

THE INFLUENCE OF THE BASIC WORK OF THE SOIL ON THE PRODUCTIONS OF MAIZE OBTAINED IN THE CONDITIONS OF THE CRISURILOR PLAIN

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Abstract

The researches were performed in the period 2014–2016 at the Agricultural Research and Development Station Oradea in a stationary experiment from 1995. The purpose of the researches was the establishing of the possibilities of reduction of the expenses with the basic work of the preluvosoil from Oradea on the crop of maize. The preluvosoil from Oradea has a high content (31,5%) of clay in the Ap. Horizon. Comparing to the version ploughed at 25 cm depth, in the versions in which the basis work of the soil was the work with the chisel, the work with the disk harrow or the ploughing executed at the depth of 12 cm, the degree of compaction of the soil has increased; as a consequence the values of the total porosity have decreased, and those of resistance to penetration have increased. The greatest differences were registered in the version worked with the disk harrow. For the crop of maize the best version of basic work of the soil was that with the ploughing of autumn executed at the depth of 25 cm. The evolution of the characteristics of the soil and the differences of production very significant statistically obtained in the years studies show that in the conditions of the preluvosoil from Oradea, for the crop of maize the best version for the basic work of the soil is the ploughing of autumn executed at the depth of 25 cm.

Key words: basic work of the soil, apparent density, total porosity, production, maize

INTRODUCTION

Guș P., and collab. (1998) consider that the works of the soil can be classified by the main purpose, the age of execution, tools, the depth of execution of the work, the complexity of the aggregates and plants, the group of plants for which is executed.

By the main purpose: the basic works have as purpose the mobilization of the soil at depths of over 15 cm, up to 80 cm; in this category are included: the ploughing, the deep aeration, the turning of the soil; the works of preparing of the germinative bed have as purpose the mobilization of the soil on the depth 10-12 cm for the purpose of assuring the conditions of seeding, germinating and growth of the plants. These works are performed with the disk harrow, the combinatory, the cultivator and the cutter; the works of maintainance of the land include the turning of stubble and the harrowing of the fields in the summer and the harrowing of the fields in the beginning of the spring;

By the age of execution: summer: is executed the turning of the stubble, the ploughing, the maintenance of the fields and cultivated crops,

the preparing of the germinative bed for successive crops. In the summer or in the first part of the autumn is executed the deep aeration and the turning of the soil; in the autumn: is executed the ploughing, the preparing of the germinative bed for the autumn crops, the preparing of the germinative bed for the crops that are seeded in the early spring; in the spring: - is prepared the germinative bed for the crops that are seeded in this period. In the hilly areas, on sandy fields, for some cultures can be executed also ploughing.

By the tools with which is executed the work of the soil: with the plough, the disk harrow, the cutting harrow, the cutting cylinder etc. (Zăhan, Bandici, 1999, Berca, 2011)

By the depth of execution of work: superficial works: the turning of the stubble, the ploughing, the leveling, the cylinder cutting, the hoeing, the superficial plough; deep works: the plough; very deep works: very deep ploughing, deep aeration, turning of the soil. (Budoï, Penescu 1996; Bogdan and coll., 2003)

By the complexity of the aggregate and the work accomplished: works of preparing the germinative bed together with the fertilization and applying of the herbicides; the performing of hoeing together with the fertilization or with the administration of erbicides on the layers of plants. (Borza, Stanciu, 2010)

Depending on the plants (groups of plants) for which is executed are divided in works of the soil for the autumn cereals, spring cereals, for hoe, etc.

MATERIAL AND METHOD

The natural environment of performing the reaseache is the Crisurilor Plain that occupies the central part of the Western Plain of Romania. (Berindei, 1977, Pop, 1977)

The researches were developed during 2014 – 2016 at the Agricultural Research and Development Station Oradea in a stationary experiment placed in 1995 with the following versions:

V₁ = plough at 25 cm depth

V₂ = plough at 12 cm depth

V₃ = work with the chisel

V₄ = work with disk harrow

The experiment was placed in random lanes, the surface of an experimental lot being of 2000 m².

