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Competitiveness of wheat (*Triticum aestivum* L.) genotypes against weed infestation under two different spacings in Sub-*Himalayan* plains of West Bengal

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Abstract

Sub Himalayan plains of West Bengal has the characteristics of high rain fall and high humidity triggering aggressive growth of weeds which become one of the major constraints in crop production during *rabi* season. An experiment was carried out with three genotypes of wheat namely K0307, HD 2733 and DBW 39 to evaluate the competitiveness of these varieties against high weed pressure under two different spacings (15 cm and 20 cm). 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. At 60 DAS the mean weed density of *Polygonum* were very high in weedy check comprising more than 85 per cent of the total weed population. Difference in weed density and weed fresh and dry weight was very low between 15 and 20 cm spacing. Successful control of weeds registered higher grain yield (39.70 q ha^{-1}) against weedy check and yield reduction was found to the tune of 69.7% in weedy plots. Weed free plots also registered higher net return (Rs. 22870 ha^{-1}) and B-C ratio (2.10) in comparison to non remunerative weedy check. Spacing had no significant effect on number of grains per spike or 1000 grain weight but net return and B-C ratio were slightly higher in 15 centimeter row spaced crop than 20 centimeter. Among the varieties, K0307 recorded significantly higher no. of tiller per sq. meter (298.5) as well as no. of grains per spike (43.2) resulting in increased yield performance (31.59 q ha^{-1}). Similarly, maximum net return (Rs. 16249 ha^{-1}) and B-C ratio (1.88) were also recorded with K0307 as compared to other two varieties.

Key words: Wheat competitiveness of genotypes**,** broad leaf weed, wheat, spacing, yield

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Introduction

Wheat occupies a prominent place as an important crop contributing 30-35 per cent of total food grain production and is next only to rice. It is an ecologically suitable crop in terai agro ecological region of West Bengal. Terai region has the characteristic of high rain fall and high humidity triggering aggressive growth of weeds, which in turn, become one of the major constraints in crop production during *rabi* season. Weed infestation during crop growing period causes more than 53 per cent reduction in grain yield depending on weed densities and type of weed flora present (Singh *et al*, 2002). Again, growth behavior of individual weed species in relation to agro ecological condition also governs the extent of yield reduction (Singh *et al*, 1997). Effective weed control enhances the wheat grain yield to the tune of 40.6 per cent (Dixit and Bhan, 1997) and becomes of paramount significance particularly under reduced tillage system. Row spacing is also supposed to be a contributing factor towards weed densities. Sometimes accommodating more number of plants through closer spacing may exert some effect on weed population. Keeping these in mind, an experiment was carried out to evaluate the competitiveness of some wheat varieties against weeds under two different spacing.

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Materials and methods

The field experiment was carried out during *rabi* seasons of 2010-11 and 2011-12 in the instructional farm of Uttar Banga Krishi Vishwavidyalaya, Pundibari, Cooch Behar (26^0 19´ 86´´N Latitude and 89^0 23´ 53´´ E Longitude). The experiment was laid-out in three factor Randomized Block Design (RBD) with twelve treatment combinations replicated thrice. The treatment details are as follows:

Factor 1 (Row spacing)	Factor 2 (Weed control measures)	Factor 3 (Genotypes)
R_1 = 15 cm	W_1 = Weed free	V_1 – K 0307
R_2 = 20 cm	W_2 = Weedy check	V_2 – HD 2733
-	-	V_3 – DBW 39

The experimental soil was sandy loam in texture having pH 5.8 with low available N (104 kg ha^{-1} N), medium available P (50.7 kg ha^{-1} P_2O_5) and low available K (145.8 kg ha^{-1} K_2O). 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^{-1}, 60 kg P_2O_5 ha^{-1} and 60 kg K_2O ha^{-1}. 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 $\sqrt{(x + 1)}$ before statistical analysis. The densities and dry weights were taken at 30, 60 and 90 DAS, whereas the plant height, other yield attributing characters as well as yields were recorded at harvest.

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 85 per cent of the total weed population. However, at 60 and 90 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 90 DAS in weedy check plots.

However, weed population was little bit less under 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 *vis-à-vis* less weed dry weight in weed free plots. Hooda and Agarwal (1991) also reported significantly maximum dry weight of weeds in wheat under weedy check. Rahaman and Mukherjee (2009) and Mukherjee *et al.,* (2011) also reported aggressive growth of *Polygonum* spp with higher densities and increased dry weight in terai region of West Bengal.

