African Journal of Agricultural Research Vol. 1 (3), pp. 070-073, October 2006
Available online at http://www.academicjournals.org/AJAR
ISSN 1991-637X© 2006 Academic Journals

Full length research paper

Influence of genotypes, planting methods and weed management on competitiveness of wheat (*Tritcum aestivum* L.) and *Phalaris minor* Retz

M Anwar Bhat*, S S Mahal, K K Vashaist, R K Mahey, A Hussain* and G M Mushki*

Department of Agronomy and Agrometeorology, Punjab Agricultural University, Ludhiana.
*Rice Research and Regional Station SKUAST-K Khudwani, J&K, India

Accepted 19 October, 2006

Field experiments were conducted at the research farm of Punjab Agricultural University, Ludhiana during 2003-04 and 2004-05. The soil of the experimental site was loamy sand in texture and neutral in reaction rating low in organic carbon and nitrogen, and medium in phosphorus and potassium. Bread wheat genotype PBW 343 tended to reduce the values for dry matter accumulation and density of *Phalaris minor* indicating comparatively more smothering effect on *Phalaris minor* as compared to *durum* wheat genotype PDW 274. PBW 343 recorded 8.52 per cent higher grain yield than PDW 274.Significant reduction in population and dry matter production of *Phalaris minor* and higher grain yield of wheat was observed under bed planting method as compared to flat planting during both the years of experimentation. Application of clodinafop 0.06 kg ha^{-1} and integrated weed control with clodinafop 0.045 kg ha^{-1} + hand / mechanical weeding effectively controlled the *Phalaris minor* and provided a weed control efficiency of 87.7 and 85.1 per cent, respectively. Integrated weed management practice resulted in 29.12 and 8.46 per cent more grain yield against the unweeded check and two hand/mechanical weedings, respectively.

Key words: Bread wheat, Durum Wheat, *Phalaris minor*, Bed planting, Weed management

INTRODUCTION

Wheat (*Triticum aestivum* L.) is one of the most extensively grown crops of the world and is the second most important source of staple food in India after rice.The wheat crop gets infested with heavy population of *Phalaris minor* and as a result of severe competition caused 30-80 % reduction in grain yield of wheat depending upon the intensity (Brar *et al*, 1993). The competitive ability of different genotypes because of their suppression ability can be used as a tool in integrated weed management systems. Furrow irrigated raised bed planting along with post-emergence herbicide application is the best option for managing *Phalaris minor* in wheat Malik *et al,* 1998). Herbicide use is efficient in controlling *Phalaris minor* but continuous use of specific herbicides (isoproturon) has led to the development of resistance (Malik and Malik, 1994). To tackle the herbicide resistance problem, an integrated weed management strategy is required to prevent further escalation in the magnitude of this problem. Manipulating the agronomic practices that provide a boost to wheat plants during the initial growth phase may reduce the population and dry matter accumulation of *Phalaris minor*. Keeping in view the above facts, an attempt was made to study the influence of genotypes, planting methods and weed management on competition of wheat and *Phalaris minor* Retz.

MATERIALS AND METHODS

Field studies were carried out during *rabi* 2003-04 and 2004-05 at research farm, Punjab Agricultural University Ludhiana (India). The

*Corresponding authors E-mail: abhat_68@yahoo.co.in.

soil of the experimental site was loamy sand in texture and normal in reaction, having 0.35% organic carbon, 111.6 kg of available N, 19.3 kg P and 241.4 kg K ha^{-1} *i e* low in organic carbon and nitrogen and medium in P and K. The field capacity and permanent wilting point of the soil were 36.80 and 11.83 cm respectively upto 180 cm depth. At the time of final ploughing, *Phalaris minor* seed was broadcasted to ensure sufficient weed population for competition. Experiment was conducted in split plot design with two genotypes (PBW 343 and PDW 274) and two planting methods (bed planting and flat planting) in main plots while the four weed control treatments (unweeded check, two hand / mechanical weedings at 20 and 40 days after sowing (DAS), clodinaop 0.06kg ha^{-1} and integrated weed management with clodinaop 0.045 kg ha^{-1}+ hand/mechanical weeding) were kept in sub plots. Hand weeding in flat sowing was done manually and mechanical weeding in bed planting was done with the tractor driven bed planter with minor adjustments. The treatment combinations were replicated four times. *Durum* wheat variety PBW 274 as well as bread wheat variety PBW 343 was sown on 3rd and 4th November during 2003 and 2004 seasons, respectively as two rows per bed with a bed planter using a uniform seed rate of 75 kg ha^{-1} in case of bed planting method. The beds were spaced 67.5 cm apart from center to center with 30 cm flat area on the top of the bed. The furrow between two beds was 37.5 cm wide. In flat planting the crop was sown in rows 22.5 cm apart using a seed rate of 100 kg ha^{-1} with a seed drill. The crop received a uniform basal dose of 40 kg P_2O_5 and 30 kg K_2O ha^{-1} through diammonium phosphate and muriate of potash respectively at the time of sowing, while as nitrogen at 120 kg ha^{-1} through urea was applied in two equal splits *i.e* half at the time of sowing and the remaining half after first irrigation. The herbicide as per the treatments was sprayed 35 DAS with knapsack sprayer fitted with a flat fan nozzle. For the control of broad leaf weeds, the crop was uniformly sprayed with metsulfuron-methyl (Algrip). The crop received four post-sowing irrigations each of 5 cm and 7.5 cm depth under bed and flat planting respectively during 2003-04 while as in the second year due to above normal rainfall only two irrigations were given. The crop was harvested on 15th and 18th April during 2004 and 2005 seasons, respectively.

