Indian J. Weed Sci. **38** (1 & 2) : 104-107 (2006)

Effect of Tillage and Weed Management on Seed Bank of *Phalaris minor* Retz. in Wheat under Rice-Wheat Sequence

U. S. Walia and L. S. Brar
Department of Agronomy and Agrometeorology
Punjab Agricultural University, Ludhiana-141 004 (Punjab), India

ABSTRACT

The zero till wheat crop sown after direct seeded puddled rice, recorded significantly higher dry matter accumulation by *Phalaris minor* as compared to conventionally sown wheat crop. However, the seed bank status was not affected due to tillage systems. Zero till sown crop recorded significantly less grain yield than conventionally tilled crop. On an average of three years, highest wheat grain yield (3843 kg ha^{-1}) was obtained in conventionally tilled wheat after transplanted rice and it was significantly more than that of zero tilled wheat after rice with or without puddling. Clodinafop at 60 g, sulfosulfuron at 25 g and fenoxaprop-p-ethyl at 100 g ha^{-1} increased wheat grain yield by 41.9, 43.7 and 39.9%, respectively, over weedy crop.

INTRODUCTION

During green revolution, the introduction of high yielding dwarf wheat varieties, responsive to high fertilizer and irrigation, resulted in significant change in ecological conditions leading to infestation of problematic grassy weeds particularly *P. minor*. Yield losses especially with the infestations of *P. minor* alone are estimated from 25-50% and under very severe infestation the losses may go upto 80% and even more (Malik *et al.*, 1996). The problem of this weed is more acute in rice-wheat cropping system due to the development of resistance in *P. minor* to isoproturon because of its continuous use for a number of years. In order to attain economical wheat yields, weeds are to be kept under check with the adoption of any effective weed control technique.

Zero till technology in wheat is gaining momentum day by day in Indo-Gangetic plains. There are two schools of thoughts regarding the fate of weeds especially *P. minor* in relation to zero till technology. Mehla *et al.* (2000) reported that zero tillage reduced the population of *P. minor* significantly and enhanced wheat productivity by 15% over conventional tillage. In contrast to these findings, Mahajan (1999) reported that crop grown under conventional tillage system showed 55.6% reduction in dry matter accumulation by *P. minor* and this system increased grain yield by 17.9% over zero tillage treatment. The infestation of *P. minor* also depends upon the type of tillage operations for crop establishment in rice and wheat which may affect distribution of weed seeds in different soil depths. So, this trial was undertaken to find out the effect of tillage systems in rice-wheat on *P. minor*.

MATERIALS AND METHODS

The trial was carried out at the research farm of the Department of Agronomy and Agrometeorology, Punjab Agricultural University, Ludhiana from 2001-02 to 2003-04 in rice-wheat rotation on loamy sand soil (83.0% sand, 13.7% silt and 3.3% clay), low in organic carbon, medium in phosphorus and high in available potassium. A permanent trial in direct seeded/transplanted rice-wheat sequence was initiated during 2001-02. Trial was laid out in split plot design with five tillage systems (both to rice and wheat) in main plots and four-weed control treatments in sub-plots. The five tillage systems were as given on next page.

Timely transplanting of rice was done in 3rd week of June and late transplanting in 3rd week of July. The sub-plot treatments consisted of post-emergence application (30-35 days after sowing of

Five Tillage Systems

Rice	Wheat		
(2001 to 2003)	2001-02	2002-03	2003-04
Direct sowing puddled broadcast	zero	zero	zero
Direct sowing without puddling line sowing	conventional	conventional	conventional
Direct sowing without puddling broadcast	zero	zero	zero
Transplanting (timely)	conventional	conventional	conventional
Transplanting (late)	zero	conventional	zero

wheat) clodinafop at 60 g ha^{-1}, sulfosulfuron at 25 g ha^{-1} and fenoxaprop-p-ethyl at 100 g ha^{-1} and weedy. Rice variety PR 115 and wheat variety PBW 343 were sown in the trial. Zero till drill was used for wheat sowing directly after rice in zero tillage treatment, whereas seed-cum fertilizer drill was used for conventional wheat sowing where four ploughings and four plankings were done before wheat sowing. The seed rate used was 100 kg ha^{-1} Wheat crop was raised by applying 125 kg N, 62.5 kg P_2O_5 and 30 kg K_2O ha^{-1}. Half of nitrogen and whole of phosphoric and potassic fertilizers were applied at the time of sowing and remaining nitrogen was applied with first irrigation. Dry matter of *P. minor* was recorded at the time of harvest. Soil samples were taken from 0-15 cm layer with tube auger from four spots per sub-plot just before sowing wheat during 2003-04 crop season, mixed uniformly and 100 g of dry soil was put in a plastic tray at room temperature. The germinated *P. minor* seedlings were recorded.

RESULTS AND DISCUSSION

During 2001-02, the conventional tillage in wheat after unpuddled direct seeded rice and transplanted rice, respectively, caused significantly less dry matter accumulation by *P. minor* as compared to all other tillage treatments. These differences were non-significant during 2002-03.

