Current Journal of Applied Science and Technology

39(48): 408-414, 2020; Article no.CJAST.66406
ISSN: 2457-1024
(Past name: British Journal of Applied Science & Technology, Past ISSN: 2231-0843, NLM ID: 101664541)

A survey of *Phalaris minor* Retz. Management in Wheat in Trans-Gangetic Plains Region of India

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

Article Information

DOI: 10.9734/CJAST/2020/v39i4831252
Editor(s):
(1) Dr. Michael Ignatius Ferreira, Research and Technology Development Services, South Africa.
Reviewers:
(1) Taís Aragão Ishizawa, Federal University of Goiás, Brazil.
(2) Champa Lal Khatik, SKNAU, India.
Complete Peer review History: http://www.sdiarticle4.com/review-history/66406

Original Research Articles

Received 20 October 2020
Accepted 26 December 2020
Published 31 December 2020

ABSTRACT

A survey was conducted to measure the extent of control of Littleseed canarygrass (*Phalaris minor* Retz.) in wheat crop in Ferozepur district in the state of Punjab (Trans-Gangetic Plains region) by Punjab Agricultural University Farmer Advisory Service Centre (FASC) Ferozepur during *rabi* 2018-19. The study aims to find out the causes of poor control of *Phalaris minor* in wheat crop on farm fields of farmers of Ferozepur district. 90 farm fields were selected randomly for collection of data. Survey data were analyzed using completely randomized design. Survey study revealed that sowings of wheat after first fortnight of November have significantly higher number of farm fields with medium control (control 50 to 60%) (3.0 farm fields) to low control (control less than 50%) (6.3 farm fields) environments of *P. minor.* High control environment (control more than 60%) has significantly higher number of farm fields (11.7) with less infestation of *P. minor* (population of *P. minor* less than 5 plants per square meter). However, in low control environments higher number of farm fields has population of *P. minor* 15 and more than 15 plants per square meter. *P. minor* appeared more in significantly higher number of farm fields (14.3), (3.7) and (7.7) in high control, medium control and less environment, respectively in the month of December. Significantly higher number of farm fields (16) used recommended herbicide to control *P. minor* in wheat crop in high control environment. However, farmers apply unrecommended herbicide in higher number of farm fields. Herbicide was applied timely to control *P. minor* in wheat crop in significantly higher number of farm fields (14) in high control environment. In low control environment farmers applied herbicide late to control *P. minor* in significantly higher number of farm fields (8.0). Farmers used right type of

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nozzle (Flat Fan and Flood Jet) to apply herbicide to control *P. minor* in significantly higher number (14) of farm fields in high control environment. Farmers used wrong type of nozzle to apply herbicide to control *P. minor* in more number of farm fields in medium control and less control environments. Optimum volume of water (150 litres of water per acre) was used to apply herbicide to control *P. minor* in wheat crop in significantly higher number of farm fields (17) in high control environment. Farmers used low volume of water (100 to 125 litres per acre) to apply herbicide to control *P. minor* in significantly higher number of farm fields (8.0) in low control environment. Farmers did not practice herbicide rotation in significantly higher number of farm fields 4.0 and 8.0 in medium control and low control respectively. *P. minor* inflorescence was not removed by farmers in significantly higher number of farm fields 4.0 and 8.0 in medium control and low control environments respectively. Inapproppropriate herbicide selection, method of application, delay in sowing of wheat and application of herbicide, lack of herbicide rotaion and non-removal of *P.minor* inflorescence were the reasons for poor control of *P. minor* in wheat crop.

Keywords: Phalaris minor; wheat; sowing; infestation; herbicide; nozzle; rotation and inflorescence.

