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EFFICACY OF CERTAIN FOLIAR HERBICIDES IN THE OIL-BEARING ROSE (*Rosa Damascena* Mill.) AND THEIR EFFECT ON THE BLOSSOM AND ESSENTIAL OIL YIELD

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Abstract

During the period 2020-2021 at the experimental field of the Institute for roses and aromatic plants - Kazanlak on meadow-cinnamon soil a field experiment was carried out in the oil-bearing rose plantation (Rosa damascena Mill.). The study was carried out on the herbicidal efficacy and selectivity of Centurion super (120g/l clethodim) and Cliofar 600 SL (600g/l clopyralid) applied in vegetation of the culture. High biological efficacy of 88-91% of clethodim has been reported against annual monocotyledon weeds and 90-92% against perennial weeds. Clopyralid has a high herbicidal effect on the annual and perennial dycotyledon weeds - 90-96%. During the study period, a higher yield of fresh blossom was obtained with the herbicides used compared to the control by 230 and 700kg/ha. With regard to the amount of essential oil obtained, it was found that the herbicides under study exceeded the control by an average of 285 and 425kg/ha. The results of the study show that in all herbicide-treated variants, visual symptoms of phytotoxicity were not observed.

Keywords: Rosa damascena Mill., weeds, herbicides, yield

INTRODUCTION

Combating weed in the oil-bearing rose is done by using soil and foliar herbicides.

According to Spasov et al. (1999) in blossom producing plantations from the oil-bearing rose against annual graminaceous weeds Gallant super (haloxyfop-p-methyl) can be used at a dose of 150-250ml/da, Fusilade super (Fluazifop-p-butyl) -150-250ml/da and Nabu extra (sethoxydim) – 300-400ml/da. The appropriate phase for applying the herbicides is 2^{nd}-3^{rd} leaf of the weeds.

Studies by Rola (1986) showed that Fusilade super at a dose of 4l/ha reduces the density of common grass up to 5%, Targa 2 l/ha – up to 3%, and Gallant 3l/ha – up to 2%.

Kovrigo and Gruzdev (1980) found that Lontrel 300 WS (300g/l clopyralid) has a high biological efficacy against the root shooting weeds. At a dose of 0, 25l/ha the amount of weeds decreased by 39-72%, and the weed mass by 54-84%. Increase of the dosage up to 0, 5l/ha results in 65-100% destruction of these weeds.

After a 9-year study on a number of herbicides based on clopyralid, Soroka and Soroka (2015) found an annual high biological efficacy against Matricaria ssp. – 90-100%, Sonhus arvensis L. and Cirsium arvense L. – 80-100%.

The results from a study by Petrova et al. (2019) of various herbicides in sunflower hybrids revealed that the combination metolachlor+terbuthylazine+clethodim have a weaker effect (90-94%) against green foxtail and cockspur grass, and against broadleaf weeds - 100%.

One of the main issues in growing the oil-bearing rose is the highly limited choice of herbicides authorized for use; therefore, studies

of new ones with reliable characteristics in an ecological aspect are needed in order to optimize systems for integrated weed control in rose plantations.

The objective of the present study was to investigate the efficacy and selectivity of the vegetative herbicides and their effect on blossom and essential oil yield in oil-bearing rose (Rosa damascena Mill.).

MATERIALS AND METHODS

In the course of two years, the experiment was laid on the same area, according to the block design method in three repetitions with the size of the experimental plot 20m^2 with the following variants: control without digging, clethodim (Centurion super) - 192g/ha and clopyralid (Cliofar 600 SL) - 150g/ha. The experiment was laid down a randomize block replicated three times.

Herbicides were applied during vegetation of the oil-bearing rose in BBCH 12-13 weed phase, targeting the base of the bushes. The efficacy of herbicides was reported on the 30th day after treatment, and the selectivity of the preparations according to the EWRS scale (at score 1 - no crop damage, at score 9 - the crop was completely destroyed). The species composition of the weeds was reported according to the visual examination method.

The following indicators are included in the study: fresh blossom yield (kg/ha) and essential oil yield (g/ha). The results were processed statistically, and the differences between the individual variants were established by one-factor analysis of variance (Zapryanov et al., 1978).

Of the elements of the climate, the most dynamic and having a direct influence on the development of the oil-bearing rose were the annual amount of precipitation and air temperature (Nedkov et al., 2005). The average annual temperature for the studied years was 11.6-12.5C^0, and the annual amount of precipitation was 553-612mm. The spring months were characterized by temperature changes typical for this region - a slow increase in temperature from March to April (Fig. 1), well-defined diurnal amplitude, without sudden prolonged colds that would cause frosting of the top parts of the rose bushes. The winter-spring precipitations were in normal values and the oil-bearing rose had sufficient moisture until the beginning of budding (Fig. 2).

