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INFLUENCE OF SYSTEM TILLAGE UPON WEEDING LEVEL IN THE MAIZE CROP GROWN AT MOARA DOMNEASCĂ – ILFOV

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Abstract

Soil tillage consists of technological elements that control weeds by cutting, soil incorporation, plant organs fragmentation and their bringing to soil surface where they freeze in winter and dehydrate in summer. Also, the weed seeds from soil surface are ploughed into the depth where there are no conditions foremergence.
In agriculture, weed-produced damage is huge (from 10-20% up to total crop loss) and is reflected by increased production costs, reduced crop yields, and product quality depreciation. The maize crop is sensitive to weeds and the crop loss can reach 70%. The research results presented in this paper were obtained from the experimental field of the Moara Domnească Didactic Farm, Ilfov County, belonging to USAMV Bucharest. The experimental variantson the tillage system were the following: plough 20 cm (control), 20 cm chisel, 40 cm chisel, 10 cm disc, the disk alternation/plough 20 cm disc, 40 cm disc/chisel. The grown hybrid of maize was P0216 (FAO 450). The maximum values for the production of fresh weed biomass and dry substance, depending on soil cultivation, were recorded in the variant worked with the disc (1,942 f.m. kg/ha and 419 d.m. kg/ha) compared to the control variant (plough 20 cm) which resulted in 1,100 f.m. kg/ha and 229 d.m. kg/ha, respectively.There is no direct link between the weed amount and the crop. The maximum yield was recorded in the classic version, 6754.6 kg/ha, while the minimum was recorded in the disc version, 5139.5 kg/ha with a production of 1525.6 kg difference/ha compared to the control.

Key words*: soil tillage, weed biomass, Zea mays* L., *yield.*

INTRODUCTION

Weeds compete with crop plants for the growth factors, have a negative influence on the quality of tillage, and reduce the effect of the measures applied in crop technology by the consumption of the water from the useful edaphic soil layer, crop and soil shading etc. Tillage plays a clear role to weed species as part of the weed control strategy (Marin, 1999).
The effect of tillage upon weed control depends on the tillage type, time period of application, quality, grown crop etc.
Maize production can be adversely affected by the presence of weeds, which results in its decrease by 30-70% (Şarpe, 1975; Budoi, Penescu, 1996; Oancea, 1998; Bîlteanu, 2001; Berca, 2004; Guș, Rusu, 2008; Rusu, Guș, 2008).
Research shows that weed-caused damage depends on a series of factors such as the level of infestation, crop species and phenological phase, the climatic conditions and the time when weeds are controlled (Bosnic, Swanton, 1997; Clay, 1998; Perron, Legere, 2000; Bogdan, 2001; Chirilă, 2001; Fukao et al., 2003; Rusu et al., 2009). Previous studies showed that, in time, soil conservation works can lead to an increase in the density of perennial weeds.
Out of the total harvested gain achieved by various methods of maize plant cultivation, 26% is weed control, 20% fertilizers and 10% density (Bîlteanu, Bârnaure, 1989). Weed control should be integrated, primarily by using agro-technical methods (crop rotation, tillage, mechanical maintenance works), supplemented by the use of herbicides. The choice of herbicides should be based on the dominant weed species, the rotation crop, the soil humus content (Roman et al., 2011).

MATERIALS AND METHODS

Research was conducted on the reddish preluvosoil of the experimental field of the Moara Domnească didactic farm, Ilfov County. The experimental variants were as follows: a_1-

plough at a depth of 20 cm (control), a_2-chisel 20 cm, a_3-chisel 40 cm, a_4-disk 10 cm, a_5-disc/plough 20 cm, a_6-disk/chisel 40 cm, disc tillage in the sequence of disc/chisel and disc/ploughing was performed in the previous winter wheat. Basic soil tillages was performed in the last decade of September.

Sowing was done in the second decade of April. The biological material was the hybrid maize P0216 (FAO 450). Fertilization was carried out with the dose $N_{120}P_{60}K_{60}$ kg/ha of 15:15:15 NPK complex fertilizer and urea.

For weed control we applied herbicide (Dual Gold dose of 1.4 l/ha (*s-metolachlor* 960 g/ l) - preemergence and Dicopur Top 1.0 l/ha (344 g/l *acid 2.4 D* + 120 g/l *dicamba*) + Titus 25DF, 50 g/ha (25% *rimsulfuron methyl*) – post-emergence). Also, we performed mechanical hoeing.

During the experiment we made observations and measurements including: seedling emergence date, height growth rate, leaf formation rate, fruition rate, biomass acumulation rate, numer of grains per cob, TGW, HM, weed level in maize crop.

