RESEARCHES ON CONTROLING REED (*Phragmites australis* (Cav.) Trin. ex Steud.) IN FARMLAND

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Abstract

In terms of worldwide corn ranked second crop of cultivated areas. In the nearby meadow or shallow ground water control of reeds represents a major problem. To achieve these objectives, in 2016, was established experience monofactorial with 10 variants. The researches were conducted in climatic conditions from farm SC Agroprod Seaca SA, about 15 km east of Turnu Măgurele and 10 km north of the Danube River. It was followed initial weeding base on which occurred experience (spectrum weed, average, participation and constancy), we aimed to also control degree by determining the degree of weed (before post-emergence treatment, at 2 weeks after application and before harvesting), the amount of nitrogen and chlorophyll concentration in leaves of corn and cane with Yara N-Tester respectively Portable Digital LED Tester chlorophyll chlorophyll Testing. The best weed control results, including cane were in order V7, V10, V6, V9. Testing on combating cane from the protective dams by applying Glyphogan 480 SL at a dose of 6 l/ha and 10 l/ha, showed that a control efficiency is achieved at begining of reeds vegetation period (May).

Key words: *Phragmites australis*, control, corn field

Worldwide corn crop ranked second in terms of cultivated areas (faostat.fao.org/site/). Weed control is an important component of any crop technology. Weed causes significant losses in maize production, these losses are proportional to the weeding, weeding spectrum, the timing of weed, weed biomass (Silva P.S.L. *et al.*, 2011). Maize plants have a low growth rate in the first part of the growing season, and because they have a low density (5-7 pl/m^2), is characterized by a period of sensitivity to weed in the first 6-8 weeks after emergence, and the lack of action to control weeds during this period, depending on the degree of weeds growing, losses can be up to 70% of production potential (Teasdale J.R., 1995), going to compromise culture. Production losses are determined by limiting access to nutrients, but also to water and light. Diego C. *et al.*, in 2012) shows that weeds have a growth rate more stressed and fail to overshadow corn plants, and in the absence of light these plants reduce the intensity of photosynthesis and therefore the amount of biomass synthesized. Clarence S., in 2005, indicates that a soil free of weeds absorbs light of whole spectrum, and in the conditions under which the soil is covered with weeds which will reflect a part of incident light, in particular infrared range, which will be directed towards the underside of the leaves, and under the influence of the lighting corn plants limit their leaves and roots growth.

MATERIAL AND METHOD

The researches were conducted in climatic conditions from farm SC Agroprod Seaca SA, about 15 km east of Turnu Măgurele and 10 km north of the Danube River, characterized by a soil type aluviosol with a humus content of 2.8%. To achieve these objectives was founded in 2016 with 10 different monofactorial experience (V_1 = Untreated control V_2 = hoeing check, first hoeing at stage of corn 2-3 leaves, second hoeing at stage of corn 4-6 leaves, third hoeing at stage of corn 8 leaves; V_3 = Titus® plus (3.26% 60.87% rimsulfuron + dicamba), in dose of 307 g / ha, in 2-3 leaves stage of maize; V_4 = Titus® Plus + 0.1% Trend® 90 (3.26% rimsulfuron + 60.87% dicamba), in dose of 307 g/ha + Glyphogan 480 SL (360 g glyphosate acid/liter), in dose of 2 l/ha, in two treatments, the first in stage of 2-3 corn leaves, applied with nozzle with directed protection, the second stage of 4-6 leaves in corn, applied with touch wicks fed by drip (Wick Rope hand Applicator); V_5 = Glyphogan 480 SL (glyphosate acid 360 g/liter), in dose of 2 l/ha, in 2-3 corn leaf stage, applied with nozzle with directed protection;

