Fruit Growing Research, Vol. XXXVIII, 2022 DOI 10.33045/fgr.v38.2022.17
https://publications.icdp.ro/index.php

STUDII PRIVIND APLICAREA ERBICIDĂRII ÎN TEHNOLOGIA DE CULTURĂ LA ZMEUR

STUDIES ON THE APPLICATION OF HERBICIDES IN RASPBERRY CULTURE TECHNOLOGY

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Abstract

Weed control in raspberry cultivation helps to reduce the economic impact of the weed control link on the technological cycle, as well as to eliminate competition for water, nutrients and sunlight, thus allowing their growth and development in normal parameters. Cultivation, mulching and herbicide are the most practical control measures. It is necessary to know both the density of weeds and the dominant species in order to establish the strategy to reduce weeding by plowing, herbicide or integrated measures, so that weed invasion falls below the economic damage threshold (PED). The application of herbicides to reduce the degree of weeding is based on the knowledge of the weed species existing in the crop, as well as the state of coverage of the plantation. In order to establish effective measures to reduce the invasion below the economic damage threshold, it is necessary to determine the density of weeds by the method of mapping them and to establish the predominant species. The mapping action took place in the period 2020-2021 and an attempt was made to cover the entire spectrum of weeds in the plantation, then averaging by species. Following the mapping of weeds in the raspberry plantation, the presence of 22 weeds identified inside the metric frame belonging to both the dicotyledonous and monocotyledonous classes was observed, most of them coming from the first group (*Capsela bursa-pastoris, Lamium amplexicaule, Cirsium arvense, Cardaria draba, Setaria glauca, Agropyron repens, Cynodon dactylon*.

Cuvinte cheie: erbicide, *Rubus idaeus*, Roundup, buruieni perene și anuale
Key words: herbicides, *Rubus idaeus*, Roundup, perennial weeds, annual weeds

1. Introduction

The pedoclimatic conditions of our country are among the most favorable for fruit crops, Romania being one of the main fruit producing countries in Europe. Due to the diversification of fruit biology and cultivation technologies (Bell et al., 2007), weed control in orchards and fruit bushes has a specific character. The problem in this direction is the cultivation system and the age of the plantations with implications during the exploitation, then the problems related to the mechanization of the soil maintenance works in rows and the insufficient rotation of the control methods, all favoring the weed proliferation. A major problem in raspberry cultivation in addition to perennial weeds is one-year-old suckers, which in some areas are controlled with herbicides. This practice is also a big part of weed management. In addition, weed control between rows is done by plowing, mulching and herbicide (Dakic et al., 2012).

In order to establish effective measures to reduce the invasion below the economic damage threshold, it was necessary to establish the density of weeds and the predominant species by the method of weed mapping. Weed mapping can be done in three different ways, namely the visual method (the degree of weeding is assessed by notes given during the diagonal planting), the quantitative gravimetric method (which consists in weighing weed species in a square meter) and the method quantitative numerical (performed by counting the plants in the sample area), in the research using the latter one.

The main purpose of the paper is to study the influence of the application of herbicides in a raspberry plantation and the implications on fruit production and quality.

The paper contains information about the composition of weed species found in the raspberry plantation, treats the influence of weeds on the crop, and describes the main methods of weed control. The advantages and disadvantages of using herbicides as a method of weed control are also highlighted.

2. Material and methods

The study was carried out within the raspberry plantation from the Rediu family fruit farm, the unit being found on the administrative territory of Rediu Commune, from Galaţi County.

The plantation was established in 2017, with four raspberry varieties: 'Laszka', 'Polka', 'Glen Ample' and 'Sokolica', with planting distances: 3 m between rows and 0.5 m between plants per row, with a support system installed, respectively trellis with three wires (Fig. 1, 2, 3, 4).

The raspberry plantation is located on a land with a slope of 5-8%, on a chernozem type soil, with a predominantly medium texture, with a high fertility, but which requires the correction of the water deficit through irrigation. Ensuring the necessary water for growth and fruiting in optimal parameters is done using drip irrigation, administering 3-4 waterings.

Soil maintenance on the intervals between rows of plants is done by weeding, chopping vegetable residues whenever needed. Weed control on plant rows is performed by manual work consisting of weeding 3-4 times a year.

