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Professional paper

EVALUATION OF THE EFFECTIVENESS OF DIFFERENT HERBICIDES IN COMBATING WEEDS IN BEAN (PHASEOLUS VULGARIS. L.) AND THEIR INFLUENCE ON YIELD

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ABSTRACT

Even beans as an agricultural crop, among others, compete with different types of weeds. To find a solution for the reduction of weeds in the bean culture, in the locality Sellarcë e Eperme-Tetovo, in the Polog region, a field experiment was set up as a randomized block design with three repetitions and the size of the plot was 21 m2. In the experiment, the number of weeds per m2, the structure of weeds, the rate of appearance, the efficiency of herbicides, the impact on yield, and the phytotoxicity of herbicides on the bean plant have been studied. The following treatments were included in the experiment: pendimethalin 5.0 l/ha, linuron 2.5 l/ha dimethenamid-p+pendimethalin 3.5 l/ha, metobromuron 3.0 l/ha, dimethenamid+terbuthylazine 4.0 l /ha, metobromuron 4.0 l/ha, pendimethalin+linuron 5.0+2.5 l/ha, absolute controls, and mechanical controls. The results showed that the structure of the barrows consists of 8 types of barrows, of which one type is from the group of monocotyledonous barrows and seven types from the group of dicotyledonous barrows. The number of barrows was 627.7 plants/m2. The dominant weeds were: Solanum nigrum with 550.7 plants/m2 or 87.7%, Echinochloa crus-galli with 37.3 plants/m2 or 5.9%, and Amaranthus retroflexus with 22.3 plants/m2 or 3.5 %.
The efficiency of herbicides in the fight against dicotyledon weeds was 83.3-96.4%, monocotyledon weeds 60.6-92.5%, and the overall efficiency was 83.0-96.2%. Regarding the phytotoxicity in the bean culture, no signs of phytotoxicity were observed from any of the herbicides used.

Keywords: dominant, monocotyledons, efficiency, phytotoxicity.

INTRODUCTION

The bean (*Phaseolus vulgaris.L.*) is a crop that occupies an important place in human nutrition because it is part of crops with high nutritional values. It is used as boiled or semi-boiled and preserved. It is cultivated in tropical, subtropical, and Mediterranean climates. It is cultivated in latitudes north of 60º to latitudes south of 50º. According to the FAO notes, the total world surface of beans is about 27 million ha. The largest producers are: China, India, Brazil, USA, while in Europe the largest producers are: Italy, France, Romania, Spain, and Hungary. The bean seed contains a high amount of protein, therefore it is counted in the group of protein vegetables. The average protein content ranges from 28-33%. It also contains 1.5-5.0% fat, 56-58% carbohydrates, 3-7% cellulose, etc.

In the Republic of North Macedonia, beans are cultivated on an area of about 1200 ha, mainly in the region of Polog, accompanied by corn, but also as a pure crop.

MATERIALS AND METHODS

The purpose of the experiment was to determine the structure of weeds in the Pollog region, the efficacy of herbicides, their impact on yield and the phytotoxicity of herbicides in bean culture. The experiment is set up according to the randomized block system with three replications with experimental plot sizes of 21m2, where the following treatment variants are included:

Variants used:

Variants	Trade name	Doses	Time of use
Pendimetalin	Stomp 330 EC	5,0 l/ha	PRE em
Linuron	Linurex 50 EC	2,5 l/ha	PRE em
12,5 g/l dimetenamid-p +250 g/l pendimetalin	Ving * P	3,5 l/ha	PRE em
Metobromuron	Proman 50 SC	3,0 l/ha	PRE em
280 g/l dimetenamid +250 g/l terbutilazin	Akris	4,0 l/ha	PRE em
Metobromuron	Proman 50 SC	4,0 l/ha	PRE em
Pendimetalin+linuron	Stomp + Linurex	5+2,5 l/ha	PRE em
Absolute kontrol	-//-	-//-	-//-
Mechanical control	-//-	-//-	-//-

Planting was carried out on May 01, 2017. Also, the treatment was done on May 01, 2017. During the treatment, calm and warm weather of 22 ºC prevailed and 400 l/ha of water was used for the treatment.
The floristic structure of the barrows was determined according to the square method, respectively by counting the barrows per unit of surface area (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.