Table 1. Influence of tillage and weed control treatments on dry matter accumulation of *P. minor* in rice-wheat system

Tillage treatments				Dry matter of *P. minor* (kg ha^{-1})				Seeds of *P. minor* kg^{-1} of dry soil (2003-04)
Rice	Wheat			2001-02	2002-03	2003-04	Mean	
(2001-2003)	2001-02	2002-03	2003-04					
Direct sowing puddled broadcast	ZT	ZT	ZT	602	566	295	487	19.1
Direct seeded unpuddled line sowing	CT	CT	CT	360	539	226	375	16.1
Direct seeded unpuddled broadcast	ZT	ZT	ZT	510	582	216	436	18.9
Transplanting (timely)	CT	CT	CT	380	577	209	388	17.9
Transplanting (late)	ZT	CT	ZT	610	575	211	465	17.4
LSD (P=0.05)				121	NS	39	60	NS
Weed control treatments								
Clodinafop 60 g ha^{-1}				70	18	137	75	2.1
Sulfosulfuron 25 g ha^{-1}				110	0	100	70	1.0
Fenoxaprop-p-ethyl 100 g ha^{-1}				210	264	121	198	10.1
Control (Unweeded)				1578	1990	568	1378	76.8
LSD (P=0.05)				230	276	45	404	6.7

ZT–Zero tillage, CT–Conventional tillage, NS–Not Significant.

Table 2. Influence of tillage and weed control treatments on wheat in rice-wheat system

Tillage treatments				Spikes m^{-2}				Grain yield (kg ha^{-1})			
Rice	Wheat			2001-02	2002-03	2003-04	Mean	2001-02	2002-03	2003-04	Mean
(2001-2003)	2001-02	2002-03	2003-04								
Direct sowing puddled broadcast	ZT	ZT	ZT	286	277	278	280	2792	3321	4042	3384
Direct seeded unpuddled line sowing	CT	CT	CT	292	279	300	290	3536	3473	4073	3693
Direct seeded unpuddled broadcast	ZT	ZT	ZT	284	279	297	286	3094	3344	4280	3572
Transplanting (timely)	CT	CT	CT	285	277	303	288	3746	3475	4311	3843
Transplanting (late)	ZT	CT	ZT	289	277	288	283	2865	3587	4252	3567
LSD (P=0.05)				NS	NS	NS	NS	469	NS	NS	259
Weed control treatments											
Clodinafop 60 g ha^{-1}				302	298	305	302	3573	3678	4460	3903
Sulfosulfuron 25 g ha^{-1}				306	297	305	303	3723	3530	4611	3954
Fenoxaprop-p-ethyl 100 g ha^{-1}				310	290	302	301	3663	3618	4262	3847
Control (Unweeded)				228	225	260	238	1867	2933	3451	2750
LSD (P=0.05)				14	12	9	10	433	266	401	335

NS–Not Significant.

However, during 2003-04, zero till wheat grown after direct seeded puddled rice resulted in significantly more dry matter accumulation by *P. minor* as compared to all other tillage techniques. From the pooled analyses of three years, it may be concluded that more dry matter of *P. minor* was recorded in zero till wheat grown after puddled direct seeded rice and alternate tillage system in wheat after puddled transplanted rice than conventionally sown crop both without and with puddling operations to rice crop (Table 1). Singh (2001) also reported 11.2% reduction in dry matter of *P. minor* in conventional tillage as compared to zero tillage system. Clodinafop at 60 g ha^{-1}, sulfosulfuron at 25 g ha^{-1} and fenoxaprop-p-ethyl at 100 g ha^{-1} being at par produced significantly less dry matter of *P. minor* than weedy.

The seed bank recorded before wheat sown in 2003-04 did not differ significantly due to tillage operations (Table 1). Clodinafop and sulfosulfuron reduced seed bank of *P. minor* significantly as compared to fenoxaprop-p-ethyl. However, in weedy crop there was significantly higher seed bank as compared to all herbicide treatments.

Tillage systems did not affect number of spikes. Crop treated with herbicides i. e. clodinafop, sulfosulfuron and fenoxaprop-p-ethyl produced significantly more wheat spikes than in weedy field.

Wheat sown with conventional tillage during 2001-02 after transplanted rice produced significantly higher grain yield than all other tillage systems except conventionally tilled wheat after direct seeded non-puddled rice (Table 2). The differences in wheat grain yield due to tillage techniques were non-significant during 2002-03 and 2003-04. On an average of three years, highest wheat grain yield (3843 kg ha^{-1}) was recorded in conventionally tilled wheat after transplanted rice which was at par with zero tilled wheat after direct seeded rice. Minimum grain yield (3384 kg ha^{-1}) was recorded in zero tilled wheat after puddled direct seeded rice. Wheat grain yields due to different herbicides were similar and higher than weedy.

REFERENCES

Mahajan, G. 1999. Management of *Phalaris minor* in wheat through agronomic manipulations. Ph. D dissertation, Punjab Agricultural University, Ludhiana.

Malik, R. K., V. K. Garg and A. Yadav, 1996. Guidelines for the management of isoproturon resistant *Phalaris minor* in wheat. *Extension Bulletin*. pp. 7. CCS Haryana Agricultural University, Hisar.

Mehla, R. S., J. K. Verma, R. K. Gupta and P. R. Hobbs, 2000. Stagnation in the productivity of wheat in the Indo-Gangetic plains. Zero till seed-cum-fertilizer drill as an integrated solution. Paper Series 8, p.1. Rice-Wheat Consortium for the Indo-Gangetic Plains, New Delhi, India.

Singh, P. 2001. Soil seed bank dynamics of *Phalaris minor* in relation to different cropping systems and agronomic manipulation. M.Sc. thesis, Punjab Agricultural University, Ludhiana.