The mapping action took place in the period 2020-2021 and tried to cover the entire spectrum of weeds in the plantation, then averaging the species and then moving on to interpreting the data. For the execution of the mapping, a metric frame with a size of one square meter was used, and then depending on the diagonal of the plantation, the distance at which the 10 measurements were made was calculated. The diagonal of the orchard being 144.4 m^2, the measurements were made once every 14.4 m, in 10 repetitions, counting the weeds on each species.

Herbicide in the plantation was done with Roundup (Glyphosate 360 g/l). The experimental variants are the following:

A Factor (Variety): a1 – 'Polka'; a2 – 'Laszka'; a3 – 'Glen Ample'; a4 – 'Sokolica';

B Factor (Sucker stage development): b1 - before the emergence of the suckers; b2 - the beginning of the appearance of suckers; b3 - suckers appeared in proportion of 50%; b4 - non-herbicide.

During the study, observations, measurements, determinations and analyzes were made regarding the way of growth and fruiting, depending on the factors studied, thus it was followed: weeding mapping and establishing the degree of weeding of the raspberry plantation; the effects of herbicide on the growth and development of suckers; the effects of herbicide on fruit production and quality.

3. Results and discussions

Following the mapping of weeds in the raspberry plantation, the presence of 22 species was observed, identified within the metric frame, belonging to both the dicotyledonous and monocotyledonous classes, most of them coming from the first group (Table 1).

Among the dicotyledonates observed, the largest share is *Lamium amplexicaule*, this species being present in all the analyzed samples, the covered surface being quite large. Another weed that is found in each sample is *Capsela bursa-pastori*, but the number of plants per square meter is much smaller. *Cirsium arvense* and *Cardaria draba* also have a high density, the appearance of which among the samples is 9 out of 10, respectively 8 out of 10.

Regarding monocotyledonous weeds, the number of species is much smaller, only 5 of the total of 22 species identified being narrow-leaved plants. Of these, *Setaria glauca*, *Agropyron repens* and *Cynodon dactylon* are found in greater numbers in the samples collected. These species, although they do not have a large share of the analyzed area, on the parts they are on are quite difficult to eliminate and create problems competing with raspberry suckers for water and nutrients (Cianciara et al., 1986; Seipp, 1986).

Many studies confirm that plant herbicide is beneficial because it helps to reduce the economic impact of the weed control link on the technological cycle, as well as to eliminate the competition exerted by weeds on raspberry plants, thus allowing their growth and development in normal parameters (Lisek et al., 1993; Rankova et al., 2004).

Both in the case of the non-herbicide variant and in the case of those in which it was herbicided, the effects of different technologies can be observed, in terms of the growth of the suckers and their density per linear meter (Table 2).

The length of the annual shoots is an important feature of the species, which has a direct influence on the quantity and quality of production for the following year, the longer the shoots and the more vigorous the production the higher the quality (Istrate et al., 2012).

The optimal period for the application of the total herbicide is before the appearance of the suckers because, at this stage, only the weeds are affected, not the raspberry plants.

In the case of variants in which the herbicide was applied before the appearance of suckers, for all four varieties analyzed the number of annual shoots per linear meter and their length are not affected by herbicide, they fall within the specific characteristics of each variety.

Analyzing the second variant in which the use of herbicide was applied at the time of the appearance of suckers, a decrease in the number of annual shoots is observed, those affected by the herbicide being fully affected and surviving only those that emerged after herbicide was applied (Fig. 5.).

The same effects are observed in the case of herbicide when 50% of the suckers appear, only that they are much more severe due to the much higher number of annual shoots. In the case of this variant,

the two-year-old stems also suffered, their leaves being deformed and yellowish in color, and the entry into vegetation being delayed (Perianu et al., 2003; Perianu, 2004).

Analyzing the length of the shoots sprouted after herbicide, the differences are noticeable compared to the first variant, the development of the plants being affected, the shoots weak, and the length being considerably reduced by up to half.

In the parts where the herbicide was not applied, the density of the annual shoots and their length did not vary much compared to the variant to which the herbicide was applied before the appearance of the annual suckers, the difference being 1-3 shoots, respectively 0.12-0.18 cm for all studied varieties.

The production and quality of the obtained fruits depends entirely on the density of the shoots from the previous year left after the execution of the cutting works, as well as on their vigor, a low vigor shoot gives low yields and weak fruits in terms of quality.

