



EFFECTS OF HERBICIDES ON BARLEY SEEDS GERMINATION DEPENDING ON GROWTH STAGE

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Abstract

An experiment was carried out including three barley varieties (Reks, NS 293 and Egej), treated with six herbicides (2,4-D, MCPP+dicamba, triasulfuron+dicamba, 2,4-D+florasulam, amidosulfuron+iodosulfuron and florasulam+flumetsulam) in the three different growth stages (tillering, first node and second node). The aim of this experiment was to consider the influence of herbicides (applied in different growth stages) on germination of barley seeds.

In all experimental years herbicides did not significantly influence barley seed germination. The growth stage during herbicide application did not affect germination of barley. If conditions do not allow herbicides to be used in the optimal period, it can be used until second node stage, without having a negative impact on the barley seeds germinations.

Key words: *barley, varieties, herbicides, growth stages, seeds germination*

INTRODUCTION

Barley (*Hordeum sativum* Jessen) in the Republic North Macedonia is grown on about 47 500 ha with average yield of 3 440 kg/ha Anonymous (2009). It is the second cultivated crop right after the wheat. It is grown as continuous crop two to three years. Because of that, barley production is disturbed by weed infestation. In barley losses due to competitive effects of weeds estimated at 15-25% of potential production. Contemporary chemical weed control in barley and wheat begins after Second World War. Since then over 50 a. i. are synthesized for selective weed control in barley and wheat. Most of the herbicides which are used in barley and wheat is foliar and tillering is optimum growth stage for application. According Folley (1985), barley is more sensitive to herbicides than wheat. Various herbicides has various influence on barley, dependent on barley varieties and the growing stages during the application. Tottman (1976), emphasizes that the knowing of growth stages during the herbicides application is of the high importance. By using the herbicides

in advance growth stages barley sensitivity can be increased and barley yield elements can be reduced Allien (1966), Markovich (1978), (Rinella et al, 2001). (Friesen et al.,1964, 1968) found that in cereals the negative influence of dicamba was increased if it is applicated in later growth stages. Barley seed production in North Macedonia is present on 1019 ha with average yield of 6 000 kg/ha. Seed germination of barley is very important for quality seed production and also, for determining correct seeding rate.

There is little data about the impact of herbicides on wheat and barley seed germination. Randy (1986), emphases that wheat seed germination was not affected by metribuzine and chlorsulfuron and their combination, but metribuzine when applied alone reduced coleoptile growth of Vona variety seed.

According to this an experiment was carried out to consider the influence of herbicides on barley seeds germination depend on growth stage.

MATERIAL AND METHODS

Field trial was conducted at the Agriculture institute in Skopje. The experimental design was randomized complete block with four replicates, and harvest plot size of 16 m². The trial was three factorial (Factor 1-herbicides, Factor 2-varieties and Factor 3-barley growth stages during herbicides application). The studies were carried

out with three barley varieties Reks, NS 293 and Egej which were seeded with seedling rate of 300 kg/ha on October 19th (1st year), November 4th (2nd year) and November 13th (3rd year). The harvest was carried out with plot combine Wintersteiger on June 22th (1st year), July 3th (2nd year) and July 18th (3rd year).

Table 1. Variants of the trial.

Variants – active ingredient (a.i.)	Rate	Time of application
Weed free control	/	/
2,4-D	1 L/ha	I, II, III*
MCPP+dicamba	4 L/ha	I, II, III*
Triasulfuron+dicamba	100 g/ha	I, II, III*
2,4-D+florasulam	0.5 L/ha	I, II, III*
Amidosulfuron+iodosulfuron	0.25 kg/ha	I, II, III*
Florasulam+flumetsulam	60m L/ha	I, II, III*

*I-tillering, II- first node, III- second node

All herbicides were applied with CO²-pressurized backpack sprayer with 300L/ha water.

Seeds germination was measured according to ISTA methods. The data were subjected to statistical analysis applying LSD-test.