The influence of soil tillage on weed level was emphasized by the dynamic determination using the gravimetric method and analytical work on each variant. The data are also shown in terms of participation according to biological classification (annual monocotyledonous, annual dicotyledonous, perennial dicotyledonous plants).

To characterize the climate conditions we used the data recorded by the Găneasa Meteorological Station.

From the climatic viewpoint, the years 2015-2016 were characterized by average annual temperatures that exceeded the normal standards for the area (Figure 1). For the maize vegetation period (April-August), the average temperature was 20.1ºC, with 1.9ºC above the normal standards in 2015 and 19.9ºC, with 1.7ºC above the normal standards in 2016.

In 2015, the amount of rainfall recorded 153.0 mm, (Figure 2) with 76.4 mm below the average annual values (very low recorded in months: April, May and July). In terms of rainfall, 2016 was different from 2015, as it accumulated an amount of 343.4 mm, with 114.0 mm over the normal standard during the growing season.

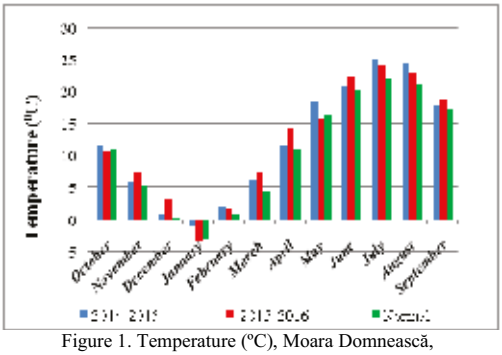

Figure 1. Temperature (ºC), Moara Domnească, Ilfov County (2014-2016 and Normal)

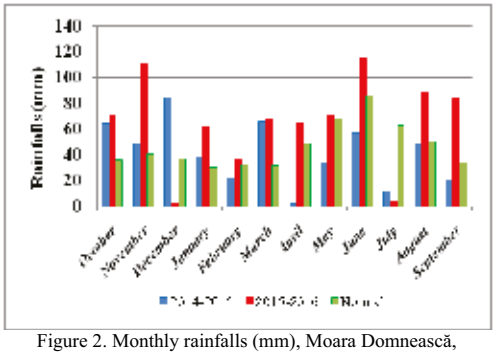

Figure 2. Monthly rainfalls (mm), Moara Domnească, Ilfov County (2014-2016 and Normal)

RESULTS AND DISCUSSIONS

The influence of basic tillage on the weed biomass in the maize crop.

Tables 1 and 2 show the results of the research in 2015-2016 regarding the influence of soil tillage on fresh and dried weed biomass at the end of the vegetation period in the maize crop.

The lowest weed level was recorded in the disc/plough 20 cm variant, i.e. 977 f.m. (fresh matter) kg./ha or 212 d.m. (dry matter) kg/ha representing 89% of the control, 20 cm plough, which resulted in 1100 f.m. kg/ha (229 d.m. kg./ha). In the unconventional system, the highest levels of weed biomass was recorded in the disc-worked variant (1942 f.m. kg/ha and 419 d.m. kg/ha, respectively).

Regarding the amount of fresh and dried biomass obtained in a nonconventional system, the value closest to the control was recorded in 20 cm plough, alternately worked with disc/chisel 40 cm.

The data analysis of the soil influence on the biological weed groups, the annual monocotyledonous plants recorded the highest rate

(shown in participation percentage). Their biomass ranged between 803 f.m. kg./ha alternative in the traditional work, disc/plough 20 cm, and 1493 kg f.m. kg/ha in the disk version, followed by annual dicotyledonous plants.

Table 1. Influence of basic tillage on fresh weed biomass in maize, Moara Domnească- Ilfov, average August 2015-2016

Tillage variant	Total weed biomass			Of which						% species participation						
				Annual monocotyledonous		Annual dicotyledonous		Perennial dicotyledonous		*Echinochla crus-galli*	*Setaria viridis*	*Digitaria sanguinalis*	*Chenopodium album*	*Portulaca oleracea*	*Polygonum aviculare*	*Convolvulus arvensis*
	kg f.m./ ha	%	Diff.	kg f.m./ ha	%	kg f.m./ ha	%	kg f.m./ ha	%							
A20	1100	100	C	939	100	100	100	61	100	45	20	20	2	7	0	6
C20	1731	157	631	1375	146	253	253	103	169	33	29	17	5	5	5	6
C40	1608	146	508	1308	139	212	212	88	144	34	33	16	9	3	0	5
Disc	1941	176	841	1493	159	302	302	146	239	41	22	16	8	5	2	6
D/A20	977	89	-123	803	86	40	40	134	219	30	31	21	0	5	0	13
D/C40	1294	118	194	1010	107	198	198	86	141	38	26	16	11	2	1	6

