

## EFFICIENCY EVALUATION OF FLUROXYPYR IN MAIZE CROP

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*SUMMARY: In the period 2009-2010, efficiency tests in maize crop were carried out with the aim of monitoring of fluroxypyr efficiency in control of broadleaved weed species. Trial was set up at two sites and test type was randomized bloc design. Applications of herbicides were performed in the phase of 3-6 leaves of maize. Efficiency evaluation of the herbicides was performed twice, visually. Results showed that fluroxypyr can be successfully applied for control of great number of broadleaved weeds such as: *Amaranthus retroflexus* L., *Chenopodium album* L., *C. hybridum* L., *Datura stramonium* L., *Solanum nigrum* L.*

**Key words:** efficiency, fluroxypyr, maize, weed control.

### INTRODUCTION

After rice and wheat, maize (*Zea mays* L.) is one of the most important field crop in the world (Sharara et al., 2005). In Serbia this culture also occupies significant place in total agricultural production due to its high yields (over 10t/ha) and volume of production of over 1-1.3 million ha annually (Milosavljević et al., 2010).

In addition to diseases and pests, weed occurrence on arable land has great impact on maize quality and yield (Sharara et al., 2005). Weed control is one of the most important conditions for achievement of stable yields (Casagrande et al., 2010), and measures that are carried out in early phases of crop development when it is the most susceptible to weed competition are especially important (Konstantinović, 2008). Planning and targeted performance of herbicide treatments is of great importance (Stanojević, 2000). Efficiency tests and studies of herbicide spectrum of action are the first precondition for successful protection of crops from weeds.

Last years, post-emergence use of foliar herbicides has become more frequent, both in narrow-row crops of wheat, barley and oats (Shah et al., 2006), and in maize (Sharara, 2005). Fluroxypyr also belongs to this group of herbicides, i.e. auxin-type herbicides, that have important application in agriculture due to wide spectrum of action to against resistant broad-leaved weed species (Tao and Yang, 2010; Zhang et al., 2011). It is translocated systematic herbicide, and selectivity toward maize can be achieved only if it is applied in prescribed crop development phase (Konstantinović, 2008). The pre-

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scribed development phase of maize in which treatments by fluroxypyr were performed is 3-6 leaves (Anonymous, 2008). The aim of the evaluation in this paper was to study fluroxypyr impact to annual and perennial broad-leaved weed species in maize crop.

## MATERIAL AND METHODS

In 2009, at sites Bački Maglić and Kovin, a trial with fluroxypyr (herbicide Patrol) was set up in rates of 0.8l/ha for efficiency evaluations and 1.6l/ha for determination of phytotoxicity to maize crop. In the following 2010, at sites Tovariševo and Zmajevo, product Starane 300 in rate of 0.6l/ha was applied for efficiency evaluations and 1.2l/ha for study of phytotoxicity of fluroxypyr to maize. Standard herbicide in all trials was herbicide dicamba (product Banvel 480) at a rate of 0.6l/ha. Trials were set up according to the scheme of randomized block design. At all sites herbicides were applied folliary in maize development of 3-6 leaves, and in the phase of intensive growth of weeds. Herbicide treatments were performed by back-sack sprayer. Efficiency evaluations were performed twice, two weeks and a month after treatments. Evaluations were done by visual assessments of number of weed species distribution on the area of 1m<sup>2</sup>, in 4 replications for each studied plot. For the purpose of herbicide efficiency evaluation, the following scale was used: poor herbicide efficiency (KE < 75%); good herbicide efficiency (KE = 75-90%); high herbicide efficiency. (KE > 90%). Phytotoxicity of herbicides was simultaneously also assessed. All evaluations were performed in accordance to OEPP/EPP methods (EPP Standards, 2004). The final results were obtained by ratio of the mean value of samples taken from 4 plots of each treatment with mean value of samples taken from four control plots.

## RESULTS

In 2009 at site Bački Maglić in maize crop, presence of nine weed species was determined: *Amaranthus retroflexus* L., *Chenopodium hybridum* L., *Cirsium arvense* (L.) Scop., *Datura stramonium* L., *Polygonum aviculare* L., *Polygonum persicaria* (L.) Small., *Sinapis arvensis* L., *Solanum nigrum* L. and *Xantium strumarium* L. In both evaluations, herbicide Patrol used at a rate of 0.8l/ha showed good efficiency (KE > 90%) in relation to weed species *Amaranthus retroflexus*, *Chenopodium hybridum*, *Datura stramonium*, *Polygonum aviculare*, *Polygonum persicaria*, *Sinapis arvensis*, *Solanum nigrum*. In relation to weed species *Cirsium arvense*, at rate of 0.8l/ha the herbicide showed good efficiency (KE = 75-90%), while in both evaluations it showed poor performance to weed species *Xantium strumarium*.