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V_6 = Glyphogan 480 SL (glyphosate acid 360 g/liter), dose in 2 l/ha, in two treatments, in first stage of 2-3 corn leaves, applied with nozzle with directed protection, in the second stage of 4-6 corn leaves, applied with touch wicks fed by drip (Wick Rope hand Applicator); V_7 = Glyphogan 480 SL (360 g/l glyphosate) in a dose of 2 l/ha, in three treatments, first in stage of 2-3 corn leaves, applied with nozzle with directed protection, the second in stage of 4-6 corn leaves, applied with touch wicks fed by drip (Wick Rope hand Applicator), third in 8 corn leaf stage, applied with touch wicks fed by drip (Wick Rope hand Applicator); V_8 = propane flame, in 2-3 corn leaf stage; V_9 = propane flame, in 2-3 leaf stage corn + Glyphogan 480 SL, in dose of 2 l/ha in 4-6 corn leaf stage, applied with touch wicks fed by drip (Wick Rope hand Applicator); V_{10} = propane flame in 2-3 corn leaf stage + Glyphogan 480SL, in dose of 2 l/ha in three treatments, first in stage of 2-3 corn leaves, applied with nozzle with directed protection, the second in 4-6 corn leaf stage, applied with touch wicks fed by drip (Wick Rope hand Applicator), third in 8 corn leaf stage of, applied with touch wicks fed by drip (Wick Rope hand Applicator). Corn was sown on 04.09.2016 by using a drill Amazone 6R. Flame treatment was carried out with the equipment in the image *(figure 1)*.

Figure 1 **Equipment for flame treatment**

Surface plots was about 100 m^2 (12 rows x 0.7 m x 12 m interrow distance leng row), 4 repetitions. Spectrum weeding determinations were made in a mesh network of 2x2 m, 0.25 m^2 frame (50x50 cm). For each of the 10 experimental variants was calculated average, participation and constancy weed before and after the treatments. Average = S/N, where S is the total number of plants of one species found in all points of determination and N the number of points where determination was done, in other words the average number of weeds in a certain species/m^2.

Participation P% = m x 100/ M, where M = $\sum m$ and represent the average number of weeds/m^2, the sum of all media of weed species identified. Constancy, K% = n x 100/N, where N is the number of points where a certain species was present.

RESULTS AND DISCUSSION

Weed spectrum before treatments for weed control was represented by two perennial monocotile weed species *Phragmites australis*, *Sorghum halepense*, 2 species of annual monocotile weed species *Setaria* spp., *Echinochloa crus galli* and 7 annual dicotyledonous weeds species *Amaranthus retroflexus*, *Xanthium strumarium*, *Sinapis arvensis*, *Polygonum convolvulus*, *Chenopodium album*, *Galinsoga parviflora*, *Vicia angustifolia* and 2 species of perennial dicotyledonous weeds species *Convolvulus arvense*, *Cirsium arvense*. Average, participation and constancy of species distribution before treatments data are centralized in *table 1*.

Table 1

Weed spectrum of experimental plots before treatments for weed control

Species	A*	P**	C***
Phragmites australis	6.4	12.9	61.2
Sorgum halepense	3.2	6.4	11.8
Perennial monocotile	**9.6**	**19.3**	
Setaria spp.	12.8	25.7	32.4
Echinochloa cruss galli	10.4	20.9	38.6
Annual monocotile	**23.2**	**46.6**	
Amaranthus retroflexus	4.8	9.6	21.3
Xanthium strumarium	2	4.0	8.4
Vicia angustifolia	2.2	4.4	10.2
Solanum nigrum	1	2.0	2.2
Poligonum convolvulus	1.2	2.4	10.8
Chenopodium album	1	2.0	20.6
Sinapis arvensis	1.4	2.8	18.4
Galinsoga parviflora	1.8	3.6	23.2
Annual dicotyledonous	**15.4**	**30.9**	
Convolvulus arvense	0.6	1.2	24.6
Cirsium arvense	1	2.0	21.4
Perennial dicotyledonous	**1.6**	**3.2**	
Total	**49.8**	**100**	

*Average; ** Participation; *** Participation

The analysis of data on the average number of weeds is found that the average number of weeds/m^2 was 49.8 plants/m^2, number of annual dicotyledonous weeds was 15.4 plants/m^2, and the number of annual monocotyledonous weeds was 23.2 plants/m^2. Regarding participation weed species is found that the largest share had an annual monocotyledonous species with 46.6%, while the lowest participation had dicotyledonous perennial species which did not exceed 1.6%. Constancy of presence of weed species in points of determination did not exceed 61.2%. Analyzing the data presented we find that before post-emergence treatments, there were no significant differences in weed spectrum, the average number of weeds/m^2, participation and constancy. Refferring to weeding maize crop at harvest, *table 2*, contains data on weed (numerical method) on species and groups of weed and control degree. Influence of herbicides treatments on weeds presented in *table 2* shows centralized data on weed species on corn crop, under the influence of applied methods of control.

