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EFFECTIVE SOLUTIONS FOR CONTROL OF *Convolvulus arvensis* L. IN WINTER WHEAT (*Triticum aestivum* L.)

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Abstract

One of the most difficult to control weeds in winter wheat is Convolvulus arvensis L. In wheat, chemical weed control is preferred of its better efficiency. The aim of the current study is to find effective solutions for Convolvulus arvensisL. The experiments were situated in the experimental field of Agricultural University in Plovdiv. The trialswereconducted in 3 replications. The following treatments are included: 1. Untreated; 2. Aminopyralid+Florasulam- 33 g/ha; 3. Florasulam +Fluroxypyr– 1.5 l/ha; 4. Florasulam +Fluroxypyr– 1.8 l/ha; 5. Fluroxypyr- 0.7 l/ha; 6. Fluroxypyr- 0.9 l/ha7. Amidosulfuron +Iodosulfuron - 100 ml/ha. The herbicides were applied in phenophase BBCH 32-33. The efficacy of the studied herbicides and rates against Convolvulus arvensis L. was evaluated by the scale of EWRS on the 14th, 28th and 56th day after application. External symptoms of phytotoxicity were not observed. The highest efficacy was recorded for Florasulam +Fluroxypyr -1.8 l/ha; and Fluroxypyr- 0.9 l/ha.

***Key words**: weeds control, efficacy, herbicides, phytotoxicity.*

INTRODUCTION

Weeds remain one of the most significant agronomic problem associated in the cultivation of winter wheat (*Triticum aestivum* L.). It is recognised to the crop as it provides food and habitat for a range of beneficial organisms. The infestation of the crop with different broad leave weeds can reduce the yield. Winter wheat is generally invaded by both grass and broad leaved weeds but major challenge offered is by broad leave weeds. One of the key weed infesting the crop is *Convolvulus arvensis* L. The aim of the current study is to find effective solutions for control of *Convolvulus arvensis* L. in winter wheat (*Triticum aestivum* L.). It is a prostrate plant unless it climbs on an object for support. The root system has both deep vertical roots and shallow horizontal lateral roots. The vertical roots can reach depths of 20 feet or more. Experiments on *Convolvulus arvensis* L. have shown that its root and rhizome growth can reach to 5 tons per acre. Control of the weed isn't easy and it can't be accomplished with a single treatment or in a single season. Effective control requires prevention of seed production, reduction of stored carbohydrates by deep tillage of the root system, competition for light from other plants and constant vigilance in removing top growth. Application of herbicides, which reduce the weed growth and kill germinating seedlings, can also be part of an integrated weed management.

MATERIALS AND METHODS

The common winter wheat variety that was an object in the resent research is Enola (*Triticum aestivum* L. subsp. *vulgare* var. *erythrospermum*). The variety is bred in Dobrudzha Agricultural Institute - General Toshevo, Bulgaria. Certificate №: 10595/30.11.2004. The plants are characterized with 80-90 cm of stem height, high tolerance to lodging, very high productive tillering. The ear is with awns. The hectolitremasses 81-83 kg on average, and the absolute seed mass of 1000 clean, air-dry seeds is 41-44 g on average. The wheat variety is early. It has very good cold and winter resistance, high drought tolerance, good resistance to Powdery mildew (*Blumeria* *graminis* f. sp. *tritici*), Yellow rust (*Puccinia striiformis*), Black rust (*Puccinia triticina*) and Leaf Blotch (*Septoria tritici*) as well as high resistance to Fusarium head blight (*Fusarium graminearum*). The wheat variety owns high and stable yield (8.50 t/ha on average) and it is suitable for intensive growing without special requirements (http://www.dai-gt.org).

The experiment was situated in the experimental field of the base for training and implementation of the Agricultural University of Plovdiv, Bulgaria during 2018-2019. The trials was conducted by the randomized block design in 3 replications. The size of the experimental plot was 20 m². The sowing date was on the 6th of October 2017 with. The sowing is performed in the optimal time for the region. The experiment included the following treatments: 1. Untreated control; 2. Derby Super WG - 33 g/ha; 3. Starane Gold - 1.5 l/ha; 4. Starane Gold - 1.8 l/ha; 5. Flurostar 200 - 0.7 l/ha; 6. Flurostar 200 - 0.9 l/ha and 7. Sekator OD - 100 ml/ha. Derby Super WG contains Florasulam + Aminopyralid-potassium Starane Gold 1.2 l/ha. Starane Gold contains 1 g/l florasulame + 100 g/l fluroxypyr; Flurostar 200 contains 200 g/l fluroxypyr; Sekator OD 100 g/kg is containing amidosulfuron + 25 g/kg iodosulfuron.

