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TOLERANCE OF *Avena fatua* AND *Phalaris minor* TO SOME GRAMINACIDES

Gul Hassan[1], Zahid Hanif, Mehboob-ul-Lateef, Muhammad Ishfaq Khan and Sabz Ali Khan

ABSTRACT

To study the tolerance of Phalaris minor and Avena fatua to graminicides, an experiment was conducted at the Department of Weed Science NWFP Agricultural University Peshawar under lab conditions, during Kharif 2003, using completely randomized design, having five treatments and two replications. The herbicide Topik 15 WP (clodinafop-propargyl) was applied at 0.11, 0.08, 0.06 and 0.04 kg ha^{-1} and Puma super (fenoxaprop-p-ethyl) was used at 0.6, 0.5, 0.4 and 0.3 kg ha^{-}1. Both herbicides were applied as post emergence. An untreated check (0 kg ha^{-1}) was also included in the respective herbicide for the comparison. The data were recorded on fresh weight (g) of these weed species and the data were subsequently subjected to %reduction from the weedy check. Regression analysis was run on the percent reduction to check data in the individual herbicide and the species separately. The subsequent computation of GR_{50} and GR_{90} after deriving the regression equations revealed that the herbicide clodinfop was more effective as compared to fenoxparop-p-ethyl, while wild oats was more sensitive as compared to canary grass to either of the herbicides tested. Thus, lower doses are recommended for the fields infested only with the wild oats alone, when treated with either of the tested graminicides.

Key word: Herbicide, sensitivity, wild oats, littleseed canarygrass, GR_{50} GR_{90}

INTRODUCTION

Phalaris minor and *Avena fatua* both are grassy weeds of wheat, which belong to family Gramineae. These are the most problematic and troublesome annual weeds of wheat fields in tropical countries including India and Pakistan. Both the weeds are highly competitive with wheat and cause severe reduction in its yield. Due to crop mimicry, it is difficult to differentiate these weeds from wheat at the seedling stage as their seedlings are identical to wheat seedlings in morphology. Life cycle of these weeds also coincides with wheat. The problem in identification at the early stage impedes in the manual control, hence herbicides application becomes inevitable. Tolerance is the phenomenon in which certain weed species resist the phytotoxic effect of a herbicide due to its genetics. The difference in tolerance of the two grass species has been practically observed in *Avena fatua* and *Phalaris minor*. To cope with such an alarming situations, different experiments on herbicide resistance in different weed particularly *Phalaris minor* and *Avena fatua* have been carried out since the last few decades. Dose response curves have important tools into the hands of weed scientists for a precise appraisal of tolerance to herbicdes (Seefeldt, *et al.* 1995). Isoproturon applied for the control of *Phalaris minor* @ 0.75 kg ha^{-1} resulted in greatest weed control (75 and 68 %

[1]Department of Weed Science, NWFP Agricultural University, Peshawar – Pakistan. Email: hassanpk_2000pk@yahoo.com

respectively) and the greatest wheat yields of 5344 and 4048 kg ha^{-1}, respectively, as compared with 4495 and 3500 kg ha^{-1}, respectively in the untreated control (Singh *et al.* 1994). Some biotypes of little seed canary grass were resistant to Isoproturon, but cross resistance to pendimethalin was not confirmed (Malik and Singh, 1995). Application from the two leaf upto the second tiller stage gave excellent control of little canary grass. Seefeldt et al. (1994) probed different resistant biotypes of wild oats to graminicides and concluded that GR_{50} values for diclofop were 3 to 64 times greater than the GR_{50} for a susceptible wild oat biotype. Tolerance was also investigated of fourteen weed cultivars (Welsh and Popay, 1994). Fenoxaprop, metribuzin and diclofop also gave a good level of control. However Isoproturon even at double the recommended concentration failed to control *Phalaris minor* biotypes, which differed in morphological characters (Dhaliwal et al., 1998). Kiec (1999) investigated fenoxaprop-p-ethyl and other grass killers and found that varieties E, F and G of wild oats were very well controlled by all herbicides, while variety A was weakly controlled by diclofop-methyl and cycloate. The use of herbicides for control of grassy weeds in wheat and other crops is a common practice in Pakistan. But, the precise information regarding the tolerance of various grassy weeds is lacking in Pakistan. Therefore, the present experiment was carried out in order to find out most effective and economical herbicides for controlling grassy weeds, to quantify the response of such weeds to used herbicides and the precise rate of the aforesaid herbicides for adequate control of the test species.