RESULTS AND DISCUSSION

Effect on *Phalaris minor*

Population and dry matter accumulation of *Phalaris minor* recorded at 120 DAS and harvest stage was not significantly influenced by the two genotypes during both the years (Table 1).However, numerically *Phalaris minor* growing with the durum variety PDW 274 tended to accumulate more dry matter as compared to that growing in bread wheat cultivar PBW 343. At harvest stage, PBW 343 tended to reduce the dry matter accumulation of *Phalaris minor* by 3.6 and 4.3 per cent as compared to PDW 274 during 2003-04 and 2004-05, respectively. Mahajan and Brar (2001) have also reported non significant differences in *Phalaris minor* dry matter production under different genotypes. Bed planting proved advantageous as it maintained lower population as well as dry matter of *Phalaris minor* than flat planting at both the stages and during both the years. At harvest stage, bed planting reduced the *Phalaris minor* population by 12.5 and 17.1 per cent during 2003-04 and 2004-05, respectively over flat sowing. Aggarwal and Goswami (2003) also observed significantly lesser population of weeds under bed planting compared to flat planting. Similarly the final dry matter accumulated by *Phalaris minor* under bed planted wheat declined by 14.23 and 11.18 per cent during 2003-04 and 2004-05, respectively as compared to flat planted wheat. Walia *et al* (2003) also noticed significantly higher *Phalaris minor* dry matter in flat planting than bed planting. Among different weed control methods, chemical (clodinafop 0.06 kg ha^{-1}), integrated (clodinafop 0.045 kg ha^{-1} +hand / mechanical weeding) weed control method and twice hand / mechanical weeding controlled the *Phalaris minor* effectively as evidenced by significant reduction in its population as well as dry matter as compared to unweeded check. The final density of *Phalaris minor* was reduced by 83.6 and 79.4 per cent under chemical weed control method over unweeded check during the year 2003-04 and 2004-05, respectively. Chemical weed control resulted in a reduction of 87.8 and 87.7 per cent in final dry matter accumulation by *Phalaris minor* as compared to unweeded control during the year 2003-04 and 2004-05, respectively. While as the corresponding values for integrated weed control method were 86.3 and 83.8 per cent. Hand / mechanical weedings provided a weed control efficiency of 62 and 55 per cent during the first and second year of the study, respectively. These results are in conformity with the findings of Walia *et al* (2003) and Yadav *et al* (2004). The interaction effects among genotypes, planting methods and weed management practices for population and dry matter production of *P. minor* were found to be non significant.

Effect on crop

Bread wheat genotype PBW 343 produced significantly higher crop biomass compared to durum wheat cultivar PDW 274during both the years of study. At harvest stage, variety PBW 343 accumulated 7.02 and 5.83 per cent more dry matter than PDW-274.The higher crop biomass of PBW-343 might be attributed to its higher tillering ability as evidenced by number of effective tillers (Table 2). The wheat variety PBW 343 recorded significantly higher grain yield as compared to PDW 274 during both the years. On an average of two years, PBW 343 recorded 8.5 per cent higher grain yield as compared to PDW 274. The higher grain yield of PBW 343 might be due to improved yield contributing characters over PDW 274.

The two planting methods failed to produce any significant differences in dry matter accumulation by crop at 120 DAS but at harvest the final crop biomass recorded under bed planting methods was significantly higher than flat planting there by provided a superiority of 4.64 and 3.34 per cent during 2003-04 and 2004-05, respectively. Bed planted wheat gave significantly more grain yield than flat planted wheat during both the years. On an average,

Table 1. Population and dry matter production of *Phalaris minor* as influenced by different genotypes, planting methods and weed management practices.