1. INTRODUCTION

Rice-wheat cropping system is practiced over 26 million hectares in South and East Asia. The rice-wheat rotation occupies about 13.5 million hectares in Indo-Gangetic Plains [1]. This is the dominant cropping system in india over 10 million hectares area [2]. In rice-wheat cropping system productivity of wheat crop (*Triticum aestivum* L.) has threatened by the menace of Littleseed canarygrass (*P. minor* Retz.). Weeds cause 24% grain yield losses in wheat [3,4]. *P. minor* is a major weed of wheat crop and is one of the most troublesome annual weed of wheat in northwestern India [5]. It is highly competitive in nature and mimics the wheat morphology [4]. Due to morphological resemblances of *P. minor* with wheat crop, it is very difficult to differentiate *P. minor* from wheat crop during initial growth stages. It start to germinate at favorable temperature 10-20 degree celcius from the month of December to January. *P. minor* has established in rice-wheat cropping system because of set time of wheat sowing after rauni (pre-sowing irrigation) which meets its requirements of both favorable temperature and soil moisture [1]. Weeds can reduce yield by up to 95% [6]. Herbicide efficacy to manage a weed is influenced by many factors, such as weed growth stage/ time of application of herbicides (day after sowing), type of herbicide formulation, application technique (type of spray pump used, type of nozzle used, water volume used), herbicide rotation, soil type, removal of *P. minor* heads as well as the climatic conditions during the application [7]. To obtain consistently satisfactory weed management with an herbicide relationships between herbicide efficacy and such factors should be well defined [8]. A survey was planned to find out the reasons for poor control of *P. minor* in wheat in Ferozepur district of Punjab.

2. METHODOLOGY

Punjab Agricultural University Farmer Advisory Service Centre (FASC) Ferozepur conducted a survey to find out the reason for differential control of *P. minor* in wheat crop in Ferozepur district during *rabi* 2018-19. District is divided into 6 blocks Zira, Makhu, Ferozepur, Ghall Khurd, Guru Har Sahai and Mamdot. For collection of detailed data 90 farm fields were selected randomly (15 farm fields from each block) and farmers were also interviewed. Data was collected under three environments, viz. high control environment (*P. minor* control more than 60%), medium control environment (*P. minor* control between 50 to 60%) and low control environment (*P. minor* control less than 50%) under the following heads like method of sowing, wheat sowing data, cropping system followed, previous rice variety, infestation of *P. minor*, time of appearance of *P. minor*, herbicides used (Recommended/Unrecommended by Punjab Agricultural University Ludhiana) and doses, percent weed control, time of application of herbicides (day after sowing), type of spray pump used, type of nozzle used, water volume used (litre/acre), herbicide rotation, soil type, removal of *P. minor* heads.

2.1 Statistical Analysis

Collected data were analysed using analysis of variance (ANOVA) completely randomized design with CPCS1software. Data of two blocks was combined to form one replication like bloks Zira + Makhu replication 1, blocks Ferozepur + Ghall Khurd replication 2 and blocks Guru Har Sahai + Mamdot replication 3.

3. RESULTS AND DISCUSSION

3.1 Date of Sowing

In high control environment (control more than 60%) of *P. minor* in wheat crop significantly higher number of farm fields (15.7) has sown wheat earlier in the month of November and lower number of farm fields sown wheat later in the month of November (Table 1). However, in medium (control 50 to 60%) and low control (control less than 50%) environments of *P. minor* in wheat crop significantly higher number of farm fields 3.0 and 6.3 respectively, sown wheat later in the month of November. Sowing date of wheat play an important role in the management of weeds in wheat. The emergence rate of *P. minor* increased with delayed sowing of wheat because of a decline in temperature [9,10].

3.2 Infestation of *P. minor*

In high control environment (control more than 60%) of *P. minor* in wheat crop significantly higher number of farm fields (11.7) has *P. minor* population less than 5 plants per square meter (Table 2). Significantly higher number of farm fields (2.7) has *P. minor* population between 5 to 15 plants per square meter in medium control (control 50 to 60%) of *P. minor* in wheat crop. However, non significant difference was observed in respect of infestation of *P. minor in* low control (control less than 50%) of *P. minor* in wheat crop. It might also be observed from the Table 2 that more number of farm fields (5.0) has *P. minor* population between 5 to 15 plants per square meter in low control (control less than 50%) of *P. minor*. Infestation of *P. minor* even at 10 plants per square meter considerably reduced the growth and yield of wheat [11].