RESULTS AND DISCUSSION

The structure of weeds consisted of 8 types of њеедс with 627.7 plants/m2, of which dicotyledons weeds were dominant with 590.4 plants/m2 or 94.1%, while monocotyledons weeds were present with 37.3 plants/m2 or 5, 9%. The dominant grass was *Solanum nigrum* with 550.7 plants/m2 or 87.7%, *Echinochloa crus-galli* with 37.3 plants/m2 or 5.9%, *Amaranthus retroflexus* with 22.3 plants/m2 or 3.5%, etc. Regarding the way of life of the 8 types of grasses, all types are therophytes.

The effectiveness of herbicides 14 days after application

Variants / Tipes of weeds	Control	Stomp 330 EC-5 l/ha		Linurex 50 SC 2,5 l/ha		Ving P * 3,5 l/ha		Proman 3,0 l/ha		Akris 4,0 l/ha		Proman 4,0 l/ha		Stomp 330 +Linurex 50 5+2,5 l/ha	
	Nr.	Nr.	KE	Nr.	KE	Nr.	KE	Nr.	KE	Nr.	KE	Nr.	KE	Nr.	KE
Solanum Nigrum	550,7	89,0	83,8	59,7	89,2	70,7	87,2	82,3	85,1	21,3	96,1	59,7	89,2	98,8	82,1
Echinochloa crus-galli	37,3	9,7	74,1	14,7	60,1	10,3	72,4	12,7	69,6	2,8	92,5	8,3	77,8	5,7	84,7
Amaranthus retroflexus	22,3	-	100	-	100	-	100	-	100	-	100	1,3	94,2	-	100
Chenopodium album	2,0	-	100	-	100	-	100	-	100	-	100	-	100	-	100
Xanthium strumarium	9,7	8,0	17,5	3,0	69,1	1,3	86,6	1,3	86,6	-	100	-	100	-	100
Polygonum lapathifolium	1,7	-	100	0,3		-	100	-	100	-	100	-	100	-	100
Polygonum convolvulus	2,0	-	100	-	100	-	100	-	100	-	100	-	100	-	100
Datura stramonium	2,0	-	100	-	100	-	100	-	100	-	100	-	100	-	100
Dicotyledons	**590,4**	**97,0**	-	**63,0**	-	**72,0**	-	**83,6**	-	**21,3**	-	**61,0**	-	**98,8**	-
Efficiency %	-	-	**83,6**	-	**89,3**	-	**87,8**	-	**85,8**	-	**96,4**	-	**89,7**	-	**83,3**
Monocotyledons	**37,3**	**9,7**	-	**14,7**	-	**10,3**	-	**12,7**	-	**2,8**	-	**8,3**	-	**5,7**	-
Efficiency %	-	-	**74,0**	-	**60,6**	-	**72,4**	-	**65,9**	-	**92,5**	-	**77,7**	-	**84,7**
Total weeds	**627,7**	**106,7**	-	**77,7**		**82,3**	-	**96,3**	-	**24,1**	-	**69,3**	-	**104,5**	-
Efficiency %	-	-	**83,0**	-	**87,6**	-	**86,9**	-	**84,7**	-	**96,2**	-	**89,0**	-	**83,3**

The efficacy of herbicides 14 days after treatment in the fight against dicotyledonous weeds was 83.3-96.4%, the effectiveness of combating monocotyledonous weeds was 60.6-92.5%, while the overall efficiency was from 83-96.2%.

The effectiveness of herbicides 18 days after application

Variants / Tipes of weeds	Controls	Stomp 330 EC-5 l/ha		Linurex 50 SC 2,5 l/ha		Ving P* 3,5 l/ha		Proman 3 l/ha		Akris 4,0 l/ha		Proman 4l/ha		Stomp 330 +Linurex 50 5+2,5 l/ha	
	Nr.	Nr.	KE	Nr.	KE	Nr.	KE	Nr.	KE	Nr.	KE	Nr.	KE	Nr.	KE
Solanum Nigrum	550,7	89,0	83,3	65,3	88,1	60,0	89,1	103,1	81,3	13,3	97,6	97,0	82,4	46,0	91,6
Echinochloa crus-galli	37,3	9,7	74,0	14,7	60,6	7,3	80,4	11,7	68,6	1,7	95,4	8,0	78,5	5,7	84,7
Amaranthus retroflexus	22,3	-	100	1,0	95,5	1,0	95,5	0,7	96,8	-	100	-	100	-	100
Chenopodium album	2,0	-	100	-	100	-	100	-	100	-	100	-	100	-	100
Xanthium strumarium	9,7	8,0	17,5	2,3	76,3	0,7	92,8	1,7	82,5	-	100	0,3	96,9	0,3	96,9
Polygonum lapathifolium	1,7	-	100	0,7	58,8	-	100	0,4	76,5	0,7	58,8	0,3	82,3	-	100
Polygonum convolvulus	2,0	-	100	-	100	0,3	85,0	-	100	-	100	-	100	-	100
Datura stramonium	2,0	-	100	-	100	-	100	-	100	-	100	-	100	-	100

