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Studies on the Depth and Periodicity of *Phalaris minor* Emergence in Wheat under Different Crop Establishment Methods

S. K. Yadav[1] and Govindra Singh
Department of Agronomy
G. B. Pant University of Agriculture & Technology, Pantnagar-263 145 (Uttaranchal), India

ABSTRACT

Depth and periodicity of *Phalaris minor* emergence were recorded in wheat sown under different establishment methods after rice which was also planted adopting various establishment methods. Maximum depth of emergence of *P. minor* was 5.92 cm under conventionally tilled wheat sown after transplanted rice, whereas minimum depth of 0.91 cm was recorded in zero tillage wheat after direct seeded rice without puddling (DS). Maximum *P. minor* population emerged from 0-3 cm depth under all the wheat establishment methods. In both conventionally tilled and zero tilled wheat after direct seeded unpuddled and puddled rice, there was no emergence of *P. minor* from 6-9 cm depth but still 5% population could emerge from this layer after transplanted rice. Conventionally tilled wheat had more weed population than zero tilled wheat after any rice establishment method. Under conventionally tilled wheat field before irrigation, there was 16% increase in *P. minor* density during 15 to 20 DAS but after first irrigation, the density of this weed increased by 175% during 20 to 40 DAS. In zero tilled wheat, the density of this weed increased by 61% before irrigation and after irrigation this increase was only 102%.

INTRODUCTION

Phalaris minor is an important and prevalent weed in wheat crop where rice-wheat rotation is being practised and it alone causes 15% reduction in the wheat yield (Brar, 1994). In rice-wheat cropping system, the tillage operations, harvesting operations and methods of rice and wheat establishment affect the weed seed distribution in soil profiles, soil seed bank, periodicity and depth of weed emergence, weed growth and development in the crop. Minimum weed population and dry weight were recorded in zero tilled wheat crop which were significantly lower than that for the conventional tilled wheat due to the fact that the intense tillage in conventional sowing would have brought the seeds in favourable moist soil layer, while they remained deep in zero and reduced tillage system (Bisen *et al.*, 2002). The first flush of *P. minor* emergence is of much significance for the crop-weed competition but in the later stages, crop gets the hold on the land. Tiwari and Bisen (1985) observed that the weed emergence pattern was greatly affected by irrigation and hoeing. Considering all these facts, a study was conducted in wheat crop sown adopting different establishment methods after rice crop which was also planted under various establishment methods to know the impact of tillage crop establishment methods periodicity and depth of emergence of *P. minor* in wheat crop.

MATERIALS AND METHODS

Field experiment was conducted during winter season of 2001-02 at Crop Research Centre of G. B. Pant University of Agriculture & Technology, Pantnagar, U. S. Nagar (Uttaranchal). In the experimental plot, rice was grown during **kharif** season adopting transplanted (TP), direct seeding in dry condition (DS) and direct seeding after puddling (WS). During subsequent winter season, wheat was sown as zero tillage (ZT) and conventional tillage (CT) by dividing the whole plot after rice into two parts. The soil of experimental plot was silty clay in texture (8.8% sand, 61.8% silt and 29.6% clay), medium in organic carbon content

[1]Present Address : Indian Lac Research Institute, Ranchi-834 010, (Jharkhand), India.

(0.7%), high in available phosphorus (29.9 kg P ha^{-1}) and low in potassium (228 kg K ha^{-1}). The wheat variety PBW 343 was sown on 28 November 2001.

Periodicity of Emergence

For recording the data on periodicity of *P. minor* emergence, an area of 25 x 25 cm was marked randomly at three locations in each plot designated as replications, under each establishment of wheat crop. *P. minor* emergence was recorded by counting the number of plants emerged in those areas at five days interval starting from the first plant seen in the field upto 25 days stage and final at 40 days stage. Then before analyses, the data were converted into density (No. m^{-2}).

Depth of Emergence

The *P. minor* plants were carefully digged out with the help of *khurpi* at 15 days stage when their seeds remained attached to the scutellar node. The depth of emergence was measured by recording the length of mesocotyle plus length of stem remained white (devoid of chlorophyll), which represent the part of stem inside the soil. In each establishment of wheat, three places were marked randomly and designated as replications and data on depth and periodicity of emergence were recorded from three places under each replication. The recorded data on periodicity of emergence were pooled for each replication and analysis was done as per the factorial randomized block design taking the wheat and rice establishment methods as two factors.

RESULTS AND DISCUSSION

Depth of Emergence

In conventionally tilled wheat after transplanted rice (TP), *P. minor* emerged from a maximum depth of 5.92 cm and a minimum depth of 0.93 cm, whereas after DS and WS rice, the highest depth of emergence was 3.41 and 3.82 cm, respectively. In zero tilled wheat after TP rice, the highest depth of *P. minor* emergence was 4.83 cm, whereas after DS and WS rice it ranged from 3.5 to 3.6 cm (Table 1).