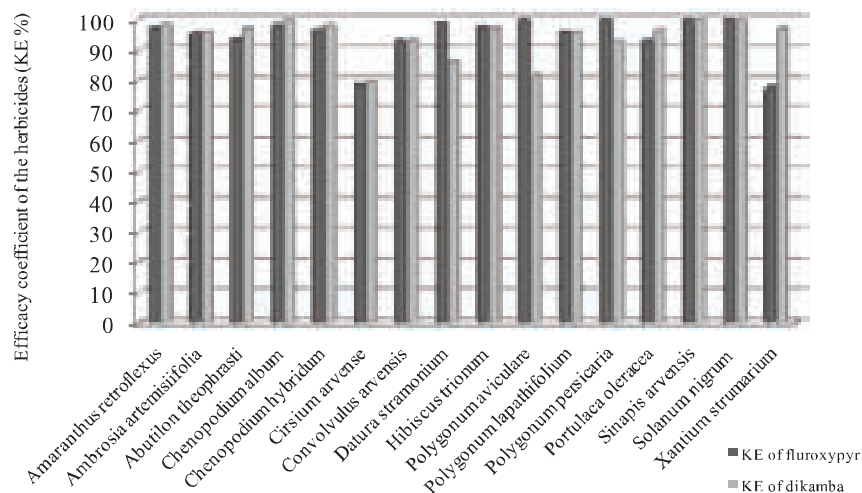
The same year, on the trial plot in Kovin, the following weeds were determined: *Amaranthus retroflexus*, *Chenopodium album* L., *Chenopodium hybridum*, *Datura stramonium*, *Hibiscus trionum* L., *Portulaca oleracea* L., *Polygonum lapathifolium* L., *Solanum nigrum* and *Xantium strumarium*. In both evaluations, herbicide Patrol used at a rate of 0.8l/ha, showed good efficiency (KE > 90%) to weed species: *Amaranthus retroflexus*, *Chenopodium album*, *Chenopodium hybridum*, *Hibiscus trionum*, *Portulaca oleracea*, *Polygonum lapathifolium* and *Solanum nigrum*. In both evaluations, the herbicide showed poor efficiency (KE < 75%) to the weed species *Xantium strumarium*. The product Banvel 480 used as standard had approximately the same results as the

tested herbicide (Graph. 1). In both trials, fluroxypyr used at a rate of 1.6l/ha, showed no signs of phytotoxicity on maize.

During 2010, at experimental plot in Tovariševo, the following weed species were determined: *Amaranthus retroflexus*, *Ambrosia artemisiifolia*, *Chenopodium album*, *Convolvulus arvensis*, *Datura stramonium*, *Hibiscus trionum*, *Polygonum lapathifolium*, *Solanum nigrum* and *Xantium strumarium*. The product Starane 300 used at a rate of 0.6l/ha, showed good efficiency in control of the following weed species: *Amaranthus retroflexus*, *Ambrosia artemisiifolia*, *Chenopodium album*, *Convolvulus arvensis*, *Datura stramonium*, *Hibiscus trionum*, *Polygonum lapathifolium* and *Solanum nigrum*. In both evaluations the herbicide showed satisfactory efficiency (KE = 75-90%) in control of weed species *Xantium strumarium*.

Before herbicide application, at experimental plots in Zmajevu nine weed species were determined: *Abutilon theophrasti* Med., *Amaranthus retroflexus*, *Ambrosia artemisiifolia*, *Chenopodium album*, *Datura stramonium*, *Hibiscus trionum*, *Polygonum aviculare*, *Solanum nigrum* and *Xantium strumarium*. In both evaluations the product Starane 300, used at a rate of 0.6l/ha showed good efficiency (KE > 90%) in relation to all determined weed species except to *Abutilon theophrasti* and *Xantium strumarium* to which it showed satisfactory efficiency.

In both trials, standard herbicide achieved similar results, as well as the studied one (Graph. 1). During experiments, no signs of phytotoxicity were observed on the maize crop.



Graph. 1. Efficiency of the studied herbicide fluroxypyr and standard herbicide dicamba after second evaluation of treatments (average for both years and all 4 studied sites)

Graf. 1. Efikasnost ispitivanog herbicida fluroksipira i standardnog preparata dikambe nakon II ocene tretmana (prosek za obe godine i sva 4 ispitivana lokaliteta)

## DISCUSSION

During 2009, evaluations of fluroxypyr efficiency showed the following: at both studied sites, i.e. Bački Maglić and Kovin the highest susceptibility to fluroxypyr showed weed species *Amaranthus retroflexus*, *Chenopodium hybridum*, *Datura stramonium* and *Solanum nigrum*. At site Bački Maglić the additional three weed spe-

cies, i.e. *Polygonum aviculare*, *Polygonum persicaria* and *Sinapis arvensis* showed extreme susceptibility to the applied herbicide with the maximum efficiency coefficient of 100%, while at site Kovin this level of susceptibility showed *Hibiscus trionum* and *Polygonum lapathifolium*. Weed species *Portulaca oleracea* and *Chenopodium album* also showed high level of susceptibility to fluroxypyr with efficiency coefficient of over 90%. Exceptional susceptibility of weed species *Sinapis arvensis* and *Chenopodium album* to fluroxypyr (KE = 100%) in wheat crop was observed in studies of Radivojević et al., 2002, and in barley Roibu et al., 2000. At site Bački Maglić, perennial weed species *Cirsium arvense* showed somewhat higher resistance to the studied herbicide, and efficiency coefficient to this weed species was less than 80%. Weed species *Xanthium strumarium* proved to have the lowest susceptibility. Efficiency coefficient for this weed species was 66-71%.

