International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
www.chemijournal.com
IJCS 2021; 9(1): 433-435

Received: 05-11-2020
Accepted: 15-12-2020

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A review on herbicidal management of *Phalaris minor* Retz. (Littleseed canarygrass)

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DOI: https://doi.org/10.22271/chemi.2021.v9.i1f.11269

Abstract
Phalaris minor is one of the important weed of winter cereal crops. It is very competitive weed of wheat crop. There are different management approaches for control of Phalaris minor like hand weeding, mechanical weeding, integrated method of weed management. This review is about chemical or herbicides control of Phalaris minor. It can cause 95% of yield loss in wheat crop. Since manual control of Phalaris minor is difficult because it is mimicry with wheat plant until flowering and other method required more time and labour, therefore for the immediate control of Phalaris minor use of herbicides is an opportunity to effectively control canarygrass with the choosing a broad span of herbicides which helps in effective management of P. minor and its resistant populations.

Keywords: Herbicidal, *Phalaris minor*, Littleseed canarygrass

Introduction
Since from the beginning of the crop cultivation weeds become the most harmful biotic factor that reduces yield and quality of crops. *Phalaris minor* is a monocot plant and graminaceous weed. Locally it is called as Gullidanda, Dumbisitti, Sitti, Kanki and Mandusi. It is a non-native winter annual grassy weed which is largely constrained to wheat fields and it has negative effects on growth and yield of wheat (Kaushik et. al., 2005) [13]. The seedlings are bluish green in color have a large, white ligule inside the leaf blade where its base wraps the stem and a leaf sheath with reddish base, mature plants range from 4 to 39 inches tall, erect leaves, flowers are produced in spike-like heads 0.80 to 4 inches long (Singh *et al.*,1999) [19]. *Phalaris minor* was reported to be a major weed in latin America and probably reached India through the import of Mexican wheat it was becoming a problem by the 1970s (*Bhan and Chodary* 1976). *Phalaris minor* Retz. has been distributed throughout the world and described as a troublesome weed for wheat, barley, vegetables, rotational crops and several other winter crops (Singh *et al.* 1999; Jaban *et al.*; 2010) [19]. It can cause up to 95% of yield reduction in wheat (Chhokar and Sharma 2008) [6]. Manual control of *Phalaris minor* is difficult became of its mimicry with wheat plants until flowering. It produces from 300 to 475 seeds per plant and matures about 2 weeks before wheat (Rammoorthy and Subbain 2006; Walia 2006; Yasin and Iqbal 2011) [17, 22, 23]. Due to its greater efficacy the chemical weed control method has rapidly extended all over the world and become one of the most used tools to control weeds (Oreke 2006) [15].

Management
Pre- emergence application of pyroxasulfone at 127.5 g/ha recorded effective in controlling *Phalaris minor* and gave the highest wheat grain yield during all the years. Pyroxasulfone 127.5 g/ha and pendimethalin 125 g/ha, as a single pre- emergence herbicides has proved quite effective against resistant *Phalaris minor* at farmers field (Kaur *et al.* 2019) [10]. Maximum inhibitory effect was recorded in case of fenoxaprop-p-ethyl 90 g a.i/ha. The excellent performance of fenoxaprop-p-ethyl in the present study appeared because of best control of grassy weeds (Kumar *et al.* 2015) [11]. Application of fenoxaprop at (100 ml/ha) and metribuzin (160 g ha^{-1}) reduced the morphological characters and dry weight production *Phalaris minor* (Dhaliwal *et al.* 1998) [8]. (Brar *et al.* 1999) [3] concluded that the bioefficacy of fenoxaprop-p-ethyl significantly reduced the dry matter production in Phalaris minor.

