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Weed Control in Young Sour Cherry Plantations

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Abstract: Studies were carried out at the Fruit Growing Institute in 2008 – 2010 in a young sour cherry plantation including the cultivars M-15 ('Érdi Nagygyümölcsű'), M-172, 'Schattenmorelle', 'Nefris', 'Heiman Ruby', 'Fanal', 'Erdi Bötermö' and 'Debreceni', grafted on Gisela 5 vegetative rootstock. In spring, before vegetation, the in-row strip was treated with the contact leaf and soil herbicide oxyfluorfen (Goal 4F – 2.5 l/ha). Directed application of glyphosate (Dominator Ultra – 6.0 l/ha) was made twice during vegetation for control of secondary (late) weed infestation. The applied herbicide combination of oxyfluorfen and glyphosate realized very good herbicide efficiency against the weed species forming the weed association in the row strip of the plantation. The period of an efficient herbicide post effect of Goal 4F lasted about 120 days. External symptoms of phytotoxicity and suppression of the vegetative and initial reproductive habits of the sour cherry trees were not established. The use of oxyfluorfen and glyphosate did not entail any risk of contaminating the environmental components with pesticide residues. That is a good reason to apply the herbicides Goal 4F and Dominator Ultra for ecologically sound weed control in sour cherry orchards.
Key words: oxyfluorfen, glyphosate, sour cherry trees, vegetative habits, yield.

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Introduction

Weed control is an important cultural practice, which largely determines success in fruit cultivation. It requires knowledge of the response of different cultivar-rootstock combinations to the applied herbicides, both soil and foliar. In literature, there are data on the effect of different herbicides on growth and fruiting of sour cherry trees (Anderson 1989; Jadczuk 1990; Szwedo and Maszczyk 2000**;** Wociór et al. 2000; Zandstra and Particka 2004; Sirrine et al. 2008). In Bulgaria, this information is limited and most instructions for weed control recommend protection activities similar to those applied in sweet cherry trees. At the same time, similar studies on the possibility of weed control in intensive-type cherry orchards (grafted on Gisela 5 vegetative rootstock, which induces slower growth of the grafted cultivars) confirmed that the success of their cultivation required weed control on the basis of selective herbicides, because Gisela 5 has a shallow root system and mechanical tillage to control weeds is not desirable to be performed.

For that reason we investigated the effect of the soil and foliar applied contact herbicide oxyfluorfen (the soil action of the active substance does not require preliminary soil tillage for good herbicide efficacy) on growth and fruiting of sour cherry cultivar-rootstock combinations, grafted on Gisela 5 vegetative rootstock.

The aim of the present study was to investigate the effect of the herbicide combination oxyfluorfen (Goal 4F) and glyphosate (Dominator Ultra) on weed infestation and growth characteristics of young sour cherry trees, grafted on Gisela 5 vegetative rootstock, in order to implement them as an environmentally friendly approach in modern fruit production.

Materials and methods

The investigations were carried out in 2008-2010 in an experimental plantation of the Fruit Growing Institute – Plovdiv, including the cultivars M-15 (‘Érdi Nagygyümölcsű’), M-172, ‘Schattenmorelle’, ‘Nefris’, ‘Heiman Ruby’, ‘Fanal’, ‘Erdi Bötermö’ and ‘Debreceni’, grafted on Gisela 5 vegetative rootstock. The plantation was established in 2005 at a planting distance 5 m x 3 m. In spring, before the beginning of the vegetation period, the soil in the row strip was treated with the contact herbicide oxyfluorfen – trademark Goal 4F, which has an effect on soil and vegetation, the rate applied being 2.5 l/ha. The following treatments were studied: V1. M-15 (‘Érdi Nagygyümölcsű’) – treated; V2. M-15 (‘Érdi Nagygyümölcsű’) – control; V3. M-172 – treated; V4. M-172 – control; V5. ‘Schattenmorelle’ – treated; V6. ‘Schattenmorelle’ – control;V7. ‘Nefris’ – treated; V8. ‘Nefris’ – control; V9. ‘Heiman Ruby’ – treated; V10. ‘Heiman Ruby’ – control; V11. ‘Fanal’ – treated; V12. ‘Fanal’ – control; V13.

'Erdi Bötermö' – treated; V14. 'Erdi Bötermö' – control; V15. 'Debreceni' – treated; V16. 'Debreceni' – control.

The experiment was set up in a long-plot design at three replications. During vegetation the late (secondary) weed infestation was controlled by two treatments of the in-row strips with the leaf systemic herbicide glyphosate (trademark Dominator Ultra – 6,0 l/ha) applied by direct spraying with a sprayer having equipment for protecting the tree foliage.