Treatment	*P. minor* population (No. m^{-2})				*P. minor* dry matter (q ha^{-1})			
	120 DAS		At harvest		120 DAS		At harvest	
	03-04	04-05	03-04	04-05	03-04	04-05	03-04	04-05
Genotype								
PBW 343	5.28 (31)	5.79 (37)	4.43 (22)	5.34 (31)	2.98 (9.10)	3.08 (9.93)	2.73 (7.62)	2.88 (8.58)
PDW 274	5.43 (33)	5.98 (39)	4.60 (24)	5.40 (32)	3.04 (9.42)	3.12 (10.16)	2.76 (7.91)	2.97 (8.97)
CD (p=0.05)	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
Planting method								
Bed planting	5.07 (28)	5.64 (34)	4.38 (21)	5.14 (29)	2.89 (8.50)	3.02 (9.39)	2.65 (7.17)	2.85 (8.26)
Flat planting	5.64 (36)	6.13 (41)	4.65 (24)	5.60 (35)	3.13 (10.02)	3.18 (10.68)	2.85 (8.36)	3.00 (9.30)
CD (p=0.05)	**0.19**	**0.21**	**0.23**	**0.30**	**0.18**	**0.15**	**0.14**	**0.12**
Weed control method								
Unweeded	8.78 (77)	9.16 (83)	7.47 (55)	8.60 (73)	4.71 (21.28)	4.95 (23.62)	4.46 (18.97)	4.60 (20.23)
Two hand / mechanical weedings	4.77 (22)	5.31 (27)	4.27 (17)	4.83 (23)	3.07 (8.48)	3.20 (9.28)	2.85 (7.18)	3.17 (9.11)
Clodinafop (0.06 kg ha^{-1})	3.93 (15)	4.43 (19)	3.12 (9)	3.97 (15)	2.08 (3.41)	2.06 (3.36)	1.81 (2.32)	1.86 (2.49)
Clodinafop (0.045 kg ha^{-1} + HW/MW)	3.95 (15)	4.66 (21)	3.20 (9)	4.08 (16)	2.18 (3.86)	2.19 (3.89)	1.88 (2.59)	2.06 (3.27)
CD (p=0.05)	**0.27**	**0.21**	**0.26**	**0.45**	**0.20**	**0.21**	**0.15**	**0.10**
Interaction	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**

Figures in parenthesis are original values, data subjected to √ x+1transformation.

bed planting method resulted in an increase of 8.5 per cent in grain yield over flat sowing. The higher grain yield under bed planting can be attributed to lower weed densities that resulted in better crop growth and ultimately improved the yield. Aggarwal and Gosswami (2003) have also reported significantly lower weed population and higher grain yield of wheat under bed planting compared to flat planting method.

Different weed control methods significantly influenced the crop biomass production. Chemical and integrated weed control being statistically at par with each other produced higher crop dry matter as compared to two hand / mechanical weedings as well as control. Hand/mechanical weedings in this respect proved superior to unweeded check. On an average, at supplemented with hand / mechanical weeding) produced 13.66 (13.55) and 2.62 (2.52) percent higher dry matter compared to control andtwo hand/mechanical weedings, respectively. Due to severe competition with *P. minor*, the crop dry matter in control plots was reduced while the absence of this competition in treated / weeded plots resulted in significantly higher dry matter production under these treatments. Similar results have been reported by Bhullar (2002). Hand / mechanical weeding, chemical and integrated weed control methods markedly improved the grain yield over weedy check. On an average, chemical weed control method recorded 7.24 and 27.67 percent higher grain yield as compared to hand/mechanical harvest stage, the application alone (and higher weeding and weedy check, respectively. The corresponding figures for

Table 2. Dry matter, effective tillers and grain yield of wheat as influenced by genotypes, planting methods and weed management practices.

Treatment	Dry matter (q ha^{-1})				Effective tillers (No. m^{-2})		Grain yield (q ha^{-1})	
	120 DAS		At harvest					
	2003-04	2004-05	2003-04	2004-05	2003-04	2004-05	2003-04	2004-05
Genotype								
PBW 343	84.4	82.7	97.3	90.7	447.6	407.5	48.59	45.30
PDW 274	81.1	78.6	90.9	85.7	407.2	376.4	44.72	41.79
CD (p=0.05)	**2.6**	**2.6**	**2.00**	**1.7**	**30.5**	**16.8**	**1.54**	**1.85**
Planting method								
Bed planting	83.2	81.8	96.2	89.2	434.0	394.7	48.57	45.33
Flat planting	82.2	79.6	92.0	87.1	420.8	389.2	44.74	41.77
CD (p=0.05)	**NS**	**NS**	**2.0**	**1.7**	**NS**	**NS**	**1.54**	**1.85**
Weed management								
Unweeded	75.7	74.0	85.9	80.7	386.4	331.3	39.52	36.30
Two hand / mechanical weedings	83.8	82.0	95.3	89.2	433.0	386.2	47.37	42.89
Clodinafop (0.06 kg ha^{-1})	85.5	83.6	97.5	91.3	443.8	420.5	49.56	47.25
Clodinafop (0.045 kg ha^{-1} + HW/MW)	85.9	83.1	97.7	91.5	446.3	429.7	50.16	47.75
CD (p=0.05)	**4.1**	**3.4**	**4.5**	**4.7**	**20.5**	**22.6**	**1.93**	**1.91**

Integrated weed control method were 8.46 and 29.12 per cent. Hand/mechanical weedings also proved significantly better than weedy treatment and exhibited a yield advantage of 19.04 per cent over control. Chauhan et al (2001) also observed good control of *Phalaris minor* and increased grain yield under clodinafop application.

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