

THE USE OF GLYPHOSATE (N-(PHOSPHONOMETHYL) GLYCINE) IN SUCKER CONTROL OF TOBACCO

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ABSTRACT

Topping of tobacco (cutting off the floral buds) is cultural practice which guarantees a high economic effect reflected in increased yield and quality. In normal conditions of growing, the topping is accompanied by vigorous formation of suckers. Removal of floral buds and suckers can be performed in two ways: mechanically (by hand or with specialized technique) and chemical (with application of physiologically active substances - FAS). According to the type of their effect on suckers, FAS are divided in those with contact activity and those with systemic activity. So far, from the products with systemic activity the salts (potassium or hallein) of the maleic hydrazide (MH) have been used. After the deadline for its use in Bulgaria has expired, there are no new systemic products to substitute it. The aim of investigation was to study the possibilities for application of the herbicide Glyphosate not only for chemical topping of tobacco plants but also for control of suckers appearing after topping, with high technical and economical effectiveness among parasitic formations, free of phytotoxic effect on the crop.

Key words: tobacco, topping, sucker formation, sucker control, active substances

УПОТРЕБАТА НА ГЛИФОСАТ (Н-(ФОСФОНОМЕТИЛ) ГЛИЦИН) ПРИ КОНТРОЛАТА НА ФИЛИЗИТЕ

Поткршувањето на цветни китка е културна традиција која гарантира висок економски ефект со зголемен принос и квалитет. Во нормални услови на растење, на врвот од тутунското растение се појавува силно формирање на филизи. Отстранувањето на цветните китки и филизите се врши на 2 начина: механички (рачно или со специјална техника) и хемиски (со примена на физиолошки активни супстанции – ФАС). Според нивното влијание врз филизите, ФАС се поделени на контактни и системични. До сега, од производите со системична активност се користеа солите на калиум или халлеин и од малеик хидразид (МН). По истекот на рокот за нивната употреба во Бугарија, не постојат други системични препарати кои би ги замениле.

Целта на ова истражување е да се проучат можностите за примена на хербицидот глифосат покрај неговата примена како хербицид и за контрола на филизите. Оваа употреба има висока техничка и економска ефикасност, без фитотоксичен ефект врз растенијата.

Клучни зборови: тутун, отстранување на филизи, контрола на филизи, активни супстанции.

INTRODUCTION

Topping of large-leaf tobaccos is cultural practice which gives high economic effect, reflected in increase of yield and quality. The same is valid for the oriental tobaccos, although in that case it is more difficult to be realised in practice.

Cutting off the floral buds makes presumptions for qualitatively different mechanism of distribution and deposition of assimilates created in tobacco leaves. They will not go mainly to the flower bud, but will be distributed in leaves, due to which they become larger, more vigorous and substantial, with higher weight and quality.

In normal conditions of tobacco growth, topping is accompanied by increased suckering. The newly established influx of anti-growth hormones formed in the top part of tobacco plant with the purpose to prevent the growth of side buds on the stem under leaf base, after cutting off the top becomes the reason for intensive sucker formation (6). The suckers are divided into: primary - highly visible, secondary - poorly visible at leaf base and thirdly - existing, but not visible. From the economic point of view, suckers can be considered as parasitic formations which draw considerable amount of assimilates from the plant for their growth (1).

Removal of floral buds, as well as of the suckers, can be performed in two ways: mechanically (by hand, with specialized technique) and chemically (with application of FAS).

Manual sucker control is labor-consuming technique with a short-term effect. By application of FAS, a better and long-lasting effect is achieved.

According to the type of their effect on suckers, FAS are divided in those with contact activity and those with systemic activity (6).

The chemical with contact activity used on large-leaf tobaccos in Bulgaria is pendimethalin (Stomp 330 EK).

Under the influence of pendimethalin, suckers embryos in leaf base rapidly turn to yellow, brown, and then die. However, 10 -12 days after the occurrence of secondary suckers is observed and they grow fast if plants have not

been treated with the same or with some other systemic chemical. So far, contact chemicals in our country have been applied only manually.

Until recently, from the products with systemic activity the salts (potassium or hallein) of the maleic hydrazide (MH) have been used. They are absorbed from the leaves of treated tobacco plants and transported to the growing tissues - suckers, preventing their growth without killing them. Thus, inhibited but still alive suckers do not allow development of secondary buds, leaving the plants free of suckers for a longer period (7 - 8 weeks) (5). Systemic chemicals can be incorporated in the soil or foliary.