MATERIALS AND METHODS

Lab. studies were conducted in the Weed Research Laboratory, at Weed Science Department, NWFP Agricultural University Peshawar. For each herbicide (Topik and Puma super) there were five treatments in each of the 2 replications. Each treatment comprising a single pot. The experiment was laid out in completely randomized design. Both the species littleseed canarygrass *Phalaris minor* and wild oats *Avena fatua* were sown at 10 seeds per pot, on 11th Sep. 2003. Two herbicides clodinafop (Topik 15 WP) and fenoxaprop-p- ethyl (Puma Super 75 EW) were sprayed at four different rates as post emergence. Clodinafop was applied @ 0.11, 0.08, 0.06 and 0.04 kg a.i ha^{-1}, while fenoxaprop-p-ethyl was sprayed @ 0.6, 0.5, 0.4 and 0.3 kg a.i ha^{-1}. Untreated check was also employed in each herbicidal treatment separately. Destructive data on fresh weight were recorded on 21st Nov. 2003. The fresh weight of those weed plants in pots were taken which were still green (those plants having both living and damaged portion, only green living portions were weighed while damaged parts were discarded) was recorded in grams (g). The means of fresh weight of two replications for each species were determined and then the percentages of weedy check data were computed by the following formula:

$$\%\text{Reduction in fresh weight} = \frac{\text{Check weight (g)} - \text{Given treatment weight (g)}}{\text{Check weight (g)}} \times 100$$

The data so recorded were subjected to linear regression (Steel and Torrie, 1980) and the Linear regression equations were derived for each herbicide and plant species. Finally GR_{50} and GR_{90} were computed by using the aforesaid regression equation for each species and herbicide, separately. Where GR_{50} is the dose (kg a.i ha^{-1}) of herbicide which reduces the fresh weight of plants by 50% and GR_{90} is the dose (kg a.i ha^{-1}) which reduces the fresh weight by 90%.

RESULTS AND DISCUSSION

Statistical analysis of the data showed that weed density in pots were significantly affected by post emergence application of Topik 15 WP and Puma super 75 EW. The fresh weight of each herbicidal treatment in either species was reduced due to herbicidal treatment. The highest fresh weight was recorded in untreated check. The maximum fresh weight of wild oats and littleseed canary grass subjected to Topik (0.684, 0.119 g) was recorded in untreated check, followed by four doses of Topik 15 WP (Table-1). Similar trend was recorded in either species exposed to Puma super 75 EW (Table-2). The percentage fresh weights of untreated check data in *Avena fatua* and *Phalaris minor* showed that the herbicide application significantly reduced the fresh weight or green herbage in either species (Table-1 and 2). The results are analogous to Brar et al. (1999) where who concluded that the used herbicides nearly provided 100% control of resistant biotypes at slightly higher rates. The findings are also in a great analogy with those of Singh et al. (1998) and Rohitashave et al. (1999), who controlled grassy weeds with different grass killers. The fresh weight declined successively when the plants were subjected to the higher doses of Topik 15 WP. Complete kill of wild oats was recorded under the highest dose (0.11 kg a.i ha^{-1}) [Table-1]. Similar trend was recorded in canary grass subjected to Topik 15 WP. However , the weight of canary grass was over all lesser than the wild oats and a complete kill of canary grass was observed even at 0.08 kg a.i ha^{-1} (Table-1).

