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EFFECTIVENESS OF POST-EMERGENCE HERBICIDES IN VINEYARDS IN OSTROV, CONSTANTA

Marga Grădilă, Daniel Jalobă*

Research and Development Institute for Plant Protection, Bucharest

*correspondence address:
Research-Development Institute for Plant Protection
8 Ion Ionescu de la Brad 013813, Bucharest, Romania
Phone: + 40 21269 32 31
Fax: + 40 21269 32 39
E-mail: marga.gradila@icdpp.ro

Abstract: Because of their perenniality and the long distance between rows, the vineyards are yearly covered by perennial and annual mono and dicotyledonous weeds which are very difficult to fight against. Since workforce reducing occurred, chemical weed control has become a necessity as the weeds may compete with the vines for water and nutrient contents of the soil. The weeds may also support the development of diseases and pests and reduce the quality and quantity of grapes production. The research was conducted on the vineyard area of Ostrov- Dobrudja hills, on two different locations (the Canlia`s and Lipnita`s villages area) and was aimed at determining the efficacy of gluphosinate - based on herbicides applied in postemergency for weed control. Field studies were placed in four- repeated randomised complete blocks and the herbicides were apllied at the rates of 3, 4 and 5 litters on hectare when the dicotyledonous weeds were on the active-growth stage (4-6 leaves) and the monodicotyledonous ones had 10-15 cm tall before twinning. Observations and determinations aimed at efficacy in weeds control compared to untreated plot and monitoring phytotoxicity effects on grapevines (yellowish, brownish, necrosis). In the experimental field the following weed species predominated: *Sorghum halepense, Sonchus arvensis, Convulvulus arvensis*, *Agropyron repens* and *Amaranthus retlofexus*. There were also found other weeds: *Chenopodium album*, *Portulaca oleracea*, *Echinochloa crus-galli*, *Setaria glauca* and *S. viridis*, but with a lower density. The results obtained demostrated that gluphosinate-based on herbicides provided good efficacy in mono and dicotyledonous weeds control from Ostrovit`s vineyard area. The best result was obtained at the rate of 5 l/ha. The invasive species *Sorghum halepense* is not completely controlled at the rate of 3 and 4 l/ha. No phytotoxicity symptoms have been shown on the researched varieties (Muscat-Ottonel and Feteasca Regala).

Keywords: *vineyards, herbicides, weeds, efficacy*.

INTRODUCTION

The pedoclimatic conditions prevailing in vineyards and especially the applied technology determine a very particular flora both by its diversity of weed species, but more by the abundance and dominant relationships between species (Berca, 2004). Romanian vineyards are infested by a large number of annual and perennial mono and dicotyledonous weeds.Thus, 114 weed species were identified by Sanda (1960), in the vineyards of Istrita teritory, Dihoru & Donita (1970) identified 54 weeds in the Babadag area, Chirila &. and Micu (1971) found in Tohani 61 species and Coste (1998) established that in the south-eastern part of the country there were 78 species of weeds in the vineyards. The most species are common to all vineyards, but the most harmful are: *Agropyron repens* (L) P. Beauv., *Amaranthus* species, *Aristolochia clematitis* (L), *Cirsium arvensis* (L) Scop., *Chenopodium album* (L), *Convulvulus arvensis* (L), *Cynodon dactylon* (L) Pers., *Digitaria sanguinalis* (L) Scop., *Echinochloa crus-galli* (L) Beauv., *Equisetum arvensis* (L), *Erigeron annuus* (L) Pers., *Erigeron canadensis* (L.) Cronquist, *Galinsoga parviflora* Cav., *Poligonum aviculare* (L), *Poligonum convulvulus* (L), *Portulaca oleracea* (L), *Rumex* species, *Setaria* species, *Solanum nigrum* (L),, *Sonchus arvensis* (L), *Sorghum halepense* (L) Pers., *Stellaria media* (L) Vill., *Taraxacum officinalis* (L.) Weber ex F.H.Wigg., *Trifolium* species, *Veronica* species, *Xantium*

