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COMPETITIVENESS OF WHEAT (*TRITICUM AESTIVUM* L.) GENOTYPES AGAINST WEED INFESTATION UNDER DIFFERENT ROW SPACING IN EASTERN INDIA

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ABSTRACT

A field experiment was conducted during *Rabi* seasons of 2010-11 and 2011-12 at Birsa Agricultural University, Ranchi to study the effect of different row spacing on yield components and yield of wheat genotypes. The experiment was conducted in split plot design with thrice replications with treatments comprising four row spacing viz. 15cm weed free, 15 cm weed check, 20 cm weed free and 20 cm weed check in main plots and three wheat genotypes viz. K0307, HD2773 and DBW 39 in sub plots. Results revealed that 20 cm weed free recorded higher grain yield (4.12 and 4.51t/ha) against weedy check and yield reduction was found to the tune of 62.4 and 60.0% in weedy plots. 20 cm weed free plots also recorded higher net return (Rs. 35223 and 35222 in 2011 and 2012) and B-C ratio (1.39 and 1.39) in comparison to non remunerative weedy check. Among the varieties, K0307 recorded significantly higher no. of tiller/m^2 (350 and 378 in 2011 and 2012) as well as no. of grains/spike (53) resulting in higher grain yield (5.01 and 4.05 t/ha). Similarly, maximum net return (Rs.40805 and 40804) and B:C ratio (1.66 and 1.66) as compared to HD2733 and DBW39, respectively.

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INTRODUCTION

Wheat is the second most important cereal crop after rice, grown under diverse agro climatic conditions on 28 M ha area in India with a production of about 84 M tones. In spite of a wide range of adoptability, little attention has been paid towards wheat production and maximization of yield potential of this crop in Jharkhand and its share to national production is less than 1%. Productivity of 2.8 t/ha is also far below the national average of 3.14 t/ha (Anon., 2013). Since wheat is a major cereal crop and population is gradually increasing with time, increasing its production and acreage should be given top priority in order to achieve food and nutritional security in the state. However, success of any crop production depends on the use of appropriate and selectivity of location-specific genotype of high yield potential, and additionally improved cultural practices is an imperative part, may not be ignored. Among the agronomic practices spacing plays a significant role in maximizing the crop yield as well as productivity. Inter row spacing is very important for proper distribution of plants over cultivated area and for better utilization of available soil and natural resources (Mali and Choudhury, 2013). Planting distance effects crop yields as it not only determines the optimum crop stand but also ensures the feasibility and effortlessness of using inter tillage devices for sufficient weed control and conservation of soil moisture. In addition, proper row spacing is important for maximizing light interception, penetration, light distribution in crop canopy and average light utilization efficiency of the leaves in the canopy and thus affects yield of a crop (Hussain *et al.,* 2003). Therefore, keeping the above facts in view, a field experiment was conducted to evaluate the effect of different row spacing on yield attribute, yield and economics of wheat genotypes in eastern India.

MATERIALS AND METHODS

A field experiment was carried out at Research Farm of Division of Agronomy, Birsa Agricultural University, Ranchi, Jharkhand located at 23°17′ N latitude and 85°19′E longitude at an altitude of 625 m above mean sea level during *rabi* 2010-11 and 2011-12 at a same site in both the years. The soil was sandy loam in texture, with pH 5.6 having organic carbon 0.49%, available nitrogen 262.6 kg/ha, phosphorus 15.3 kg/ha and potassium 172.5 kg/ha. The experiment was laid out in split plot design with three wheat genotypes (K0307, HD2773 and DBW 39) and four row spacing (15cm weed free, 15 cm weed check, 20cm weed free and 20 cm weed check), replicated thrice. The crop was sown on November 28 and 30 during 1st and 2nd year of experimentation, respectively with a fertilizer dose of 120 kg N/ha, 60 kg P_2O_5/ha and 40 kg K_2O/ha. One- third of N along with full dose of P and K was applied as basal and remaining two- third N was top dressed in two splits, one-third at crown root initiation and rest one-third at active tillering stage. Weed population and weed dry biomass were recorded from an area enclosed in a quadrate of 0.50 m^2 randomly selected at 3 places in each plot. Weed data were subjected to square-root transformation "(x + 1) before statistical analysis. The densities and dry weights were taken at 30 and 60 DAS, whereas the other yield

attributing characters as well as yields were recorded at harvest. All the genotypes of wheat were harvested on 29 and 27 March during 1st and 2nd year of experimentation, respectively. The data pertaining to yield attributes, yield and economics were analyzed statistically as per the methods suggested by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