The research carried out on using herbicides in raspberry plantation also focused on the way in which the production and quality of the fruits are affected by the herbicides, by affecting the shoots from the previous year. The analysis of the data presented in table 3 shows that, once the shoots were affected, they did not produce quality fruit the following year and the production was not profitable in terms of quantity either.

Analyzing the weight of raspberry fruits, it was observed that in the case of non-herbicides and herbicides before the appearance of annual shoots, their mass does not vary much, the difference being 0.2 g for 'Laszka', 0.1 g for 'Sokolica' and 'Glen Ample', respectively. 0.2 g for 'Polka'. In these variants, the fruit falls within the dimensions characteristic of each variety, so the yields are also high (Table 3).

Regarding the herbicidal variants, where the shoots suffered from the herbicide in the previous year, there is a decrease of over 30% in weight, the weak vigor of the shoots offering lower quality fruit. The low number of shoots that could be left to cut also affects the production in the case of the two variants. From the recorded data there is a significant decrease in production, by over 50% for all studied varieties.

Field observations have shown that plants affected by herbicide produce less fruit per shoot, and these are usually small, lighter in weight, and in some cases even deformed. In conclusion, production is considered to be low in terms of quantity and quality.

4. Conclusions

From the observations and determinations made it can be concluded that the plants affected by the herbicide produce less fruit per shoot, and they are usually small, lighter in weight and in some cases even deformed, so the production is considered to be poor quantitatively and qualitatively.

In the case of variants in which the herbicide was applied before the appearance of suckers, for all four varieties analyzed, the number of annual shoots per linear meter and their length are not affected by herbicide, they fall within the specific characteristics of each variety.

The optimal period for the application of Roundup herbicide (Glyphosate 360 g/l) is before the appearance of suckers because, at this stage, only weeds are affected, not raspberry suckers.

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Tables and figures

Table 1. Species identified in the raspberry plantation following weed mapping

No.	Species	No./m^2	Presence
1.	*Lamium maculatum* L.	24	8/10
2.	*Lamium aplexicaule* L.	117	10/10
3.	*Cardaria draba* L.	34	8/10
4.	*Capsela bursa-pastori* L.	50	10/10
5.	*Chenopodium album* L.	6	7/10
6.	*Amaranthus retroflexus* L.	3	4/10
7.	*Phacelia tanacetifolia* L.	2	3/10
8.	*Polygonum convolvulus* L.	16	9/10
9.	*Cirsium arvense* L.	41	9/10
10.	*Convolvulus arvensis* L.	14	7/10
11.	*Veronica chamaedrys* L.	11	6/10
12.	*Taraxacum oficinale* L.	3	4/10
13.	*Senecio vernalis* Waldst & Kit	2	3/10
14.	*Verbascum sinuatum* L.	3	3/10
15.	*Polygonum aviculare* L.	5	5/10
16.	*Vicia cracca* L.	7	6/10
17.	*Setaria glauca* L.	28	7/10
18.	*Agropyron repens* L.	31	8/10
19.	*Sorghum halepense* L.	17	6/10
20.	*Cynodon dactylon* L.	25	6/10
21.	*Apera spica-venti* L.	12	4/10
22.	*Alyssum desertorum* L.	2	3/10

Table 2. Number of annual suckers per linear meter and their length in Roundup herbicide variants (Glyphosate 360 g/l)

No.	Variety (A)	Variant* (B)	2020		2021	
			No. of suckers/ml	Suckers height (m)	No. of suckers/ml	Suckers height (m)
1.	a1-Laszka	b_1	19	2.29	18	2,10
		b_2	13	1.67	12	1.47
		b_3	8	1.20	7	1.10
		b_4	17	2.11	16	2.00
2.	a2-Sokolica	b_1	22	2.40	20	2.25
		b_2	13	1.62	14	1.42
		b_3	8	1.31	8	1.21
		b_4	20	2.23	19	2.03
3.	a3-Glen Ample	b_1	34	2.58	32	2.38
		b_2	19	1.70	18	1.52
		b_3	13	1.35	11	1.15
		b_4	30	2.46	28	2.26
4.	a4-Polka	b_1	27	2.09	26	1.89
		b_2	17	1.56	15	1.46
		b_3	11	0.97	10	0.87
		b_4	25	2.14	23	2.04