$LSD_{5\%}$ = 112.4 kg f.m./ha ; $LSD_{1\%}$ = 159.8 kg f.m. /ha ; $LSD_{0.1\%}$ = 231.4 kg f.m./ha

The annual dicotyledonous biomass ranged from 40 f.m. kg/ha (disc/plough 20 cm) to 302 f.m. kg/ha (disc) and from 7 d.m. kg/ha (alternative disc/plough 20 cm) to 46 d.m. kg/ha (disc). The weed species commonly found in maize fall with in the annual monocots class. Among these, the predominant species was *Echinochloa crus-galli* with one green biomass total participation between 30 and 45% and 27-50% on the total dry biomass, according to tillage. From the annual dicotyledonous, the *Chenopodium album* species was predominant, with a level of participation between 2 and 11% of the total weed biomass.

Table 2. Influence of basic tillage on dry weed biomass in maize, Moara Domnească- Ilfov, average August 2015 - 2016

Tillage variant	Total weed biomass			Of which						% species participation						
				Annual monocotyledo-nous		Annual dicotyledonous		Perennial dicotyledonous		*Echinochloa crus-galli*	*Setaria viridis*	*Digitaria sanguinalis*	*Chenopodium album*	*Portulaca oleracea*	*Polygonum aviculare*	*Convolvulus arvensis*
	kg d.m. /ha	%	Diff	kg d.m./ ha	%	kg d.m./ ha	%	kg d.m./ ha	%							
A20	229	100	C	209	100	13	100	7	100	50	21	20	2	4	0	3
C20	367	160	138	312	149	42	323	13	186	36	34	13	5	3	3	6
C40	304	133	75	254	121	39	300	11	157	27	39	17	11	2	0	4
Disc	419	183	190	356	170	46	354	17	243	42	26	16	8	3	1	4
D/A20	212	92	-17	188	90	7	54	17	243	33	35	20	0	4	0	8
D/C40	269	118	40	231	110	28	215	10	143	43	28	15	8	2	1	3

$LSD_{5\%}$ = 16.5kg d.m./ha ; $LSD_{1\%}$ = 23.5kg d.m./ha ; $LSD_{0.1\%}$ =34.1 kg d.m./ha

Influence of tillage system on weed number.

Table 3 shows the results of basic tillage influence on the number of weeds/m^2. Before harvesting the average weeding data obtained from the red preluvosoil of Moara Domnească revealed a number of 17-19 weeds/m² in the conventional variants, and 24-35 weeds/m² in the unconventional variants.

The analysis of weeds/m^2 in the conventional and unconventional system shows the dominance of the annual monocotyledonous species, at a rate of between 66-79% of the total weed number, followed by the annual dicotyledonous species.

Compared with the plough 20 cm variant, a reduced number of weeds/m^2 was recorded in the alternative disc/plough 20 cm (17 plants/m^2). The unconventional system recorded the maximum number of weeds/m^2 in the disc variant, of which 66% represent annual monocots species.

Table 3.Influence of tillage system on the number of weeds/m², average August 2015-2016

Tillage variant	Total weeds/m²	%	Annual monocotyledonous		Annual dicotyledonous		Perennial dicotyledonous	
			No. weeds/m²	%	No. weeds/m²	%	No. weeds/m²	%
A20	19	100	15	79	3	16	1	5
C20	32	100	21	66	6	19	5	15
C40	28	100	21	75	4	14	3	11
Disc	35	100	23	66	7	20	5	14
D/A20	17	100	13	76	3	18	1	6
D/C40	24	100	16	66	4	17	4	17

The influence of soil tillage on maize production.

The tillage system influenced the maize yields, along with the weed level. The highest production (Table 4) was recorded in the classic alternative disc/plough 20 cm (6754.6 kg/ha), with a difference of 89.5 kg/ha compared to the control (ploughing 20 cm), which resulted in 6665.1 kg seeds/ha.

In the nonconventional system, production represented 77.1-90.6% compared to the control, with negative differences of 624.9-1525.6 kg grains/ha. In the application of minimum tillage system, the productions that were the closest to the control were obtained in the chisel 40 cm worked variants, i.e. 5917.4 and alternatively 6040.2 kg grains/ha, respectively.

