

Effect of the soil herbicide flumioxazin (Pledge 50 WP) on weed infestation and vegetative habits of young plum plantations

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Abstract: The studies were carried out in the period 2009-2010 in a young plum plantation of the Fruit-Growing Institute – Plovdiv. The cultivars included in the experiment were Tuleu timpuriu, Cacanska najbolja, Cacanska leptotica originating from *Prunus domestica* L. and Black Star belonging to *Prunus salicina* Lindley grown on own roots and grafted on the yellow plum seedling rootstock. In spring, before vegetation, the soil herbicide flumioxazin (Pledge 50 WP) was applied in the in-row strip of the orchard at the rate of 40 g/da (4 kg/ha). The herbicide efficiency of Pledge 50 WP was evaluated in dynamics (every 30 days) by the quantitative-weight method. Biometric characteristics, as shoot length increment and stem cross-section area, measured at the end of the vegetation period for evaluating the effect of the herbicide on tree growth, were reported.

The applied herbicide showed very good herbicide efficiency against the weed species in the in-row strip of the plantation. The period of the efficient herbicide post-effect lasted about 5 months. External symptoms of phytotoxicity and tree growth suppression were not visualized. The values of biometric characteristics were higher in the plants involved in the treated variants as compared to the control, which confirmed the selectivity of flumioxazin in plum plantations at the applied rate. A tendency for depressing effect on the growth was established in Black Star cultivar of *P. salicina*.

Key words: weeds, flumioxazin (Pledge 50 WP), plum cultivars, vegetative habits

Introduction

The development of current approaches to weed control infestation in plum orchards requires recognition of efficiency and selectivity of the active substance of herbicides on tree growth. Plums, like other stone fruits, are sensitive to herbicide application (Stamatov *et al.* 1982; Clay 1984; Wazbinska 1997; Devyatov *et al.* 2000; Rankova 2004). The soil herbicide flumioxazine has a contact action and efficiency against a significant number of annual grassy and broad-leaved species, typical for weed associations in fruit orchards in Bulgaria (Gerasimova and Rankova 2011). Flumioxazin (Pledge 50 WP) is registered in some European countries as suitable for application in a series of agricultures, including fruit orchards and vine (Price *et al.* 2002; Wilson *et al.* 2002; Richardson and Zandstra 2006). There are data in the scientific literature on the effect of flumioxazin on weed infestation and growth on fruit species. Treatment with flumioxazine (trade name Pledge 50 WP) was performed in the second half of April. The results of the experiment show that herbicide Pledge 50 WP, introduced at rates of 2 and 4 kg/hd, showed no toxic effect on annual Monocotyledon weeds. Among annual dicotyledonous weeds, *Xanthium strumarium* L. is less sensitive to this herbicide. As regards the nutrient content in apples, there are no significant differences between the control and the treated variants (Gerasimova and Rankova 2011).

The aim of the present investigation was to study the effect of herbicide flumioxazin (Pledge 50 WP) on weed infestation and growth habits of young plum trees and its use as an ecologically sound approach in modern fruit production.

Materials and methods

The studies were carried out in the period 2009-2010 in a young plum plantation of the Fruit Growing Institute – Plovdiv. The cultivars included in the experiment were Tuleu timpuriu, Cacanska najbolja, Cacanska lepotica originating from *P. domestica* L. and Black Star belonging to *P. salicina* Lindley, grown on own roots and grafted on the yellow plum seedling rootstock. In spring, before vegetation, the soil herbicide flumioxazin (Pledge 50 WP) was applied in the in-row strip of the orchard at a rate of 40 g/da (4 kg/ha). Sixteen cultivar/rootstock combinations were formed and included in the study. The following variants were tested:

1. Cacanska lepotica/yellow plum – control;
2. Cacanska lepotica/yellow plum – treated;

3. Cacanska lepotica/grown on own roots – control;
4. Cacanska lepotica/grown on own roots – treated;
5. Cacanska najbolja/yellow plum – control;
6. Cacanska najbolja/yellow plum – treated;
7. Cacanska najbolja/grown on own roots – control;
8. Cacanska najbolja/grown on own roots – treated;
9. Tuleu timpuriu/yellow plum – control;
10. Tuleu timpuriu/yellow plum – treated;
11. Tuleu timpuriu/grown on own roots – control
12. Tuleu timpuriu/grown on own roots – treated
13. Black Star/yellow plum – control;
14. Black Star/yellow plum – treated;
15. Black Star/grown on own roots – control
16. Black Star/grown on own roots – treated

The efficiency of Pledge 50 WP herbicide was evaluated in dynamics (every 30 days) by the quantitative-weight method. Biometric characteristics including shoot length increment (cm) and trunk cross-section area (TCSA in cm²) measured at the end of the vegetation period for the effect of the herbicide on tree growth were reported. The obtained results were processed by the dispersion analysis method.