In oriental tobacco there is no specialized technique for topping and treatment, although this is highly effective measure for this type, too. Manual topping is also very hard to perform. For this reason, chemical topping of plants finds its place here, implemented with systemic chemicals (MH). The effectiveness of the applied measure is reflected in 20-30% higher yield per decare and in improved quality of tobacco (2).

Until recently, the problem of sucker formation in tobacco was solved by application of the potassium salt of maleic hydrazide (Royal MH-3). After the deadline for its use in Bulgaria has expired (18.07.2009), there are no new systemic chemicals to substitute it. Maleic hydrazide is essentially a herbicide, which gave us an idea to search for a product with similar effect as the herbicides already known in practice.

The mechanism of action of glyphosate (N-(phosphonomethyl) glycine) has been known for a long time. It is a total herbicide with systemic action. The herbicide is absorbed by tobacco leaves and transferred toward the growing (meristem) parts of the plant - : root, top and suckers (3). When glyphosate is applied by spraying of the top parts of the plant, significant part of the herbicide is accumulated in the nearby (meristem) tissues - vegetative top, leaves of the vegetative top and suckers. No published data can be found in Bulgarian and world literature on application of glyphosate for chemical topping or sucker control in tobacco.

The aim of investigation was to study

the possibilities for application of the herbicide Glyphosate both for chemical topping of tobacco plants and for control of suckers appearing after

topping, with high technical and economical effectiveness among parasitic formations and no phototoxic effects on the crop.

MATERIAL AND METHODS

Two-year investigations (2009 - 2010) were carried out in the experimental field of Tobacco and Tobacco products Institute in Markovo. Tobacco plants were treated with the herbicide Glyphogan 480 SL (glyphosate/n-(phosphonomethyl)- glycine, isopropylamine salt) of Agan Chemical Manufacturers Ltd, and Royal MH-30 (21.7% maleic hydrazide, potassium salt) of the company Crompton Uniroyal Chemical was used as a standard.

In the first investigation year (2009) the task of the trial was to estimate the possibility of glyphosate application in sucker control and to determine the effective rate in oriental tobacco Basma (variety Plovdiv 7) and the large-leaf Virginia (variety Virginia 0514). Three rates were investigated in the oriental variety (50, 100 and 200 ml/dca) and three in Virginia (100, 200 and 300 ml/dca).

During the second year of investigation (2010), the trial was set up with Virginia 0514, to compare technical effectiveness of glyphosate with the standard maleic hydrazide

and investigation of possibilities for chemical topping of tobacco inflorescences. Glyphosate (Glyphogan 480 SL) was applied in a rate of 300 ml/dca, and the standard maleic hydrazide (Royal MH-30) in a rate of 1500 ml/dca. Topped but untreated tobacco was used as a check.

Trials were set up by the method of long plots with four replications. The size of the plots was 10 m² and 20 m² in the first and the second investigation years respectively. Tobacco plants were topped up to the 20-th leaf, in the beginning of flowering stage (10-15% of plants are flowered in the plots treated immediately before topping, applying a back sprayer with 30 l/dca solution. For chemical topping of the inflorescences, tobacco was treated in the stage of buttonization, with Glyphogan 480 SL in a rate of 300 ml/dca. Plants were monitored 10 and 20 days after topping and treatment. Readings were made on suckers type and growth as well as on the occurrence of phytotoxic effects on tobacco (according to EWRS scale).

RESULTS AND DISCUSSION

Results of investigations in 2009 are presented in Table 1.

In oriental tobaccos, after removal of floral buds and plant treatment, suckers growth recorded on the 10th day was respectively 6-8 cm with solution rate of 50 ml/dca, 4-6 cm in a rate of 100 ml/dca, 2-4 ml in a rate of 200 ml/dca and 6-8 cm in the topped but untreated plants. On the 20th day of topping and treatment, the readings for suckers growth were as follows: 10-15 cm for the lower rate, 8-10 cm for the medium and 4-6 cm for the higher rate.

In large-leaf tobaccos, suckers growth recorded on the 10th day from removal of floral buds and plant treatment was respectively 8-10 cm with solution rate of 100 ml/dca, 6-8 cm in

a rate of 200 ml/dca, 3-5 ml in a rate of 300 ml/dca and 12-15 cm in the untreated check variant. As can be seen from the results in both tobacco types, low herbicide rates (50 - 100 ml/dca) fail to achieve effective control of suckers and their growth is similar to that of the check variant. High herbicide rates (200-300 ml/dca) give good control of suckers, with phytotoxic effects typical for the glyphosate - etiolation, prevention of their growth and occurrence of necrosis. In the same time, none of the investigated rates has shown phytotoxic effect on treated tobacco plants.

