

STUDY ON RATIONAL USE OF HERBICIDES IN INTENSIVE PLANTATIONS OF APPLE

STUDIU PRIVIND UTILIZAREA RAȚIONALĂ A ERBICIDELOR ÎN PLANTAȚIILE INTENSIVE DE MĂR

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Abstract: Experience was organized during 2009 - 2010, at SCDP Iasi research base (Velnița), in intensive apple plantation, located on land with low slope, on cambic chernozem soil type. Dicotyledonous weed species with highest frequency are: *Amaranthus retroflexus*, *Chenopodium album*, *Convolvulus arvensis*, *Taraxacum officinale*, *Sonchus arvensis*, *Polygonum ssp*, *Stellaria media* and *Cirsium arvense*. Monocotyledonous species of very high frequency meet: *Elynes repens*, *Echinochloa crus-galli*, *Sorghum halepense*, *Digitaria sanguinalis*, *Cynodon dactylon* and *Setaria glauca*. The selective herbicides used and studied was: Roundup, Touchdown Sanglypho and were well tolerated by apple species. There were no reported symptoms of phytotoxicity in any variant or variety (note 1 EWRS scale). In terms of effectiveness (degree of destruction of weeds) best results has the experimental variants were noted V3-herbicide + -mechanical works, where weed control was 94.6% grade 1-2 EWRS scale and V6 herbicide Touchdown System with 3 l / ha.

Key words: technology, system maintenance soil, apple, herbicides

Rezumat: Experiența au fost organizată în perioada 2009 – 2010, la Baza de cercetare – dezvoltare Velnița a S.C.D.P.Iași, într-o plantație intensivă de măr, amplasată pe un teren cu pantă redusă, pe un sol de tip cernoziom cambic. Dintre speciile de buruieni dicotiledonate cu frecvența cea mai ridicată sunt: *Amaranthus retroflexus*, *Chenopodium album*, *Convolvulus arvensis*, *Taraxacum officinale*, *Sonchus arvensis*, *Polygonum ssp.*, *Stellaria media* și *Cirsium arvense*. Dintre speciile monocotiledonate cu frecvență foarte mare se întâlnesc: *Elynes repens*, *Echinochloa crus-galli*, *Sorghum halepense*, *Digitaria sanguinalis*, *Setaria glauca* și *Cynodon dactylon*. În ce privește selectivitatea erbicidelor s-a constata că erbicidele luate în studiu: Roundup, Sanglypho și Touchdown au fost bine tolerate de specia măr. Nu au fost semnalate simptome de fitotoxicitate în nici o variantă sau soi (nota 1 pe scara EWRS). Sub aspectul eficacității (grad de distrugere a buruienilor) dintre variantele experimentale s-au remarcat V₃, unde controlul buruienilor a fost de 94,6 % nota 1-2 pe scara EWRS și V₆ erbicidul Touchdown.

Cuvinte cheie: tehnologie, sistem de întreținere a solului, măr, erbicide

INTRODUCTION

The main purpose of using herbicides in fruit growing is their effectiveness on weeds. The application of herbicides in years with heavy

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rainfall on weeding land protects the culture of weed competition in critical periods in which the mechanic methods are not possible (Perianu, 2004; Prica and Prica, 1984)

In fruit growing there are used large amounts of organic fertilizers, from the preparatory work of land, at planting and fazial fertilization during fructification period. Whenever such fertilizers are used, occurs a strong weeding, in the fertilized plantations appear weed species usually difficult to refute such as *Agropyron repens*, *Cirsium arvense*, *Convolvulus arvensis* etc. (Lazar, 1974; Platon and Dumitrache, 1990).

Since the range of herbicides in recent years has become much diversified, the SCDP Iasi, between 2009-2010, has experienced a number of herbicides for weed control in apple orchards.

MATERIAL AND METHOD

The experiments were held during 2009 – 2010, at the research base – Velnița development centre, SCDP Iași, in an intensive apple plantation, located on land with low slope, soil type on cambic chernozem.

Biological material was represented by two apple varieties: Golden Delicious and Idared, grafted on MM 106. Planting distance were 4 x 4 m, with a density of 624 trees/ha. Crown shape: oblique arms palmate.

Variants experience:

- V1 – untreated-manual work;
- V2 – untreated-mechanical works;
- V3 – Herbicide + mechanical works;
- V4 – Herbicide Roundup 3 l / ha;
- V5 – Herbicide Sanglypho 4 l / ha;
- V6 – Touchdown herbicide System 3 l / ha.

Herbicide application was made with the vermorel, on a band of 1.2 to 2.0 m width, when the weeds have reached 10-15 cm height. There were used 150 l/ha solution.

Climatic conditions were different in the years 2009-2010 as a whole, creating a favourable development of the main groups of weeds. Overall average monthly temperatures in April-September period were within the normal range, except some absolute maximum recorded in July and August which exceeded 35° C.