Table 2

Results on structure of weeds in maize crop before harvest, depending of weed species

Variant	Method of weeds control/ Weed species	*Phragmites australis*	*Sorgum halepense*	*Setaria sp.*	*Echinochloa cruss galli*	*Amaranthus retroflexus*	*Xanthium strumarium*	*Vicia angustifolia*	*Solanum nigrum*	*Poligonum convolvulus*	*Chenopodium album*	*Sinapis arvensis*	*Galinsoga parviflora*	*Convolvulus arvense*	*Cirsium arvense*
V_1	Untreated check	15.6	7.4	8.8	16.2	5.2	4.4	1.6	0.4	2	0.2	2.2	1.2	2.6	2.8
V_2	Hoeing check	1.2	0.2	0	0	0	0	0	0	0	0	0	0	0.2	0
V_3	Titus® Plus	12.2	1.8	3.8	1.2	0.2	0.4	0	0	0.6	0	0	0	0.8	1
V_4	Titus® Plus + Trend Glyphogan 480 SL	3.8	0.6	1.2	0.2	0.2	0	0	0	0.2	0	0	0	0.6	0.6
V_5	Glyphogan 480 SL	8.2	2.2	3.4	2.6	0.2	0	0	0	0	0	0	0	0.6	0.6
V_6	Glyphogan 480 SL Glyphogan 480 SL	2.2	0.8	1.2	1	0.2	0	0	0	0	0	0	0	0.4	0.6
V_7	Glyphogan 480 SL Glyphogan 480 SL Glyphogan 480 SL	1.6	0.4	0.2	0.2	0	0	0	0	0	0	0	0	0.2	0
V_8	Propane flame	6.6	2.6	1.2	1	0	0.2	0	0	0.2	0	0	0	0.2	0
V_9	Propane flame Glyphogan 480 SL	2.8	1	0.4	0.2	0	0	0	0	0	0	0	0	0	0
V_{10}	Propane flame Glyphogan 480 SL Glyphogan 480 SL	1.8	0.4	0.2	0.2	0	0	0	0	0	0	0	0	0	0

Analyzing the data results that: applying the methods for combating *Phragmites* reduce the number of plants/m^2 from 15.6 at untrated check to 1.2 at hoeing check; implementation of a single method for combating in phenological corn stages BBCH 12-14 caused a reduction to 12.2 plants/m^2 *Phragmites* plants with treatment Titus® Plus, treatment with Glyphogan 480 SL to 8.2 plants/m^2 and to propane flame treatment 6.6 plants/m^2; the application of two or three consecutive methods of weed control was followed by the decrease of *Phragmites* plants to 1.6 plants/m^2. For *Sorghum halepense* level of weed presence it was 7.4 plants/m^2 at untrated check to 0.2 plants/m^{2}at hoeing check weeding 3 times and reached 0.4 plants/m^2 when applying 3 consecutive herbicide treatments. For *Setaria* at untrated check were 8.8 plants/m^2 and at hoeing check and variants with two or three control methods reached 0 plants/m^2.

Table 3

Results on weeding maize crop before harvest, depending of category of weeds

Var	Method of weeds control/ Category of weed species	Perennial monocotile	Annual monocotile	Annual dicotyledonous	Perennial dicotyledonous	Total
V_1	Untreated check	23	25	17.2	5.4	70.6
V_2	Hoeing check	1.4	0	0	0.2	1.6
V_3	Titus® Plus	14	5	1.2	1.8	22
V_4	Titus® Plus + Trend Glyphogan 480 SL	4.4	1.4	0.4	1.2	7.4
V_5	Glyphogan 480 SL	10.4	6	0.2	1.2	17.8
V_6	Glyphogan 480 SL + Glyphogan 480 SL	3	2.2	0.2	1	6.4
V_7	Glyphogan 480 SL+ Glyphogan 480 SL+Glyphogan 480 SL	2	0.4	0	0.2	2.6
V_8	Propane flame	9.2	2.2	0.4	0.2	12
V_9	Propane flame +Glyphogan 480 SL	3.8	0.6	0	0	4.4
V_{10}	Propane flame Glyphogan 480 SL Glyphogan 480 SL	2.2	0.4	0	0	2.6

For *Echinochloa crus galli* year if untreated control were a number of 16.2 plantys/m^2 and the hoeing control, and at variants with two or three methods of weed control reached 0 plants/m^2. In case of *Amaranthus*, *Xanthium*, *Vicia*, *Solanum*, *Polygonum*, *Chenopodium*, *Sinapis*, species, application of control methods were followed by reducing to 0 the number of plants/m^2. For *Convolvulus* the presence of weed was reduced from 2.6 plants/m^2 at untreated control to 0.2 plants/m^2 in case of hoeing control, to 0 in case of propane flame burning and three treatments (propane burning flame, and two treatments with Glyphogan).

