

WEEDS CONTROL IN POTATO CROP USING DIFFERENT METRIBUZIN DOSES

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Abstract. The paper present results of a two year study regarding the influence of different metribuzin doses in potato crop. Field experiments were carried out in the years 2014-2015 to the National Institute of Research and Development for Potato and Sugar Beet – Brasov, Romania and in Feldioara area, to a local farmer. All variants treated with metribuzin influenced significantly the increase in potato yield in comparison with the control variants, in which weeds were not suppressed by chemicals. All metribuzin variants gave a significantly higher yield compared to the control one. On all variants with metribuzin were obtained a uniform yields, which ranged from 28.5 t/ha to 25.1 t/ha in 2014 and from 35.5 t/ha to 29.2 t/ha in 2015. For good results it's important to take account of the potential weed reserve in soil and to see the correlation between meteorological data and the intensity of weed infestation.

Keywords: potato, weed, metribuzin, applied doses, yield

INTRODUCTION

After sugar beet, maize, soya bean and bean, potato it is one of the most compete plants by weeds. The modern technologies framed the production losses between 42-72% (Sarpe and al., 1976). Weeds are seen like “green pollution” (Berca, 1998). The terms expressed the danger represented by extremely high level of weeds and the high qualitative and quantitative losses caused on agricultural crops. During vegetation potato crops need a good aeration and soil ventilation, demanding reduction of maintenance works, what can be done with herbicides help. Herbicide rates must be adjusted for soil texture, percentage organic matter, soil pH, weed species, potential for soil residue, and other herbicides used (Frâncu, 1998).

The most important period for weed control in potato crops begins before emergence and lasts until the close of the rows. During this period the annual weeds with early spring germination appear, and the soil humidity and the growing temperature also stimulate the perennial species to start up in vegetation. The pre-emergence herbicide has the goal of maintaining the potato field clean in the first part of vegetation controlling important weeds (Hermeziu and Hermeziu, 2012).

Due to its high efficiency in controlling grass and broadleaf weeds and good selectivity, metribuzin (the active ingredient of Sencor) is the most commonly used herbicide in Romanian potato crops. Characteristic for the weed population of potato fields in Brasov area are annual weeds like *Amaranthus spp.*, *Chenopodium spp.*, *Setaria spp.* and from among perennial plants *Cirsium arvense* and *Convulvulus arvensis* can cause problems. Weed control is one of the most important factors for a successful crop production and therefore the prevention of weed-crop competition at an early stage plays a very important role. From the beginning of the growing season until a plant height of 25-30 cm potato is very susceptible to weed infestation (Dobozi and Lehoczky, 2002).

If a mixed population of annual weeds is allowed to compete with potatoes all season, each 10% increase in dry weed biomass causes a 12% decrease in tuber yield (Mircov and al., 2006). One redroot pigweed (*Amaranthus retroflexus* L.) or barnyardgrass [*Echinochloa crus-galli* (L.) Beauv.] per meter of row reduced marketable tuber yield 19 to 33% (VanGessel and Renner, 1990; Baziramakenga and Leroux, 1998). Metribuzin it's an herbicide from triazine group, used to control grass and broadleaf weeds in potato crop. Microbial degradation is the primary route of soil metribuzin elimination.

Metribuzin is moderately absorbed by soil with high clay content and organic matter; absorption decreases as pH increases. Herbicide efficacy against weeds is conditioned by pedologic and climatic factors, especially clay-humus complex and rainfall falling in the next 20 days after application. Products based on metribuzin are selective for potato. Metribuzin is routinely used to control annual broadleaf weeds. In Romania it has been a standard treatment for many years and is extremely cost effective.

MATERIAL AND METHODS

The field trials were established in 2014 and 2015 to the National Institute of Research and Development for Potato and Sugar Beet – Brasov and in Feldioara, a village 17 km NE from Brasov to a local farmer (table 1). The field experiments each year were set up in random block, 4 replicate plots with 4 rows each with 20 plants. The size of elementary plot was 25.2 m². Control measures against late blight (*Phytophthora infestsans*) and Colorado beetle were done according to the common practices and in concordance with the local climatic conditions.