Yearly average temperature was 9.6° C and yearly precipitation totalled 520 mm. The plantation has a gentle land slope of 3.5% average soil is chernozem leached without irrigation possibilities. Soil system maintenance between tree rows was black field alternating with grass bands. On the tree row there were used herbicides. Weed mapping itself is determining the number of weeds per m² (metric frame with side 1 m) in 4 repetitions diagonal plot (10 determinations from 1 ha) and gravimetric method. Weeding degree was expressed as a percentage of the number of weeds per m² or as weed dry weight per m² to the maximum number or weight of weeds registered in the version that received no treatment.

RESULTS AND DISCUSSIONS

Data on weed mapping in apple orchards: Mapping is determining the number of weeds on m² and helps us to know the species, weed associations and groups that will determine the dominant biological control measures.

They also offer important information on: weeding forecast, herbicide rotation, herbicide or combination of herbicides, monocotyledonous and dicotyledonous weeds ratio, annual and perennial weeds. Also it highlights the presence of large groups of perennial weeds that can be controlled by special methods, limited to those areas.

The determinations made in the experimental plot found that monocotyledonous weed species represent 40% and dicotyledonous 60%. Dicotyledonous weed species with highest frequency are: *Amaranthus retroflexus*, *Chenopodium album*, *Convolvulus arvensis*, *Taraxacum officinale*, *Sonchus arvensis*, *Polygonum ssp*, *Stellaria media* and *Cirsium arvense*. Monocotyledonous species of very high frequency we found: *Elynes repens*, *Echinochloa crus-galli*, *Sorghum halepense*, *Digitaria sanguinalis*, *Cynodon dactylon* and *Settings glauca*.

In the second half of the vegetation period a new generation rises from seeds of annual weeds, dominated by: *Digitaria sanguinalis*, *Amaranthus retroflexus*, *Solanum nigrum*, *Chenopodium album* and others species which if not removed will disseminate a huge number of seeds hard to controlled in coming years.

Data on the efficacy of new herbicides in weed control: In the experiments performed there were used the following herbicides: Roundup, Touchdown Sanglypho and that have the same active substance (glyphosat), but with a different trade name depending on the origin.

Concerning the herbicides selectiveness there was found that the studied herbicides: Roundup, Touchdown and Sanglypho were well tolerated by apple specie. There were no reported symptoms of phyto-toxicity in any variant or variety (grade 1 on EWRS scale) (table 1).

In terms of effectiveness (degree of weeds destruction) from the experimental variants V3 stands out, where weed control was 94.6%, grade 1-2 on EWRS scale and V6 - Touchdown herbicide.

At Touchdown herbicide, the active substance translocation process from plant to rhizomes occurs slowly compared with the other two products.

After 40 days from the application appeared some annual weed from seeds. Roundup herbicide has very good efficacy against perennial weeds, after its application recovers some annual weed seed species that invade the land.

Optimal use of herbicides within their minimum and maximum limits approved by eliminating trends of unjustified overdose, spare us of the waste and negative impact on the environment (table 1). Products used for weed control efficacy was assessed by grades from 1-9 according to EWRS scale.

Tree-weed competition when out of control, especially when infestation with "weed problem" is over 30%, although the negative effect is not immediately visible, lower fruit production, trees are suffering, especially during critical periods (binding fruit, intense growth of shoots, fruit maturation) and yields will be of lower quality and quantity. During experimental fruit harvest was reduced due to weed-problem

infestation and high degrees of weeding, note 9 on EWRS scale recorded in V1-untreated variant, 30% decrease.

Table 1

Influence of soil maintenance methods on the row og trees upon the production, selectivity and efficacy of weed control in apple orchard

Variants	Dose l/ha	Time of application	Notes EWRS		Weeds control	
			Select.	Effect	Annual	Perennial
Golden Delicious						
V ₁ Untreated + manual work	-	-	-	1	100.0	92.0
V ₂ Untreated + mechanical work	-	-	-	1	98.0	90.3
V ₃ -sprayer + mechanical work	3.0	Postem.	1	1	100.0	98.0
V ₄ -sprayer with Roundup	3.0	Postem.	1	1	100.0	96.4
V ₅ - sprayer with Sanglypho	4.0	Postem.	1	1	100.0	98.4
V ₆ - sprayer with Touchdown	3.0	Postem.	1	1	98.2	88.1
Idared						
V ₁ Untreated + manual work	-	-	-	1	98.4	92.0
V ₂ Untreated + mechanical work	-	-	-	1	95.2	81.6
V ₃ -sprayer + mechanical work	3.0	Postem.	1	1	100.0	98.8
V ₄ -sprayer with Roundup	3.0	Postem.	1	1	95.6	94.6
V ₅ - sprayer with Sanglypho	4.0	Postem.	1	1	100.0	98.8
V ₆ - sprayer with Touchdown	3.0	Postem.	1	1	98.5	90.3

There are not big differences between experimental variants concerning the obtained average production in the two apple varieties studied, between variants of herbicide soil system maintenance and control variant based mainly on manual work.

