

**NEW RESULTS REGARDING MAIZE CROPS CULTIVATED IN THE  
CONVENTIONAL AND NO-TILLAGE SYSTEMS AT "AGRODELTA"  
TULCEA AGRICULTURAL COMPANY**

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**Keywords:** *Agrodelta, conventional and no-tillage systems, Gaspardo, Regina model*

**Abstract**

*In Romania, maize is the main cultivated plant and maize crops are extremely important from an economical point of view. Research with the no-tillage system applied to maize crops were made in the Romanian Plain, Sarpe (1968,1987, 2000, 2008, 2009), in Banat, Motiu (2004) and in the Flood Plain of the Danube River, Sarpe (2004, 2005, 2007,2008). The results obtained in Romania confirm the results of the research made in other countries: Philips and Young (1973), Koller (1999), Derpsch (2001).*

*"Agrodelta" is the first agricultural company from Tulcea County which in 2009 cultivated maize in the no-tillage system on a 200 hectares area of land, the results obtained being quite remarkable.*

*In the conventional system, under the weather conditions of the year 2009, the grain yield recorded from the maize crops amounted to 7,200 kg/ha, while in the no-tillage system a grain yield of 7,500 kg/ha was recorded - so the yields obtained in the technological systems were practically equal. However, there were small differences in terms of fuel consumption. For example, in the no-tillage system, a 78 litres/ha fuel consumption was recorded, while in the no-tillage system this recorded 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 made for all the mechanical works performed from the sowing stage to the harvesting stage, these expenses amounted to RON 2,350.00 per hectare, while in the no-tillage system, they amounted to only RON 610.00 per hectare.*

**INTRODUCTION**

The no-tillage system is the most COST-EFFICIENT farming system which, according to Derpsch (2001), is practiced 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;
- Diminishes the number of farming machines from 10 to only 3: sowing machine, herbicide-application equipment, and harvesting combine;
- Reduces considerably the working time-and consequently 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 "Agrodelta" agricultural company will be a good example and reference for all the similar companies from Tulcea County as well as for companies from neighbouring counties.

## **MATERIAL AND METHODS**

The experiments with maize cultivated in the conventional and no-tillage systems were carried out at the "Agrodelta" Agricultural Company situated in the Danube Delta on an alluvial soil, which contains in the arable layer a + 30 cm humus 2-4%, clay 20- 30%. The following weed species were identified on the plot where the respective experiment was made: *Chenopodium album*, *Xanthium italicum*, *Amaranthus retroflexus*, *Sativia glauca*, *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 cultivated 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 liters/hectare. In the plot cultivated by the conventional system, the land was ploughed in the autumn, then in was submitted to a disking operation in the spring and laboured by combinatory before sowing.

## RESULTS AND DISCUSSION

Table 1 presents 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  
“Agrodelta” Tulcea Agricultural Company, 2010**

| Dominant weed species   |         |                    |                                |                  |       |     |
|---|---------|--------------------|--------------------------------|------------------|-------|-----|
| 1. <i>Cirsium arvense</i>   |         |                    | 7. <i>Chenopodium album</i>    |                  |       |     |
| 2. <i>Sonchus arvense</i>   |         |                    | 8. <i>Polygonum aviculare</i>  |                  |       |     |
| 3. <i>Sonchus venalis</i>   |         |                    | 9. <i>Sonchus oleraceus</i>    |                  |       |     |
| 4. <i>Capsella bursa pastoris</i>   |         |                    | 10. <i>Xanthium strumarium</i> |                  |       |     |
| 5. <i>Veronica hederifolia</i>  |         |                    | 11. <i>Solanum nigrum</i>      |                  |       |     |
| 6. <i>Echinochloa crus-galli</i>  |         |                    |                                |                  |       |     |
| Herbicides applied  | Doses   | Time of appl.      | Selectivity (EWRS grades)      | Weed control (%) | Yield |     |
|   |         |                    |                                |                  | kg/ha | %   |
| 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 + Merlin Duo   | 3.5 1.0 | preem.<br>postern. | 1.0<br>1.0                     | 98.0             | 6,680 | 103 |
| EWRS grades 1 = Without phytotoxic symptoms<br>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 Merlin Duo 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 Merlin Duo 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.

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 hereinbelow.