The herbicides were applied in crop stage 2nd – 3rd stem node (BBCH 32-33) on 20.04.2018. The plant density was 450 plants/m². Predecessor of Winter wheat in the crop rotation was sunflower (*Helianthus annuus* L., hybrid P 64 LE 25). The performed soil tillage before the wheat sowing is deep ploughing followed by disking and cultivation. Fertilization with 300 kg ha^{-1} with NPK 15:15:15 applied before sowing and spring dressing with 300 kg ha^{-1} NH_4NO_3 is done. The efficacy of the studied herbicides and rates against the Field bindweed (*Convolvulus arvensis* L.) was evaluated by the 10 score scale of EWRS was evaluated on the 14th, 28th and 56th day after application as described by Zhelyazkov et al. (2017). The selectivity by the 9 score scale of EWRS as described by Zhelyazkov et al. (2017) was evaluated on the 7th and the 14th day after the herbicide application (at score 0 there are not damages on the crop, and at score 9 the crop is completely destroyed). The hectoliter seed mass was measured by weighing two parallel samples of 100 dm^3 air dry seeds. The hectoliter mass is calculated, as the arithmetic means of the established mass of the two samples (in grams) multiply by 100 and the resulting is divided into 1000 to obtain the mass in kilograms (Tonev et al., 2018). The absolute seed mass of 1000 clean, air-dry seeds, expressed in grams was also measured (Tonev et al., 2018). The seed moisture content was measured at the time of harvest with portable moisture meter model “DRAMINSKI GMM mini”. The height of the winter wheat plants was determined as 10 plants were measured and the results were divided to 10 to obtain average values. That was performed for each replication of every treatment. The length of the winter wheat ears was determined as the ears of 10 plants were measured and the results were divided to 10 to obtain average values. That was also performed for each replication of every treatment. Statistical analysis of collected data was performed by using Duncan’s multiple range test by the software SPSS 19. Statistical differences were considered significant at $p < 0.05$.

On the basis of the analysis of the meteorological data we can indicate the vegetation period of 2017-2018 as favorable for the growth, development and realization of the productive abilities of the winter wheat plants from the trial.

RESULTS AND DISCUSSIONS

During the 7 days before, 7 days after and during the herbicide treatment, no temperature values were reported that could contribute to a wrong assessment of the efficacy, selectivity and phytotoxicity of the studied herbicides (Figure 1).

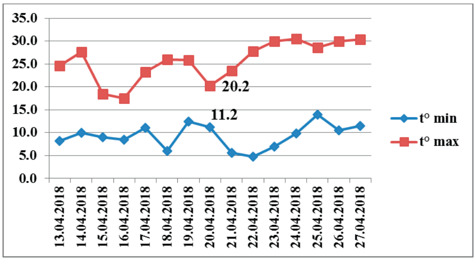

Figure 1. Minimum and maximum air temperatures 7 days before and 7 days after the herbicide application on 20.04.2018 (°C)

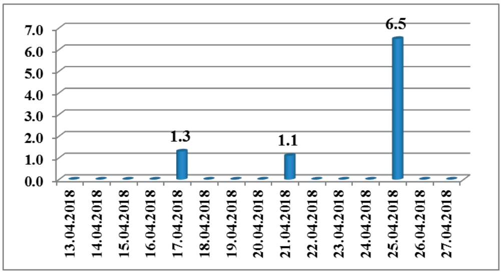

Figure 2. Precipitation 7 days before and 7 days after the herbicide application on 20.04.2018 (mm)

A rainfall during or immediately after treatment can wash the unabsorbed amount of the herbicide (Tonev et al., 2007; Tonev et al., 2011). On the day of the treatment the amount of precipitation is 0.0 mm. The total rainfall 7 days after the herbicide application is 7,6 mm (Figure 2). However, we do not take into account the effect of this precipitation on the efficacy, selectivity and phytotoxicity of the studied herbicides.

Due to the late application time of the herbicides (BBCH 32-33 of the winter wheat) the efficacy rates of all tested products and their doses are lower than the actual ones. It was reported that the most resistant weed species in the trail conducted by Mitkov et al. (2017) was the Field bindweed.

There were no visible signs of phytotoxicity on the crop caused by any of the studied herbicide products and the phytotoxicity score by EWRS was 0.

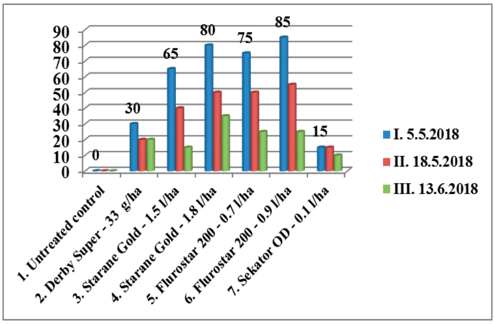

Figure 3. Efficacy of the studied herbicide products against *Convolvulus arvensis* L.

The efficacy of the studied herbicide products against the Field bindweed is shown on Figure 3. Derby Super WG applied at rate of 33 g/ha affects this difficult -to-control weed but the efficacy is extremely low in the order of 30% on the 1st reporting date (05.05.2018). On the 2nd and the 3rd reporting dates 18.05 and 13.06.2018, respectively, the efficacy decreased was more severe. Delchev (2013) did not found any efficacy of Derby Super WG against Field bindweed in his study.

