

BIOLOGICAL EFFECT OF SOME SOIL HERBICIDES IN VIRGINIA TOBACCO

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ABSTRACT

During 2008-2009, a randomized field experiment was conducted with 4 soil herbicides on an alluvial-meadow soil in the village Karadzhhalovo, Bulgaria. The experiment was conducted with flue cured tobacco variety Virginia 0454, on a soil which had been previously planted with wheat. It consisted of Devrinol 4 F at a dose 4,0 l/ha (a.s. napropamide); Pronin 720 EC at a dose 2,5 l/ha (a.s. propizohlor); Stomp New 33 EC at a dose 4,0 l/ha (a.s. pendimethalin); Harness at doses 1,5 l/ha and 2,5 l/ha (a.s. acetochlor).

In the areas with herbicides, one mechanized processing in line spacings and one hand hoeing in the rows were carried out. In the control without herbicides, two mechanized and two manual handlings of the soil were made. The preparations were applied 24 hours before the tobacco planting without incorporation.

Stomp New 33 EC in a dose 4,0 l/ha and Pronin 720 EC in a dose 2,5 l/ha showed very good to excellent efficacy against susceptible annual weeds. Pendimethalin and propizohlor help to increase the yield from 39,58% to 40,47% and to increase the average percentage of 1st class Virginia tobacco for 6,5%. When conditions for growth and development of flue cured tobacco are more favorable, the application of herbicides has less effect on yield increase. The application of soil herbicides before tobacco planting allows a reduction of manual and mechanical hoes, without an adverse effect on the culture.

Key words: herbicides, Devrinol 4F, Stomp 33 EC, Harness, Pronin 720 EC, virginia tobacco, weeds

БИОЛОШКИОТ ЕФЕКТ НА НЕКОИ ПОЧВЕНИ ХЕРБИЦИДИ ВРЗ ТУТУНОТ ОД ТИПОТ ВИРЦИНИЈА

Во селото Карацалово, Бугарија (2008-2009) извршен е рандомизиран полски експеримент со 4 почвени хербициди на алувијално-ливадска почва со тутун од сортата вирцинија 0454 (на површина на која претходно е одгледувана пченица): Devrinol 4F со доза од 4,0 l/ha (а.м. napropamide); Pronin 720 EC со доза 2,5 l/ha (а.м. propizohlor); Stomp (New) 33 EC со доза од 4,0 l/ha (а.м. pendimethalin); Harness со доза од 1,5 l/ha и 2,5 l/ha (а.м. acetochlor). На третираните површини беше извршено едно механизирано меѓуредово окопување и едно рачно окопување во редовите. Во контролата без хербициди беа извршени 2 механизирани и 2 рачни окопувања на почвата. Препаратите беа аплицирани 24 часа пред расадувањето на тутунот, без инкорпорација.

Stomp (New) 33 EC со доза од 4,0 l/ha и Pronin 720 EC со доза од 2,5 l/ha имат добра до одлична ефикасност против едногодишните плевели. Пендиметалинот и пропизохлорот овозможува зголемување на приносот од 39,58% до 40,47 %, како и зголемување на процентот на 1-та класа на тутунот во просек од 6,5 %. Кога условите за раст и развиток на вирцинијата

се поповолни, примената на хербицидите има помал ефект врз зголемувањето на приносот. Примената на почвените хербициди пред садењето на тутунот овозможува намалување на рачните и механизираниите окопувања, без какви било негативни ефекти на културата.

Клучни зборови: хербициди, Devrinol 4F, Stomp 33 EC, Harness, Pronin 720 EC, тутун од типот вирџинија, плевели

INTRODUCTION

The tobacco production in Bulgaria includes many manual operations. This makes this sector of Bulgarian agriculture insufficiently profitable and competitive. One of the mandatory elements of the new, more efficient and modern technologies is the streamlining of the systems for pest management in tobacco against the weeds.

