

**THE EFFECTIVENESS OF HERBICIDES USED IN APPLE ORCHARDS OF FRUIT TREES IN THE VOINEȘTI BASIN**

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**Abstract**

*The research was conducted at the Research Station - Horticulture Development Voinești located in the center of Dâmbovița Basin orchards belonging to the Southern Carpathian hills.*

*Under current conditions, when the interest in environmental production is increasing, based on the principles of greener fruit consumption, it was intended that through research programs established for the period 2006 - 2020 to find solutions to achieving these goals: deepening the knowledge of the weeding degree within apple orchards and determining the optimal timing of herbicide application on the ground and their type; determining optimal quantities of herbicides and weed control in apple orchards in doses with low-environmental impact.*

Keywords: herbicides, preemergence, postemergence, monocots, dicots.

**1. INTRODUCTION**

Soil tillage depends on the maintenance system and varies depending on the climate, the culture system and the crop species.

In determining the soil maintenance system within orchards, it should be considered as follows:

- Achieving a well established vegetation cover to allow at any time of year and in any weather, a good traffic imposed by technological needs inside the interval;
- Improved soil characteristics and fertility by increasing the contribution of the herbs grown between rows;
- Determining the optimal dosage of herbicides in a rational combat against weeds in the row of trees, herbicides having a low environmental impact;

Research conducted at the Research Station for Fruit Growing of Voinești were developed in the context of establishing technology particularities in intensive apple growth with the main objective to increase the quantity and quality of some apple varieties with genetic resistance to disease to overcome competitive pressures from both Romanian market and the export.

**2. MATERIALS AND METHODS**

Research held during 2006 - 2009 at The Research - Development of Horticulture of Voinești had the goal to establish specific technology of maintenance in the organic soil of orchards pursuing to establish the degree of weeding; establishment of seed reserve in the soil, and to determine the efficiency of herbicides in fighting the weeds of apple orchards;

1. The degree of weed as a result of mapping and determination of soil seed reserve

Prior to herbicides administration we had to determine weed and floristic composition of orchards in order to recommend the herbicides that have the best spectral efficiency based on combat against monocotyledonous or dicotyledonous weeds.

Measurements were made only among the trees row and not on the interval on no I nonherbicised blank range variants and 4 repetitions on parcels diagonals, before post-emergence herbicide application at the end of summer (second half of August) and in all experimental years . According to the methodology of work, field weeds were determined by assessments square meter using metric frame. Were covered plots and were noted for all species encountered and notes on abundance and dominance were assigned to each species. Based on these data we calculated the participation of each weed species in general (P%). Weed coverage territory was experienced in scale from 1-9, (1) minimum 1-10% coverage of the surface, the maximum (9), 90-100% coverage.

Soil samples with weed seeds were placed in special vessels fitted with mesh, being washed in running water, weed seeds remaining on the sieve. These were put on the filter paper or blotting paper to dry, and then were counted, resulting in 1dm<sup>3</sup> of existing number in soil.

Analysis of weed seed rate reported in square meter shows that if protosol alluvial soil typically recorded 3040 seeds / m, and brown soil - eumezobazic moderate gleyed 10870 seeds / m; be inferred that will arise over 200 plants / m.p. so we have a high degree of weeding.

For weed control in orchards of apple fruit within the Research Station for Fruit Growing Voinești, preemergence herbicides were tested during the period 2006-2009: Simanex 50SC, Simadon 50PU, Stomp 330 EC, Venzar 80WP, postemergence herbicides Vegepron DS: Glyphosat 360 SL NAF 595, Salt DMA, Glyphogan 480 SL; Glyphogan 480 SL + Hyspray (adjuvant); Glyphogan 480 SL + Frygate (adjuvant); Glyphosat NAF 360 SL 595 + Hyspray (adjuvant); Glyphosat NAF 360 SL 595 + Frygate (adjuvant); Basta 14 SL; Roundup 360 EC Touchdown EC; Glialka 36 EC; Ground-up; Folar FW 525; Glyphosate Borzesti; CERL 250 EC; IceDin Forte.

The experiments were organized at the farm no. 1 Voinești on a parcel of apple fruit with size of 7000 square meters, with trees 9 years old in 2006, and 12 years in 2009. Each herbicide and dose were used as follows: pre-emergence herbicides variants and witness variants occupied each 100sqm, post-emergence herbicide and associated variants that have been administered or in a combination with an adjuvant, occupied 200sqm each.

Pre-emergence herbicides were applied during the period April 10 to 15 after first rows of trees (width 1.5 m) were drilled being taken care of with a back pump (sprayer) with a capacity of 15 l.

Post-emergence herbicides were applied when weeds were in full growth and had an average height of between 15-20cm, in the calendar period of May 10 to 20.