Table 1

Technical data				
	Braşov		Feldioara	
Soil type	Cambic chernozeum		Chernozeum	
Clay	27%		32%	
Humus	4,68%		3,45%	
pH	6,7		6,0	
Pre crop	winter wheat	pea	alfalfa	winter wheat
Fertilization	N:P:K 15:15:15 1000 kg/ha	N:P:K 15:15:15 1000 kg/ha	N:P:K 15:15:15 1200 kg/ha	N:P:K 15:15:15 1200 kg/ha
Planting mode	manual		mechanic	
Planting data	01.04.2014	27.04.2015	10.04.2014	16.04.2015
Planting distance (cm)	75/30	75/30	75/25	75/25
Harvesting data	16.09.2014	1.10.2015	22.09.2014	29.09.2015
Variety	Christian		Marfona	

Herbicides were applied with a knapsack sprayer with 10 l capacity (nozzle type TJ 11002). The weeds species, growth stages and population level were recorded by counting the number of individual species in 4 x 0.25 m² quadrats and estimating the % ground cover of each species in the untreated plots. Statistical analysis was done using factorial analysis of variance (ANOVA), the statistical and rating differences between mean values was performed by LSD test.

RESULTS AND DISCUSSION

Climatic characterization of 2013-2014 year to Braşov

From planting to flowering of the potato from April to June, average monthly temperatures were close to normal. In the second part of the growing season in July, August and September registered monthly average temperatures exceed MMA values with 1.2, 1.2 and 0.7 ° C. The amount of rainfall during the winter, preceding potato crop, was close to the annual average, ensuring a good supply of soil water. April was very rainy, rainfall was 237% higher than MMA. May, wetter (122.2% compared to MMA in 14 days with rain) and with temperature slightly higher than characteristics of the area, contributed to a good start and uniform emergence of potato crops. High frequency of days with rain, 19 days in June and 18 days in July, with optimum temperatures, favored beside the development of plants the late blight attack, whose control was relatively difficult. High temperatures and low rainfall in August caused maturing of plants and stopped the vegetation to middle early varieties (figure 1).

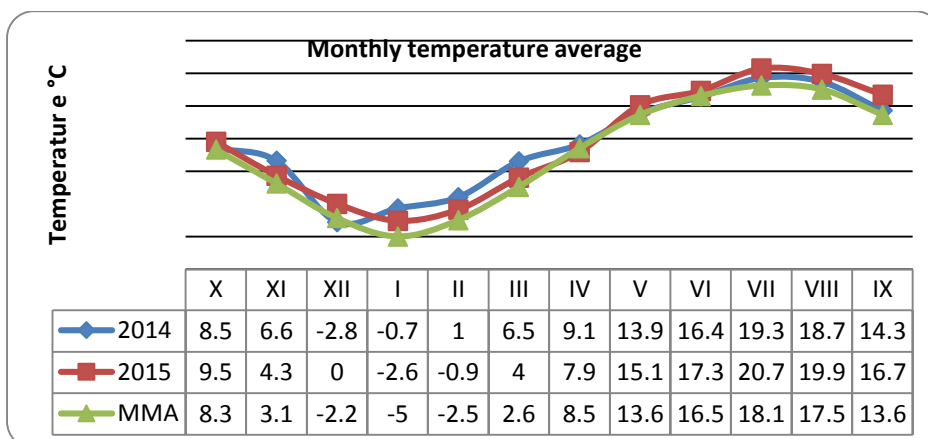


Figure 1. Monthly temperature average

Climatic characterization of 2014-2015 year to Braşov. In Brasov the year 2014-2015 was warmer and with more rain than normal. Air temperature average was higher with 1.7°C and rainfalls have exceeded the multi-annual amount by 83.1 mm. Lower rainfall levels compared to MMA occurred during the growing season in April-August. Due to this low volume of rainfall potato planting and maintenance from the beginning of the growing season were carried out in good conditions. Although the rainfall values in May and July were below the multiannual averages, the rainfalls exceeded 40 /m², which led to a normal vegetation without stress during the tuberisation period. In June and September the rainfall rate was high (monthly 15 rainy days), exceeding by 81.6% and 111.4% respectively the multiannual averages (figure 2).