Results and discussion

The contact herbicide flumioxazin (Pledge 50 WP) used at the rate of 4.0 l/ha achieved efficient control of the broad-leaved weed species *Veronica hederifolia* L., *Sinapis arvensis* L., *Lamium amplexicaule* L., *Lamium purpureum* L., *Capsella bursa pasroris* L., *Polygonum aveculare* L., *Xanthium strumarium* L., *Chenopodium album* L., *Amaranthus retroflexus* L., *Portulaca oleracea* L., *Solanum nigrum* L.). Rapidly developing necrosis as early as 5-7 day after the herbicide application was observed in the emerged single plants of the species *Veronica hederifolia* L., *Sinapis arvensis* L., *Lamium amplexicaule* L. and *Lamium purpureum*. It was due to the leaf effect of Pledge 50 WP. The period of the efficient herbicide post-effect lasted about 5 months.

The good herbicide efficiency of flumioxazin against all the broad-leaved weed species provided favorable conditions for the compensatory processes in favor of the Annual grassy and perennial weeds – mainly *Apera spica-venty* L. and *Poa annua* L. and of the perennial weeds – mainly *Convovulus arvensis* L. and *Artemisia vulgaris* L. For control of the above species, directed spraying with Glyphosate (Roundup – 6.0 l/ha) was applied twice during vegetation. A rapid herbicide effect was reported, expressed through

chlorosis, followed by necrosis and dying of the weeds within 7-10 days after treatment.

The applied herbicide combination flumioxazin and glyphosate 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 the application of the herbicides.

The data from 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 in cultivars Tuleu timpuriu, Cacanska najbolja, Cacanska leptica - variants 1-12 (Figure 1).

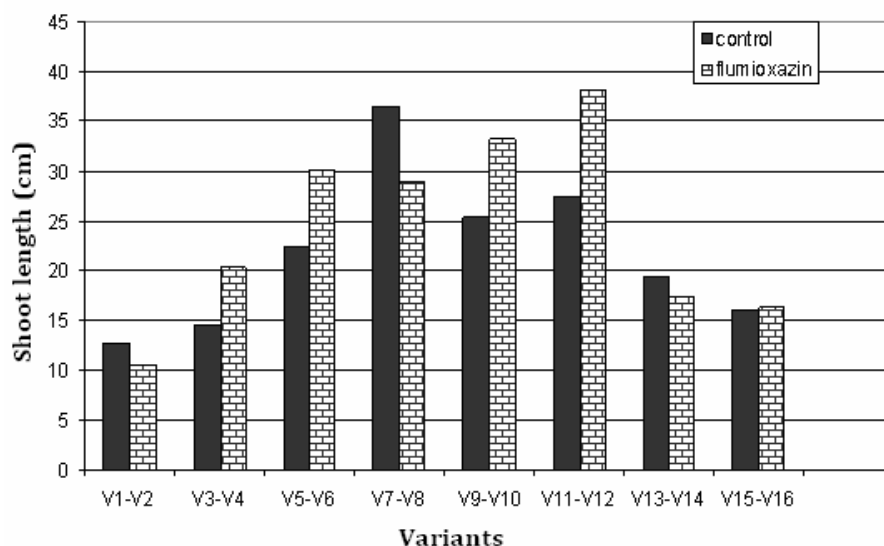


Fig.1 Effect of the herbicide flumioxazin (Pledge 50 WP) at the rate of 4.0 l/ha on the average annual shoot length increment

Analogous results of the effect of the applied herbicide combination were obtained for the stem cross-section area (Figure 2). Higher values of the cross-section area were reported in the treated variants in the cultivars Tuleu timpuriu, Cacanska najbolja, Cacanska leptica (variants 1-12), the differences to the control variants being statistically significant.

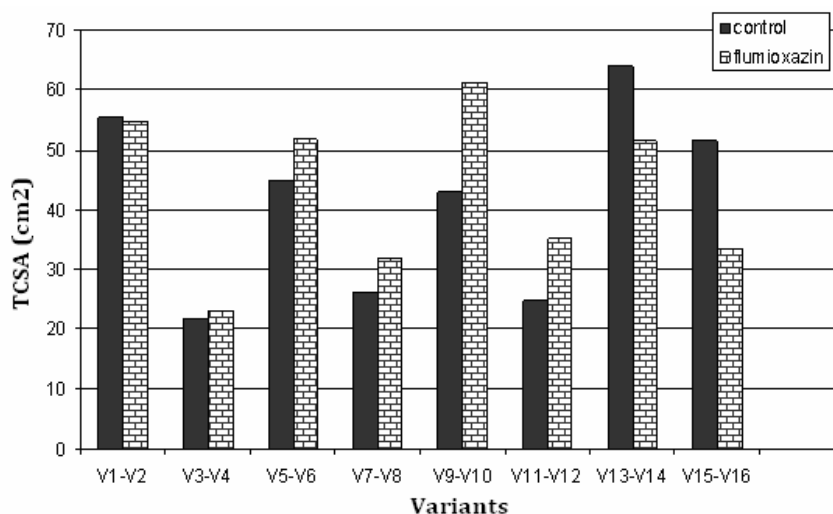


Fig. 2 Effect of the herbicide flumioxazin (Pledge 50 WP) at the rate of 4.0 l/ha on the average TCSA.

