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# EFFECT OF SOME SOIL HERBICIDES ON THE VEGETATIVE HABITS OF YELLOW PLUM SEEDLINGS AND THE PLUMCOT CULTIVAR 'STANDESTO' IN A NURSERY

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***Abstract***

*The study on the effect of applying the soil herbicides Metofen (metolachlor + oxyfluorfen) and Pledge 50 WP (flumioxazin) on the vegetative habits of yellow plum seedling rootstocks and the plumcot cultivar 'Standesto' in a nursery was carried out in the period 2010-2012 at the Fruit Growing Institute of Plovdiv. Treatment with the herbicides was applied in the second half of March, immediately after sowing the seeds and before the beginning of vegetation, in a second-year nursery field. The herbicides provided a full control of weed infestation and the efficient herbicide post-effect lasted for 3.5-4 months. Visual symptoms of phytotoxicity expressed as a light chlorosis, were observed in the plants treated with the higher rate of Metofen - 2.40 l/ha. Strong phytotoxicity and death of whole plants was observed after treatment with Pledge 50 WP. In the second-year nursery neither visual symptoms of phytotoxicity, nor an obvious suppression of the grafted tree development was observed in the variants treated with the herbicides. In the second-year nursery, the application of Metofen (1.20-2.40 l/ha) or Pledge 50 WP (80.0 g/ha) could be recommended for weed control.*

***Key words****: herbicide, phytotoxicity, plumcot, vegetative habits, yellow plum seedlings.*

## INTRODUCTION

Weed control in the fruit-tree nursery field is one of the major agrotechnical practices, determining to a great degree the production of high quality planting material with a good health status. A number of studies on that problem show different results of treatment with herbicides – from incidence of phytotoxicity (chlorosis, necrosis, growth suppression of the rootstocks and the grafted trees) to a lack of growth suppression and obtaining high quality planting material (Rankova, 2007; Bradley and Schneider, 2008; Popov and Rankova, 2009; Rankova, 2011; Rankova et al., 2012; Abit and Hanson, 2013).

The aim of the present study was to investigate the effect of the soil-applied herbicides Metofen (metolachlor + oxifluorfen) and Pledge 50 WP (flumioxazin) on the growth habits of yellow plum seedling rootstock in the first-year nursery field and the cultivar/rootstock combination 'Standesto' grafted on yellow plum seedling rootstock in the second-year nursery.

## MATERIALS AND METHODS

The study on the effect of the soil-applied herbicides Metofen and Pledge 50 WP on the vegetative habits of yellow plum seedling rootstock was carried out in the period 2010-2012 at the Fruit-Growing Institute of Plovdiv. Stratified seeds (stones) of yellow plum were seeded at 3-5 cm depth at a 5-7 cm distance in the row, on an experimental plot in the period 15-25 March. Treatment with soil herbicides was applied immediately after sowing the seeds. The effect of the combined herbicide Metofen (S-metolachlor 500 g/l + oxyfluorfen 80 g/l) and of Pledge 50 WP (flumioxazin) was studied, each of the herbicides used at two different rates. The following variants were established: 1. Control (untreated, hand-weeded); 2. Metolachlor + oxyfluorfen - 1.20 l/ha; 3. Metolachlor + oxyfluorfen - 2.40 l/ha; 4. Flumioxazin - 80.0 g/ha; 5. Flumioxazin - 200.0 g/ha.

The trial was established by the standard method of long rows, in four replicates. The control was maintained free of weeds by hand

weeding every 30 days. During the vegetation period the rootstocks were grown following the standard technology.

During vegetation the efficacy of the applied herbicides was evaluated by reporting weed infestation in the separate variants in dynamics, by the quantitative-weight method, every 30 days after the date of treatment, until the end of the herbicide post-effect.

During the vegetation period plant growth and development were followed out - emergence, external symptoms of toxicity (chlorosis, necrosis, growth suppression).

In August ($15^{th}$-$20^{th}$) the rootstocks were graded for quality by reporting the biometrical characteristics height (cm) and thickness at the place of grafting (mm). Grading of plants in that period coincided with the time of grafting, determined as the most suitable in Bulgarian fruit-growing practice.

The results obtained were processed by the dispersion analysis method. After grading, the rootstocks were grafted with the plumcot cultivar 'Standesto'.

