NEW RESULTS FOR MAIZE CROPS CULTIVATED IN THE NO-TILLAGE SYSTEM AT THE NATIONAL INSTITUTE FOR AGRICULTURAL MECHANIZATION FROM BĂNEASA- BUCHAREST

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Abstract

In Romania, maize is the main cultivated plant and maize crops are extremely important from an economic point of view. Research with the no-tillage system applied to maize crops were made in the Romanian Plain, Șarpe (1968, 1987, 2000, 2008, 2009), in Banat, Moțiu (2004) and in the Flood Plain of the Danube River, Șarpe (2004, 2005, 2007, 2008). The results obtained in Romania confirm the results of the research made in other countries: Philips and Young (1973), Köller (1999), Derpsch (2001).
In the conventional system, under the weather conditions of the year 2011, the grain yield recorded from the maize crops amounted to 6,200 kg/ha, while in the no-tillage system a grain yield of 6,500 kg/ha was recorded – so the yields obtained in the two technological systems were practically equal. However, there were significant differences in terms of Diesel fuel consumption. For example, in the conventional system, a 78 litres/ha Diesel fuel consumption was recorded, while in the no-tillage system this amounted to only 25 litres/ha. Big differences were also recorded as regards the expenses in the conventional and no-tillage systems. In the conventional system, the expenses incurred for all the mechanical works performed from the sowing stage to the harvesting stage amounted to RON 2,350.00 per hectare, while in the no-tillage system, they amounted to only RON 610,00 per hectare.

Key words: conventional system, no-tillage system, Gaspardo, Regina model

The no-tillage system is the most COST-EFFICIENT farming system which, according to Derpsch (2001), is practised on hundreds of millions of hectares in the USA, Brazil, Argentina, and even in Paraguay.

In Romania, numerous research studies regarding application of the no-tillage system to maize crops were made at Fundulea, in the Romanian Plain by Șarpe (1968, 1987, 2000, 2008, 2009), in Banat by Moțiu (2004) and in the Flood Plain of the Danube River by Șarpe and Poienaru (2004, 2005, 2007, 2008, 2009). The results obtained were quite remarkable, demonstrating the economic and practical efficiency of the no-tillage system. Based on this research, many agricultural companies from Romania are currently using the no-tillage system on large surfaces. Thus, for example, the S.C. 3 Brazi Agricultural Company uses the no-tillage system applied to maize, barley, wheat and soybean crops on approximately 45,000 hectares.

The no-tillage system presents some other economic advantages:

- Reduces soil erosion – there are some 4 million hectares of eroded soil in Romania;
- Diminshes the number of farming machines from 10 to only 3: sowing machine, herbicide-application equipment, and harvesting combine;
- Reduces considerably the working time – and, as a consequence, labour productivity per hectare and per ton of product increases.
- The most important advantage of the no-tillage system is the diminution of the mechanical work related expenses and the considerable increase of the **PROFIT** recorded by cultivated hectare.

The results obtained at the National Institute for Agricultural Mechanization from Baneasa will be a good example and reference for all local farming companies as well as for farming companies from the entire country.

MATERIAL AND METHOD

The experiments with maize cultivated in the conventional and no-tillage systems were carried out at the National Institute for Agricultural Mechanization from Băneasa on a type of soil which contains in the arable layer a +30 cm humus 2-4%, and clay 20-30%. The following weed species were identified on the plot where the respective experiment was made: *Chenopodium*

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album, Xanthium italicum, Amarantus retroflexus, Sativia glauga, Sorghum halepense, Cirsium arvense. In the plot cultivated by the conventional system, the maize was sowed by means of an SPC-8 Romanian made sowing machine, and in the plot cultivated by the no-tillage system the maize was cuktivated by a Regina model sowing machine manufactured by the Italian company Maschio-Gaspardo.

In the plot cultivated by the no-tillage system, the weeds which were 20-50 cm tall before the maize was sowed were treated by the Roundup applied in doses of 5 litres/hectare. In the plot cultivatred by the conventional system, the land was ploughed in the autumn, then in was submitted to a disking operation int the spring and laboured by combinatory before sowing.

RESULTS AND DISCUSSIONS

In *table 1* we present the data regarding the selectivity and efficacy of herbicides as well as the grain yield.