### 3. RESULTS AND DISCUSSION

The data presented in (table.1), follows that for in seed weed, control good and very good results were obtained by pre-emergent herbicides: PU Simadon 50 6 kg / ha, Simarex 50 About 3-3.5 kg / ha, herbicides have effective action on many annual and perennial weed seed but do not control weeds already emerged and neither perennial weeds in vegetation. A preemergence herbicide for Romania with good efficacy in weed control proved Vegepron (a mixture of two herbicide simazine + diuron) DS dose of 5-8 l / ha which has a long time for action and a broad spectrum of combat. It appears that an important role for the success of a pre-emergence herbicides represents the enough moisture in the soil. In the use of pre-emergence herbicides it has not been required a preparation of soil and neither an incorporation into the soil, as they were taken before the emergence of weeds.

**Table 1. Efficiency of preemergence herbicides in weed controlling within Apple Orchards (Voinești 2006-2009)**

Herbicide	Dose/ha Kg (l)	Weed control (%)		Note EWRS	
		Annual	Perennial	Eficacity	Fito toxicity
Witness 1, untreated, not worked	-	0	0	9	1
Witness 2, untreated, worked for 2 times	-	90	60	3	1
Venzar 80 WP	3	85	20	3	1
Simadon 50 PU (ST)	6	90	0	3	1
Simanex 50 SC	3-3,5	95	60	2	1
Stomp 330EC	5-6	90	20	3	1
Vegepron DS	5-8	95	60	2	1
Simanex 50SC+ Glyphogan480 SL	3+3	95 100	60 95	2 1	1 1

After applying pre-emergent herbicides the soil remained clear for about 60 days and then weeds started to rise, at first some scattered species resistant to products namely: *Taraxacum officinale*, *Polygonum aviculare*, *Agropyrum repens*, *Polygonum persicaria*, *Rumex sp*, *Digitaria sanguinalis*. After 80 days have been treated with Glyphogan 41 / ha, the soil remaining free of weeds until fruit harvest.

Following the effectiveness of herbicides, we find that unrelated herbicides applied only on pre-emergence treatments fight against monocotyledonous and dicotyledonous weeds in seed over a period of 2-3 months, but remain unbroken especially those perennial weeds that infested the plantations, like: *Agropyrum repens*, *Convolvulus arvensis*, etc.

The results show that the pre-emergence herbicides reduce weeding degree by 50-70% when applied correctly and in optimal time.

A good efficiency over 90% up to 100% against annual and perennial weeds, including couch grass, was carried out with the variants treated by preemergence associated with post-emergence herbicides based on glyphosate, or by using only the post-emergence products based on glyphosate (Roundup 360 EC, 36 EC Glialka, glyphosate 360SL NAF 595, etc.) or based on glufosinate (Basta 14 SL).

From the data presented in (table 2), regarding post-emergence herbicide efficacy of weed in apple orchards in 2006-2009 it stands with good efficiency in existing weeds in the orchard, the following: Touchdown EC 51 / ha Ground - UP 51 / ha glyphosate Borzesti 41 / ha, Roundup 360 EC 41 / ha, Glihosat360 SL NAF 595 41 / ha, Salt DMA 21 / ha, Glialka 36 EC 51 / ha, Folar 525 FW 61 / ha, Basta 14 SL 51 / ha. Dosage hectare refers to the actual treaty, ie only on the bands of rows of trees. Noted that by being contact or systemic post-emergence herbicides these are fully effective when weeds are in active growth phase and have a height of 15-20 cm, up to flowering weeds.

Glyphosate-based products (Glyphogan 480 SL, Roundup 360 EC, Ground - UP, Glialka 36 EC) in minimal doses had a partial effect on *Ranunculus repens*, *Convolvulus arvensis*, but by the adding of 0.5%

(1 l / ha) of Hyspray, they have total effect of all weeds. Folar herbicide FW 525 at a dose of 5-6 l / ha has good effect in fighting the weeds, but after about 90 days they appear scattered weed seeds in some places: *Ranunculus repens* and *Taraxacum officinale*.

At the dose of 51 / ha, the herbicide Basta 14 SL has a good efficacy in combating all annual and perennial weeds, but after approx. 30 days, part of the weeds like *Cirsium arvensis*, *Ranunculus repens*, *Mentha* and *Agropyrum repens* regenerated, that within 45 days it is necessary to apply a new treatment with Basta 14 SL in the same dose (51/ha).

In weeds infested orchards, especially by *Rumex crispus*, with a very good effect is used CERL 250 EC herbicide 1.5l/ha or Icedin Forte applied when weeds are in full growth.

It was found, for example, that after the initial application of herbicide 2,4D, its degradation does not start immediately, and the number of microorganisms remains practically unchanged, constituting the so-called "dormant" phase. The duration of this phase is dependent on the rate of multiplication of micro-organisms, being reduced as the temperature increases. It is followed by the "phase of rapid degradation", whose speed is proportional to the concentration of the herbicide in the soil. Adapting a herbicide decomposition of soil microflora is, to some extent, specific for a given substance: for example, adaptation to the decomposition of atrazine, but influences the MCPA (M. Berka, 2004). It should be noted that post-emergence herbicides have to be applied while sunny time and stop if rainfall is expected within the next 5-6 hours fall. As an important recommendation we have to remember that no herbicides should be applied during flowering trees as also a part of the weeds are blooming (ex. *Taraxacum officinalis*) and herbicides are toxic to bees.