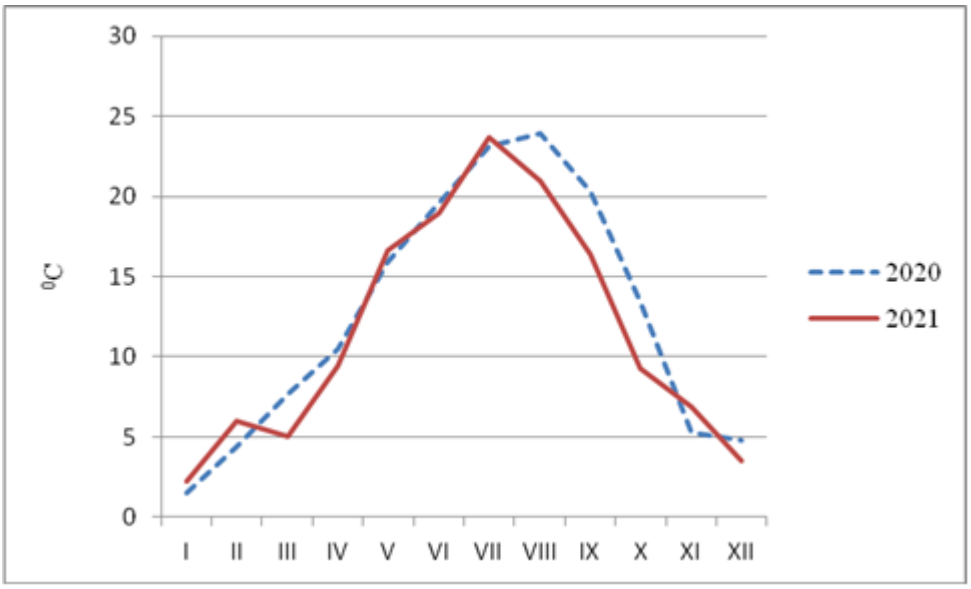

Figure 1. Monthly average temperatures during the period 2020-2021

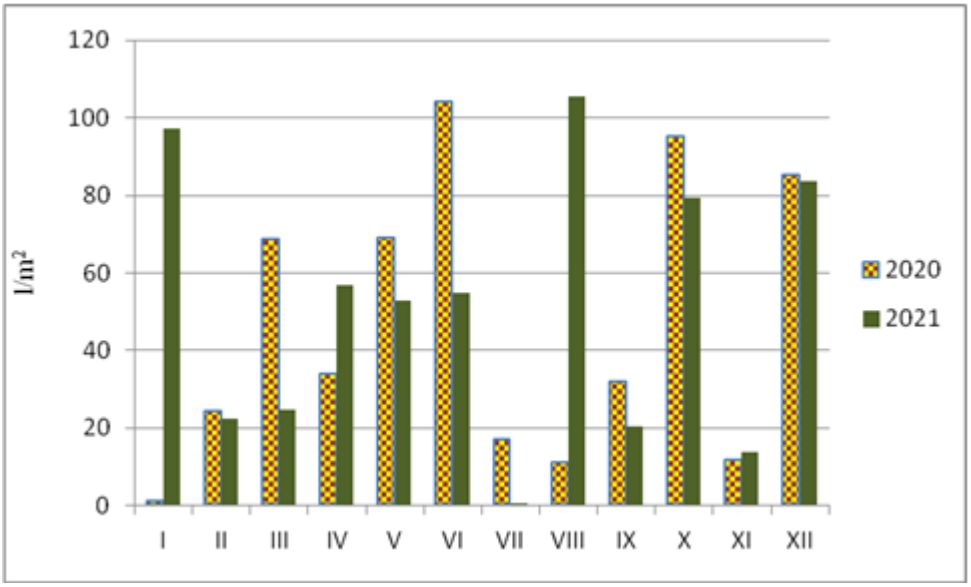

Figure 2. Precipitation distribution during the period 2020-2021

In conclusion, we can note that the weather conditions during the two years, for the most part, were favourable for the formation of normal yields of the oil-bearing rose and the applied vegetation herbicides.

RESULTS AND DISCUSSION

The results obtained regarding the species composition of weeds and the herbicidal efficacy of the applied herbicides were analogous during the years. In the row strip the predominant annual species were yellow foxtail (*Setaria glauca L.),* slender meadow foxtail (*Alopecurus myosuroides Huds*.), annual meadow grass (*Poa annua L.*), hairy crabgrass (*Digitaria sanguinalis L.*), smallflower galinsoga (*Galinsoga parviflora Cav*.), white goosefoot (*Chenopodium album L.*), common knotgrass (*Polygonum aviculare L*.), common fumitory (*Fumaria officinalis L.)*, shepherd's purse (*Capsella bursa-pastoris L.*), field chamomile (*Anthemis arvensis L.*), common cocklebur (*Xantium strumarium L.*), and from the perennial ones – Bermuda grass (*Cynodon dactylon L.*), creeping thistle (*Cirsium arvense L.*), field bindweed (*Convolvulus arvensis L.*), hoary cress (*Cardaria draba L.*), field sowthistle (*Sonhus arvensis L.*) and common mugwort (*Artemisia vulgaris L.*).