Dicotyledons	**590,4**	**97,0**	**-**	**69,3**	**-**	**62,0**	**-**	**113,1**	**-**	**19,7**	**-**	**97,4**	**-**	**46,3**	**-**
Efficiency %	-	-	**83,6**	**-**	**88,3**	**-**	**89,5**	**-**	**80,8**	**-**	**96,7**	**-**	**83,5**	**-**	**92,1**
Monocotyledons	**37,3**	**9,7**	**-**	**14,7**	**-**	**7,3**	**-**	**11,7**	**-**	**1,7**	**-**	**8,0**	**-**	**5,7**	
Efficiency %	-	-	**74,0**	**-**	**60,6**	**-**	**80,4**	**-**	**68,6**	**-**	**95,4**	**-**	**78,6**	**-**	**84,7**
Total weeds	**627,7**	**106,7**	**-**	**84,0**	**-**	**69,3**	**-**	**124,8**	**-**	**21,4**	**-**	**105,6**	**-**	**52,0**	
Efficiency %	-	-	**83,0**	**-**	**86,6**	**-**	**88,9**	**-**	**80,1**	**-**	**96,6**	**-**	**83,2**	**-**	**91,7**

Average number of plants per ha 100,000

The evaluation of the efficiency after 28 days resulted in the following: efficiency against dicotyledons weeds 80.8-96.7%, efficiency against monocotyledons weeds 60.6-95.4%, overall efficiency 80.1-91.7%.

Yield kg/plant and kg/ha

Variants	Yeld/ plant in gr.				Yeld/ha in ton			
	Repetition				Repetition			
	I	II	III	Mes.	I	II	III	Mes.
Absolut controls	8	5	5	**6**	0.8	0.5	0.5	**0.6**
Mechanical controls	18	22	18	**13**	1.8	2.2	1.8	**1.8**
Pendimetalin	26	20	26	**24**	2.6	2.0	2.6	**2.4**
Linuron	28	22	30	**27**	2.8	2.2	2.0	**2.7**
Dimetenamid-p +pendimetalin	32	34	28	**31**	3.2	3.4	2.8	**3.1**
Metobromuron 3 l/ha	32	22	28	**27**	3.2	2.2	2.8	**2.7**
Dimetenamid+terbutilazin	38	36	30	**35**	3.8	3.6	3.0	**3.5**
Metobromuron 4 l/ha	24	30	36	**30**	2.4	3.0	3.6	**3.0**
Pendimetalin+linuron	30	24	38	**31**	3.0	2.4	3.8	**3.1**

Based on the obtained results, it appears that the highest average yield per bean plant has been achieved in the dimethenamid+terbuthylazine variant, 35 g/plant, while the lowest yield has been achieved in the pendimetalin variant, 24 g/plant. Even the yield per hectare was higher in the dimethenamid+terbuthylazine variant, 3.5 t/ha, while the lowest yield was achieved in the pendimetal variant, 2.4 t/ha.

CONCLUSION

1. The structure of grasses consisted of 8 types of grasses with 627.7 plants/m2 of which the dominant were dicotyledonous grasses with 590.4 plants/m2 or 94.1% while monocotyledonous grasses were present with 37.3 plants/m2 or 5.9%.
2. The dominant grass was Solanum nigrum with 550.7 plants/m2 or 87.7%, Echinochloa crus-galli with 37.3 plants/m2 or 5.9%, Amaranthus retroflexus with 22.3 plants/m2 or 3.5%.
3. Regarding the way of life of the 8 types of grasses, all types are therophytes.
4. The effectiveness of herbicides 14 days after treatment in the fight against dicotyledonous weeds was 83.3-96.4%, the effectiveness of fighting monocotyledonous weeds was 60.6-92.5%, while the overall efficiency was from 83-96.2%.

5. The evaluation of efficiency after 28 days resulted as follows: efficiency against dicotyledonous weeds 80.8-96.7%, efficiency against monocotyledonous weeds 60.6-95.4%, overall efficiency 80.1-91.7%.
5. The highest yield was achieved in the dimethenamid+terbuthylazine variant, 3.5 t/ha, while the lowest yield was in the pendimetal variant, 2.4 t/ha.

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