In spring, at the beginning of the vegetation period, the herbicides Metofen and Pledge 50 WP were applied again in the second-year nursery field, using two different rates of each herbicide. The following variants were established: 1. Control (untreated, hand-weeded); 2. Metolachlor + oxyfluorfen - 1.20 l/ha; 3. Metolachlor + oxyfluorfen - 2.40 l/ha; 4. Flumioxazin - 80.0 g/ha; 5. Flumioxazin - 200.0 g/ha.

The efficacy of the applied herbicides was evaluated during vegetation by reporting weed infestation in the separate variants (in dynamics, by the quantitative-weight method, every 30 days after the date of treatment) until the end of the herbicide post-effect. During the vegetation period the plants were grown following the standard technology.

When the trees were dug up (in November) they were graded for quality according to their height (cm), thickness at 15 cm above the place of grafting (mm) and average annual length increment (cm). The results obtained were processed by the dispersion analysis method.

## RESULTS AND DISCUSSION

### 1. Effect of soil herbicides on the specific composition and the level of weed infestation in the nursery field in the first and in the second year

Weed association in the fruit tree nursery in the experimental fields of the Fruit-Growing Institute of Plovdiv is of the "arable type", i.e. the annual early and late spring weed species are prevailing. The development of the following grassy weed species was established: ivy leaf speedwell (*Veronica hederifolia* L.), blackgrass (*Alopecurus myosuroides* L.), common groundsel (*Senecio vulgaris* L.), field brome (*Bromus arvensis* L.), wild barley (*Hordeum murinum* L.), white goosefoot (*Chenopodium album* L.), redroot pigweed (*Amaranthus retroflexus* L.), prostrate knotweed (*Polygonum aviculare* L.), purslane (*Portulaca oleracea* L.), horseweed (*Erigeron canadensis* L.) (Rankova and Tityanov 2013; Rankova and Zhivondov 2013; Rankova and Tityanov 2014).

During the first three months after applying the herbicides, the weeds available in the different variants were reported by species and in number. On the $60^{th}$ and $90^{th}$ days single plants of the species *Alopecurus myosuroides* L. and *Bromus arvensis* L. were found in the variants treated with the herbicides (Figure 1). All the studied herbicides at the rates applied showed a good control of weed infestation and the post-effect lasted for about 3.5-4 months. The herbicide effect continued for about 120 days after treatment, i.e. until the beginning of August.

In the period when the efficient herbicide post-effect subsided, the major representatives in the weed association were the late spring species purslane (*Portulaca oleracea* L.) and horseweed (*Erigeron canadensis* L.). The results obtained about the effect of the active substances, applied at the studied rates, on the weed infestation level and the duration of the efficient herbicide post-effect showed that it is possible to realize efficient weed control in the fruit tree nursery (Figure 1).

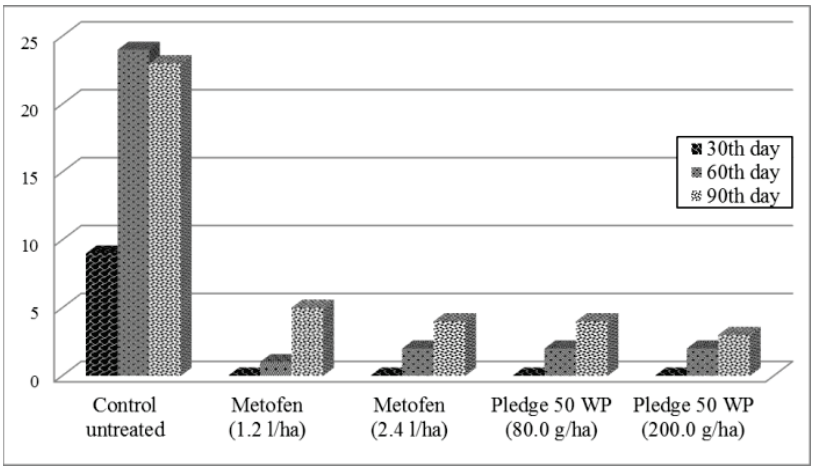


Figure 1. Effect of soil herbicides on the level of weed infestation (av. number of plants/$m^2$)

The realization of a long-term herbicide effect, lasting for about 4 months after the herbicide application, provides favorable conditions for the development of the grafted plants, at a time when weed-cultural plant competition has the greatest suppressing effect.

