(2):122-126.

Mukherjee, D. (2016). Influence of fertility levels on the performance of wheat cultivars under new alluvial zone of West Bengal. *J. Agroecology and Natural Resource Mgt.,* 3(3): 206-208.

Rathore, S.S., Shekhawat, K., Premi, O.P., Kandpal, B.K. and Chauhan, J.S. (2014). Comparative effect of irrigation system and nitrogen fertigation on growth productivity and water use efficiency of Indian mustard under semi-arid condition of Rajasthan. *Indian J. Agro*., 59(1): 112-118.

Sharma, Indu; Gyanendra Singh and R.K. Gupta (2013). Wheat Improvement in India, Proceedings of the Regional Consultation on Improving Wheat Productivity in Asia, Bangkok, Thailand.pp-8187.