The efficiency of oxyfluorfen against the weed species forming the weed association in the row-strip of the plantation was monitored at intervals (on 30^{th}, 60^{th}, 90^{th}, 120^{th} and 150^{th} day) and the duration of the efficient herbicide post effect was reported. Absolute dry matter (using the weighing method) and chlorophyll *a, в* and *a+в* (spectrophotometrically) in average leaf samples of the separate treatments were analyzed in the vegetation period (15-20 June). The yield (kg per tree) and the average fruit weight (g) were reported. At the end of vegetation (October), the following biometrical characteristics were reported: annual shoot length increment (cm) and trunk cross-section area (TCSA, S, cm^2). The results obtained were processed by the dispersion analysis method. (ANOVA, Using MS Excel 2010 Analysis Tool Pak Add-Ins).

Results and Discussion

During the study period, the following annual weed species forming the weed association in the row strip were detected in the plantation: *Veronica hederifolia* L.*, Sinapis arvensis* L.*, Lamium purpureum* L.*, Capsella bursa pasroris* L.*, Poa annua* L.*, Alopecurus myiosuroides* L.*, Apera spica-venti* L.*, Xanthium strumarium* L.*, Chenopodium album* L.*, Amaranthus retroflexus* L.*, Portulaca oleracea* L. Occurrence of chlorosis was observed 4-5 days after treatment, followed by necrosis in the aboveground parts of the weed plants. Data on the herbicide efficacy of oxyfluorfen were similar in the years of the study and the herbicide demonstrated good post-effect duration, lasting about 150 days after treatment. Due to the low toxic effect on grassy weeds, conditions for certain compensatory processes could be created in favor of the species *Poa annua* L. and *Alopecurus myosuroides*.

The good herbicide efficiency of oxyfluorfen against all the annual weeds created favorable conditions for the development of compensatory processes for the benefit of perennial weeds – mainly *Convonvulus arvensis* L. and *Sorgum halepense* L. Two treatments with Dominator Ultra – 6.0 l/ha were applied by direct spraying during vegetation for the control of these species. A very rapid herbicide effect was observed, expressed in chlorosis, followed by necrosis and dying of the weed plants in a 7-10 day period after treatment.

The applied herbicide combination Goal 4F and Dominator Ultra destroyed efficiently the weed competition for water and inserted fertilizers throughout the vegetation period.

External symptoms of phytotoxicity and obvious suppression in tree growth were not observed after herbicide application.

Data obtained about the average yield per tree (kg) and average fruit weight (g) showed no depressing effect of the applied herbicide combination. Differences compared to the control were statistically non-significant, but a clear tendency of higher yields in the treatments was outlined (Fig. 1 and Fig. 2)

Data about the biometrical measurements showed one and the same tendency during the years of the experiment and they were presented as average values. The results obtained about the average annual shoot length increment confirmed that the applied herbicide combination did not have a depressing effect on growth (Fig. 3). Differences relative to the control were statistically non-significant in some treatments, but a tendency of higher values of the average annual shoot length increment was reported in the treatments with the herbicide combination Goal 4F + Dominator Ultra.

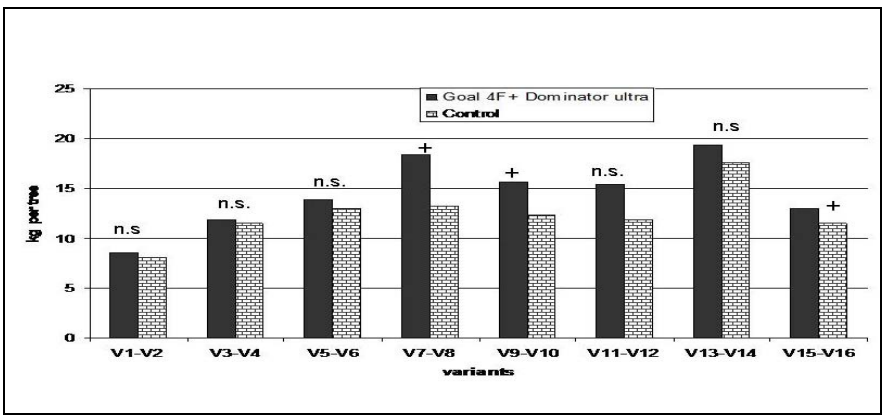

Figure 1. Effect of the herbicide combination Goal 4F + Dominator Ultra on the average yield (kg per tree)