Tables 2 and Photo 1 and 2 present the results of the glyphosate and the standard Royal MH-30 effects on the suckers 20 days after topping and treatment of tobacco plants. Both

the physiological effects and the effectiveness of glyphosate and maleic hydrazide are similar. In contrast to the standard, however, the effective rate of glyphosate is 5 times lower, which supposes lower value of the treatment. Duration

of the effects of both chemicals on suckers control is 20 days after treatment.

Suckers in the check plants (topped but untreated) are developing freely.

Table 1. Results of investigation of Glyphosate on suckers control in 2009

Variants Tobacco type Rate (ml/dca)	Time of monitoring, suckers growth (cm), phytotoxicity on tobacco		
	10th day	20th day	EWRS
Oriental tobacco			
50	6-8	10-15	0
100	4-6	8-10	0
200	2-4	4-6	0
Check	6-8	12-15	-
Large-leaf tobacco			
100	8-10	15-20	0
200	6-8	10-15	0
300	2-4	3-5	0
Check	12-15	20-22	-

Table 2. The effectiveness of Glyphogan 480 SL application on sucker formation in 2010

Chemicals	Rate (Conc.)	Suckers growth and size				Effective- ness %	Duration of the effect (in days)
		I reading	II read.	III read.	N		
Glyphogan 480 SL	300 ml/ dca	1-2	No 1-2 cm	No 1-2 cm		100	20
Royal MH-30 (standard)	1500 ml/dca	1-2	No 1-2 cm	No 1-2 cm		100	20
Check	-	1-2	Free 7-8 cm	Free 12-14 cm		-	-

Excellent results were also obtained in the trial when glyphosate was applied for chemical treatment of tobacco. Photo 5 shows

the effect on plant 10 days after treatment of tobacco bud.



Photo 1 Tobacco topped and treated with Glyphogan 480 SL with 300ml/dca - 20 days after treatment



Photo 2 Tobacco topped and treated with Royal MH-30 with 1500ml/dca - 20 days after treatment



Photo 3 Topped, untreated tobacco - 20 days after treatment



Photo 4 Tobacco plant prior to treatment of floral bud for chemical topping



Photo 5 Tobacco plant 10 days after treatment of floral bud with Glyphogan 480 SL - 300 ml/dca

Observations were made on phototoxicity in the top 4-5 leaves, together with necrosis and falling out of floral buds. Plants which have completed their growth at 22nd-23rd leaf are not affected by the herbicide and no symptoms of phytotoxicity are observed on them. In manual or mechanical topping the affected leaves are removed together with flowers, so that they have no reflection upon the yield. In addition to this, despite the chemical topping of floral bud, no suckers development is observed on plants. Chemical topping of tobacco plants will result in higher production and economic effect - reduction of manual labor with simultaneous removal (topping) of floral buds and sucker control in the plants.

CONCLUSIONS

1. For the first time possibilities were made for application of glyphosate as physiologically active substance in both chemical topping and sucker control in tobacco.

2. Physiological effect of glyphosate is identical with that of the maleic hydrazide which has been used with the same purpose so far.

3. No symptoms of negative phytotoxic effect have been observed in treatments with recommended rates of glyphosate.

4. Chemical topping of tobacco plants with glyphosate yields higher production and economic effect - reduced manual labor with simultaneous removal (topping) of floral buds and sucker control in the plants.

REFERENCES

1. Димитров А., Бозуков Х., Николов П., Драчев Д., 2005. Тютюнопроизводство за фармери. Изд. „Виденов и син“, София.
2. Златев Г. и др., 1979. Промислени технологии за производство на ориенталски и едролисни тютюни в България. Изд. “Христо Г. Данов”, Пловдив.
3. Монсанто Ръндъп - Технология на приложение. Фирмен проспект.
4. Gregory D. Goins, David A. Danehover, Albert R. Butler, 1993. Influence of method and degree of sucker control on the concentration of divatrienediols, yield and quality of Flue-Cured tobacco. Tobacco science, 37:78-83.
5. Loren R. Fisher, Joseph A. Priest, 2004. Topping and sucker management and use of ethephon. Flue-Cured Tobacco Information, North Carolina State University, pp. 106-130.
6. Heinz Seltmann, 1970. Modern methods of tobacco sucker control. 5-th Intern. Tobacco Scientific Congress, Hamburg, Germany, pp. 19-25
7. Seltman H, B.C. Nichils, 1984. Agronomical, chemical, physical and visual characteristics of hand-suckered vs. maleic hydrazide-treated Flue-Cured and Burley tobacco. Agron.Journal, 76:375-378.