The weedy field was dominated with naturally occurring highly aggressive broad leaved weeds like *Polygonum persicaria*, *Polygonum pensylvenicum*, *Physalis minima*, *Chenopodium album*, *Ageratum conyzoides*, *Oldenlandia diffusa*. In the initial stages grasses like *Cynodom dactylon*, *Digitaria sanguinalis* were also observed in experimental field. The dominant weed flora in the experimental field was two species of *Polygonum* having higher competitive ability and damaging potential than other broad leaved weeds.

Weed density data (Table 1) clearly reflected the aggressiveness of broad leaf weed infestation in this region. At 60 DAS the mean weed density of *Polygonum* were very high in weedy check comprising more than 90 per cent of the total weed population. However, at 60 DAS the weed density vis-à-vis weed dry weight were recorded to be nil as weed control measures were adopted only after 30 DAS. Unchecked growth of weeds with high fresh weight was indicated in higher dry weight of weeds at 60 DAS in weedy check plots. However, weed population was little bit less less than 15 centimeter spacing against 20 centimeter spacing in the initial growth stages. It might be due to overcrowding of crop plants. But in later stages the less difference in weed dry weight among the two different spacing could be attributed to similar fresh weight. Mortality of weeds with herbicides and hoeing resulted in lower weed density visà-vis less weed dry weight in weed free plots. Hooda and Agarwal (1991) and Singh *et al*. (2015) also reported significantly maximum dry weight of weeds in wheat under weedy check. Mukherjee *et al*. (2011) also reported aggressive growth of *Polygonum spp* with higher densities and increased dry weight. Maximum yield attributes and yield were recorded in weed free plots due to low weed pressure which might have resulted in increased nutrient, water, space and light supply to the crop due to absence of strong crop weed competition. This, in turn, might have resulted in greater photosynthesis and hence better translocation of photosynthates besides larger sink and stronger reproductive phase (Pandey *et al*., 2005) as reflected in maximum number of spike m per square meter, number of grains per spike and thousand grain weight (Table 2). However, spacings had no significant effect on number of grains per spike or 1000 grain weight. Successful control of weeds registered higher grain yield against weedy check. Bharat and Kachroo (2007) and Kumar *et al*. (2016) also recorded increased yield attributes with higher grain yield in wheat under weed free plots. Weed free plots also registered higher net return and B-C ratio (Table 3) in comparison to non remunerative weedy check. Pandey and Kumar (2005) also reported that weed control treatment recorded significantly higher net return than weedy checks. Among the genotypes, K0307 recorded significantly higher no. of tiller per sq. meter as well as no. of grains per spike resulting in increased yield performance. Similarly, maximum

Table 1: Weed density and weed dry matter of wheat genotypes as influenced by different row spacing and weed management practices