*Table 2*

**Fuel consumption in litres/hectare "Agrodelta" Tulcea Agricultural Company, 2010**

| <b>CONVENTIONAL SYSTEM<br/>Mechanical and manual works</b> | <b>Fuel<br/>consump.<br/>(litres/ha)</b> | <b>NO-TILLAGE SYSTEM<br/>Mechanical works</b> | <b>Fuel<br/>consump.<br/>(litres/ha)</b> |
|--|--|---|--|
| 1. Autumn ploughing + harrowing                            | 30.0                                     | 1. –  | –  |
| 2. Disk  | 8.0                                      | 2. –  | –  |
| 3. Combinator  | 7.0                                      | 3. –  | –  |
| 4. Sowing by SPC-8   | 6.0                                      | 4. Sowed by Gaspardo, Regina                  | 7.0                                      |
| 5.1 <sup>st</sup> mechanical hoeing                        | 4.0                                      | 5. Appl. of herbicides before sprouting       | 1.5                                      |
| 6.1 <sup>st</sup> manual hoeing                            | -  | 6. –  | –  |
| 7. 2 <sup>nd</sup> mechanical hoeing                       | 4.0                                      | 7. Appl. of herbicides on vegetation          | 1.5                                      |
| 8. 2 <sup>nd</sup> manual hoeing                           | -  | 8. –  | –  |
| 9.3 <sup>rd</sup> mechanical hoeing                        | 4.0                                      | 9. –  | –  |
| 10. 3 <sup>rd</sup> manual hoeing                          | 4.0                                      | 10. –   | 15.0                                     |
| 11. Harvesting by Claas combine                            | 15.8                                     |   |  |
| <b>TOTAL CONSUMPTION</b>                                   | <b>78.0</b>                              | <b>TOTAL CONSUMPTION</b>                      | <b>25.0</b>                              |

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 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.

*Table 3*

**Cost of maize cultivation incurred for mechanical and manual works  
"Agrodelta" Tulcea Agricultural Company, 2010**

| <b>CONVENTIONAL SYSTEM<br/>Mechanical and manual works</b> | <b>Cost<br/>(RON/ha)</b> | <b>NO-TILLAGE SYSTEM<br/>Mechanical works</b> | <b>Cost<br/>(RON/ha)</b> |
|--|--------------------------|---|--------------------------|
| 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. 1 <sup>st</sup> mechanical hoeing                       | 170                      | 5. Appl. of herbicides before sprouting       | 120                      |
| 6. 1 <sup>st</sup> manual hoeing                           | 360                      | 6. –  | –                        |
| 7. 2 <sup>nd</sup> mechanical hoeing                       | 170                      | 7. Appl. of herbicides on vegetation          | 120                      |
| 8. 2 <sup>nd</sup> manual hoeing                           | 360                      | 8. –  | –                        |
| 9. 3 <sup>rd</sup> mechanical hoeing                       | 170                      | 9. –  | –                        |
| 10. 3 <sup>rd</sup> manual hoeing                          | 360                      | 10. –   | –                        |
| 11. Harvesting by Claas combine                            | 300                      | 11. Harvesting                                | 300                      |
| <b>TOTAL RON</b>   | <b>2,350</b>             | <b>TOTAL RON</b>                              | <b>610</b>               |

*Table 4*

**Profit in RON/hectare of maize cultivation in the conventional and no-tillage  
systems "Agrodelta" Tulcea Agricultural Company, 2010**

| <b>Maize yield<br/>(kg/ha)</b> | <b>Maize cost<br/>(RON/kg)</b> | <b>Maize value<br/>(RON/ha)</b> | <b>Cost of materials and<br/>mechanical works/1 ha</b> | <b>PROFIT<br/>in RON for 1 maize<br/>crop hectare</b> |
|--------------------------------|--------------------------------|---------------------------------|--|---|
| <b>CONVENTIONAL SYSTEM</b>     |                                |                                 |  |   |
| 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   |
| <b>NO-TILLAGE SYSTEM</b>       |                                |                                 |  |   |
| 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*

## **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* and *Convolvulus arvensis* to spring in mass. The plot must be then treated by glyphosate-based herbicides such as Roundup, Cosmic, Dacglisat, Dominator, Gallup, Glifotim, Glyphogan 480, Glyphostock, Sanglypho and Rocco. All these 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 liters 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 in a dose of 1.0 l/ha shall be applied - 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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