



E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; SP5: 205-207

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(Special Issue- 5)
International Conference on
“Food Security through Agriculture & Allied Sciences”
(May 27-29, 2019)

Performance of wheat varieties under different irrigation condition

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Abstract

A field experiment was conducted during winter seasons of 2011-12 and 2012-13 to assess the performance of different wheat varieties under limited irrigation condition. The experimental work was conducted in split-plot design with three replications. Three different levels of irrigation based on crop growth stages *viz.*, four irrigations at CRI, maximum tillering, heading and milking stage (I1), three irrigations at CRI, heading and milking stage (I2), two irrigation at CRI and heading stage (I3), were randomly allotted to main-plots, while ten wheat varieties *viz* NW2036, HD2733, HD2888, K9107, HUW468, HUW234, K0307, NW1066, BG2 and BG3 were allocated randomly to sub-plots. Four irrigations being similar to three irrigations recorded 12.29 and 15.98 percent higher total and effective tillers compared to minimum recorded under two irrigations i.e. 309 and 294/m² respectively. However, three irrigations being similar to four irrigations recorded higher net return and B:C ratio to the extent of 15.48 and 12.37 percent compared to minimum recorded under two irrigations i.e. 44959 and 1.86 respectively. Among varieties, K9107 being similar to K0307 recorded significantly higher grain and straw yield as well as B:C ratio to the tune of 34.37, 29.40 and 52.90 percent respectively, compared to minimum recorded by NW2036 i.e. 3878, 5817 kg/ha and 1.72.

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

Introduction

Wheat is the most important cereal crop after rice in India. Among different species, *Triticum aestivum* is the most important because of its higher calorific values as well as a good supplement for nutritional requirement of human body due to presence of 9-10 percent protein and 60-80 percent carbohydrates (Sharma and Jain, 2014) [4]. Wheat is not only consumed in various forms in Indian cuisine but wheat straw is also a good source of feed for a large population of cattle in the country. The world production of wheat is 2654 M ton from 30 M ha area. In India production level of wheat had a quantum jump of 6.46 million ton from an area of 9.75 million ha in 1950-51 to 98.38 million ton from an area of about 30.6 million hectares during 2016-17 with national productivity of 3.21 ton/ha (Anonymous, 2017) [1]. In Jharkhand wheat is grown in about 0.18 M ha area and producing 0.34 M ton with an average productivity of 1.88 ton/ha. Agro climatic condition is suitable for wheat growing in Jharkhand although only 12% area is irrigated. Wheat is grown as second crop in sequence after *kharif* crop. Lack of awareness about suitable high yielding varieties, farmers are unable to fetch potential yield of wheat. Farmers having limited irrigation facilities can increase their productivity by judicious use of irrigation water along with use of suitable high yielding wheat variety. Keeping above view in consideration, an experiment was conducted to assess the performance of wheat varieties under limited irrigation condition of Jharkhand.

Materials and Methods

A field experiment was conducted at Birsa Agricultural University (23°17' N latitude, 85°10' E longitude and 625 m above mean sea level) in the Chhotanagpur plateau range during winter seasons of 2011-12 and 2012-13. The experimental soil was sandy-loam in texture with low organic carbon (0.42 %), moderately acidic (pH 6.2) in nature, low available nitrogen (215.30 kg/ha), medium phosphorus (21.25 kg/ha) and medium potassium (186.30 kg/ha). The experimental work was conducted in split-plot design with three replications.

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Three different levels of irrigation based on crop growth stages *viz.*, four irrigations at CRI(20 DAS), maximum tillering (40 DAS), heading and milking stage (55 DAS) (I1), three irrigations at CRI, heading and milking stage (I2), two irrigation at CRI and heading stage (I3), were randomly allotted to main-plots, while ten wheat varieties *viz.* NW2036, HD2733, HD2888, K9107, HUW468, HUW234, K0307, NW1066, BG2 and BG3 were allocated randomly to sub-plots. A seed rate of 120 kg/ha were taken and sown at row spacing of 20 cm. The crop was raised with recommended package and practices of weed management with application of Total (sulfosulfuron 75% + metsulfuron5% WG) 39.566 g/ha at 30 days after sowing. Irrigations applied as per treatment on the basis of critical levels as per schedule approach using 5 cm depth of irrigation water. The recommended dose of fertilizer was 120:60:40 kg/ha. Whole of P and K and half of N was applied as basal dose and remaining nitrogen was top-dressed after first irrigation. All other agronomic practices were kept normal for all the treatments. Observations regarding growth like plant height (cm), number of tillers/m² were recorded at harvest of crop while observations on fifty percent flowering was monitored regularly and specific dates were noted as per varieties. Harvesting of individual plot was done at physiological maturity when crop turned yellowish as like straw colour. Harvested plants were sun dried for few days in same plots followed by carefully bundled, tagged and finally brought to threshing floor. The bundle weight of net plot was recorded individually. Whole biomass was weighted just before the threshing. Threshing was done by power thresher plot wise and cleaned separately for taking the grain weight from the net plots. Straw yield was recorded by subtracting grain weight from total biomass yield. Data collected on different growth, yield and quality parameters were analyzed statistically by Fisher's analysis of variance technique and the least significant difference (LSD) test at 5% probability level was employed to test the significance of treatment means (Gomez & Gomez, 1984)^[2].

