Soil Herbicides Efficacy in Pumpkins

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ABSTRACT
Pumpkins competitiveness to weeds is variable and depending on the stage of development. Weeds that occur in pumpkin crops are related flora with other row crops. In order to study the soil herbicide efficacy in pumpkin crops, *Cucurbita pepo* L., variety Olivia, testing was conducted on the experimental field at the Backi Petrovac locality, at the Institute for Alternative Culture, during 2015. The experiment was set according to EPPO/OEPP standards (2012), in the aim to determine the efficacy and phytotoxicity of the herbicide, applied in various quantities and combinations. Weed control was done by applying the herbicide linuron in an amount of 2 and 2.5 l ha^{-1} and s-metolachlor (1.2 and 1.5 l ha^{-1}). It was determined 15 weed species established in the pumpkin crop. Temporal phytotoxicity was determined in variants with s-metolachlor application in the quantity of 1.5 l ha^{-1}.

INTRODUCTION
As an intercrop, pumpkins were grown in the former Yugoslavia at around 335 000 ha, mostly in the central Serbia, and were mainly intended for animal feed (Popovic, 2000). Today, the only raised for the production of seed from which oil is obtained. Areas that cover the 2000-3000 ha have a tendency of growth (Berenji, 2010). Oil pumpkin is produced on 45,500 ha of arable land (Kapaun, 2002). At the world level, production of pumpkin was 17 million tons in 2002, according to FAO data, while the same year the total production of all species of the genus Cucurbita was 156 million tons, exceeding the production of tomatoes. Today, most pumpkins grown in the US, Mexico, India and China. The economically most important weeds, and the weeds more difficult to suppress are the perennial broadleaved weeds, although some annual weeds can be a problem. Main weeds, a large number and cover the weed community made *Ambrosia artemisiifolia* L., *Amaranthus retroflexus* L., *Datura stramonium* L., *Abutilon theophrasti* Medic., *Chenopodium album* L., *Cirsium arvense* L., *Echinochloa crus-galli* L., *Solanum nigrum* L., *Sorghum halepense* (L.) Pers., *Xanthium strumarium* L. (Besek et al., 2012). Successful production of the pumpkin can be achieved only by integrating measures that ensure clean crop in the period from emergence until the conclusion of rows and simultaneously eliminate and minimize the negative impacts later germinated weeds (Berenji, 2010). The widest application for weed control is a combination of preparation based on s-metolachlor (Dual Gold 960 EC-1-1.4 l ha^{-1}) and linuron (Afalon 1 l ha^{-1}). They are effective in broadleaf weed control in pumpkin crops (Ostojic and Baric, 2002).

MATERIALS and METHODS

In order to study the efficacy of herbicides on pumpkin crops, *Cucurbita pepo* L., variety Olivia, testing was conducted on the experimental field at the Backi Petrovac locality, Institute for Alternative Culture in 2015. The experiment was set according to EPPO / OEPP standard (2012) to determine the efficacy and phytotoxicity of the herbicide in various quantities and combinations. Weed control is done by applying the herbicide linuron (Afalon) in an amount of 2 and 2.5 l ha^{-1} and S-metolachlor (Dual Gold) in quantities of 1.2 and 1.5 l ha^{-1}, and the combination linuron+s-metolachlor (1 + 1 l ha^{-1}). The experiment was a randomized block design, with the basic plot of 25m^2 with four replications (EPPO Standards, 2012). Besides the variant with herbicides in the experiment included an untreated control plot. The herbicides were applied 7th May 2015, after planting and before the emergence of the crop (preemergence). Assess the effectiveness of the herbicide were carried out according to EPPO/OEPP methods of identifying and counting the dominant weed species after treatment. Efficiency coefficient (Ef.) was calculated according to the Dodel (Janjic, 2005) and evaluations were made 19 (Ef1) and 40 (Ef2) days after treatment (table 1).

RESULTS

In experimental pots, it was found and determined 15 weed species: *Abutilon theophrasti* Medik., *Amaranthus retroflexus* L., *Ambrosia artemisiifolia* L., *Chenopodium album* L., *Convolvulus arvensis* L., *Cynodon dactylon* Pers., *Datura stramonium* L., *Fumaria officinalis* L., *Hibiscus trionum* L., *Lamium purpureum* L., *Myosotis arvensis* (L.) Hill., *Polygonum aviculare* L., *Solanum nigrum* L., *Sorghum halepense* (L) Pers.and *Xanthium strumarium* L. The following annual broadleafs weeds were dominated: *Abutilon theophrasti* Medik., *Amaranthus retroflexus* L., *Ambrosia artemisiifolia* L., *Chenopodium album* L., *Datura stramonium* L., *Fumaria officinalis* L., *Hibiscus trionum* L., *Lamium purpureum* L., *Myosotis arvensis* (L.) Hill., *Polygonum aviculare* L., *Solanum nigrum* L., *Xanthium strumarium* L. The perennial broadleaf species *Convolvulus avensis* L. and perennial grassweeds *Cynodon dactylon* Pers. and *Sorghum halepense* (L) Pers. were established also (table 1).