Table 4

Results regarding efficacity of weeds control for main species of weeds from corn field

Variant	Method of weeds control/ Weed species	*Phragmites australis*	*Sorgum halepense*	*Setaria sp.*	*Echinochloa cruss galli*	*Amaranthus retroflexus*	*Xanthium strumarium*	*Vicia angustifolia*	*Solanum nigrum*	*Poligonum convolvulus*	*Chenopodium album*	*Sinapis arvensis*	*Galinsoga parviflora*	*Convolvulus arvense*	*Cirsium arvense*
V_1	Untreated check	Mt	Mt	Mt	Mt	Mt	Mt	Mt	Mt	Mt	Mt	Mt	Mt	Mt	Mt
V_2	Hoeing check	92.3	97.3	100	100	100	100	100	100	100	100	100	100	92.3	100
V_3	Titus® Plus	21.8	75.7	56.8	92.6	96.2	90.9	100	100	70	100	100	100	69.2	64.2
V_4	Titus® Plus + Trend Glyphogan 480 SL	75.6	91.9	86.4	98.8	96.2	100	100	100	90	100	100	100	76.9	78.5
V_5	Glyphogan 480 SL	47.4	70.3	61.4	84.0	96.2	100	100	100	100	100	100	100	76.9	78.5
V_6	Glyphogan 480 SL Glyphogan 480 SL	85.9	89.2	86.4	93.8	96.2	100	100	100	100	100	100	100	84.6	78.5
V_7	Glyphogan 480 SL Glyphogan 480 SL Glyphogan 480 SL	89.7	94.6	97.7	98.8	100	100	100	100	100	100	100	100	92.3	100
V_8	Propane flame	57.7	64.9	86.4	93.8	100	95.5	100	100	90	100	100	100	92.3	100
V_9	Propane flame Glyphogan 480 SL	82.1	86.5	95.5	98.8	100	100	100	100	100	100	100	100	100	100
V_{10}	Propane flame Glyphogan 480 SL Glyphogan 480 SL	88.5	94.6	97.7	98.8	100	100	100	100	100	100	100	100	100	100

Table 5

Results regarding efficacity of weeds control from corn field depending of category of weeds

Variant	Method of weeds control/ Weed species	Perennial monocotile	Annual monocotile	Annual dicotyledonous	Perennial dicotyledonous	Total
V_1	Untreated check	Check	Check	Check	Check	Check
V_2	Hoeing check	93.9	100.0	100.0	96.3	97.7
V_3	Titus® Plus	39.1	80.0	93.0	66.7	68.8
V_4	Titus® Plus + Trend Glyphogan 480 SL	80.9	94.4	97.7	77.8	89.5
V_5	Glyphogan 480 SL	54.8	76.0	98.8	77.8	74.8
V_6	Glyphogan 480 SL Glyphogan 480 SL	87.0	91.2	98.8	81.5	90.9
V_7	Glyphogan 480 SL Glyphogan 480 SL Glyphogan 480 SL	91.3	98.4	100.0	96.3	96.3
V_8	Propane flame	60.0	91.2	97.7	96.3	83.0
V_9	Propane flame Glyphogan 480 SL	83.5	97.6	100.0	100.0	93.8
V_{10}	Propane flame Glyphogan 480 SL Glyphogan 480 SL	90.4	98.4	100.0	100.0	96.3

Table 3 shows the centralized results of the degree of weeding maize crop under the influence of methods of weed control. Analyzing the data presented shows that perennial monocotile species

decreased from 23 plants/m^2 at untreated control to 1.4 plants/m^2 at hoeing control and application of methods of fighting was followed by reducing the number of annual monocotile weeds from 25 plants/m^2 at untreated control to 0 plants/m^2 at hoeing control, and between 0.4 and 5 plants/m^2 for other weeds control methods

For perennial dicotyledonous weeds species is found that the number of weed plants was reduced from 5.4 to 0.2 neprăşit witness plants/m^2 for hoeing witness, for annual dicotyledonous species their number decreased from 17.2 plants/m^2 at untreated control to 0 at hoeing control to witness hoeing. Other experimental variations (less in order V_3, V_5 and V_8), reduces weed spectrum. Considering the effectiveness of different control methods used in the experiment, in tables 4 and 5 show that each variant can cause significant reduction in the number of weeds, both in what concerns a particular species *(table 4)* and the categories of weeds *(table 5)*, the best results are obtained (except for witness weeding 3 times) variants V_4 and V_7.