**Table 2. Efficiency of some post emergence herbicides in weed controlling within Apple Orchards (Voinești 2006-2009)**

Herbicide	Dose/ha Kg (l)	Weed fighting (%)		Noted EWRS	
		M	D	Efficacy	Fito-toxicity
Maxtor 1, untreated, unworked	-	0	0	9	1
Maitor 2, untreated, worked for two times	-	70	90	2	1
Touchdown CE	4-5	100	100	1	1
Ground - UP	3-4	100	100	1	1
Glifosat Borzesti	3-4	100	90	1	1
Roundup 360 CE	3-4	100	90	1	1
Glyphosat360 SL NAF 595	4	100	90	1	1
Sare DMA	2	0	80	1*	1
Glialka 36 EC	5-6	100	100	1	1
Folar 525 FW	5-6	100	90	1	1
Basta 14 SL	5	100	100	1	1
Glyphogan 480 SL	4	100	95	1	1
Cerlit250EC	1,2-1,5	0	90	1*	1
IceDin Forte	2,0-2,5	0	80	2*	1
Glyphogan 480 SL+ Hyspray	3+1	100	100	1	1
Glyphogan 480 SL+ Frygate	3+1	100	100	1	1
Giiphosat360 SLNAF 595+Hyspray	3+1	100	100	1	1
Glyphosat360 SLNAF 595+ Frygate	3+1	100	100	1	1
Cerlit 250EC+ Glyphogan 480 SL	1+3	100	95	1	1

Legend:

M- monocotyledonous;  
D- dicotyledonous;

\* for dicotyledonous weeds;

#### 4. CONCLUSIONS

On the floristic composition and the degree of weed in apple orchards

1. The apple orchards of Voinești area are infested with a wide range of weeds, the most common being: *Agropyrum repens* 65.5%, *Poa annua* 10.5%, 1.0% *Digitaria sanguinalis* of the monocotyledonous weeds and *Taraxacum officinalis* 8.5%, *Cirsium arvense* 10.5%, 10.5% *Ranunculus repens*, *Sinapis arvensis* 3.5%, 2.0% *Rumex crispus*, *Lotus corniculatus* 1.0%, 2.0% *Mentha*, *Trifolium* sp. 2.8%, *Convolvulus arvensis* 1.0% of the dicotyledonous.

2. In the apple orchards potential weed seeds are located in the soil to a depth of 0-10 cm between 304 pcs/dm<sup>3</sup> in plots with typical alluvial protosol and up to 1087 pcs/dm<sup>3</sup> in plots with brown soils moderately gleyed.

3. Analyzing the amount of weed seeds related to the square meter it is inferred that they will arise over 200 plants/m, so there is the possibility of a high degree of weed, taking into account the mapping method which is based on determination of annual weeds from the soil reserve.

The determination of the effectiveness of herbicides in weed control in apple orchards

1. To establish the most suitable strategy, herbicides and annual optimal dosage is necessary to carefully identify the orchard weeds.

2. When the orchard is infested with monocotyledonous weeds, in particular *Agropyrum repens*, it is recommended the use one of the post-emergence products: Touchdown EC 51/ha Ground - UP 51/ha glyphosate Borzești 41/ha Roundup 360 EC 41/ha, Glyphosat 360 NAF 595 SL 4L/ha, Glialka 36 EC 51/ha, Folar 525 FW 61/ha, Basta 14 SL 51/ha, Glyphogan 480 SL 41/ha when weeds are caught in full growth and at maximum height of 15 - 20 cm.

3. When dicotyledonous weeds are dominant a good effect is obtained by administering post-emergence products CERL 250 EC 1.5 l/ha or IceDin Forte 2.0l/ha. But to combat monocotyledonous weeds a CERL 250 EC herbicide is used combined with Glyphogan 480 SL.

4. When the mono- and dicotyledonous annual weeds are predominant, good results are obtained when applied pre-emergence in the early spring of one of the products: Simanex 50 SC in a dose of 3-3.5 l/ha or 50 PU Simadon 6-8 kg/ha, Stomp 330 EC 51/ha, 5 to 8 January Vegepron DS/ha, which provides protection for at least 3 months.

5. After a correct herbicide for 3-4 years, weeds reserve diminishes considerably.

6. Against trees the recommended herbicides did not produce phytotoxic effects.

7. With glyphosate herbicides, when the solution contacts the foliage of trees, it is necessary to remove the dried portion by cutting, if possible immediately after treatment. Also, we should avoid touching the foliage of trees by CERL products and Icedin Forte 250 EC.

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