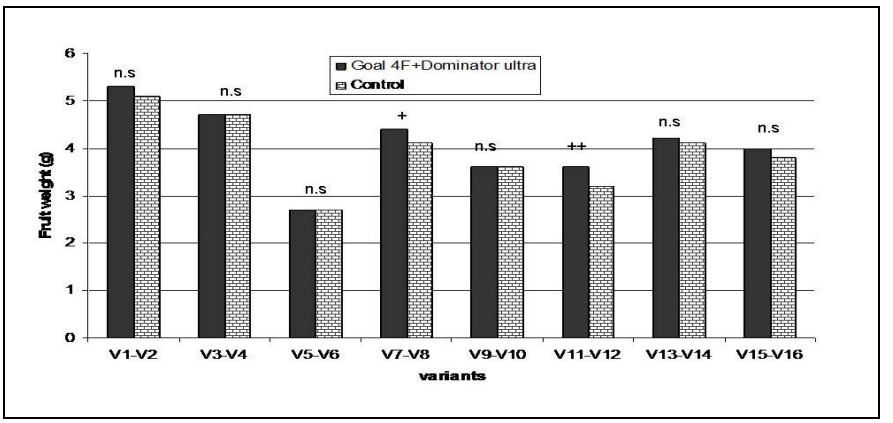

Figure 2. Effect of the herbicide combination Goal 4F + Dominator Ultra on the average fruit weight (g)

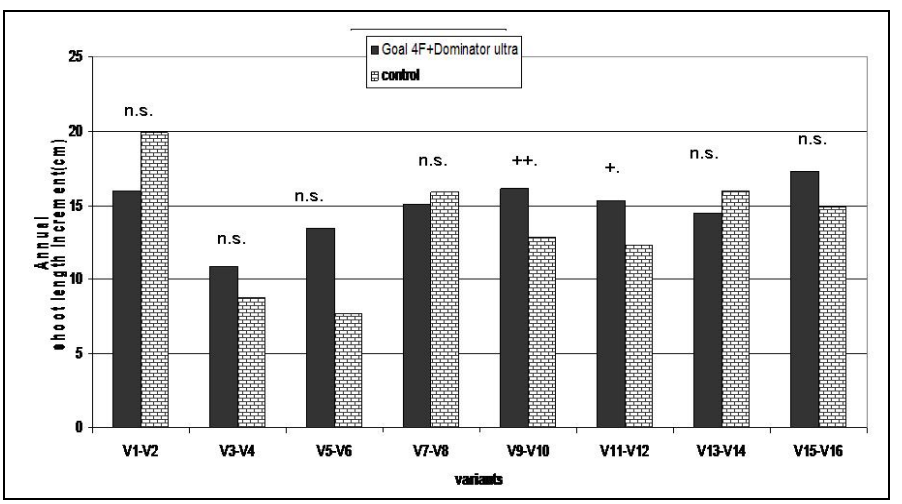

Figure 3. Effect of the herbicide combination Goal 4F + Dominator Ultra on the average annual shoot length increment

Analogous results of the effect of the applied herbicide combination were obtained for TCSA (Fig. 4). Higher values of the cross-section area were reported in the treatments, the differences compared to the controls being statistically significant. These results provided grounds to conclude that the applied combination of the soil and leaf herbicides does not exert a depressing effect on tree growth.

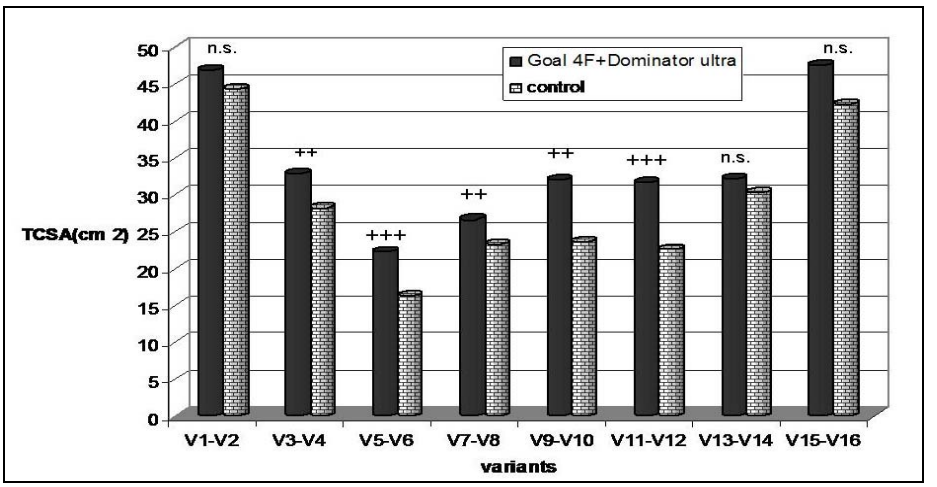

Figure 4. Effect of the herbicide combination Goal 4F + Dominator Ultra on TCSA

Data about the content of leaf pigments in medium leaf samples from the different treatments were similar during the years of study and they are presented as average values in Table 1.