Analyzing data on degree of control of weed species under the influence of control methods (Table 4) where there is a degree of Phragmites control varied between 21.8% in variant V3 (treatment with Titus Plus) and 89.7% in variant V7 where three treatments with Glyphogan were applied, while at the control (cultivating 3 times) degree of control was 92.3%. For Sorghum halepense degree of control ranged from 75.7% at variant V3 to 94.6% at V7 and V10 variants. For Setaria spp. degree of control ranged from 56.8% at variant V3 to 97.7% at V7 and V10 variants.

Application of 3 treatments with Glyphogan controled entirely annual dicotyledonous species. At Convolvulus arvense it is found that degree of control was 69.2% after treatment with Titus and 100% plus treatment with propane in the early stages of vegetation filled with Glyphogan. It appears that the greatest degree of weed species control was recorded in the control, weeding 3 times.

Table 5 centralized data on the degree of weed control taking into consideration biological groups of weeds under the influence of weed control methods tested. Analyzing the influence of methods to control the perennial mocotyledonous species are found that this varied between 39.1 after treatment with Titus plus and 90.4% after three times application of Glyphogan treatments. The fact that at annual mocotyledonous lowest level of control was registered in the case of a single treatment with Glyphogan (V5) is explained by the fact that they were countered only weed species that were emerged when applying treatment and then sprang other weeds. The highest degree of control annual mocotyledonous species was recorded in application of 3 treatments with Glyphogan (V7).

For dicotyledonous annual weeds lowest degree of control was when Titus Plus herbicide was applied (V3) and in variants V7, V9 and V10 degree of control was 100%, higest. In case of dicotyledonous perennial species the highest control was recorded after combined treatment with propane and Glyphogan V9 and V10. Analyzing the influence of weed control methods tested it is found that the order of effectiveness was witness hoeing 3 times (V2); treatments with Gllyphogan (V7), Propane + Glyphogan (V10); 2 treatments with Glyphogan (V6); tratment with TitusPlus + Glyphogan (V4); weeds control with propane

Table 6

Corn yields obtained under the influence of weed control methods

Variant	Weed control methods	Productions (kg/ha)	Differences
V_1	Untreated check	1360.0	Check
V_2	Hoeing check	5210	3850***
V_3	Titus® Plus	4820	3460***
V_4	Titus® Plus + Trend Glyphogan 480SL	4950.0	3590***
V_5	Glyphogan 480SL	4700.0	3340***
V_6	Glyphogan 480SL Glyphogan 480SL	4830.0	3470***
V_7	Glyphogan 480SL Glyphogan 480SL Glyphogan 480SL	4980	3620***
V_8	Propane flame	3510.0	2150***
V_9	Propane flame Glyphogan 480SL	5100.0	3740***
V_{10}	Propane flame Glyphogan 480SL Glyphogan 480SL	5180	3820***
		DL 5%	267.7
		DL 1%	409.1
		DL 0,1%	541.7

Table 6 centralized data obtained regarding maize yields under the influence of weed control methods applied. It found that yields ranged from 1,360 kg/ha to untrated control up to 5,210 kg/ha to witness weeding 3 times, the best results were recorded for the first 3 places V_{10} (5,180 kg/ha), V_9 (5,100 kg/ha), V_7 (4,980 kg/ha), while the worst results were recorded in V_7 (3,510 kg/ha) where production still increased with 2,105 kg/ha.

All weed control methods applied were determined to obtain very significant production increases compared to the untreated control.

CONCLUSIONS

At the beginning of the research, the highest participation in the weed spectrum was the *Phragmites*.

The application for weed control treatments had reduced the number of each species of weeds compared to untreated control, the reduction was proportional to the number of chemical treatments applied. Yields ranged from 1,360 kg/ha to untrated control up to 5,210 kg/ha to witness weeding 3 times, the best results were recorded for the first V_{10} (5,180 kg/ha).

Corn yields very significant increases were recorded by apllication of suitable methods of weed control.

At the beginning of the research, spectrum weed it was comparable in all experimental variants, the highest participation in the weed spectrum was the *Phragmites*.

The application for weed control treatments had reduced the number of each species of weeds compared to untreated control, the reduction was proportional to the number of chemical treatments applied. Corn yields very significant increases were recorded by aplivcarea methods of weed control.

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