species (Chirila, 2001). Fighting weeds by chemical means in vineyards is of major importance because while the reducing of the labor force occurred, in conditions of no mechanical and manual weed control, the weeds have become a great competitor for the water consumption and fertilizing elements and also a factor for the reduction of the quality and the quantity of table and wine-making grapes (Tomoiaga, 2013). Also, weeds create and maintain a microclimate favourable to the development of downy mildew and grey mould, and by shading grapes they delay their maturing in the autumn, while a heavy infestation of *C. arvensis* may reduce yields by up to a half (Julliard, 1971). Toxic substances are secreted by weeds with negative consequences on the growth of vine root. (Elmer & Michailides, 2007). Due to the diversity of weed species (dicotyledonous and monocotyledonous, terofite, hemiterophite and geophysites, ephemera, spring and summer-autumn) herbicides and application time should be carefully chosen to achieve effective weed control. In this context, the paper presents data on the advantages of combating weeds from vineyards with herbicides applied in post-emergence, aiming to improve the quality and quantity of the yield.

MATERIALS AND METHODS

The research was carried out in the vineyard of Ostrov-Hills of Dobrudja, situated in the south east of Romania, in 2 different locations of the vineyard, in the Canlia and Lipnita villages in Constanta County. The trials were placed in randomized complete blocks in 4 repetitions on a typical cambic chernozem soil in Lipnita and loess type in Canlia with a sandy structure, pH 6.8-7.2 and a humus content of 2.5-3.2%. The assortment of cultivars included the Muscat-Ottonel variety, 5 years old and Feteasca Regala variety, 7 years old. Herbicides were applied in post-emergence, between rows by a manual pump, when dicotyledonous weeds were in the phase of active growth (4-6 leaves) and perennial weeds before tillering when the height was 10-15 cm. The herbicide gluphosinate 15SL was applied at 3.0, 4.0 and 5.0 l/ha. The standard reference (ammonium gluphosinate) was applied at 4.0 and 5.0 l/ha. Chemical weed control by post-emergence herbicide required the following preparatory works: pruning and weeding the shoots so that the herbicides administered on the soil should not be taken over by the superficial roots and through the shoots from the base of the vines, as well as the conducting and binding of the cordons in order to equally distribute the foliar apparatus to light radiation and thus to counteract weed competition. Weed density was assessed in ground % and in coupla/m². Weed control (efficacy) was assessed at 14, 30, 60 days after application in % control comparative with untreated. Also, observations on the weeds present in the experimental plots before treatment, and selectivity - at each date of the efficacy assessment were performed. Determination of segetal flora was performed on a square meter using a metric frame. Statistical preparation of the results was based on the analysis of ARM-9 (P=.05, Student-Newman-Keuls).

RESULTS AND DISCUSSIONS

The year 2017 was favourable for weeds development in the vineyards of Ostrovit, since the end of winter and early spring were mild and warm, with positive temperatures and the pluviometric regime exceeded the multiannual average for this area, values that created favourable conditions for the development of segetal flora (Table 1). In experimental field at Canlia the predominant weed was *Sorghum halepense,* an invasive weed in Romania (Dihoru, 2004). *S. halepense* is a thermophilic and heliophilous species that finds satisfactory growth and development conditions in Romania due to the high fertility of soils, especially under the conditions of substantial underground water intake. The large number of seeds (2.000-

5.000/plant) produced by each plant as well as the extensive rhizome system make this weed to be difficult to combat. The rhizomes grow vertically in depth, reaching 1.5-2 m in the soil, which gives them great drought resistance. The plant height of 1-1.5 m allows it to shade the surrounding plants, thus reducing the amount of water and nutrients available to the crop. The % ground cover of *S. halepense* was: 32.5% before treatments, 42% at 14 days of treatments, 52% at 1 month after treatments and > 60% at 2 months after treatments. In this conditions of infestation with *S. halepense*, the herbicide gluphosinate had a moderate efficacy in control of this species, the best results were obtained at the dose of 5.0 l/ha respectively: 86% at 14 days of treatments (Table 2) and 72 % at 2 months after treatments (Table 4). At a dose of 3.0 l/ha, because of the very high degree of weed infestation at 2 months after application, the control rate was only 52% lower, as the species *S. halepense* grew over all the weeds present in the Canlia vineyard (Table 4 and Figure 1).