Treatments	30 DAS						60 DAS					
	2010			2011			2010			2011		
	Grassy	BLW	Total	Grassy	BLW	Total	Grassy	BLW	Total	Grassy	BLW	Total
Row Spacing												
15.0 cm, Weed Free	0.71(0)	0.71(0)	0.71(0)	0.71(0)	0.71(0)	0.71(0)	0.71(0)	0.71(0)	0.71(0)	0.71(0)	0.71(0)	0.71(0)
15.0 cm, Weed Check	4.02(15.78)	8.12(65.78)	9.03(81.56)	4.40(18.89)	8.58(73.67)	9.63(92.56)	4.64(21.11)	8.38(70.11)	9.56(91.22)	4.64(21.11)	8.38(70.11)	9.56(91.22)
20.0 cm, Weed Free	0.71(0)	0.71(0)	0.71(0)	0.71(0)	0.71(0)	0.71(0)	0.71(0)	0.71(0)	0.71(0)	0.71(0)	0.71(0)	0.71(0)
20.0 cm, Weed Check	4.00(15.56)	7.89(62.22)	8.82(77.78)	4.16(16.89)	8.89(78.89)	9.80(95.78)	4.45(19.33)	8.47(71.78)	9.55(91.11)	4.45(19.33)	8.47(71.78)	9.55(91.11)
SEm ±	0.13	0.33	0.35	0.11	0.20	0.14	0.12	0.31	0.32	0.12	0.31	0.32
CD (p = 0.05)	0.44	1.14	1.20	0.37	0.69	0.48	0.41	1.06	1.11	0.41	1.06	0.11
Genotypes												
K 0307	3.17(10.67)	5.69(40.78)	6.33(51.44)	3.32(11.89)	6.26(50.11)	6.91(62.00)	3.54(13.89)	5.92(44.44)	6.71(58.33)	3.54(13.89)	5.92(44.44)	6.71(58.33)
HD 2733	3.16(10.56)	5.86(43.44)	6.47(54.00)	3.30(11.78)	6.40(52.67)	7.04(64.44)	3.54(13.78)	6.14(48.22)	6.90(62.00)	3.54(13.78)	6.14(48.22)	6.90(62.00)
DBW 39	3.10(10.11)	5.88(43.78)	6.46(53.89)	3.35(12.11)	6.23(49.78)	6.90(61.89)	3.42(12.78)	6.20(49.22)	6.90(62.00)	3.42(12.78)	6.20(49.22)	6.90(62.00)
SEm ±	0.04	0.08	0.09	0.04	0.15	0.13	0.04	0.09	0.08	0.04	0.09	1.64
CD (p = 0.05)	0.12	0.25	0.27	0.13	0.45	0.39	0.11	0.27	0.25	0.11	0.27	4.92

Note: Data subjected to square root transformation. Figure in parenthesis indicate original value.

Table 2: Yield attributes of wheat genotypes as influenced by different row spacing and weed management practices

Treatment	Effective tillers/m^2		No. of grains/spike		1000-grain weight (g)	
	2011	2012	2011	2012	2011	2012
Spacing						
15.0 cm, Weed Free	255	354	38.0	25.6	40.36	41.17
15.0 cm, Weed Check	247	316	36.1	25.6	39.31	39.91
20.0 cm, Weed Free	275	408	42.2	26.1	42.36	42.31
20.0 cm, Weed Check	228	347	33.6	26.1	37.57	40.82
SEm ±	4.3	5.4	0.6	0.3	0.41	0.19
CD (p=0.05)	14.9	18.6	2.0	N.S	1.41	0.76
Genotypes						
K 0307	350	378	53.0	25.1	54.37	42.54
HD 2733	323	356	47.2	26.1	52.17	41.01
DBW 39	332	334	49.7	26.3	53.07	39.61
SEm ±	6.4	13.3	1.1	0.3	0.29	0.33
CD (p=0.05)	19.1	N.S	3.4	0.9	0.87	0.95

Table 3: Yield and economics of wheat genotypes as influenced by different row spacing and weed management practices

Treatment	Grain yield (t/ha)		Straw yield (t/ha)		Net return (Rs./ha)		B:C ratio	
	2011	2012	2011	2012	2011	2012	2011	2012
Spacing								
15.0 cm, Weed Free	3.64	3.73	5.32	4.79	29625	29620	1.24	1.24
15.0 cm, Weed Check	3.47	3.22	5.09	4.35	27160	27159	1.14	1.14
20.0 cm, Weed Free	4.12	4.51	6.03	5.41	35223	35222	1.39	1.39
20.0 cm, Weed Check	3.04	3.69	4.46	4.30	19425	19424	0.77	0.77
SEm ±	0.12	0.06	0.16	0.17	906	1718	0.04	0.07
CD (p=0.05)	0.41	0.19	0.55	0.58	3127	5930	0.13	0.25
Genotypes								
K 0307	5.01	4.05	7.32	6.59	40805	40804	1.66	1.66
HD 2733	4.51	3.81	6.62	6.22	33508	33503	1.37	1.37
DBW 39	4.76	3.49	6.95	6.04	37120	37119	1.51	1.51
SEm ±	0.12	0.13	0.18	0.15	1054	1768	0.04	0.07
CD (p=0.05)	0.36	0.39	0.55	0.46	3162	5303	0.13	0.21

net return and B-C ratio were also recorded with K0307 as compared to other two varieties taken in the experimentation. It can be concluded that K0307 could perform better even under high weed pressure with 20 cm row spacing minimizing the pressure exerted by broad leaved weeds especially *Polygonum spp*. However, effective control of weeds could trigger the production potential to a huge extent in eastern region of Jharkhand.

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