Results

Irrigation levels

Different level of irrigations did not influenced growth, yield attributing characters as well as days taken to 50% flowering of wheat except total and effective tillers. However, two irrigation at CRI and heading stage (I3) recorded least plant height, spike length, seeds/spike, 1000 seed weight and days

to 50% flowering and were maximum with four irrigations at CRI, maximum tillering, heading and milking stage (I1). Different irrigation levels influenced total and effective tillers of wheat. Four irrigations being similar to three irrigations recorded 12.29 and 15.98 percent higher total and effective tillers compared to minimum recorded under three irrigations i.e. 309 and 294/m² respectively.

Yield and economics

Four irrigations being similar to three recorded 13.29 and 6.07 percent higher grain and straw yields compared to lowest yield recorded under two irrigations i.e. 3963 and 5880 kg/ha. However, three irrigations being similar to four irrigations recorded higher net return and B:C ratio to the extent of 15.48 and 12.37 percent compared to minimum recorded under two irrigations i.e. 44959 and 1.86 respectively. This may be due to increase in irrigation frequency made availability of nutrients to the crop resulted increased effective tillers which lead to increase in grain yield. Mukherjee (2016)^[3] also recorded similar findings that maximum yield and net return was found with four irrigations and was at par with three irrigations.

Varieties

Variety NW1066 being significantly higher over rest of the varieties recorded 47.72% taller plant compared to minimum recorded under variety BG3. Similarly, variety NW1066 also recorded 9.59 percent longer days taken to 50% flowering compared to minimum days taken by NW 2036 and HUW 234 i.e. 77.65 days for both varieties. Variety K9107 being similar to HUW468, HUW234 and K0307 recorded 22.60 percent significantly higher spike length compared to HD2733 i.e. 10.44 cm. K0307 being similar to HD2733, HD2888 and K9107 in case of total tillers and HD2733 and K9107 in case of effective tillers recorded 48.26 and 48.4 percent higher tillers compared to lowest recorded under NW2036 i.e. 384 and 371/m² respectively.

Yield and economics

Among different wheat varieties, K9107 being similar to K0307 recorded significantly higher grain and straw yields as well as B:C ratio to the tune of 34.37, 29.40 and 52.90 percent respectively, compared to minimum recorded by NW2036 i.e. 3878, 5817 kg/ha and 1.72. Alam, *et al.*, (2005)^[5] and Kumar *et al.*, (2005)^[6] also reported variety K0307 was found beneficial among the different varieties.

Table 1: Growth and yield attributes of wheat as influenced by irrigation levels and varieties of wheat (pooled of 2 years)

Irrigation levels	Plant height (cm)	Days to 50% flowering	Spike length(cm)	Total Tiller/ m ²	Effective tillers/m ²	seeds/spike	Test weight (g)
I1-4 irr	108	80.10	11.63	347	341	53.21	39.57
I2- 3 irr	106	79.47	11.65	330	313	52.36	37.50
I3- 2 irr	101	78.87	11.20	309	294	48.64	36.50
S.Em±	1.91	0.43	0.19	6.52	6.91	1.63	1.87
CD(P=0.05)	NS	NS	NS	25.60	27.12	NS	NS
Wheat varieties							
NW2036	102	77.56	10.87	259	250	57.36	35.83
HD2733	92	78.89	10.44	361	348	48.18	38.72
HD2888	102	79.56	10.78	339	322	48.58	33.33
K9107	114	81.89	12.80	344	330	53.67	45.06
HUW468	103	78.78	12.22	336	322	47.56	40.11
HUW234	105	77.56	12.04	323	312	53.27	36.17
K0307	108	78.56	12.33	384	371	49.17	35.89
NW1066	130	85.00	10.53	341	328	49.56	40.67
BG2	107	79.11	11.62	333	317	50.43	37.22

BG3	88	77.89	11.29	269	260	56.27	35.56
S.Em±	2.44	0.73	0.34	16.72	15.42	2.31	1.65
CD(P=0.05)	6.91	2.05	0.96	47.28	43.61	6.54	4.67
Interaction							
S.Em±	4.23	1.26	0.59	28.96	26.71	4.00	2.85
CD(P=0.05)	11.97	3.55	NS	NS	NS	NS	NS

Table 2: Yield and economics of wheat as influenced by irrigation levels and varieties (pooled of 2 years)

Varieties	Yield (kg/ha)		Cost of cultivation (Rs)	Net return (Rs)	B:C
	Grain	Straw			
L1- 4 irrigations	4490	6237	25503	51579	2.02
L2- 3 irr	4410	6481	24853	51919	2.09
L3- 2 irr	3963	5880	24203	44959	1.86
S.Em±	67	112.06		1184	0.05
CD(P=0.05)	262.49	437.03		4637	0.19
Wheat varieties					
NW2036	3878	5817	22903	43008	1.72
HD2733	4500	6302	22903	52553	2.12
HD2888	3956	5904	22903	44282	1.78
K9107	5211	7529	22903	65479	2.63
HUW468	4089	5708	22903	45426	1.83
HUW234	4089	6133	22903	46702	1.88
K0307	4622	6933	22903	56036	2.25
NW1066	4467	5718	22903	50368	2.03
BG2	4178	6267	22903	48258	1.93
BG3	3889	5681	22903	42746	1.72
S.Em±	220	327.37		3818.49	0.15
CD(P=0.05)	623	925.80		10798.70	0.44
Interaction					
S.Em±	381.74	567.02		6613.83	0.27
CD(P=0.05)	NS	NS		NS	NS

Conclusion

The study indicated that irrigation had significant influence on tillering of wheat which ultimately reflected in terms of yield of grain and straw, accordingly three irrigations in wheat was similar to four irrigations in producing higher yields and fetching higher monetary return. Significant response of varieties were observed on growth, yield attributes and yield of wheat. Thus variety K9107 and K0307 were found beneficial to farmers with maximum yield and net return.

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