Gluphosinate is a nonselective post-emergence herbicide which inhibits glutamine syntheses (GS) enzyme in susceptible plants (Bellinder et al., 1985; Wender et al., 1990). Environmental condition such as air temperature and relative humidity at application can influence the activity of many post-emergence herbicides (Prasad et al., 1967; Ritter & Coble, 1981). Low relative humidity prior to, during, and after treatment may cause the dehydration of the cuticle, thus possibly reducing absorption of water soluble herbicides such a gluphosinate. For example, the tolerance of *Setaria viridis* to gluphosinate was significantly higher when relative humidity was maintained at 40% compared with 95%. Under these circumstances from the experimental field at Canlia, the herbicide glufosinate had a good efficacy at all doses in control of *Setaria* spp. (annual monocotyledonous). This species was present in a much lower percentage due to the dominant species *S. halepense*, which inhibited the growth and development of *Setaria*. For perennial dicotyledonous species at Canlia was present *S. arvensis* with the % ground cover: 17% before treatments, 20.5% at 14 days of treatments, 24.5% at 1 month after treatments and >26.5 at 2 months after treatments and the best result was obtained at the dose of 5.0 l/ha (Tables 2, 3, 4).

In experimental field at Lipnita the predominant weeds were: annual dicotyledonous: *Amaranthus retroflexus*, perennial dicotyledonous: *Convolvulus arvensis* and perennial monocotyledonous: *S. halepense* and *Agropyron repens.* There were also present the species: *Chenopodium album*, *Portulaca oleracea*, *Echinochloa crus-galli*, *Setaria glauca* and *Setaria viridis* but in low density. For the perennial monocotyledonous the dominant weeds were *S. halepense* and *A. repens* which had together a coverage percentage > de 52% at 2 months after tretaments. At 14 days of treatments in experimental field at Lipnita herbicide gluphosinate had a good efficacy in control of weeds in grapevine the best results were obtained at the dose of 5.0 l/ha: *S. halepense* (95%), *A. repens* (98%), *A. retroflexus* (99%), *C. arvensis* (93%) (Table 2). Generally, the herbicidal effect was maintained during the two months of observations and the weed control was more effective when the herbicide was applied at higher doses and when the weeds had a height of 10 cm compared to the height of the weeds 5 or 15 cm. Results obtained are similar to those in the literature (Gregory et al., 1997). The invasive species *S. halepense* was not completely controlled at the rate of 3.0 and 4.0 l/ha: at 1 month after treatments: 72% at dose of 3.0 l/ha (Table 3, Figure 2) and 79% at 4.0 l/ha, respectively: 61% at dose of 3.0 l/ha and 68% at 4.0 l/ha at 2 months after treatments (Tables 4). For species *A. repens* the best result was obtained at the dose of 5.0 l/ha but at 2 months after treatments, the effectiveness in weed control was lower (64% at dose of 3.0 l/ha), due to high capacity of shooting and the ability to permanently form new rhizhomes. The rhizomes of *A. repens* are found deep in the soil at a depth of 2-12 cm and according to the literature from a single 1m square of soil we can find up to 2890 g of rhizomes totalling 495 m long with 26 000 buds from which they will start new aerial shoots that make it difficult to

fight this perennial species (Slonovschi et al., 2001). The herbicide gluphosinate 15 SL had a good efficacy in control of *C. arvensis*, at Lipnita the good results were obtained at all doses (Tables 2, 3, 4).