Results regarding the weeds. In period of examination were registred 8 species like dominant (*Amaranthus retroflexus*, *Setaria gluaca*, *Veronica hederifolia*, *Chenopodium album*, *Convolvulus arvensis*, *Cirsium arvense*, *Galium aparine*, *Atriplex patula*) and some other species less important in potato field. Visual evaluations of crop injury and weed control were made May 20, June 6 and June 23, 2014 and June 3, June 17 and July 6, 2015.

Weed control was based on a 0 to 100% scale, where 0 = no control and 100 = no living weeds.

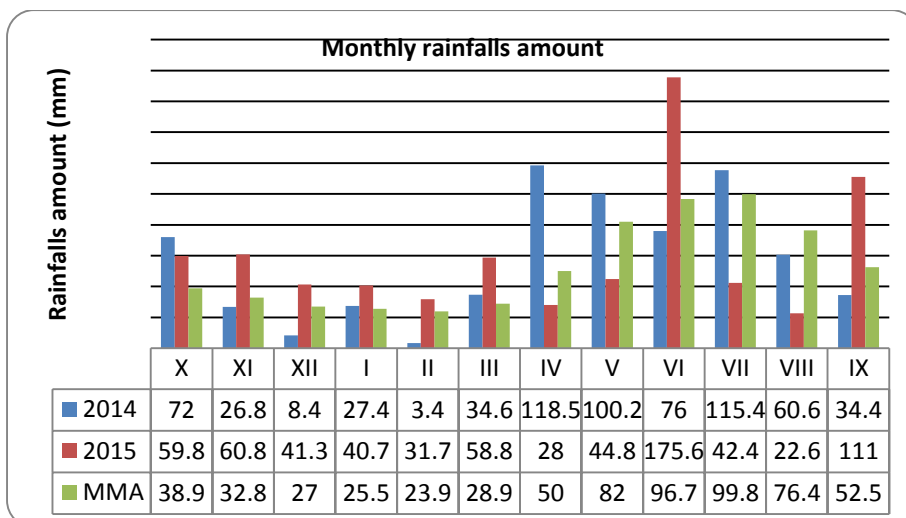


Fig. 2. Monthly rainfalls amount

Table 2

Number of weed per m² - Brasov 2014

Variant	Dose (kg/ha)	Location	Weed species								
			AMARE	SETGL	VERHE	CHEAL	CONAR	GALAP	ATRAPA	CIRAR	Other species*
Control	-	Brasov	27	72	24	25	18	34	20	18	8
	-	Feldioara	22	78	24	20	25	27	23	20	5
Metribuzin	1.0	Brasov	1	12	3	0	1	2	1	0	0
	1.0	Feldioara	2	10	5	1	2	2	2	0	0
Metribuzin	0.75	Brasov	1	17	2	2	2	4	3	1	2
	0.75	Feldioara	2	11	6	2	2	2	2	4	2
Metribuzin	0.5	Brasov	2	18	4	0	3	3	1	3	3
	0.5	Feldioara	2	12	8	0	2	3	1	2	2
Metribuzin	0.6+0.4	Brasov	0	5	0	0	0	0	0	0	0
	0.6+0.4	Feldioara	0	9	2	0	2	0	0	0	0

**Raphanus raphanistrum, Capsella bursa-pastoris, Sonchus arvensis, Agropyron repens*

According to the research, the greatest weed number had control variant in both years, both in Brasov and Feldioara (Tables 2-3). The lowest weediness in 2014 and 2015 was observed in treatments with Metribuzin 0.6+0.4 in both locations. Other variants of the application of metribuzin also showed high efficacy in reducing the number of weed plants. No phytotoxic symptoms (any kind of chlorosis, necrosis or deformation) were observed in any plot at any of the assessment timings.