The studies carried out to establish the biological efficacy of the foliar systemic herbicides applied alone, without performing soil treatments during the period of their active action, showed the following:

Clethodim at a dose of 192 g/ha showed a very good herbicidal effect on the annual graminaceous weeds – bristle grass, slender meadow foxtail, annual meadow grass and hairy crabgrass spread in the experimental area, with the percentage of efficacy reaching 88-91 for both years (Tables 1 and 2). It destroys 90-92% of the perennial graminaceous weeds.

Observations on the biological efficacy of the clopyralid applied at a dose of 150 g/ha showed a very good effect against the annual dicotyledonous weeds 93-96%. The herbicide controlled common knotgrass, field chamomile and smallflower galinsoga. For perennial weeds, the percentage of destruction was 90-94 for both experimental years. From the broadleaf perennial species, creeping thistle and field sowthistle were sensitive, which confirmed the efficacy of the herbicide from previous studies (Kovrigo and Gruzdev, 1980).

Table 1. Biological efficacy of herbicides - year 2020

Variants	Dose, g/ha	Annual weeds				Perennial weeds			
		monocotyledonous		dicotyledonous		monocotyledonous		dicotyledonous	
		number/ m^2	efficacy %	number/ m^2	efficacy %	number/ m^2	efficacy %	number/ m^2	efficacy %
Untreated control	-	25		30		20	-	16	
Clethodim	192	3	88	10	-	2	90	6	-
Clopyralid	150	8	-	2	93	6	-	1	94

Table 2. Biological efficacy of herbicides - year 2021

Variants	Dose, g/ha	Annual weeds				Perennial weeds			
		monocotyledonous		dicotyledonous		monocotyledonous		dicotyledonous	
		number/ m^2	efficacy %	number/ m^2	efficacy %	number/ m^2	efficacy %	number/ m^2	efficacy %
Untreated control	-	11		24		13	-	10	
Clethodim	192	1	91	8	-	1	92	2	-
Clopyralid	150	4	-	1	96	3	-	1	90

External symptoms of phytotoxicity and visible disturbances in the development of rose bushes from the variants with applied herbicides were not observed.

Table 3. Effect of the herbicides on blossom and essential oil yield - year 2020

Variants	Blossom yield		Essential oil yield	
	kg/ha	%	g/ha	%
Untreated control	4120	100	1580	100
Clethodim	4500	109	1970 *	125
Clopyralid	4820 *	117	2070 **	131
Gd 5%	532		230	
Gd 1%	882		381	
Gd 0.1%	1648		713	

The differences in the productive qualities of the individual variants in terms of fresh blossom yield are shown by one-factor analysis of variance (Tables 3 and 4). For both study years, the variant with the application of clopyralid exceeded the control by 700 and 620 kg/ha, with a well-secured difference observed in 2020 and a very well-secured one in 2021. The resulting fresh blossom yield after clethodim treatment was higher than the control variant by 380 and 230 kg/ha, being statistically proven for 2022.

Table 4. Effect of the herbicides on blossom and essential oil yield - year 2021

Variants	Blossom yield		Essential oil yield	
	kg/ha	%	g/ha	%
Untreated control	4410	100	1850	100
Clethodim	4640 *	105	2030 *	110
Clopyralid	5030 ***	114	2210 ***	119
Gd 5%	185		117	
Gd 1%	307		194	
Gd 0.1%	575		363	

The amount of essential oil obtained per hectare is different for the variants and depends on the blossom yield and the percentage of oil in the blossom. The herbicides studied were found to outperform the control by 10-31%. A higher yield of essential oil in both years was obtained with clopyralid, statistically proven at P 1 and P 0.1%.

The effects of clethodim and clopyralid on rose blossom and essential oil yields were

correlated with the biological efficacy of the herbicides against graminaceous and broadleaf weeds.

CONCLUSION

1. High biological efficacy of 88-91% of clethodim against annual and 90-92% against perennial graminaceous weeds has been reported.
2. Clopyralid exhibits a high herbicidal effect on the annual and perennial broad leaf weeds - 90-96%.
3. The herbicides included in the study revealed a higher fresh blossom yield compared to the control by 5-17%.
4. After treatment with clethodim and clopyralid, a higher amount of rose essential oil has been obtained compared to the control.

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