Table 4. Influence of basic tillage on maize yield, Moara Domnească-Ilfov, average 2015-2016

Tillage variant	Yield kg/ha	%	Diff. kg/ha
A20	6665.1	100	C
C20	5418.9	81.3	-1246.2
C40	5917.4	88.7	-747.7
Disc	5139.5	77.1	-1525.6
D/A20	6754.6	101.3	89.5
D/C40	6040.2	90.6	-624.9

$LSD_{5\%}$ = 208.7 kg./ha ; $LSD_{1\%}$ = 296.7 kg /ha ; $LSD_{0.1\%}$ = 429.6 kg/ha

CONCLUSIONS

The research performed during 2015-2016 showed that the lowest weed level was recorded in the classic version, i.e. 20 cm.

The fresh and dry biomass obtained in the nonconventional system recorded values that were the closest to the control (20 cm) in the alternate variant disc/chisel 40 cm.

In both conventional and nonconventional systems, in terms of weed number/m², annual themonocotyledonous species were dominant, with 13 to 23 plants/m², representing 66-79% of the total number of weeds, followed by dicotyledonous species from the annual group.

In the application of minimum tillage system, the closest quantitative yields were obtained in the chisel 40 cm variants, i.e. 5917.4 kg/ha, and in the disc/chisel 40 cm sequence, i.e. 6040.2kg/ha.

REFERENCES

Berca M., 2004. Managementul integrat al buruienilor. Ed. Ceres, București. p.73-79.

Bîlteanu Gh., Bîrnaure V., 1989. Fitotehnie. Ed. Ceres, Bucureşti. p. 233-240.

Bîlteanu Gh., 2001. Fitotehnie. Ed. Ceres, București. p. 220-227.

Bogdan I., 2001. Cercetări privind combaterea buruienilor din cultura de porumb, cu referire specială la specia *Echinochloa crus-galli* (L.) - Teză de doctorat. U.S.A.M.V. Cluj-Napoca.

Bosnic A., Swanton C., 1997. Influence of barnyardgrass (*Echinochloa crus-galli*) time of emergence and density on corn (*Zea mays*). Weed Science,45 (2), 276-282.

Budoi Gh., Penescu A., 1996. Agrotehnică. Editura Ceres, Bucureşti. p. 261-262.

Chirilă C., 2001. Biologia buruienilor. Ed. Ceres, București. p.15-21.

Clay S.A., Aguilar I., 1998. Weed seedbanks and maize growth following continuous maize or alfalfa. Agronomy Journal, 90:813-818.

Fukao T., Ida S., Rumpho M.E., Kennedy R.A., 2003. Differențial gene expression of the ά-chain of

mitocondrial H-transporting ATP synthase between dormant and non-dormant seeds of paddy Echinochloa weeds. Weed Biology and Management, Central Region Agricultural Research Center, NARO; 3:15-20.

Guş P., Rusu T., 2008. Sisteme de lucrări minime ale solului. Al 5-lea Simpozion cu participare internațională. Ed. Risoprint, Cluj-Napoca. p. 66-71.

Marin D.I., 1999. Cercetări privind elaborarea sistemului de lucrări ale solului pentru menținerea și sporirea fertilității acestuia și creșterea producției de porumb boabe în condițiile solului brun roșcat din zona Moara Domnească - Teză de doctorat. U.S.A.M.V. București.

Perron F., Legere A., 2000. Effects of crop management practices on *Echinochloa crus-gali* and *Chenopodium album* seed production in a maize/soyabean rotation. Weed Research, 40: 535-547.

Oancea I., 1998. Tratat de tehnologii agricole. Ed. Ceres, București. p.195-197.

Pop A.I., Guş P., Rusu T., Bogdan I., Moraru P. I., 2008. The influence of minimum soil tillage on the soil structure, weed development and maize production. p. 66-71.

Roman Gh.V., Tabără V., Robu T., Pârşan P., Ştefan M., Axinte M., Morar M., Cernea S.,2011. Fitotehnie - Vol.1. Ed. Universitară, Bucureşti. p. 229-230.

Rusu T., Guş P., 2008. Sisteme de lucrări minime ale solului. Ed. Risoprint. Cluj-Napoca. p.104-106.

Rusu T., Guş P., Bogdan I., Moraru P.I., Pop A.I., Clapa D., Marin D.I., Oroian I., Pop L.I., 2009. Implications of Minimum Tillage Systems on Sustainability ofAgricultural Production and Soil Conservation. Journal of Food, Agriculture & Environment, vol. 7(2/2009), p. 335-338.

Şarpe N., 1975. Eficacitatea erbicidelor pe bază de 2,4 D şi MCPA asociate cu dicamba la cultura grâului de toamnă. Producţia vegetală - Cereale şi plante tehnice, 4.