Table 1. Vegetative habits of trees treated with herbicides

Variants	Annual shoot length increment (cm)	LSD	TCSA (cm ²)	LSD
1	12.7	LSD 5% - 12.0	55.4	LSD 5% - 6.4
2	10.5 n.s.		54.8 n.s.	
3	14.6	LSD 5% - 4.5	21.7	LSD 5% - 0.24.
4	20.4 *		23.0 **	1% - 0.57
5	22.4	LSD 5% - 5.7	44.9	LSD 5% - 26.8
6	30.1 *		51.7 n.s.	
7	36.5	LSD 5% - 17.7	26.1	LSD 5% - 12.6
8	29.0 n.s.		31.8 n.s.	
9	25.4	LSD 5% - 8.0	43.0	LSD 5% - 3.9.
10	33.3 *		61.3 **	1% - 9.10
11	37.5	LSD 5% - 6.3	24.8	LSD 5% - 3.1.
12	37.8 *		35.1 **	1% - 7.16
13	19.4	LSD 5% - 1.8	64.1	LSD 5% - 32.9
14	17.4		51.6 n.s.	
15	16.0 n.s.	LSD 5%-10.5	61.6	LSD 5% - 20.4
16	16.3 n.s.		33.5 n.s.	

n.s.-non significant, *- significant at $P < 0.05$, ** - significant at $P < 0.01$

The results gave the grounds to conclude that the soil herbicide flumioxazin (Pledge 50 WP) used at the rate of 4.0 l/ha does not exert a

depressing effect on tree growth in cultivars originated from *P. domestica* L. A tendency to produce a depressing effect on tree growth was established in cv. Black Star of the species *P. salicina*.

Conclusion

The soil herbicide flumioxazin (Pledge 50 WP) applied at the rate of 4.0 l/ha showed very good herbicide efficiency against the weed species in the in-row strip of the plantation. The period of the efficient herbicide post-effect lasted about 5 months. External symptoms of phytotoxicity and tree growth suppression were not visualized. The values of biometric characteristics were higher in the plants of the treated variants compared to the control, which confirmed the selectivity of flumioxazin in plum plantations at the applied rate. A tendency to produce a depressing effect on the growth was established in cv. Black Star originating from *Prunus salicina* Lindley.

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UTICAJ ZEMLJIŠNOG HERBICIDA FLUMIOKSAZINA (Pledge 50 WP) NA ZAKOROVLENOST I VEGETATIVNI RAST MLADIH ZASADA ŠLJIVE

- originalni naučni rad -

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Rezime

Istraživanja su vršena u periodu od 2009-2010 u mladom zasadu šljive Instituta za voćarstvo u Plovdivu. Ogled je vršen na sortama Tuleu timpuriu, Cacanska najbolja, Cacanska lepotica poreklom od *Prunus domestica* L. i Black Star koja pripada *Prunus salicina* Lindley uzgajanoj na sopstvenom korenu i kalemljenoj na podlozi žute šljive. U proleće, pre početka vegetacije, primenjen je zemljišni herbicid flumioksazin (Pledge 50 WP) u unutarrednom pojasu zasada u količini od 40 g/da (4 kg/ha). Efikasnost herbicida Pledge 50 WP ocenjivana je u intervalima od 30 dana pomoću kvantitativne-težinske metode. Prikazane su biometrijske karakteristike, kao što su porast izdanka i površina poprečnog preseka stabla, izmerene na kraju vegetacionog perioda radi ocenjivanja uticaja herbicida na rast stabla.

Primenjeni herbicid pokazao je veoma dobru efikasnost u suzbijanju korovskih vrsta u unutarrednom pojasu zasada. Period naknadnog efekta herbicida trajao je oko 5 meseci. Nisu primećeni spoljašnji simptomi fitotoksičnosti i usporenosti rasta stabla. Vrednosti biometrijskih karakteristika bile su više kod biljaka u tretiranim varijantama u odnosu na kontrolnu varijantu, što je potvrdilo selektivnost flumioksazina u zasadima šljive pri primenjenoj dozi. Tendencija uticaja na smanjenje rasta utvrđena je na sorti Black Star vrste *Prunus salicina*.

Ključne reči: korovi, flumioksazin (Pledge 50 WP), sorte šljive, vegetacioni habitus