**2. Effect of soil herbicides on the vegetative habits of yellow plum seedlings**

At the time of emergence of the yellow plum plants, the incidence of necrosis was observed in the variants treated with flumioxazin, which was more prominent in the variant with the higher rate applied (Variant 5), causing even the death of some seedlings. The symptoms of phytotoxicity in Variant 3 (Metofen - 2.40 l/ha), expressed as slight necrosis, were overcome for about 40 days after the plant emergence. In both variants with flumioxazin treatment (Variants 4 and 5), single plants remained and developed further, overcoming the stress from the herbicide application and until August they were already suitable for grafting.

The results of the biometric analysis show that lower values of height were reported in the variants treated with herbicides, the interdependence being more obvious when applying the higher rates of the active substances. The smallest values of height were established in Variant 3 (Metofen - 2.40 l/ha) (Figure 2). Thickness at the place of grafting of the seedlings in the variants treated with herbicides varied within 6.1-7.1 mm (Figure 3), which makes them suitable for grafting in the year they were sown. That is the reason to conclude that the studied active substances do not have a depressing effect on stem thickness of yellow plum seedling rootstocks.

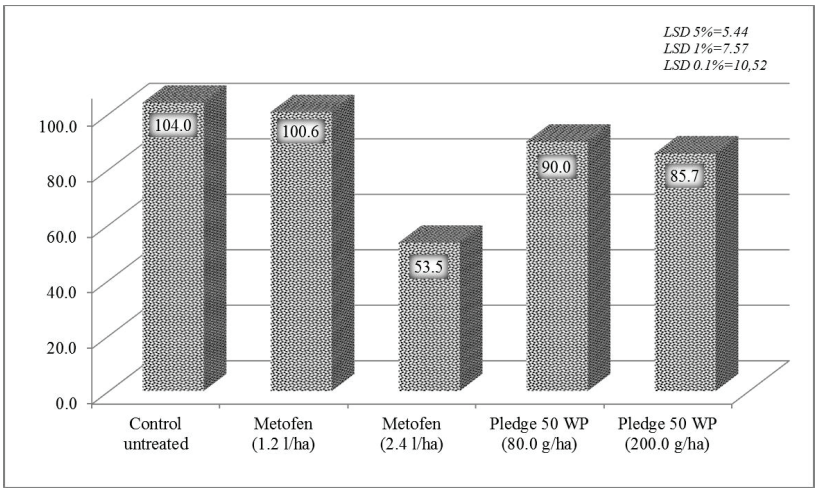


Figure 2. Effect of soil herbicides on the height of yellow plum seedlings

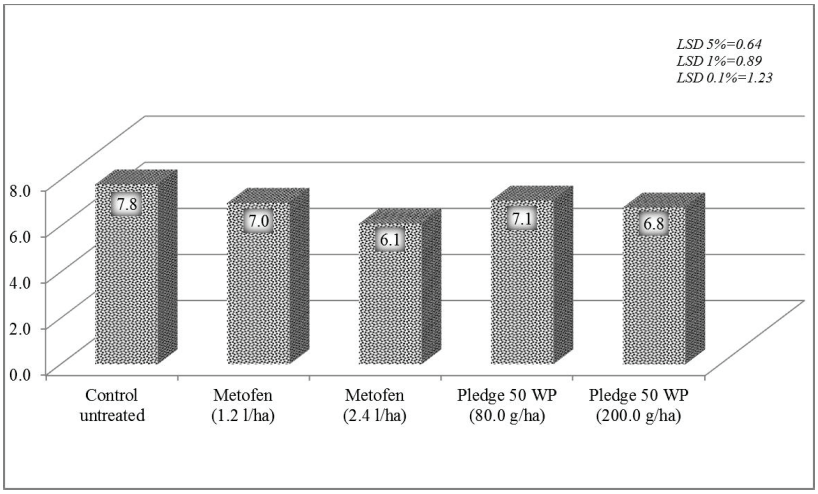


Figure 3. Effect of soil herbicides on the thickness at the place of grafting of yellow plum seedlings

**3. Effect of soil herbicides on the vegetative habits of the plumcot cultivar 'Standesto' grafted on yellow plum seedling rootstock, grown in the second-year nursery field**

After applying the herbicides in springtime in the second-year nursery field, neither external symptoms of phytotoxicity, nor obvious suppression of the development of the grafted trees were observed. Those results show that seedling rootstocks are more susceptible to herbicide treatment than the grafted cultivars in the second-year nursery field. The results of the biometric analysis show the tendency that when the higher rate of the active substances is applied, lower values of the biometric characteristics are reported (Figure 4).