Table 1. The amount of precipitation (average, mm) registered in Ostrov, during 2010-2017

Year	Month			
	April	May	June	July
2010	40	54	76	116
2011	37	56	59	66
2012	65	114	40	18
2013	47	60	84	37
2014	36	72	90	44
2015	46	20	64	35
2016	63	76	35	20
2017	134	70	192	231

Source:http://www.meteoromania.ro/anm2/clima/monitorizare-climatica

Table 2. The efficacy of herbicides in weed control in grapevines, 14 days after treatment

Treatment	Rate (l/ha)	Weeds						
		Sorghum halepense		*Sonchus arvensis*	*Amaranthus retroflexus*	*Agropyron repens*	*Convolvulus arvensis*	*Setaria species*
		Efficacy (%)						
Untreated	-	0.0*	0.0**	0.0	0.0	0.0	0.0	0.0
Glufosinate	3.0	73.0 d	87.0 b	78.0 b	91.0 c	80.0 c	87.0 c	100.0 a
Glufosinate	4.0	77.0 c	91.0 b	86.0 ab	97.0 bc	91.0 b	93.0 b	100.0 a
Glufosinate	5.0	86.0 a	95.0 a	95.0 a	99.0 ab	97.0 a	100.0 a	100.0 a
Standard reference	4.0	80.0 b	89.0 b	88.0 ab	95.0 bc	85.0 bc	96.0 b	100.0 a
Standard reference	5.0	86.0 a	92.0 ab	95.0 a	99.0 a	91.0 b	100.0 a	100.0 a
LSD P=.05		1.574-1.953	3.485-4.349	6.841-9.688	1.898-4.959	2.886- 5.810	0.764-5.162	.
Standard Deviation		0.829t	2.702t	4.850t	3.989t	2.906t	3.254t	0.00t

0*- Canlia; 0**-Lipnita

Table 3. The efficacy of herbicides in weed control in grapevines, 1 month after treatment

Treatment	Rate (l/ha)	Weeds						
		Sorghum halepense		*Sonchus arvensis*	*Amaranthus retroflexus*	*Agropyron repens*	*Convolvulus arvensis*	*Setaria species*
		Efficacy (%)						
Untreated	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Glufosinate	3.0	67.0 c	72.0 c	75.0 c	83.0 d	71.0 c	80.0 c	99.0 a
Glufosinate	4.0	73.0 b	78.0 b	81.0 b	88.0 bc	81.0 b	88.0 b	100.0 a
Glufosinate	5.0	82.0 a	87.0 a	87.0 a	93.0 a	92.0 a	96.0 a	100.0 a
Standard reference	4.0	73.0 b	81.0 b	82.0 b	87.0 c	83.0.b	86.0 b	100.0 a
Standard reference	5.0	82.0 a	87.0 a	85.0 a	90.0 b	88.0 ab	91.0 b	100.0 a
LSD P=.05		2.544-3.008	2.793-3.581	2.840-3.423	1.521-2.103	6.009 - 8.292	3.722 - 5.883	0.725 - 1.000
Standard Deviation		1.211t	1.518t	1.508t	1.090t	3.618t	2.972t	3.170t

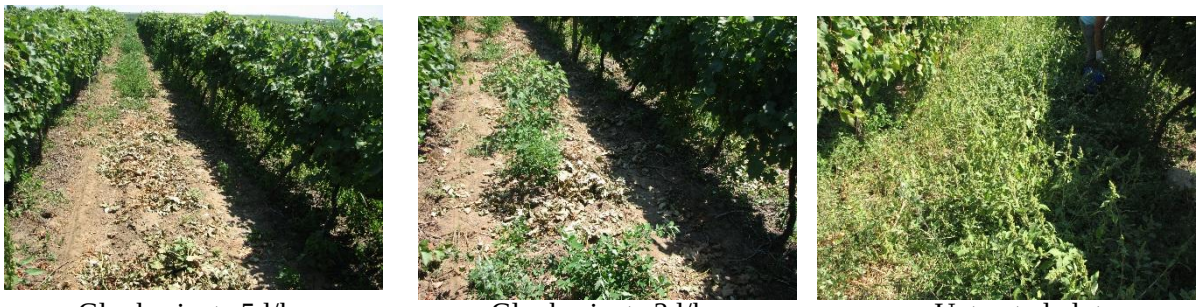
Table 4. The efficacy of herbicides in weed control in grapevines, 2 months after treatment