Minimum depth of emergence of *P. minor* in conventionally tilled wheat after DS rice was 0.93 cm and after WS and TP rice, it was 1.51 cm. In zero tilled wheat after DS rice, the minimum depth of emergence was 0.91 cm but after WS and TP rice, it was 1.91 and 2.5 cm, respectively. On an average, after transplanted rice, emergence of *P. minor* in wheat was from deeper layers as compared to DS and WS rice under conventionally tilled and zero tilled wheat establishment methods. Chhokar *et al.* (1999) revealed that the maximum emergence of *P. minor* was obtained from 2.5 cm depth and further increase in the seeding depth reduced the emergence of this weed because of mechanical impedance offered by soil column lying over the germinating seeds. He also opined that only 10% seedlings emerged when seeded at 10 cm depth and no emergence was found at 12.5 cm depth or beyond as observed under pot culture condition.

In conventionally and zero tilled wheat after DS rice, more than 80% population of *P. minor* emerged from 0-3 cm depth, whereas in

Table 1. Depth of *P. minor* emergence in wheat as affected by wheat and rice establishment methods

Establishment methods		Depth of emergence (cm)			Per cent emergence from various depths			
Rice	Wheat	Max.	Min.	Av.	0-3 cm	3-6 cm	6-9 cm	9-12 cm
DS	CT	3.41	0.93	2.13	87.5	12.5	0.0	0.0
WS	CT	3.82	1.51	2.63	80.0	20.0	0.0	0.0
TP	CT	5.92	1.51	3.63	60.0	35.0	5.0	0.0
DS	ZT	3.50	0.91	2.03	80.0	20.0	0.0	0.0
WS	ZT	3.60	1.91	2.17	71.5	28.5	0.0	0.0
TP	ZT	4.83	2.50	3.31	55.0	40.0	5.0	0.0

DS–Direct seeded unpuddled, WS–Direct seeded puddled, TP–Transplanted, CT–Conventionally tilled, ZT–Zero tilled.

Table 2. *P. minor* density (No. m^{-2}) in wheat at various growth stages as affected by different rice and wheat establishment methods

Establishment methods	Before irrigation		After irrigation	
	15 DAS	20 DAS	25 DAS	40 DAS
Wheat				
CT	5.3 (193)	5.4 (224)	5.9 (394)	6.3 (616)
ZT	4.4 (82)	4.8 (132)	5.2 (202)	5.5 (267)
LSD (P=0.05)	0.2	0.3	0.4	0.5
Rice				
DS	4.7 (122)	4.9 (156)	5.5 (275)	5.8 (339)
WS	4.7 (127)	4.9 (146)	5.2 (264)	5.7 (411)
TP	5.0 (164)	5.4 (232)	5.0 (356)	6.2 (576)
LSD (P=0.05)	NS	0.4	NS	NS

Original values are given in parentheses. NS–Not Significant.

conventionally tilled wheat after TP rice, only 60% *P. minor* emerged from 0-3 cm. In case of zero tilled wheat after TP rice, there was 55% emergence of *P. minor* from 0-3 cm layer. In conventionally tilled wheat after DS rice, 12.5% population emerged from 3-6 cm layer, whereas in case of WS and TP rice, the emergence from this layer was 20 and 35%, respectively, but in case of zero tilled after DS rice, 20% population came from 3-6 cm. In case of zero tilled wheat after TP rice, the *P. minor* emergence was 40% from this layer. In both conventionally tilled and zero tilled wheat after DS and WS rice, there was no emergence of *P. minor* from 6-9 cm but still 5% population could emerge from this layer after TP rice. No emergence of this weed was recorded at depth beyond 9.0 cm under any wheat or rice establishment methods.

Periodicity of Emergence

Conventionally tilled wheat field had higher density of *P. minor* than that of zero tilled wheat at all the growth stages (Table 2). There was an increase in the population of *P. minor* with stages upto 40 days after sowing (DAS). Various rice establishment methods (DS, WS and TP) had non-significant effect on density in the subsequent wheat crop at various growth stages except at 20 DAS, when there was significantly more *P. minor* population after TP rice.

Under conventionally tilled wheat field before irrigation, there was 16% increase in *P. minor* density during 15 to 20 DAS but after first irrigation, the density of this weed increased by 175% during 20 to 40 DAS. In zero tilled wheat, the density of this weed increased by 61% before irrigation and after irrigation this increase was only 102%. There was 181% increase in the density of this weed in wheat after TP and WS rice before irrigation but after irrigation, this increase was only 117%. Singh *et al.* (2002) had also observed that wheat grown after TP rice had more *P. minor* population than grown after DS rice in single cycle of rice-wheat system.

Zero tilled wheat had significantly less *P. minor* population than CT wheat under all the rice establishment methods. Verma and Srivastava (1989) also reported that the conventionally tilled wheat had 21 to 28% more *P. minor* populations than zero tilled wheat.

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