3.3 Appearance of *P. minor*

P. minor appeared more in wheat crop in significantly more number of farm fields (14.3) in the month of December in high control (control more than 60%) environment. Similarly, in medium (control between 50 to 60%) and low control (control less than 50%) environments significantly higher number of farm fields 3.7 and 7.7, respectively observed in the month of December (Table 3). Low temperature during the late sowing of wheat (December/January) favours the emergence and the growth of *P. minor* and thus crop suffer badly in respect of its yield [10]. The emergence rate of *P. minor* increased with delayed sowing of wheat because of a decline in temperature [9].

3.4 Herbicide used (Recommended / Unrecommended)

Significantly higher number of farm fields (16) used recommended herbicide (Recommended by Punjab Agricultural University Ludhiana) to control *P. minor* in wheat crop in high control (control more than 60%) environment. No significant difference was observed in farm fields number in medium control (control 50-60%) and low control environments (control less than 50%) in respect of use of recommended and unrecommended herbicide to control *P. minor* in wheat crop (Table 4). Bio-efficacy of unrecommended herbicide was not evaluated which results in variation in *P. minor* control. It is very essential to select an appropriate kind of chemical and to use it at a specific rate for effective weed control [12].

3.5 Time of Herbicide Application

Herbicide was applied timely (30-35 days after sowing) to control *P. minor* in wheat crop in significantly higher number of farm fields (14) in high control environment (control more than 60%) (Table 5). No significant difference was observed in farm field number in medium control environment (control between 50 to 60%) in respect of timely and late application of herbicide to control *P. minor* in wheat crop. However, farmers applied herbicide late (55-60 days after sowing) to control *P. minor* in wheat crop in significantly higher number of farm fields (8.0) in low control (control less than 50%) environment. Correct timing of herbicide application plays an important role in achieving effective weed control without causing crop injury. Crop tolerance to herbicides and weed control efficacy varies with herbicide choice, application dose, application timing, and environmental conditions [13]. Sulfosulfuron and fenoxaprop plus metribuzin provided effective control of *P. minor* when applied at 14 days after sowing (DAS) and 21 DAS wheat stages, all four herbicides were equally effective when applied at 30 DAS, and only pinoxaden worked effectively at 45 DAS wheat stage [14].

3.6 Type of Nozzle

In high control environment (control more than 60%) farmers used right type of nozzle (Flat Fan and Flood Jet) to apply herbicide to control *P. minor* in wheat crop significantly higher number (14) of farm fields (Table 6). However, medium control (control between 50 to 60%) and low control environments (control less than 50%)

were differed non-significantly in respect of type of nozzle to apply herbicide to control *P. minor* in wheat crop. As it is evident from the Table 6 that farmers used wrong type of nozzle (Brass Cone Nozzle) to apply herbicide to control *P. minor* in more number of farm fields in medium control and low control environments. Herbicide must adequately be in contact with plant for absorption by plant and reach at the site of action to toxic level without being deactivated for effective weed control [12].

3.7 Water Volume Used

Optimum volume of water (375 to 500 litres per hectare) was used to apply herbicide to control *P. minor* in wheat crop in significantly higher number of farm fields (17) in high control environment (control more than 60%) (Table 7). No significant difference was observed in farm fields number in respect of volume of water used for herbicide application to control *P. minor* in medium control environment (control between 50 to 60%). However, farmers used low volume of water (250 to 312.5 litres per hectare) to apply herbicide to control *P. minor* in wheat crop in significantly higher number of farm fields (8.0) in low control environment (control less than 50%). Efficacy of all glyphosate formulations can be improved by considering water volume as well as the quality [8].

3.8 Herbicide Rotation

No significant difference was observed in farm fields number in respect of herbicide to control *P. minor in* wheat crop in high control (control more than 60%) environment. Farmers did not practice herbicide rotation in significantly higher number of farm fields 4.0 and 8.0 in medium control (control between 50 to 60%) and low control (control less than 50%) respectively (Table 8).

3.9 Removal of *P. minor* Heads (Inflorescence)

No significant difference was observed in farmer's number in respect of removal of *P. minor* inflorescence (Heads) in High control (control more than 60%) environment. *P. minor* inflorescence was not removed by farmers in significantly higher number of farm fields 4.0 and 8.0 in medium control (control between 50 to 60%) and low control (control less than 50%) environments respectively (Table 9).