The data in Table-2 exhibit the fresh weight of wild oats and canary grass when exposed to Puma Super. The highest fresh weight (2.94 g) of wild oats was recorded in the untreated check. The fresh weight was reduced with application of Puma super both in wild oats and canary grass. However, reduction was more pronounced in wild oats as compared to canary grass (Table-2). Although, erratic but a complete kill of wild oats was recorded even at 0.4 kg a.i ha^{-1} (Table-2). Similar findings were also reported by Singh and Singh (1998), where herbicides control treatments significantly reduced the dry weight of weeds. The estimated linear regression equations for the computation of GR_{50} and GR_{90} are as follows

$\hat{Y} = 18.49 + 886.63X$ (wild oats exposed to Topik)

$\hat{Y} = 0.32 + 949.70\ X$ (canarygrass exposed to Topik)

$\hat{Y} = 17.82 + 166.23\ X$ (wild oats exposed to Puma super)

$\hat{Y} = 18.27 + 150.52\ X$ (canarygrass exposed to Puma super)

GR_{50} values of Topik 15 WP for wild oats and canary grass are 0.03 and 0.05 (kg ha^{-1}) respectively, while GR_{50} values of Puma super 15 WP are 0.19 and 0.21 for wild oats and canary grass respectively (Table-3). GR_{90} values of Topik 15 WP for wild oats and canary grass are 0.08 and 0.09, respectively, while GR_{90} values of Puma Super 75 EW are 0.43 and 0.48 kg a.i ha^{-1} for wild oats and canary grass, respectively (Table-4). Similar trend was observed in the research findings of Smitt and Cairns (2000) where LD_{50} values for susceptible and resistant biotypes were varying confirming the resistance of biotypes to herbicides. The findings of Malik *et al.*,(1998) reveal that some resistant biotypes of weeds required 6 times greater doses of a herbicides than sensitive biotypes for same level of control. Whereas, the findings of Seefeldt (1994) manifested upto 64 times higher GR_{50} in the resistant as compared to the susceptible biotypes.

It is concluded from our data that the lesser doses of Topik 15 WP are required for the control of wild oats and canary grass as compared to Puma super 75 EW whose greater doses experimentally depicted the control of wild oats and canary grass, thus

Topik 15 WP is more effective herbicide against wild oats and canary grass. Moreover, the GR_{50} and GR_{90} values of wild oats for Topik 15 WP and Puma super 75 EW are lesser than canary grass, it is also concluded that wild oats is more susceptible to both the herbicides than canary grass. Thus, lower doses of either herbicide may be used in the fields where wild oats alone is a problem. The higher doses of the both tested herbicides will be required for the adequate kill of little seed canary grass in the infested fields.

Table-1. Effect of different doses of Topik 15 WP on fresh weight (g) and % fresh weight reduction of wild oat and canary grass

Dose kg a.i ha^{-1}	Fresh weight wild oat (g)	% Reduction wild oat	Fresh weight canary grass (g)	% Reduction canary grass
0.0	0.684	0.0	0.119	0.0
0.04	0.178	75.0	0.067	51.0
0.06	0.81	90.0	0.090	26.0
0.08	0.105	84.6	0.0	100.0
0.11	0.0	100.0	0.0	100.0

Table 2. Effect of different doses of Puma Super 75 EW on fresh weight (g) and % fresh weight reduction of wild oats and canary grass

Dose kg a.i ha^{-1}	Fresh weight wild oat (g)	%Reduction wild oats	Fresh weight canary grass (g)	%Reduction canary grass
0.0	2.940	0.0	1.512	0.0
0.3	0.129	95.6	0.066	95.6
0.4	0.0	100.0	0.174	100.0
0.5	0.124	92.7	0.202	92.7
0.6	0.0	100.0	0.127	100.0

Table-3. GR_{50} values of wild oat and canary grass for Topik 15 WP and Puma Super 75 EW

Species	Topik kg a.i ha^{-1}	Species	Puma Super kg a.i ha^{-1}
Wild oats	0.03	Wild oats	0.19
Canary grass	0.05	Canary grass	0.21

Table-4. GR_{90} values of wild oat and canary grass for Topik 15WP and Puma Super 75 EW

Species	Topik kg a.i ha^{-1}	Species	Puma Super kg a.i ha^{-1}
Wild oats	0.08	Wild oats	0.43
Canary grass	0.09	Canary grass	0.48

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