UDC: 635.21-295.4:631.559(497.751)"2017"
Professional paper

THE PRE-em USE OF SOME HERBICIDES IN THE CONTROL OF WEEDS IN POTATOES AND THEIR INFLUENCE ON THE YIELD

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Abstract

In order to mitigate the problem with weeds in the potato crop in the 2017 growing season in the towns Bogovinje-Tetovo (Polog region), a field experiment was established according to the randomized block system with three replications with experimental plot sizes of 21 m2.
In the experiment, we investigated the structure of weeds, the degree of appearance, the efficacy of herbicides and the eventual phytotoxicity of the herbicides used.
The potato planted was the cultivar "Silvana" and the following treatment variants were included: pendimetalin 5 l/ha, linuron 2.5 l/ha, metobromuron 3 l/ha, metobromuron 4 l/ha, metribuzin 0.75 kg/ha PRE-em, metribuzin 1 kg/h PRE-em, mechanical controls and absolute controls.
From the obtained results, it was found that the structure of weeds consists of 9 types of weeds, of which 3 species from the group of monocotyledonous weeds and 6 species from the group of dicotyledonous weeds. The number of weeds was 126 plants/m2. The dominant weeds were *Echinochloa crus-galli* with 93.7 plants/m2, *Polygonum lapathifolium* with 10.0 plants/m2, and *Polygonum aviculare* with 9.3 plants/m2. The efficiency of herbicides in the fight against dicotyledonous weeds has been from 97.7-100%, monocotyledonous weeds from 95.8-98.2%, while the overall efficiency without geophytes has been from 96.8-98.4%. Regarding phytotoxicity in the potato culture, no signs of phytotoxicity were observed in any variant of the treatment.

Keywords: dicotyledons, geophytes, efficacy, phytotoxicity.

1. Introduction

Potato (*Solanum tuberosum L.*) is an important agricultural crop which is cultivated in 125 countries of the world and consumed by 1 billion people. According to the world producer, the potato is the fourth agricultural crop after wheat, maize, and rice, while according to its use for human food, it is the third crop after wheat and rice. Potato tubers on average contain 76.3% water, 17.5% starch, 2.0% protein, 0.1% fat, 1.1% ash, and 0.7% fibrous matter.
Potato tubers are also rich in amino acids such as (tryptophan, lysine, valine, methionine, etc.), very important for the human body. Potato skins and bulbs contain a specific substance known as solanine.
In addition to its nutritional value, the potato is also a very good crop from an agrotechnical point of view because it is a very important pre-crop for many other agricultural crops. As a foraging crop that feeds abundantly, it leaves the soil loose and rich in mineral matter.
In Macedonia, potatoes are cultivated on an area of 13,000 ha with a tendency for continuous growth and with an average yield of something over 13 t/ha. This yield is very low compared to the genetic potential possessed by the various potato cultivars and to the favorable climatic conditions possessed by the Republic of North Macedonia.

https://doi.org/10.62792/ut.jasrd.v2.i3-4.p2661

2. Material and methods

Precisely, the low average yield at the country level was the purpose of the experiment and to ascertain whether this low yield is dependent, among other things, on the use of inadequate herbicides. Another goal was to determine the structure of weeds in the Polog region, the effectiveness of herbicides, their impact on yield, and eventually the phytotoxicity of herbicides in potato culture.
For answers to these questions and dilemmas, we set up the field experiment in the Bogovinje locality - Polog region, in the 2017 vegetative year.
In the experiment, the structure of the weeds, the rate of appearance, the efficacy of the herbicides, and the eventual phyto-toxicity of the herbicides as well as the impact on the yield were investigated.
The experiment was set up according to the randomized block system with three replications with experimental plot sizes of 21m2, the following treatment options were included: pendimethalin 5.0 l/ha, linuron 2.5 l/ha, metobromuron 3.0 l/ha, metobromuron 4.0 l/ha, metribuzin 0.75 kg/ha PRE-em, metribuzin 1.0 kg/h PRE-em, mechanical control and absolute control.
Planting was carried out on 26.03.2017 and Silvana cultivar was used for planting as a moderately early cultivar. Treatment with herbicides was carried out on 11.04.2017.
During the treatment, calm and warm weather of 18 ºC prevailed, and 400 l/ha of water was used for the treatment.