* B Factor (Raspberry annual sucker development stage): b_1 – before the emergence of the suckers;b_2 the beginning of the appearance of suckers; b_3 – suckers appeared in proportion of 50%; b_4 - non-herbicide

DOI 10.33045/fgr.v38.2022.17

Table 3. Fruit production and quality in the herbicide version with Roundup (Glyphosate 360 g/l)

Nr.	Variety (A)	Variant* (B)	Fruit weight (g)	Fruit lenght (cm)	Kg/m liniar	t/ha
1.	a1-'Laszka'	b_1	9,9	3.6	5.1	13.9
		b_2	6,8	2.3	3.4	9.3
		b_3	4,1	2.0	2.1	5.9
		b_4	9,7	3.4	4.9	13.4
2.	a2-'Sokolica'	b_1	9,4	3.5	4.2	11.4
		b_2	5,7	2.1	2.6	7.1
		b_3	3,8	1.9	1.7	4.7
		b_4	10,1	3.4	4.4	12.0
3.	a3-'Glen Ample'	b_1	7,4	2.7	3.5	9.7
		b_2	4,2	1.8	2.2	6.2
		b_3	3,4	1.7	1.2	3.5
		b_4	7,4	2.6	3.5	9.5
4.	a4-'Polka'	b_1	6,1	2.4	2.7	7.5
		b_2	4,2	1.6	1.8	4.9
		b_3	2,7	1.3	1.1	3.1
		b_4	5,9	2.6	2.6	7.2

* B Factor (Raspberry annual sucker development stage): b_1 – before the emergence of the suckers;b_2 the beginning of the appearance of suckers; b_3 – suckers appeared in proportion of 50%; b_4 - non-herbicide

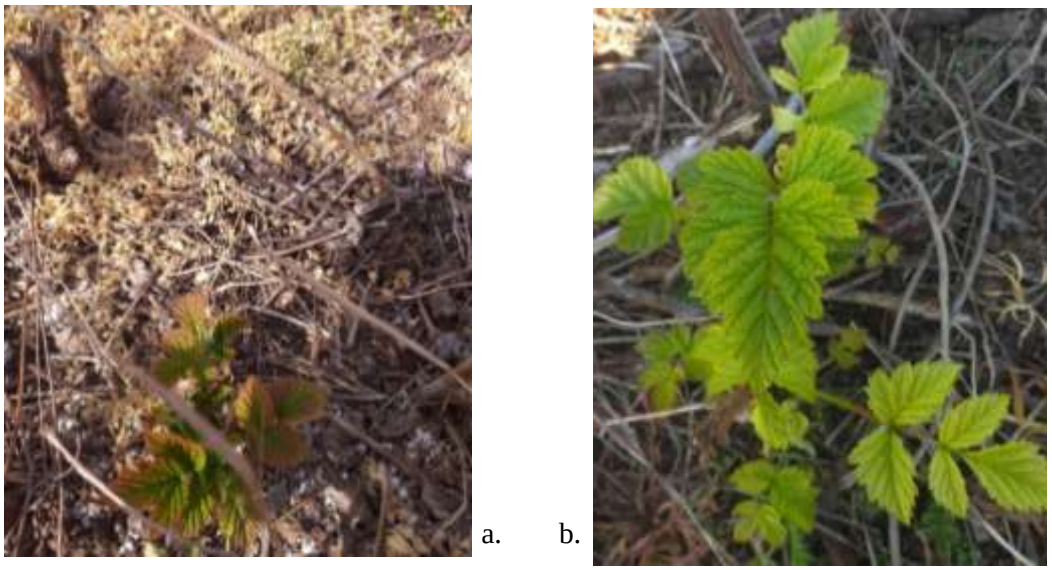
Fig. 1. Aspects of the '*Polka*' variety (original)

Fig. 2. Aspects of the '*Laszka*' variety (original)

 DOI 10.33045/fgr.v38.2022.17

Fig. 3. Aspects of the '*Glen Ample*' variety (original)

Fig. 4. Aspects of the '*Sokolica*' variety (original)



a. b.

Fig. 5. Effects of Roundup herbicide on annual shoots applied before the appearance of the annual suckers (a) and after the appearance of the annual suckers (b)