Table 1

Selectivity, efficacy and grain yield recorded for the Pioneer hybrid National Institute for Agricultural Mechanization from Băneasa – Bucharest, 2011

Dominant weed species 1. Cirsium arvense 2. Sonchus aqrvense 3. Sonchus venalis 4. Capsella bursa pastoris 5. Veronica hederifolia 6. Echinochloa crus-galli			7. Chenopodium album 8. Polygonum aviculare 9. Sonchus oleraceus 10. Xanthium strumarium 11. Solanum nigrum			
Herbicides applied	Doses	Time of appl.	Selectivity (EWRS grades)	Weed control %	Yield kg/ha	Yield %
Conventional system						
1. Not hoed	-	-	1.0	0.0	700	10
2. Hoed 3 times (manually and mechanically)		-	1.0	94.0	6,500	100
No-tillage system						
3. Untreated	-	-	1.0	0.0	790	12
4. Ceredin Super + Guardian	3.5 1.0	preem. postem.	1.0 1.0	98,0	6,680	103
EWRS grades 1 = Without phytotoxic symptoms 9 = Totally compromised maize plants						
LSD: 0% = 180 kg/ha; 1% = 230 kg/ha; 0.1% =310 kg/ha						

Analyzing the data presented in *table 1*, we shall notice that the Pioneer hybrid tolerated very well the Guardian and Ceredin Super herbicides. As regards the weed control in the conventional system in a separate 10 hectare-plot, by 3 mechanical hoeing runs and 3 manual hoeing runs, a 94% weed control level was achieved. In the no-tillage system, where the Guardian herbicide was applied in doses of 3.5 l/ha after sowing and respectively the Ceredin Super in a dose of 1 l/ha in the vegetation stage, when the maize plants were in the 3-5 leaf-stage, the level of weed control amounted to 98%.

A grain yield of 6,500 kg/ha was recorded in the conventional system and respectively of 6,680 kg/ha in the no-tillage system, so the grain yields recorded in the two systems were practically equal. As regards the not hoed variant in the conventional system, the grain yield was very small, amounting to only 700 kg/ha, and in the untreated variant in the no-tillage system it amounted to 790 kg/ha. However, there were big differences in terms of fuel consumption, as it stands out from *table 2*.

Table 2

Fuel consumption in litres/hectare National Institute for Agricultural Mechanization from Băneasa – Bucharest, 2011

CONVENTIONAL SYSTEM Mechanical and manual works	Consump. Litres/ha	NO-TILLAGE SYSTEM Mechanical works	Consump. Litres/ha
1. Autumn ploughing + harrowing	30.0	1. - 2. -	– –
2. Disk	8.0	3. -	–
3. Combinator	7.0	4. Sowed by Gaspardo, Regina	7.0
4. Sowing by SPC-8	6.0	5. Appl. of herbicides before sprouting	1.5
5. 1st mechanical hoeing	4.0	6. -	–
6. 1st manual hoeing	–	7. Appl. of herbicides on vegetation	1.5
7. 2nd mechanical hoeing	4.0	8. -	–
8. 2nd manual hoeing	–	9. -	–
9. 3rd mechanical hoeing	4.0	10. -	15.0
10. 3rd manual hoeing	–		
11. Harvesting by Claas combine	15.8		
TOTAL CONSUMPTION	78.0	TOTAL CONSUMPTION	25.0

As illustrated by the table hereinabove, the fuel consumption in the conventional system from maize sowing to the maize harvesting stage amounted to 78 litres of Diesel fuel, while in the no-tillage system it was of only 25 litres per hectare.

Big differences were also recorded as regards the expenses incurred with the mechanical works in the two systems, conventional and no-tillage, as illustrated by *table 3* here in below.