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 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 (39.70 q ha^{-1}) against weedy check. Yield reduction to the tune of 69.70 per cent under weedy check reflected the feasibility of weed control measures in this experiment. Bharat and Kachroo (2007) also recorded increased yield attributes with higher grain yield in wheat under weed free plots. Weed free plots also registered higher net return (Rs. 22870 ha^{-1}) and B-C ratio (2.10) 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. The biomass production of wheat crops did not vary significantly under 15 and 20 centimeter spacing; however maximum biomass production was recorded under 15 centimeter row spacing. This might be due to extra number of plants accommodating the same area. More number of plants through closure spacing contribute higher grain yield (11.89 percent yield increment) by producing more number of spikes per square meter. In terms of production economics, net return and B-C ratio were slightly higher in 15 centimeter row spaced crop compared to 20 centimeter spacing.

Among the varieties, K0307 recorded significantly higher no. of tiller per sq. meter (298.5) as well as no. of grains per spike (43.2) resulting in increased yield performance (31.59q ha^{-1}.). However, the varieties did not differ significantly in total biomass production. Similarly, maximum net return (Rs. 16249 ha^{-1}) and B-C ratio (1.88) 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 15 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 terai region of West Bengal.

Table 1. Broad leaved weeds density and dry weight as influenced by various genotypes, spacing and weed management options

Treatments		Weed density (No. per sq m.)			Weed dry weight (g)		
		30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS
Genotypes							
K0307	Weeded	22.2	24.3	20.4	12.5	33.6	48.7
		(492.67)	(590.33)	(414.67)	(156.07)	(1130.56)	(2367.47)
	Weed free	23.2	1.0	1.0	11.5	1.0	1.0
		(538.33)	(0.00)	(0.00)	(132.14)	(0.00)	(0.00)
HD 2733	Weeded	25.2	26.8	19.8	12.7	40.3	50.6
		(634.33)	(715.67)	(390.00)	(159.34)	(1626.12)	(2558.60)
	Weed free	24.0	1.0	1.0	12.0	1.0	1.0
		(577.0)	(0.00)	(0.00)	(142.20)	(0.00)	(0.00)
DBW39	Weeded	24.7	26.0	20.1	10.7	43.3	52.2
		(608.33)	(674.67)	(404.00)	(113.98)	(1873.37)	(2725.83)
	Weed free	23.1	1.0	1.0	12.1	1.0	1.0
		(534.00)	(0.00)	(0.00)	(145.78)	(0.00)	(0.00)
Spacing							
15 cm	Weeded	27.5	29.2	24.2	14.9	46.9	61.0
		(753.33)	(854.00)	(587.00)	(220.63)	(2195.38)	(3720.31)
15 cm	Weed free	28.4	1.0	1.0	13.0	1.0	1.0
		(806.00)	(0.00)	(0.00)	(168.46)	(0.00)	(0.00)
20 cm	Weeded	31.4	33.6	25.0	14.5	49.4	62.7
		(982.00)	(1126.67)	(621.67)	(208.75)	(2434.68)	(3931.59)
20 cm	Weed free	29.1	1.0	1.0	15.9	1.0	1.0
		(843.33)	(0.00)	(0.00)	(251.66)	(0.00)	(0.00)

DAS- Days after sowing; Data transformed to √ (x+1); figures in parentheses indicate original values.

Table 2. Yield attributes, yield and production economics of wheat genotypes as influenced by different row spacing and weed management practices

Treatments	No. of tiller per m^2	Grains per spike	1000 grain wt (g.)	Grain yield (q ha^{-1})	Biomass (q ha^{-1})	Net return (Rs ha^{-1})	B:C ratio
Row spacing							
15 cm	246.1	38.7	40.2	29.45	52.1	13895	1.75
20 cm	225.5	35.8	40.7	26.32	50.9	10452	1.66
CD (P=0.05)	18.5	NS	NS	1.85	NS	-	-
Weed management							
Weed free	361.5	39.9	43.1	39.70	71.4	22870	2.10
Weedy check	104.2	33.8	36.8	12.10	32.6	-5190	0.72
CD (P=0.05)	29.2	3.2	3.7	6.18	5.8	-	-
Variety							
K0307	298.5	43.2	39.7	31.59	53.7	16249	1.88
HD 2733	276.8	36.2	40.8	29.25	49.2	13675	1.74
DBW39	219.3	34.4	37.8	24.81	48.3	8791	1.51
CD (P=0.05)	26.4	3.6	NS	5.20	NS	-	-

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