Table 2

The influence of soil system maintenance methods on fruit production and quality

Variants	Average production t/ha	Quality /t	
		Extra+quality I	II nd quality
Golden Delicious			
V ₁ Untreated + manual work	26.34	17.97	8.37
V ₂ Untreated + mechanical work	24.8	17.70	7.1
V ₃ -sprayer + mechanical work	27.50	21.01	6.49
V ₄ -sprayer with Roundup	26.22	18.03	8.19
V ₅ - sprayer with Sanglypho	27.10	19.88	7.22
V ₆ - sprayer with Touchdown	26.12	19.97	8.15
Idared			
V ₁ Untreated + manual work	17.7	13.70	3.98
V ₂ Untreated + mechanical work	26.62	19.32	7.30
V ₃ -sprayer + mechanical work	27.78	21.33	6.45
V ₄ -sprayer with Roundup	27.50	21.01	6.49
V ₅ - sprayer with Sanglypho	27.00	19.64	7.36
V ₆ - sprayer with Touchdown	26.62	19.32	7.30

Next we present an estimation of costs and profitability for improved technology per hectare of apple intensive orchard where were applied post emergent herbicides from Glyphosat group (during vegetation), when the weeds were 15-20 cm height. Touchdown- System 4 herbicide with total systemic action, biodegradable 3 litres/ha dose, in 150 litres of water/ha was applied in May-June and the second treatment at the same dose only post emergent on the large groups of weeds, in August. All the observations were compared with standard technology. Bo be mentioned that for all calculation elements was used the 2004 dollar value of 33.500 lei (3.35 RON). The table 3 clearly shows the superiority of the improved technology using only herbicides to control weeds on the row of trees, the profitability showing economic efficiency, from 8.8 lei/ha to 19 800 euro/ha in case of the improved technology.

Table 3

Retention of herbicides used in the apple orchard - Velnița - SCDP Iasi

Nr. crt.	Trade name	The active substance	Conc. g/l	Toxicity group	Remaining
1	Roundup	glyphosat	360	IV	0
2	Sanglypho	glyphosat	360	IV	0
3	Touchdown	glyphosat + trimesium	480	IV	0

As a basis of comparison there was used variant 1, which is now considered as representative for the orchards and farms and consists of digging soil on the trees row in the fall, followed by 2 +3 manual cultivations during the growing season.

As the results, in table 4, we can observe that the highest costs are made in variant 1, with 35.540 thousand lei/ha (classic variant), and lowest cost of soil system maintaining method on the trees row was registered in variant 4 with two application of Roundup herbicide in May and in August localized applied on large groups of weeds. Advantages of using herbicides on the row of trees do not stop only to the economic advantages; they offer a range of social privileges on labour productivity and ergonomics, making the timely and easy to work.

Table 4

Estimated anti-calculation costs and profitability in apple

Nr.crt.	Economic efficiency	Standard technology thousands lei/ha	Improved technology using herbicides thousands lei/ha
1	<i>Production costs</i>	35.540	39.150
2	<i>Cost of production</i>	7.095	7.950
3	<i>Average price of delivery</i>	7.500	9.150
4	<i>Income</i>	38.000	46.100
5	<i>The profit rate</i>	8.80	19.80

Manual soil system maintenance on the row of trees require large amounts of labour, is expensive and may be due to the climate of labour shortages in certain periods, works are carried out from the optimal technology.

The efficiency benefit of a rational herbicide each year, which has a dynamic, cumulative dose of herbicide, can be reduced by 20-30%, without affecting the efficacy of weed control. Application version works mechanical sprayers + (V3), although costs incurred are higher relative to other types of herbicides, is justified by the creation of favourable conditions (soil loosening and aeration) for microorganisms activity in soil, root system growth due to soil mobilization by mechanical works. (tab. 5).

Data analysis leads us to understand that economic evidence is the key factor that depends on choosing the most useful options to maintain soil on the row of trees and weeds control.

Table 5

Soil system maintenance expenses per apple trees row (lei / ha)

Variants	Materials	Manual work	Mechanical work	Total Thousand lei/ha
<i>V₁ Untreated + manual work</i>	-	3.540	-	3.540
<i>V₂ Untreated + mechanical work</i>	-	-	1163	1163
<i>V₃ sprayer + mechanical work</i>	900	190	522	1612
<i>V₄ – sprayer with Roundup</i>	887	190	-	1.077
<i>V₅ – sprayer with Sanglypho</i>	1.118	190	-	1308
<i>V₆ – sprayer with Touchdown</i>	1.092	190	-	1.282

CONCLUSIONS

1. Factors influencing weeding and pest thresholds are: state plantations, the number of goals in the plantations, tree vigour, climatic conditions that year, in terms of orchard weed vigour, so it is very difficult to provide fixed data on economic threshold pest.

2. By applying a rational herbicide every year, there is a cumulative effect in dynamic doses of herbicide can be reduced by 20-30%.

3. For weed control in the forms of resistance do not occur, we recommend alternating some herbicides belonging to different chemical groups and have different mechanisms of action.

4. The economic consequences of herbicide use in apple orchards and elsewhere are very positive. Most favourable effects recorded by applying herbicides row of trees when required by the maintenance costs are reduced by 35-55% and the economy of manual labour may amount to 18-25 days per man/ha.

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