Table 3

Cost of maize cultivation incurred for mechanical and manual works
National Institute for Agricultural Mechanization from Băneasa – Bucharest, 2011

CONVENTIONAL SYSTEM Mechanical and manual works	Cost RON/ha	NO-TILLAGE SYSTEM Mechanical works	Cost RON/ha
1. Autumn ploughing + harrowing	270	1. -	–
2. Disking	90	2. -	–
3. Combinator	40	3. -	–
4. Sowing by SPC-8	60	4. Sowed by Gaspardo, Regina	70
5. 1st mechanical hoeing	170	5. Appl. of herbicides before sprouting	120
6. 1st manual hoeing	360	6. -	–
7. 2nd mechanical hoeing	170	7. Appl. of herbicides on vegetation	120
8. 2nd manual hoeing	360	8. -	–
9. 3rd mechanical hoeing	170	9. -	–
10. 3rd manual hoeing	360	10. -	–
11. Harvesting by Claas combine	300	11. Harvesting	300
TOTAL RON	2,350	TOTAL RON	610

Table 4

Profit in RON/hectare of maize cultivation in the conventional and no-tillage systems
National Institute for Agricultural Mechanization from Băneasa – Bucharest, 2011

Maize yield kg/ha	Maize cost RON/kg	Maize value RON/ha	Cost of materials and mechanical works /1 ha	PROFIT in RON for 1 maize crop hectare
CONVENTIONAL SYSTEM				
4,000	0.54	2,000	3,480	- 1,480
4,500	0.54	2,250	3,380	- 1,230
5,000	0.54	2,500	3,480	-980
5,500	0.54	2,750	3,480	-730
6,000	0.54	3,000	3,480	-480
6,500	0.54	3,250	3,480	-230
7,000	0.54	3,500	3,480	+20
NO-TILLAGE SYSTEM				
4,000	0,54	2,000	1,610	+ 390
4,500	0,50	2,250	1,610	+ 640
5,000	0,54	2,500	1,610	+ 870
5,500	0,54	2,750	1,610	+ 1,140
6,000	0,54	3,000	1,610	+ 1,390
6,500	0,54	3,250	1,610	+ 1,640
7,000	0,54	3,500	1,610	+1,830

Note: The price of maize franco-warehouse is ranged between RON 0.495 and RON 0.595 per kg (an average of RON 0.545/kg). Agricultural Profit, issue No. 33 of September 2009

According to the data presented in *table 3* hereinabove, maize cultivation costs from the ploughing to the harvesting stage amounted to RON 2,350 in the conventional system and only to RON 610 in the no-tillage system.

The most important results from a cost-efficiency perspective are the ones presented in *table 4*, in which we have analyzed the profit obtained from a hectare of maize cultivated in the conventional and respectively no-tillage system.

Based on the relevant results obtained at the "Agrodelta" Tulcea Agricultural Company, we have elaborated the following strategy for the control of annual and perennial weeds.

STRATEGY

For the control of annual and perennial weeds in maize crops cultivated in the no-tillage system

This strategy is valid only for the farmers who use the no-tillage system and cultivate various types of maize hybrids.

In spring, time will be allowed to annual and perennial weeds such as *Cirsium arvense Sonchus arvensis, Taraxacum officinale affinale* and *Convulvulus arvensis* to spring in mass. The plot must be then treated by glyphosate-based herbicides such as Roundup, Cosmic, Dacglisat 50WL6, Dominator, Gallup, Glialua 36 CE, Glisocig 360, Glifotim, Elyfas, Glyphogan 480, Glyphostock Kawasate, Sanglypho and Rocco. All

theses herbicides contain 360 g/l glyphosate active substance.

Glyphosate-based herbicides must be applied 1-7 days before the maize is sowed or within 5 days after it has been sowed in a dose of 4.5-6.0 litres per hectare.

Application of glyphosate-based herbicides is strictly forbidden after the maize has sprung, because the crops will be "burnt" by these herbicides.

One of the following herbicides shall be applied together (tankmix) with the glyphosate-based herbicides:

Merlin Duo in a dose of 3-5 litres/ha;

Gardoprim Plus Gold 500 SC in a dose of 5-7 litres/ha;

Dual Gold 960 EC in a dose of 2-3 litres/ha;

Frontier Forte in a dose of 2-3 litres/ha.

Proponit 720 EC in a dose of 4-5 litres/ha.

After the maize has sprung, when plants have 3-5 or maximum 7 leaves, and the annual and perennial weeds are 5-10 cm tall and even 15-20 cm tall, the Ceredin Super herbicide shall be applied in a dose of 1.0 l/ha – this herbicide being able to destroy over 700 species of annual and perennial dicotyledonous weed species which infest maize crops from Romania and Europe.

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