According to FAO, the losses caused by weeds in tobacco in the world amounted to 37% of total production. The results of experiments in Bulgaria, conducted in different ecological conditions indicate that this percentage is even higher and reached 42 points. When the weed density is even 2 - 3 numbers weeds/m² during the growing season of the crop, the yield falls from 14% to 18%. The harmful effect of the weeds in tobacco is not only a reduction of the yield. The weed infestation affects the quality of production and makes difficult or impossible the mechanization of the production and supporting the development of diseases and pests.

The chemical control against the weeds in comparison with the mechanical destruction methods has significant advantages. The chemical

method is more effective compared to mechanical processing of the rows and hand hoeing. The herbicides allow the application of a rational technology for growing of the crops. That is one of the main factors for determination of the quality of tobacco leaves / 2, 5, 6 /.

Therefore, the continuous streamlining of the systems for weed control in tobacco is not only of scientific but also of important practical significance.

Furthermore, the use of environmentally friendly systems of herbicides is an integral part of the good plant protection practice in any culture. Solving the problem of weeds in tobacco requires regular review of new herbicides, of their biological efficacy and their influence on the yield and the quality of the culture.

The aim of the study was to establish the biological effectiveness and the spectrum of action on 4 soil herbicides in Virginia tobacco, to study the influence of herbicides on tobacco yield and the quality and to explore opportunities to reduce the vegetation treatments of soil by the use of herbicides.

MATERIAL AND METHODS

The field experiments were conducted during 2008 – 2009 year on alluvial-meadow soil in the village Karadzalovo, Bulgaria in flue-cured tobacco variety Virginia 0454, after wheat as a precrop. The humus content in the test area at depths of 0 to 30 cm averaged 2,5 %. The field moisture of the soil at the time of treatment was 34-36%.

The random field experiment included six options in four replications. The size of the test area was 100 m² (Barov, Shanin, 1965). Four soil herbicides were investigated: Devrinol 4 F in a

dose 4, 0 l / ha (a.s. napropamide); Pronin 720 EC in a dose 2,5 l / ha (a.s. propizohlor); Stomp New 33 EC in a dose 4,0 l / ha (a.s. pendimethalin); Harness at doses of 1,5 l / ha and 2,5 l / ha (a.s. acetochlor). The control was without herbicides. One mechanized processing in the line spacing and one hand hoeing in the rows have being made in the areas with herbicides. Two mechanized and two manual handlings of the soil were carried out in the control areas. The herbicides were brought 24 hours before the tobacco planting without incorporation. The treatment was carried out

with a knapsack sprayer at expense of working solution 300 l / ha.

The yield was statistically processed by analysis of variance (Zapryanov, Marinkov, 1978). The proof of the differences between the versions is established by Duncan test (1995, cit. Johnson, 2008) at a significance level $\alpha=0,05$ (5%) and 0,01(1%). To establish the biological efficacy of the investigated herbicides the following indicators were reported: Species

composition of weeds - the reading on 28th and 45th day following the preparations at fixed sites 1 m², in four repetitions. Density of weeds - the reading is a quantitative method / number of weeds on 1 m² / on 28th and 45th day following the preparations at fixed sites 1 m², in four repetitions. To establish the impact of herbicides on tobacco, the following parameters were reported: Yield - kg/dka dry tobacco; Quality - I, II, III class in percentages.

RESULTS AND DISCUSSION

Stomp New 33 EC in a dose of 4,0 l/ha shows excellent efficacy in both years of the study. In 2008, 28 days after the introduction of the preparation, 96% to 98% sensitive weeds were killed (Table 1) and in 2009 – 94,5% to 97,5% of them (Table 2). At field conditions, Stomp New 33 EC demonstrated good duration of herbicide action. 45 days after the treatment, efficacy of the preparation was with score 1-2 by EWRS in both experimental years. At the same time, in plots without herbicides and with two hoes, weed infestation was 31,5 – 33,5% higher (Table 1 and 2). These data confirmed the results of other experiments that pendimetalin has excellent efficacy against *Digitaria sanguinalis* Scop., *Echinochloa crus-galli* L., *Setaria viridis* L.(P.B.) and *Setaria glauca* P.B. and very good efficacy against *Amaranthus retroflexus* L. and *Amaranthus blitoides* L., good efficacy against *Portulaca oleracea* L. and *Chenopodium album* L. *Abutilon theophrasti* Medic., *Xanthium strumarium* L. and *Datura stramonium* L. are resistant.