On the 1st reporting date the efficiency of the herbicide product Starane Gold against the weed was higher independently the studied rates. At the rate of 1.5 l/ha the efficacy was 65% and at the rate of 1.8 l/ha the efficacy reached 85%. On the 2nd and the 3rd reporting dates the efficacy of the herbicide product was also decreased, but for the application of the higher rate of 1.5 l/ha the efficacy was the highest for the concrete trial conditions.

On the 1st reporting date the efficiency of the herbicide product Flurostar 200 against *C. arvensis* was higher independently the studied rates. At the rate of 0.7 l/ha the efficacy was 75% and at the rate of 0.9 l/ha the efficacy reached 85%. On the next two reporting dates the efficacy of the herbicide product was also decreased. Similar efficacy (76%) results against this noxious weed war recorded by Radivojević et al. (2006) after the application of Starane 250 at rate 0.8 l/ha.

We do not report any satisfactory efficacy from the herbicide product Sekator OD at all three evaluation dates independently the reporting dates. The same results were obtained by Delchev (2013) and Mitkov et al. (2017) where Secator OD did not control the weed Field bindweed. Practically the weed was not controlled by any of the products used in the study.

On the last reporting date, the weed recovered to a great extent (around 80%) thanks to the amounts of rainfall during the reporting period after herbicide treatments. Similar results were obtained in study conducted by Culhavi and Manea (2011). In their experiment all the variants treated with herbicides, 30 days after treatment and mainly 60 days after treatment *Convolvulus arvensis* L. tended to regenerate shooting new sprouts.

Picture 1. Untreated control

Picture 2. Derby Super 33 g/ha - 13.06.2018

Picture 3. Starane Gold 1.8 l/ha - 13.06.2018

Picture 4. Flurostar 200 - 0.9 l/ha - 13.06.2018

On Figure 4 is shown the data for the height of the winter wheat plants at harvesting time. The shortest plants in the study were the plants of the untreated control (variant 1) (75.56 cm) as well as the plants from treatment 7 (Secator OD - 0.1 l/ha) (75.67 cm) where the efficacy was negligible.

That is probably due to the infestation with Field bindweed and its concurrence with the winter wheat for space, water and nutrients. It is a relatively poor competitor for light (Wiese and Phillips, 1976).

The plants with the higher reported efficacy after the herbicide application are higher. For the treatments 4 (Starane Gold - 1.8 l/ha) and 6 (Flurostar 200 - 0.9 l/ha) the height reached 86.27 and 87.43 cm respectively.

The values for these two treatments were with proved difference according to Duncan's test in comparison to the other treatments in the experiment.

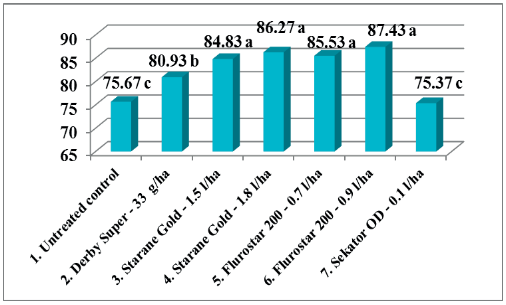

Figure 4. Height of the winter wheat plants at harvesting time, cm.

The variants treated with higher rates of the studied herbicides had higher yields in comparison with those treated with lower doses.

This was probably due to the highest efficacy of the herbicides (Figure 5).

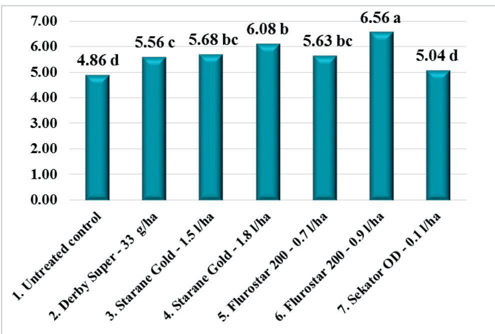

Figure 5. Winter wheat grain yield, t/ha

CONCLUSIONS

The experimental conditions for the growing season of 2018-2019 were favorable for the growth, development and realization of the productive abilities of the winter wheat variety Enola grown in the study.

The temperature values and precipitation during the 7 days before, 7 days after and during the herbicide treatment were suitable for appropriate assessment of the efficacy, selectivity and phytotoxicity of the active substances.

The highest efficacy against *Convolvolus arvensis* L. was recorded for Starane Gold and Flurostar 200. The efficacy of Derby Super WG is extremely low. No satisfactory efficacy from Sekator OD was found.

On the last reporting date, the weed recovered to a great extent (approximately 80%) thanks to the amounts of rainfall during the vegetation;

There were no visible signs of phytotoxicity on the crop caused by any of the studied herbicide products.

The plants treated with Starane Gold and Flurostar 200 were the highest and had the longest ears in the study.

The absolute seed mass of 1000 seeds, the hectoliter seed mass and the yield were higher when Starane Gold and Flurostar 200 are applied in high rates.

The plants of the untreated control and those treated with Sekator OD were the shortest and had the shortest ears as well as the lowest grain yield.

The plants of the untreated control had the lowest absolute seed mass of 1000 seeds and hectoliter seed mass.

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