Phalais minor (grass weed) causes more competitive pressure on wheat so that their effective control by there herbicides Phalaris minor. The ready mix of mesosulfuron + iodosulfuron at 14.4 (12+2.4) and clodinafop + metsulfuron-methyl at 64.0 (60+4) g/ha was effective in controlling weeds and producing wheat yield (Prinsa *et al.* 2019) [16]. (Chhokar *et al.* 2019) [7] indicated that both pre- emergence flumioxazin and early post emergence flufenacet are quite effective for the control of little canary grass including populations which are multiple herbicide- resistant. Alternative herbicides namely pinoxaden and mesosulfuron+iodosulfuron remained effective on more than 85% of Phalaris minor accessions tested. Many biotypes are in the developing resistance category. Thus, currently there is an opportunity to effectively control canarygrass by selecting from a diverse range of herbicides and other cultural practices.(Chaudhary *et al.* 2016) [4] accomplished an experimental trail on wheat and found that lowest number of weed density (5.13 m/sq), total weed dry weight (17.31per mt sq) and highest weed control efficiency (83.85%) was recorded with the application of sulfosulfuron at the rate 25 g per ha followed by other treatments with application of clodinafop, metsulfuron and methyl metribuzin. (Kumari *et al.* 2013) [12] carried out field trail on wheat at CCS Haryana Agricultural University Hisar during 2011-12 and reported that application of sulfosulfuron + metsulfuron at the rate 32 g per ha resulted maximum weed control efficiency (89.2%) which was at par with sulfosulfuron at the rate 25 g per ha + metribuzin at the rate 210 g per ha may be due to more control of grassy and broad leaf weeds. (Walia *et al.* 2010) performed their field experiment on wheat at Department of Agronomy, Punjab Agricultural University, Ludhiana during the rabi seasons of 2008-09 and 2009-10 and sulfosulfuron 25% at the rate 36, 45 and 54 g per ha with 625 ml or 750 ml per ha of surfactant commercial resulted in significant reduction in dry weight of *Phalaris minor* and broadleaf weeds during both the years. (Saini *et al.* 2010) [20] performed an experiment on wheat and found the minimum population and dry matter accumulation of *Phalaris minor* with the application of sulfosulfuron at the rate of 25 g per ha. (Chhokar *et al.* 2007) conducted an experimental trail on wheat at Directorate of Wheat Research, Karnal, Haryana and recorded that minimum dry weight of Phalaris minor (5 and 0.7 g per m. sq.) in year 2002-03 and 2003-04 respectively with the application of sulfosulfuron at the rate 30 g per ha + metsulfuron at the rate 2 g per ha as compared to other treatments. (Mishra *et al.* 2005) [14] carried out a field experiment on wheat during the rabi season of 2000-2001 and 2001-2002 at Jabalpur and revealed that application of metribuzin at the rate 0.30 kg/ha at 35 DAS significantly reduced the population of Phalaris minor during both the year. (Singh and Kundra 2003) [18] conducted an experimental trial on wheat and revealed that weed population of Phalaris minor was controlled maximum by the combined application of sulfosulfuron and fenoxaprop. (Chauhan *et al.* 2001) [5] conducted the experimental trail on wheat and reported that maximum weed control efficiency (90%) with the application of clodinafop at the rate of 60 g/ha and sulfosulfuron at the rate 25 g/ha proved very efficient against isoproturon resistant Phalaris minor. (Balyan 2001) [1] conducted an experiment at Haryana Agricultural University, Hisar in 1997-98 and 1998-99 found that sulfosulfuron at the rate 25 g +0.1% surfactant, isoproturon at the 1000 g and tank mixture of isoproturon +metsulfuron methyl at the rate 750 +4 g/ha proved best to provide satisfactory control of grassy as well as broad leaf weeds. All these herbicides gave 55-85% control on grassy weeds.

Conclusion

Phalaris minor causes more competitive stress on wheat. Because it is mimicry weed and resemble wheat plant until flowering so it is difficult to control manually but application of pre-emergence herbicides are found effective in controlling Phalaris minor population. It is necessary to select the suitable chemicals capable of controlling effectively and economically all the type of weeds present in wheat crop, alternative herbicides at different application rates and time are found effective in controlling P. minor population and increasing wheat yield. All the herbicides significantly reduce the population and dry weight production of little seed canary grass. Chemical treatments were effective in reducing the growth characters of little canary seed and helps in increasing wheat yield.

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