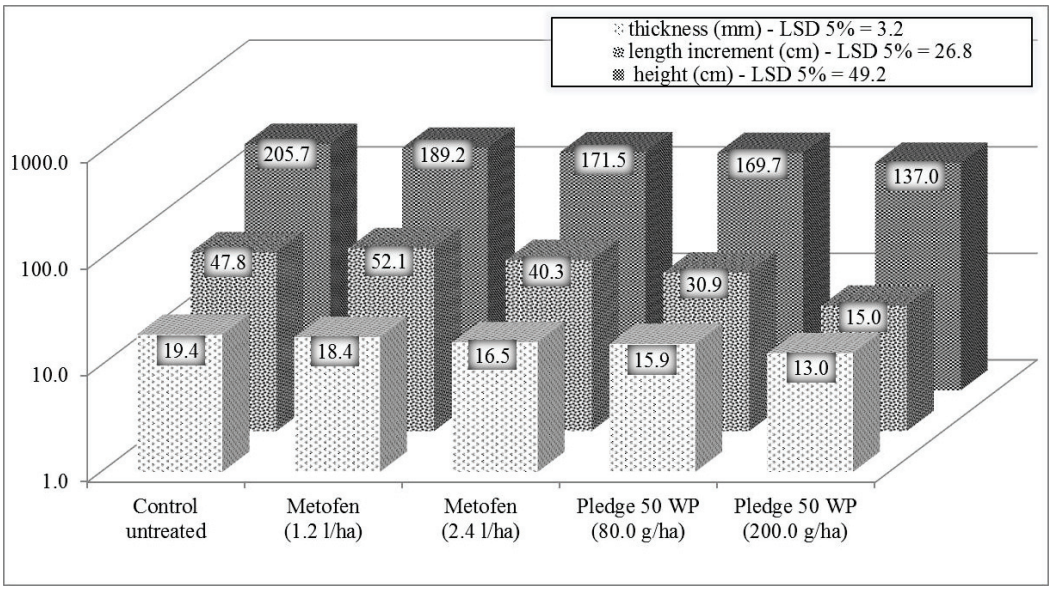


Figure 4. Effect of soil herbicides on growth of the plumcot cultivar 'Standesto', grafted on yellow plum seedling rootstock

Growth suppression was found after treatment with the higher rate of Pledge 50 WP. Similar results about the suppressing effect of the higher rate of flumioxazin were established in analogous studies in a nursery field with almond trees grafted on apricot seedling rootstock (Rankova and Tityanov, 2013; Rankova and Zhivondov, 2013; Rankova and Tityanov, 2014).

## CONCLUSIONS

The higher rates of the herbicides deliver better and longer control of weed vegetation in the first and second-year nursery fields. Satisfactory herbicide efficacy was also established when applying the lower rates (Variants 2 and 4).

The higher rates of the active substances suppressed the vegetative habits of yellow plum seedling rootstock. The depressing effect of the active substances is obviously expressed concerning height and less expressed concerning thickness at the place of grafting.

Strong phytotoxicity causing the death of the seedlings was reported after treatment with Pledge 50 WP - 200.0 g/ha.

After applying the herbicides in springtime, in the second-year nursery field, neither external symptoms of phytotoxicity, nor obvious suppression of the development of the grafted trees were observed. That gives the grounds to conclude that seedling rootstocks are more susceptible to herbicide treatment than the grafted cultivars in the second-year nursery field.

Treatment with Metofen - 1.2 l/ha or Pledge 50 WP - 80.0 g/ha can be recommended for weed control in the first-year nursery with yellow plum seedlings. In the second-year nursery with grafted trees the recommended rates for weed control with those herbicides are Metofen - 1.2-2.4 l/ha and Pledge 50 WP - 80.0 g/ha.

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