Table 1. Chlorophyll content in leaves (mg/g to absolute dry matter)

Treatments	Absolute dry matter %	Chlorophyll to absolute dry matter (mg/g)		
		a	*в*	*a+в*
1	44.8406	2.4572	1.1266	3.5817
2	43.3464	2.5896	1.2388	3.8261
3	43.0042	2.6814	1.2832	3.9622
4	44.7722	2.242	1.0375	3.2776
5	44.5426	3.2485	1.4576	4.7033
6	45.7227	2.8064	1.2512	4.0552
7	43.7974	2.5489	1.189	3.7357
8	44.9875	2.3227	1.0367	3.3575
9	44.0157	3.019	1.3895	4.4059
10	45.6742	2.63	1.1982	3.8259
11	43.2605	2.724	1.3436	4.0651
12	46.0061	2.7079	1.2298	3.9355
13	43.4566	2.4952	1.105	3.5981
14	45.4379	2.6185	1.1167	3.7331
15	44.7567	2.3543	1.0982	3.4505
16	45.116	2.508	1.2288	3.7346

A significant effect of the applied herbicides on the content of leaf pigments was not established (Tab. 1). Differences compared to the respective control were statistically non-significant. However, a tendency to a higher content of leaf pigments was observed in the plants treated with herbicides. This indicated the lack of a depressing effect of the active substance on the physiological tree status.

The results obtained provided grounds to conclude that the application of the herbicide combination Goal 4F + Dominator Ultra in young sour cherry plantations did not have a depressing effect on tree growth. The higher values of the biometrical characteristics in the treatments were a result of both the lack of phytotoxicity caused by the herbicides and the elimination of weed competition for moisture and nutrients. A depressing effect on the initial productive habits of the sour cherry trees was not observed.

From an ecological point of view the application of oxyfluorfen does not entail any danger of contamination with herbicide residues. The active substance has a low migration capacity in the soil profile and it does not percolate into the ground waters (Cleave 1984).

The results obtained, as well as some other data about the broad spectrum herbicide effect of oxyfluorfen make it suitable for use in young sour cherry orchards (Tonev 2000; Rankova 2006; IPM, 2008; Rankova and Zhivondov 2010; Rankova et al. 2012). This is a good reason to apply the herbicides Goal 4F and Dominator Ultra for ecologically sound weed control in young sour cherry orchards.

Conclusion

The applied herbicide combination of oxyfluorfen and glyphosate achieved very good herbicide efficiency against the weed species forming the weed association in the row strips of the orchard. The period of the efficient post effect of Goal 4F lasted for about 150 days.

External symptoms of phytotoxicity and depression of the vegetative and the initial productive habits of the sour cherry trees were not established. The use of oxyfluorfen and glyphosate did not entail any risk of contaminating the environmental components with pesticide residues. This is a good reason to apply the herbicides Goal 4F and Dominator Ultra for ecologically sound weed control in young sour cherry orchards.

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SUZBIJANJE KOROVA U MLADIM ZASADIMA VIŠNJE

-originalni naučni rad-

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Rezime

Ispitivanja su izvršena na Institutu za voćarstvo u periodu od 2008. do 2010. godine u mladom zasadu višnje na sortama M-15 ('Érdi Nagygyümölcsű'), M-172, 'Schattenmorelle', 'Nefris', 'Heiman Ruby', 'Fanal', 'Erdi Bötermö' i 'Debreceni', kalemljenim na vegetativnoj podlozi Gisela 5. U proleće, pre vegetacije, redni prostor je tretiran kontaktnim lisnim i zemljišnim herbicidom oksifluorfenom (Goal 4F – 2,5 l/ha). Usmerena - direktna primena glifosata (Dominator Ultra – 6,0 l/ha) izvršena je dva puta tokom vegetacije radi suzbijanja sekundarne (kasne) pojave korova. Primenjena kombinacija herbicida oksifluorfena i glifosata pokazala je veoma dobru efikasnost u suzbijanju korovskih vrsta da formiraju korovsku zajednicu u pojasu unutar redova zasada. Period efikasnog naknadnog dejstva herbicida Goal 4F trajao je oko 120 dana. Nisu primećeni spoljašnji simptomi fitotoksičnosti i usporenosti vegetativnog i početnog reproduktivnog ponašanja stabala višnje. Primenu oksifluorfena i glifosata nije pratio rizik kontaminacije ekoloških komponenti ostacima pesticida. To predstavlja dobar razlog za primenu herbicida Goal 4F i Dominator Ultra u ekološki bezbednom suzbijanju korova u zasadima višnje.

Ključne reči: oksifluorfen, glifosat, stabla višnje, izgled, prinos.