Tested preparations Afalon (linuron) and Dual Gold (s-metolahlor) had a high efficiency on a broadleaf weed species *Abutilon theophrasti* Medik., *Amaranthus retroflexus* L., *Ambrosia artemisiifolia* L., *Datura stramonium* L., *Fumaria officinalis* L., *Hibiscus trionum* L., *Lamium purpureum* L., *Myosotis arvensis* (L.) Hill., *Polygonum aviculare* L.

During the second assessment, all applied combinations had a low effect on the perennial grass weeds *Cynodon dactylon* Pers. and *Sorghum halepense* (L) Pers., as well as on the *Xanthium strumarium* L., which was also found during the first assessment. The overall effectiveness of the herbicide during the second evaluation was 78.33 to 88.08%.

Herbicide phytotoxicity was performed according to a European Weed Research Society scale (Janjic, 1985). Temporal phytotoxicity was determined during the application Dual Gold in quantity of 1.5 l ha^{-1} (table 2). According to the literature, s-metolachlor can be phytotoxic at the soils with low content of humus (with values below 1% of humus) and soils with a pH below 5.5. In terms of time after treatment due to the unfavorable conditions for development (cold and too wet or dry weather) can occur plant injuries (Sekulic and Jelicic, 2013).

Weed species	Afalon (linuron) 2 l/ha		Afalon (linuron) 2,5 l/ha		Dual Gold (s-metolachlor) 1,2 l/ha		Dual Gold (s-metolachlor) 1.5 l/ha		Afalon + Dual Gold (linuron+s-metolachlor) 1+1 l/ha	
	Ef1	Ef2	Ef1	Ef2	Ef1	Ef2	Ef1	Ef2	Ef1	Ef2
Abutilon theophrasti Medik.	100	100	100	100	100	50,00	100	100	100	100
Amaranthus retroflexus L.	93,33	90,47	100	98,80	80,00	91,66	86,66	95,23	93,33	92,85
Ambrosia artemisiifolia L.	100	100	100	100	100	100	100	100	100	100
Chenopodium album L.	100	88,00	100	100	88,88	92,00	100	100	100	96,00
Convolvulus arvensis L.	100	33,33	100	33,33	20,00	33,33	100	33,33	100	33,33
Cynodon dactylon Pers.	68,42	71,42	10,52	71,42	73,68	85,71	47,36	85,71	68,42	85,71
Datura stramonium L.	100	100	100	100	100	100	100	100	100	100
Fumaria officinalis L.	100	100	100	100	100	100	100	100	100	100
Hibiscus trionum L.	100	100	100	100	100	100	100	100	100	80,00
Lamium purpureum L.	100	100	100	100	100	100	100	100	100	100
Myosotis arvensis (L.) Hill.	100	100	100	100	100	100	100	100	100	100
Polygonum aviculare L.	66,66	100	66,66	100	100	100	100	100	100	100
Solanum nigrum L.	75,00	80,00	75,00	100	75,00	80,00	100	100	100	100
Sorghum halepense (L) Pers.	27,84	53,12	60,75	87,50	69,62	84,37	53,16	90,62	40,50	96,87
Xanthium strumarium L.	50,00	61,53	66,66	69,23	66,66	53,84	66,66	61,53	66,66	69,23
Total efficacy	48,78	78,33	58,53	88,08	65,85	84,11	59,14	88,44	56,09	88,44

Table 2. Evaluation of herbicide phytotoxicity

No.	Preparations	Amount (l ha^{-1})	First evaluation	Second evaluation
1	Afalon (linuron)	2	1	1
2	Afalon (linuron)	2,5	1	1
3	Dual Gold (s-metolachlor)	1,2	1	1
4	Dual Gold (s-metolachlor)	1,5	2	2
5	Afalon + Dual Gold (linoron+s-metolachlor)	1+1	1	1
6	CONTROL (untreated)	-	-	-

CONCLUSIONS

- In a field trial was identified and determined 15 weed species, dominated by broadleaf weed species, with the presence of perennial weeds (*Convolvulus arvensis* L., *Cynodon dactylon* Pers. and *Sorghum halepense* (L) Pers.)
- Herbicide combination linuron and s-metolachlor had the highest overall efficiency (88.44%) on the present weed species
- all applied hebricides had a low effect on the perennial grass weeds *Cynodon dactylon* Pers. and *Sorghum halepense* (L) Pers., as well as on the broadleaf species *Xanthium strumarium* L.
- Temporal phytotoxicity was determined during the application of s-metolachlor in higher quantity of 1.5 l ha^{-1}

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