Table 1. Effect of date of wheat sowing on *P. minor* control in wheat crop

Date of sowing	No. of farm fields		
	High control environment (control >60%)	Medium control environment (control 50-60%)	Low control environment (control <50%)
1 to 10 November	15.7	1.0	1.7
11 to 20 November	1.0	3.0	6.3
21 to 30 November	1.3	0	0
P = .05	1.5	1.6	2.5

Table 2. Infestation of *P. minor in* wheat crop

Infestation of *P. minor* (Number of plants per square meter)	No. of farm fields		
	High control environment (control >60%)	Medium control environment (control 50-60%)	Low control environment (control <50%)
Less than 5	11.7	0.7	0
5 to 15	5.0	2.7	5.0
More than 15	1.3	0.7	3.0
P = .05	1.5	1.6	2.5

Table 3. Appearance of *P. minor in* wheat crop

Appearance of *Phalaris minor*	No. of farm fields		
	High control environment (control >60%)	Medium control environment (control 50-60%)	Low control environment (control <50%)
November	3.0	0.3	0.3
December	14.3	3.7	7.7
January	0.6	0.0	0.0
P = .05	0.6	0.3	0.3

Table 4. Herbicide used (Recommended / Unrecommended)

Herbicide used	No. of farm fields		
	High control environment (control >60%)	Medium control environment (control 50-60%)	Low control environment (control <50%)
Recommended (Recommended by Punjab Agricultural University Ludhiana)	16.0	1.0	3.0
Unrecommended	2.0	3.0	5.0
P = .05	9.8	NS	NS

Table 5. Time of herbicide application

Time of herbicide application	No. of farm fields		
	High control environment (control >60%)	Medium control environment (control 50-60%)	Low control environment (control <50%)
Timely	14	0.3	0.0
Late	4	3.7	8.0
P = .05	5.5	5.5	0.8

Table 6. Effect of type of nozzle used on *P. minor* control

Type of nozzle used	No. of farm fields		
	High control environment (control >60%)	Medium control environment (control 50-60%)	Low control environment (control <50%)
Right (flat fan/flood jet	14.3	0.7	1.0
Wrong (brass cone nozzle/spray gun nozzles)	3.6	3.3	7.0
P = .05	4.4	5.0	6.9

Table 7. Effect of volume of water used to apply herbicide on *P. minor* control

Volume of water used	No. of farm fields		
	High control environment (control >60%)	Medium control environment (control 50-60%)	Low control environment (control <50%)
Otimum (375 to 500 lires per hectare)	17.0	2.3	0.0
Low (250 to 312.5 litres per hectare)	1.0	1.7	8.0
P = .05	6.8	NS	0.9

Table 8. Effect of herbicide rotaion on *P. minor* control

Herbicide rotation	No. of farm fields		
	High control environment (control >60%)	Medium control environment (control 50-60%)	Low control environment (control <50%)
Yes	9.7	0.0	0.0
No	8.3	4.0	8.0
P = .05	NS	0.6	0.9

Table 9. Effect of removal of *P. minor* inflorescence on *P. minor* control

Removal of *P. minor* inflorescence	No. of farm fields		
	High control environment (control >60%)	Medium control environment (control 50-60%)	Low control environment (control <50%)
Yes	9.3	0.0	0.0
No	8.7	4.0	8.0
P = .05	NS	0.6	0.9