Pronin 720 EC in a dose of 2,5 l/ha shows very good efficacy against annual wheat weeds and very good efficacy against annual broad-leaf weeds. In 2008, 28 days after its submission, 95,5% to 97,5% of the weeds were killed. (Table 1) and in 2009 94% to 96% of them

(Table 2). 45 days after the treatment, efficacy of the preparation was with score 1-3 by EWRS in experimental years. At the same time, in the plots without herbicides and with two hoes, weed infestation was 28,5%–31,0% higher (Table 1 and 2).

Propizohlor, as demonstrated by other studies, has excellent efficacy against the annual wheat weeds - *Setaria* ssp., *D. sanguinalis*, *E. crus-galli*, and very good efficacy against *A. retroflexus* and *A. blitoides*. The effect is weaker against *P. oleracea* and *C. album*.

All herbicides were sprayed only 24 hours before planting without an incorporation, but they had no inhibitory effect on the growth and development of tobacco variety Virginia 0454.

Moreover, the application of Stomp New 33 and Pronin 720 EC allows the reduction of the manual and the mechanical hoeing without adverse effect on the weed infestation and on the culture.

It should be mentioned that Harness in a dose 2,5 l/ha caused some inhibition of growth and development of the culture, which has been overcome till the end of the vegetation period of tobacco.

Table 1. Biological efficacy of herbicide preparations in 2008

Herbicide preparations	Dose, l/ha	% of destroyed weeds						EWRS efficacy
		28 days after treatment			45 days after treatment			
		wheat weeds	broad-leaf weeds	average% of destroyed	wheat weeds	broad-leaf weeds	average% of destroyed	
Pronin 720 EC	2,5	97,5	95,5	96,5	95,0	93,0	94,0	1-2
Devrinol 4 F	4,0	91,5	94,5	93,0	90,0	94,0	92,0	1-3
Stomp New330 EC	4,0	98,0	96,0	97,0	97,0	96,0	96,5	1-2
Harness	1,5	94,0	91,0	92,5	88,0	86,0	87,0	2-4
Harness	2,5	97,5	93,0	95,5	91,0	85,0	88,0	1-4
Control	-	93,0	93,0	93,0	60,0	66,0	63,0	-

Table 2. Biological efficacy of herbicide preparations in 2009

Herbicide preparations	Dose, l/ha	% destroyed weeds						EWRS efficacy
		28 days after treatment			45 days after treatment			
		wheat weeds	broad-leaf weeds	average% of destroyed	wheat weeds	broad-leaf weeds	average% of destroyed	
Pronin 720 EC	2,5	96,0	94,0	95,0	94,0	90,0	92,0	2-3
Devrinol 4 F	4,0	90,0	92,0	91,0	89,0	92,0	90,5	2-4
Stomp New330 EC	4,0	97,5	94,5	96,0	95,0	95,0	95,0	1-2
Harness	1,5	92,0	92,0	92,0	89,0	89,0	89,0	2-4
Harness	2,5	94,0	94,0	94,0	92,0	91,0	90,5	2-4
Control	-	92,0	92,0	92,0	65,0	62,0	63,5	-

The results for the influence of the soil herbicides on yield and the quality of tobacco are presented in Table 3 and Table 4.

In 2008, the highest yield was obtained in options Stomp New 330 EC in a dose 4,0 l/ha. It was 269,7 kg/dka, which is 40,47% higher yield compared to the control. Pronin 720 EC increases the yield for 39,58%, compared to the control.