No differences in crop vigour were observed on any of the plots at any of the assessments timings.

Table 3

Number of weed per m² - Brasov 2015

Variant	Dose (kg/ha)	Location	Weed species								
			AMARE	SETGL	VERHE	CHEAL	CONAR	GALAP	ATRAPA	CIRAR	Other species*
Control	-	Brasov	18	59	17	25	23	30	13	18	10
	-	Feldioara	17	65	22	23	17	18	20	25	12
Metribuzin	1.0	Brasov	3	10	0	0	2	4	2	3	2
	1.0	Feldioara	5	8	0	0	3	6	1	5	1
Metribuzin	0.75	Brasov	5	4	0	5	4	7	2	7	5
	0.75	Feldioara	5	5	0	2	5	4	3	5	3
Metribuzin	0.5	Brasov	10	7	0	4	5	5	3	3	5
	0.5	Feldioara	9	4	0	0	6	6	3	3	5
Metribuzin	0.6+0.4	Brasov	0	4	0	2	3	0	1	2	0
	0.6+0.4	Feldioara	2	5	0	0	4	5	2	0	1

**Raphanus raphanistrum*, *Capsella bursa-pastoris*, *Sonchus arvensis*, *Agropyron repens*

Table 4

Potato yield (t/ha) - 2014

Location	Variant				
	Control	Metribuzin 1.0	Metribuzin 0.75	Metribuzin 0.50	Metribuzin 0.6+0.4
Brasov	13.3	28.7	26.6	25.6	27.7
LSD (P=0.1)	6.8003				
Standard deviation	4.5774				
CV	11.46				
Feldioara	14.41	27.9	28.3	25.1	28.6
LSD (P=0.1)	7.5701				
Standard deviation	5.0956				
CV	17.60				

Results regarding the yield. In both years all variants treated with metribuzin has showed significantly higher yield compared to control variant. The data clearly show the negative influence of weeds on control variant. Higher average potato yields were obtained in 2015 which is explained by the fact that this year had bigger amount of rainfall and also a more favorable rainfall distribution.

All metribuzin variants gave a significantly higher yield compared to the control one. Controlling weeds at the beginning of the season increased potato yields more than 40% compared with unweeded control. On all variants with metribuzin were obtained a uniform yields, which ranged from 25.1 t/ha to 28.7 to/ha in 2014 (table 4) and from 29.8 to/ha to 35.5 to/ha in 2015 (table 5). The highest potato yield was in variant with Metribuzin 1.0 kg/ha in 2014 to Feldioara, while the lowest yield was obtained in Control variant with only 14.5 t/ha due to the climatic conditions of 2015. Applied methods of chemical weeds control showed high level of efficiency in reducing the number and biomass of weeds.

All variants with metribuzin significantly increase the yield in comparison with variant were metribuzin was not used.

Table 5

Location	Potato yield (t/ha) - 2015				
	Control	Metribuzin 1.0	Metribuzin 0.75	Metribuzin 0.50	Metribuzin 0.6+0.4
Brasov	14.5	32.1	29.8	29.2	32.0
LSD (P=0.1)	5.7240				
Standard deviation	3.8529				
CV	20.17				
Feldioara	15.2	35.5	31.2	30.2	32.5
LSD (P=0.1)	5.255				
Standard deviation	3.774				
CV	17.20				

CONCLUSIONS

In two year average all metribuzin variants gave a significantly higher yield compared to the control variant, on all investigated chemical treatments were measured approximately equal tuber yields. Based on the conducted research it can be concluded that the yields obtained were in direct accordance with the efficiency of the applied treatment and meteorological conditions during the experiment. It's important to take account of the potential weed reserve in soil and to see the correlation between meteorological data and the intensity of weed infestation. In Control plot (untreated) was an intense competition between potato plants and weeds for soil and climatic resources. It's necessary to introduce an antigaminicid for *Setaria* sp. which is largely saw in potato crop in this area.

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