Treatment	Rate (l/ha)	Weeds						
		Sorghum halepense		*Sonchus arvensis*	*Amaranthus retroflexus*	*Agropyron repens*	*Convolvulus arvensis*	*Setaria species*
		Efficacy (%)						
Untreated	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Glufosinate	3.0	58.0 c	58.0c	72.0 e	75.0 d	64.0 d	74.0 c	98.0 a

Glufosinate	4.0	65.0 b	65.0 b	76.0 d	84.0 c	73.0 c	83.0 bc	100.0 a
Glufosinate	5.0	71.0 a	71.0 a	83.0 a	90.0 a	83.0 a	90.0 ab	100.0 a
Standard reference	4.0	64.0 b	64.0 b	78.0 c	83.0 c	75.0 b	82.0 bc	100.0 a
Standard reference	5.0	71.0 a	71.0 a	81.0	87.0 b	82.0 a	92.0 a	100.0 a
LSD P=.05		2.766-2.965	2.766-2.965	1.567-1.851	1.361-1.880	1.574-1.961	6.200-8.197	1.136-1.701
Standard Deviation		1.1259t	1.1259t	0.7755t	0.8255t	0.7656t	3.7012t	3.9728t

Gluphosinate 5 l/ha Gluphosinate 3 l/ha Untreated plot

Figure 1. The effectiveness of herbicides on vineyards at 30 days after treatment at Canlia



Gluphosinate 5 l/ha Gluphosinate 3 l/ha Untreated plot

Figure 2. The effectiveness of herbicides on vineyards at 30 days after treatment at Lipnita

CONCLUSIONS

Every year, the vineyards from Ostrov area are infested by mono and dicotyledonous species of annual and perennial weeds, hard to fight**.**

Weed control was achieved by post-emergence application of the gluphosinate 15 SL herbicide at doses of 3.0, 4.0 and 5.0 l/ha.

The standard reference (ammonium gluphosinate) was applied at 4.0 and 5.0 l/ha

In the experimental field from Canlia the dominant weed was the species *Sorghum halepense,* which had a degree of ground cover over 62%, which resulted in lower efficacy.

In experimental field at Lipnita, the predominant weeds were: annual dicotyledonous: *Amaranthus retroflexus,* perennial dicotyledonous: *Convolvulus arvensis* and perennial monocotyledonous: *Sorghum halepense* and *Agropyron repens.*There were also present the species: *Chenopodium album, Portulaca oleracea, Echinochloa crus-galli, Setaria glauca* and *Setaria viridis,* but in low density.

The results obtained demostrated that gluphosinate-based on herbicides provided good efficacy in mono and dicotyledonous weeds control from Ostrovit`s vineyard area. similar with standard reference.

The best result was obtained at the rate of 5 l/ha gluphosinate 15 SL. The invasive species *S. halepense* is not completely controlled at the rate of 3 and 4 l/ha.

The herbicidal effect was maintained during the two months of observations and the weed control was more effective when the herbicide was applied at higher doses and when the weeds had a height of 10 cm compared to the height of the weeds 5 or 15 cm.

For perennial species *A. repens* the best result was obtained at the dose of 5.0 l/ha but at 2 months after treatments the effectiveness in weed control was lower due to high capacity of shooting and the ability to permanently form new rhizhomes.

No phytotoxicity symptoms have been shown on grapevine varieties (Muscat-Ottonel and Feteasca Regala).

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