In 2009 the results were similar. The highest yield had Stomp New 330 EC - 333,8 kg/dka, followed by Pronin 720 EC - 293,0 kg/dka. It is noteworthy that in 2009 the relative increase of the yield was less. In the new version of Stomp 330 EC and Pronin 720 EC it is respectively 29,37% and 16,73%, compared to the control.

The analysis of these data shows that in the year with more favorable conditions for growth and development of tobacco, as well as in 2009, the positive effect of the herbicides on the yield of tobacco is less pronounced. For example, in 2008 the increase of the yield ranged from 0,78% to 40,47% and in 2009 - from 1,19% to 29,37%. The highest rate of tobacco 1st class in both years was obtained with variants Pronin 720 EC – 59,0% in 2008 and 55,5% in 2009, followed by Stomp New 33 EC - 57,5% in 2008 and 54,0% in 2009. The percentage of first class tobacco is higher in all variants treated with herbicides, compared to the untreated control.

Table 3 Yield and quality of tobacco variety Virginia 0454 in 2008

Herbicides preparations	Dose, l/ha	Yield of tobacco			quality of tobacco, %		
		kg/dka	distinction to the control	Relative yield, %	I class	II class	III class
Pronin 720 EC	2,5	268,0	76,0	139,58	59,0	29,0	12,0
Devrinol 4 F	4,0	266,7	74,7	138,90	55,0	32,0	13,0
Stomp New330 EC	4,0	269,7	77,7	140,47	57,5	34,5	8,0
Harness	1,5	261,9	69,9	136,40	54,0	30,5	15,5
Harness	2,5	193,5	1,5	100,78	40,0	25,0	35,0
Control		192,0		100	49,0	25,0	26,0

Table 4 Yield and quality of tobacco variety Virginia 0454 in 2009

Herbicides preparations	Dose, l/ha	Yield of tobacco			quality of tobacco, %		
		kg/dka	distinction to the control	Relative yield, %	I class	II class	III class
Pronin 720 EC	2,5	293,0	42,0	116,73	55,5	31,0	13,5
Devrinol 4 F	4,0	288,4	37,4	114,90	54,0	32,0	14,0
Stomp New330 EC	4,0	333,8	82,8	129,37	54,0	34,5	11,5
Harness	1,5	272,8	21,8	108,68	54,0	32,0	14,0
Harness	2,5	254,0	3,0	101,19	41,0	30,0	29,0
Control		251,0		100	49,5	30,0	20,5

CONCLUSIONS

1. Stomp 33 New EC (a.s. pendimetalin) in a dose of 4,0 l ha/ and Pronin 720 EC (a.s. propizohlor) in a dose of 2,5 l / ha, applied 24 hours before planting of the flue cured tobacco showed good to excellent efficacy against susceptible annual weeds. The efficacy of the preparations was with a score from 1 to 3 by EWRS in both experimental years.
2. Pendimetalin has excellent efficacy against *D. sanguinalis*, *E. crus-galli*, *S. viridis* and *S. glauca*. Pendimetalin has very good efficacy against *A. retroflexus* and *A. blitoides* and good efficacy against *P. oleracea* and *C. album*. *A. theophrasti*, *X. srumarium* and *D. stramonium* are resistant.
3. Propizohlor has excellent efficacy against annual wheat weeds - *Setaria* ssp., *D. sanguinalis*, *E. crus-galli* and very good efficacy against *A. retroflexus* and *A. blitoides*. The effect is weaker against *P. oleracea* and *C. album* L.
4. Pendimetalin and propizohlor help to increase the yield average for 27% and to increase the percentage of Ist class of Virginia tobacco average for 6,5%.
5. When conditions for growth and development of tobacco are more favorable, the application of herbicides has less effect on increasing of the yield.
6. The application of soil herbicides before planting of tobacco allows a reduction of manual and mechanical hoes, without adverse effect on weed infestation and on the culture.

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