RESULTS AND DISCUSSION

In 1st year (Table 2) barley seed germination was ranged from 96,0 % at NS 293 variety treated with 2,4D+florasulam at second node stage to 97,8 % at Reks variety treated

with MCPP+dicamba at tillering stage. The investigated herbicides did not significantly influence the barley seed germination.

Table 2. Influence of herbicides on barley seeds germination (1st year).

Variants	Varieties								
	Reks			NS 293			Egej		
	Tillering	First node	Second node	Tillering	First node	Second node	Tillering	First node	Second node
	%	%	%	%	%	%	%	%	%
Weed free control	97.3	97.3	97.3	96.0	96.0	96.0	96.8	96.8	96.8
2,4-D	96.3	96.3	96.5	96.5	96.8	96.8	96.8	97.5	96.5
MCPP+dicamba	97.8	96.3	96.5	97.3	97.0	97.3	96.5	97.0	96.0
Triasulfuron+dicamba	96.5	97.0	96.3	96.8	96.8	96.5	96.8	96.3	96.5
2,4-D+florasulam	96.5	96.3	96.5	97.0	96.5	96.0	96.5	96.3	97.5
Amidosulfuron+iodosulfuron	96.3	96.3	97.0	96.3	97.3	97.0	97.0	97.3	96.8
Florasulam+flumetsulam	96.5	96.5	97.0	96.8	97.3	97.0	96.8	96.3	97.3
LSD 0.05	1.7	2.2	2.0	1.4	1.3	1.6	1.9	1.9	1.9
LSD 0.01	2.3	3.0	2.7	2.0	1.8	2.1	2.5	2.5	2.6

In 2nd year (Table 3) the highest barley seed germination (98,8%) was measured at NS 293 variety treated with amidosulfuron + iodosulfuron at tillering stage. Lowest barley seed germination (97,0 %) was measured at NS 293 variety treated with 2,4-D at first and second

node stage and amidosulfuron+iodosulfuron at first node stage, also at Egej variety treated with 2,4-D+florasulam and florasulam+flumetsulam at first node stage. The investigated herbicides did not significantly influence the barley seed germination.

Table 3. Influence of herbicides on barley seeds germination (2nd year).

Variants	Varieties								
	Reks			NS 293			Egej		
	Tillering	First node	Second node	Tillering	First node	Second node	Tillering	First node	Second node
	%	%	%	%	%	%	%	%	%
Weed free control	97.8	97.8	97.8	98.0	98.0	98.0	98.0	98.0	98.0
2,4-D	98.3	97.8	97.8	97.8	97.0	97.0	97.5	97.5	97.3
MCP+dicamba	97.8	98.0	97.8	97.5	98.0	97.8	98.3	97.8	97.3
Triasulfuron+dicamba	97.5	98.0	97.5	97.8	97.5	97.0	97.3	97.3	97.8
2,4-D+florasulam	97.8	97.5	97.8	97.8	97.3	96.8	97.3	97.0	97.3
Amidosulfuron+iodosulfuron	97.5	97.8	98.0	98.8	97.0	97.5	97.5	97.8	97.5
Florasulam+flumetsulam	97.5	97.5	97.8	97.5	98.0	97.5	97.8	97.0	97.8
LSD 0.05	1.6	1.1	1.1	1.4	1.4	1.6	1.5	1.5	1.3
LSD 0.01	2.1	1.5	1.5	1.9	1.9	2.1	2.0	2.0	1.8

In 3rd year (table 4) the highest barley seed germination (97,5%) was measured at NS 293 variety treated with 2,4-D at first node stage, also, at Reks variety treated with florasulam+flumetsulam at second node stage. Lowest barley seed germination (95,8%)

was measured at NS 293 variety treated with florasulam+flumetsulam at second node stage. Also in this year the investigated herbicides did not significantly influence the barley seed germination.

Table 4. Influence of herbicides on barley seeds germination (3rd year.)