4. CONCLUSION

As conclusions, poor control of *P. minor* was observed in farm fields where farmers sown wheat after first fortnight of November, used unrecommened herbicides after 60 days of sowing of wheat with wrong nozzle (mostly brass cone nozzle or spray gun nozzle) mixed with low volume of water (250 to 312.5 litres per hectare). Herbicide rotations were not practiced and *P. minor* inflorescences were not removed in previous years. Inapropppropriate herbicide selection, method of application, delay in sowing of wheat and application of herbicide, lack of herbicide rotaion and non-removal of *P.minor* inflorescence were the villain of the piece. Wheat was sown timely (1 to 10 November) on more number of farm fields in high control environment (control more than 60%). Higher number of farm fields has less *P. minor* population in high control environment. Medium control (control between 50 to 60%) and low control environments (control less than 50%) were differed non-significantly in respect of use of recommended and unrecommended herbicide to control *P. minor in* wheat crop. Late application of herbicides (55-60 days after sowing) was done in significantly higher number of farm fields in low control (control less than 50%) environment. Right type of nozzles (Flat Fan and Flood Jet) were used to apply herbicide to control *P. minor in* wheat crop in significantly higher number of farm fields in high control environment. However, wrong type of nozzle was used to apply herbicide in significantly higher number of farm fields in medium control and low control environments. Number of farm fields were higher on which optimum volume of water (375 to 500 litres of water per acre) was used to apply herbicide to control *P. minor in* wheat crop in high control environment. However, farmers used low volume of water (250 to 312.5 litres per hectare) to apply herbicide in significantly higher number of farm fields in low control environment. Herbicide rotations were not practiced in significantly higher number of farm fields in medium control and low control environments. *P. minor* inflorescence was not removed in significantly higher number of farm fields in low control environments.

COMPETING INTERESTS

Author has declared that no competing interests exist.

REFERENCES

1. Yadav A, Malik RK. Herbicide resistant *P. minor* in Wheat –A Sustainability issue. Resource book. Department of Agronomy and Directorate of Extension Education, CCSHAU, Hisar, India. 2005; 152.
2. Mahajan A, Gupta RD. The rice-wheat cropping system. In: Integrated nutrient management (inm) in sustainable rice-wheat cropping system. Springer, Dordrecht. 2009;109-117. Available:https://doi.org/10.1007/978-1-4020-9875-8_7
3. Jabran K, Mahmood K, Melander B, Bajwa AA, Kudsk P. Weed dynamics and management in wheat. Adv Agron. 2017;145:97-166.

4. Joshi HC, Joshi B, Guru SK. Management of Isoproturon-Resistant *P. minor* in wheat by alternate herbicides under tarai region conditions. J Agric Sci Food Res. 2019;10:263.
5. Bhullar MS, Pandey M, Kumar S, Gill G. Weed management in conservation agriculture in India. Indian J Weed Sci. 2016;48:1-12.
6. Chhokar RS, Sharma RK, Chauha DS, Mongia AD. Evaluation of herbicide against *P. minor* in wheat in north-western Indian plains. Weed Res. 2006;46:40-49.
7. Kudsk P, Streibig JC. Herbicides – A-two-edged sword. Weed Res. 2003;43:90-102.
8. Dogan MN, Ogut D, Mulleder N, Boz O, Brants I, Voegler W. Effect of water volume and water quality on the efficacy of glyphosate on some important weed species in Turkey. 25th German Conference on Weed Biology and Weed Control. Braunschweig, Germany. 2012;229-234.
9. Tiwari AN. Final technical report. All India coordinated research programme on weed control, Centre Gujrat, Kanpur, India: Chandra Shekhar Azad Uni. of Agriculture & Technology; 1990.
10. Malik RK, Singh S. Proceedings of the International Symposium on Integrated Weed Management. Indian Society of Weed Science. 1993;1:225-235.
11. Hussain S, Khaliq A, Bajwa AA, Matloob A, Areeb A, Ashraf U, et al. Crop growth and yield losses in wheat due to little seed canary grass infestation differ with weed densities and changes in environment. Planta Daninha. 2017;35:017162328.
12. Varshney S, Hayat S, Alyemeni NA, Ahmad A. Effect of herbicide application in wheat fields. Plant Signal Behav. 2012;7(5):570-575.
13. Lemerle D, Hinkley RB, Kidd CR, Leys AR. Symptoms of injury caused by herbicides in wheat and barley. Advisory Bull (Dept. Agriculture, New South Wales). 1986;4:1-14.
14. Rasool R, Bhullar MS, Gill GS. Growth stage of *P. minor* Retz. and wheat determines weed control and crop tolerance of four post-emergence herbicides. Span J Agric Res. 2017;15(1):1001.
Available:https://doi.org/10.5424/sjar/2017151-9728

Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sdiarticle4.com/review-history/66406