Variants used:

Variants	Commercial name	Dose	Time of use
Pendimetalin	Stomp 330 EC	5,0 l/ha	PRE-em
Linuron	Linurex 50 EC	2,5 l/ha	PRE-em
metobromuron	Proman 50 SC	3,0 l/ha	PRE-em
metobromuron	Proman 50 SC	4,0 l/ha	PRE-em
Metribuzin	Metrex WG 70	0,75 kg/ha	PRE-em
Metribuzin	Metrex WG 70	1,0 kg/ha	PRE-em
absolute control	-//-	-//-	-//-
mechanical control	-//-	-//-	-//-

The floristic structure of the weeds was determined according to the square method, respectively by counting the weeds per unit of surface (1 m2) in the treated variants and the absolute control variant. The efficiency coefficient was determined according to the method of Dodel et.al. (1967).
The eventual phytotoxicity is determined visually according to the scale from 1-9 proposed by EWRS.

3. Results and discussion

The structure of weeds consisted of 9 types of grasses with 126 plants/m2, of which narrow-leaved grasses were dominant with 95.4 plants/m2 or 75.7%, while broad-leafed grasses were present with 30.6 plants/m2 or 24, 3%.
The dominant weeds were *Echinochloa crus-galli* with 93.7 plants/m2 or 74.4%, *Polygonum lapathifolium* with 10.0 plants/m2 or 7.9%, *Polygonum aviculare* with 9.3 plants/m2 or 7.4 % etc. Regarding the way of life of weeds, out of 9 types of weeds, 8 types or 88.9% are therophytes, while 1 type, or 11.1% are geophytes.

Efficacy of herbicides

Variants / Type of weeds	1	2		3		4		5		6		7	
	Nr	Nr	EK	Nr	EK	Nr	EK	Nr	EK	Nr	EK	Nr	EK
Echinochloa crus-galli	93,7	2,3	97,5	4,0	95,7	3,3	96,5	1,7	98,2	2,3	97,5	1,7	98,2
Chenopodium album	7,3	-	100	-	100	-	100	-	100	-	100	-	100
Amaranthus retroflexus	2,7	-	100	-	100	-	100	-	100	-	100	-	100
Polygonum aviculare	9,3	-	100	-	100	-	100	-	100	-	100	-	100
Polygonum lapathifolium	10,0	-	100	-	100	-	100	-	100	-	100	-	100
Anagali sarvense	1,0	-	100	-	100	-	100	-	100	-	100	-	100
Setaria viridus	0,7	-	100	-	100	-	100	-	100	-	100	-	100
Xanthium strumarium	0,3	-	100	-	100	-	100	0,7	-	0,3	-	0,3	-
*Sorgum halepense**	1,0	1,3	-	3,0	-	2,7	-	1,3	-	2,3	-	1,7	-
Dicotyledons	30,6	-	-	-	-	-	-	0,7	-	0,3	-	0,3	-
Efficacy	-	-	100	-	100	-	100	-	97,7	-	99,0	-	99,0
Monocotyledons	94,4	2,3	-	4,0	-	3,3	-	1,7	-	2,3	-	1,7	-
Efficacy	-	-	97,6	-	95,8	-	96,5	-	98,2	-	97,6	-	98,2
Without geophytes	125	2,3	-	4,0	-	3,3	-	2,4	-	2,6	-	2,0	-
Efficacy	-	-	98,2	-	96,8	-	97,4	-	98,1	-	97,9	-	98,4

** Geophytes were not taken into account when calculating the efficiency*

EK-Efficiency coefficient

Nr-number of plants per m2

The variants involved in the experiment:

1-control
2-pendimetalin 5,0 l/ha
3-linuron 2,5 l/ha
4- metobromuron 3 l/ha
5- metobromuron 4 l/ha
6- metribuzin 0,75 kg/ha
7- metribuzin 1,0 kg/ha

The efficiency in combating dicotyledonous weeds has been 97.7% in the variant metobromuron 4.0 l/ha to 100% in the variants pendimethalin 5.0 l/ha, linuron 2.5 l/ha and metobromuron 3 l/ha. The efficiency in combating monocotyledonous weeds was from 95.8% in the linuron variant 2.5 l/ha to 98.2% in the metribuzin variant 1.0 kg/ha. While the overall efficiency was from 96.8% in the linuron variant to 98.4% in the metribuzin 1.0 kg/ha variant.

Yield per plant gr/plant and yield per hectare t/ha

Variants	Yield/ plant in gr.				Yield /ha in ton			
	Repetition				Repetition			
	I	II	III	Average	I	II	III	Average
Pendimetalin	580	510	638	576	25.1	22.1	27.6	24.9
Linuron	520	480	612	573	22.5	24.8	26.6	24.6
Metobromuron 3 l/ha	584	584	502	557	25.3	25.3	21.7	24.1
Metobromuron 4 l/ha	512	580	640	577	22.1	25.1	27.5	24.9
Metribuzin 0,75 kg/ha	604	624	586	605	26.1	27.1	25.4	26.2
Metribuzin 1,0 kg/ha	705	686	654	682	30.5	29.7	28.3	29.5
Mechanical control	512	486	420	473	22.2	21.1	18.2	20.5
Absolute control	280	320	340	313	12.1	13.8	14.8	13.6

Based on the obtained results, it appears that the highest average yield per potato plant was achieved in the metribuzin variant 1 kg/ha and 682 gr/plant, while the lowest yield was achieved in the metobromuron 3 l/ha variant and 557 gr/plant. Even the yield/hectare was higher in the metribuzin 1 kg/ha variant and 29.5 t/ha, while the lowest was in the metobromuron 3 l/ha variant and 24.1 t/ha.

4. Conclusions and recommendation

According to the obtained results, the following conclusions can be drawn:

1. The structure of the weeds consisted of 9 types of weeds with 126 plants/m2 (with geophytes) of which narrow-leaved weeds were dominant with 95.4 plants/m2 or 75.7% (with geophytes), while broad-leafed weeds were present with 30 .6 plants/m2 or 24.3%.
2. The dominant weeds were *Echinochloa crus-galli* with 93.7 plants/m2 or 74.4%, *Polygonum lapathifolium* with 10.0 plants/m2 or 7.9%, *Polygonum aviculare* with 9.3 plants/m2 or 7.4% etc. Regarding the life form out of 9 types of weeds, 8 types or 88.9% are therophytes, while 1 type or 11.1% are geophytes.
3. The efficiency in combating dicotyledonous weeds has been 97.7% in the variant metobromuron 4.0 l/ha to 100% in the variants pendimetalin 5.0 l/ha, linuron 2.5 l/ha and metobromuron 3 l/ha.
4. The efficiency in combating monocotyledonous weeds was from 95.8% in the linuron variant 2.5 l/ha to 98.2% in the metribuzin variant 1.0 kg/ha.
5. While the overall efficiency was from 96.8% in the linuron variant to 98.4% in the metribuzin variant 1.0 kg/ha.
6. Based on the obtained results, the highest average yield per potato plant was achieved in the metribuzin variant 1 kg/ha and 682 gr/plant, while the lowest yield was achieved in the metobromuron 3 l/ha variant and 557 gr. / plant. Even the yield per hectare was higher in the metribuzin 1 kg/ha variant and 29.5 t/ha, while the lowest in the metobromuron 3 l/ha variant and 24.1 t/ha.
7. All the herbicides used did not reflect signs of phytotoxicity in the treated plants.

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