Variants	Varieties								
	Reks			NS 293			Egej		
	Tillering	First node	Second node	Tillering	First node	Second node	Tillering	First node	Second node
	%	%	%	%	%	%	%	%	%
Weed free control	97.0	97.0	97.0	96.8	96.8	96.8	97.5	97.5	97.5
2,4-D	96.3	96.5	96.3	96.8	97.5	96.5	96.8	96.5	96.5
MCP+dicamba	97.0	96.3	96.5	97.0	96.8	97.0	96.5	97.0	97.0
Triasulfuron +dicamba	96.8	96.8	97.0	96.5	97.0	96.8	97.0	96.5	97.0
2,4-D+florasulam	96.8	96.8	96.8	96.8	97.0	96.8	97.3	97.0	97.3
Amidosulfuron+iodosulfuron	96.5	96.8	97.3	97.0	97.3	97.0	97.0	97.0	97.3
Florasulam+flumetsulam	96.5	97.0	97.5	97.0	97.3	95.8	97.3	96.8	96.8
LSD 0.05	1.4	1.2	1.5	1.4	1.1	1.5	1.3	1.2	1.2
LSD 0.01	1.8	1.7	2.1	1.9	1.6	2.0	1.8	1.6	1.6

There is no differences between growth stages during the herbicide applications in all three years of testing (Table 5), so growth stages have no impact on barley seed germination. Similar results were reported by

(Danica et al.,1987) where examined herbicides do not have negative impact on wheat seed germination treated in tillering and shooting stage.

Table 5. Influence of growth stages on barley seeds germination.

	Average of all herbicides								
	1 st year			2 nd year			3 rd year		
	Reks	NS 293	Egej	Reks	NS 293	Egej	Reks	NS 293	Egej
	%	%	%	%	%	%	%	%	%
Tillering	96.6	96.8	96.7	97.7	97.8	97.6	96.6	96.8	97.0
First node	96.4	96.9	96.8	97.8	97.5	97.4	96.7	97.1	96.8
Second node	96.6	96.8	96.8	97.8	97.3	97.5	96.9	96.6	97.0

According Spasic (1972), the investigated herbicides including 2,4-D, MCPA, MCPA+dicamba and terbutrin have not negative impact on wheat seed germination.

Germination of galt barley variety was not affected by treating parent plants with MCPA, 2,4-D and metribuzine (Jeffery and John, 1984)

CONCLUSIONS

Based of the obtained results it can be concluded that the influence of herbicides on barley seed germination is not dependent on the growth stages during the application. If

conditions do not allow herbicides to be used in the optimal period, it can be used no later than second node stage, without having a negative impact on the barley seed germination.

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ВЛИЈАНИЕ НА ХЕРБИЦИДИТЕ НА 'РТЛИВОСТА НА ЈАЧМЕНОТ ВО ЗАВИСНОСТ ОД ФАЗАТА НА ПОРАСТ

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Резиме

Во текот на три години беа изведени испитувања кај три сорти јачмен (*рекс*, *НС 293* и *егеј*) со 6 хербицидни варијанти (2,4-Д, МЦПП+дикамба, триасулфурон+дикамба, 2,4-Д+флорасулам, амидосулфурон+јодсулфурон и флорасулам+флуметсулам) во три различни фази на пораст (братење, прво коленце и второ коленце).

Целта на овој експеримент беше да се утврди влијанието на хербицидите аплицирани во три различни фази на пораст врз 'ртливоста на јачменот.

Во трите години на испитување хербицидите не влијааа врз 'ртливоста на јачменот. Исто така, фазите на пораст на јачменот за време на третирањето немаа влијание врз 'ртливоста на семето јачмен. Ако условите не дозволуваат хербицидите да се употребат во оптималниот период, тие може да се аплицираат до фаза појава на второ коленце без да имаат негативно влијание врз 'ртливоста на јачменот.

Клучни зборови: *јачмен, сорти, хербициди, фази на пораст, 'ртливост*