During 2010, evaluations of fluroxypyr efficiency provided the following results: at sites Tovariševo and Zmajevu the highest susceptibility to the applied herbicide showed weed species *Chenopodium album*, *Datura stramonium*, *Polygonum aviculare*, *Solanum nigrum* (KE = 100%) and *Amaranthus retroflexus*, *Ambrosia artemisiifolia*, *Abutilon theophrasti*, *Convolvulus arvensis*, *Hibiscus trionum* and *Polygonum lapathifolium* (KE = 90-100%). At these sites, *Xanthium strumarium* also showed the lowest susceptibility to fluroxypyr. Efficiency coefficient for this weed species was 85-86% (Table 1).

Table 1. The average fluroxypyr efficiency (herbicides Patrol and Starane 300) and standard herbicide Banvel 480 to different weed species

Tabela 1. Prosečna efikasnost herbicida fluroksipir (preparata Patrol i Starane 300) i standardnog preparata Banvel 480 na različite korovske vrste

Weed species	Product Patrol	Standard Banvel 480	Product Starane 300
	0.8l/ha	0.6l/ha	0.6l/ha
Herbicide efficiency (%) after second evaluation			
Annual dicotyledonous			
<i>Abutilon theophrasti</i> Med.	-	97	93
<i>Amaranthus retroflexus</i> L.	97	99	97
<i>Ambrosia artemisiifolia</i> L.	-	96	96
<i>Chenopodium album</i> L.	94	100	100
<i>Chenopodium hybridum</i> L.	97	98	-
<i>Datura stramonium</i> L.	97	86	100
<i>Hibiscus trionum</i> L.	100	97	96
<i>Polygonum aviculare</i> L.	100	81	100
<i>Polygonum lapathifolium</i> L.	100	96	92
<i>P. persicaria</i> (L.) Small.	100	93	-
<i>Portulaca oleracea</i> L.	93	97	-
<i>Sinapis arvensis</i> L.	100	100	-
<i>Solanum nigrum</i> L.	100	100	100
<i>Xanthium strumarium</i> L.	69	97	86
Perennial dicotyledonous			
<i>Cirsium arvense</i> (L.) Scop.	78	79	-
<i>Convolvulus arvensis</i> L.	-	93	93

## CONCLUSION

The above given results showed that in recommended rates fluroxypyr can be successfully applied for control of great number of broadleaved weed species in maize, without phytotoxicity to the crop. Good efficiency (KE > 90%) the herbicide showed in relation to weed species: *Amaranthus retroflexus*, *Ambrosia artemisiifolia*, *Abutilon theophrasti*, *Convolvulus arvensis*, *Chenopodium album*, *Chenopodium hybridum*, *Datura stramonium*, *Hibiscus trionum*, *Portulaca oleracea*, *Polygonum lapathifolium*, *Polygonum aviculare*, *Polygonum persicaria*, *Sinapis arvensis* and *Solanum nigrum*. It showed satisfactory efficiency (KE = 75 - 90%) in relation to *Cirsium arvense* and weak in relation to *Xanthium strumarium*. Considering the fact that *Xanthium strumarium* is one of the most dangerous competitors in maize (Karimmojeni et al., 2010), it is necessary to use fluroxypyr in combination with other active ingredients, more efficient to this weed species.

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## ISPITIVANJE EFIKASNOSTI FLUROKSIPIRA U USEVU KUKURUZA

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### Izvod

Tokom 2009-2010 godine, u usevu kukuruza, sprovedena su istraživanja u cilju praćenja efikasnosti fluroksipira u suzbijanju širokolisnih korovskih vrsta. Ogled je postavljen na dva lokaliteta po šemi slučajnog blok sistema. Herbicidi su primenjeni kada je kukuruz bio u fazi 3-6 listova. Ocena efikasnosti preparata izvršena je dvokratno, vizuelnom procenom. Rezultati su pokazali da se fluroksipir uspešno može primeniti za suzbijanje velikog broja širokolisnih korovskih vrsta kao što su: *Amaranthus retroflexus* L., *Chenopodium album* L., *C. hybridum* L., *Datura stramonium* L., *Solanum nigrum* L.

**Ključne reči:** efikasnost, fluroksipir, kukuruz, suzbijanje korova.

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