The crop rotation used: wheat – maize.

Fertilization: N₁₂₀ kg/ha s.a ; P₉₀ kg/ha s.a.

The determination of the bulk density and of the resistance to penetration was made after the preparing of the germinative bed using the

methodology of the Institute of Researches for Pedology, Agrochemistry and Environment Protection Bucharest. (Florea 1987, Stepănescu, 1979)

The bulk density represents the report between the mass of the soil and the total volume: (Canarache 1990, Domuța 2005, 2006)

$$BD = \frac{M}{V_t} = \frac{M}{V_s + V_p}$$

In which: BD – aparent density [g/cm³];

M – mass of the soil [g];

V_t – total volume of the soil [cm³];

V_s – volume of the solid part of the soil [cm³];

V_p – volume of the pores [cm³].

The bulk density is determined following a prelevtion of a soil sample in unmodified site, which is usually accomplished using metallic cylinders. (Domuța 2006, 2012, 2014, Rusu, 2005)

Total porosity (PT) was calculated with the formula:

$$PT = \left(1 - \frac{BD}{D}\right) \times 100 ; \text{ In which:}$$

BD – bulk density, g/cm³

D – specific density, 2,65 g/cm³

The interpretation of the results was accomplished with the help of the analysis of the variance.

The hydraulic conductibility, the resistance to penetration and the chemical parameters of the soil were determined after the methodology used by the Institute of Researches for Pedology and Agrochemistry Bucharest. (Florea, 1987)

The soil from the research field has the following profile: Ap = 0 – 24 cm; El = 24 – 34 cm; Bt₁ = 34 - 54 cm; Bt₂ = 54 - 78 cm; Bt/c = 78 - 95 cm; C = 95 - 145 cm. Is remarked the fact that the migration of the colloidal clay has determined the appearance of the horizon of El with 31,6 % colloidal clay and of two horizons of accumulation of colloidal clay Bt₁ and Bt₂ with 39,8 % și 39,3 % colloidal clay.

The soil is characterized by a very large hydrostability of aggregates of soil greater than 0,25 mm, 47,5 % on the layer of 0 - 20 cm. It has a total average porosity on the depths 0 - 20 cm, 20 - 40 cm, 40 - 60 cm and small on the depths 6 - 80 cm, 80 - 100 cm and 100 - 150 cm. The values of the total porosity decrease on the profile of the soil of surface to depth. The hydraulic conductibility is large on the depth 0-20 cm, average on the depths 20-40 cm and 40 cm, small and very small on the following studied depths. The bulk density – 1,41 g/cm³ – characterizes a weak battered soil on the depth 0-25 cm.; on the other depths studies the apparent weight underlines a moderated soil and strongly battered. On the irrigation depths (0 – 50 cm, 0

- 75 cm) and on 0 - 150 cm the soil is strongly battered. (Şandor and collab., 2001). The field capacity has an average value on the entire profile of soil and the coefficient of fading has, also, the average value until the depth of 80 cm and large under this depth.

The soil from the research field has a reaction weakly acid on the entire depth studied, with increasing values from the surface to the depth.

The supply with clay is weak, and that with total nitrogen, weak – average, on the entire research depth. The C/N report has a larger value on the depth 0 - 20 cm (8.01) and decreases with the determination depth.

The yearly fertilization with shots of Phosphorus specific to the agrotechniques of the irrigated soils determined the increasing of the Phosphatic level of the brown soil from the research field so that after 39 years of stationary researches the quantity of mobile Phosphorus from the soil increased on the ploughed layer from 22,0 ppm (average soil supplied) to 150,8 ppm (soil very well supplied).

The soil is very well supplied in Potassium (150.8 ppm). The content of the soil in changeable Magnesium on the profile of the soil has a similar evolution with that of the Potassium, the soil being average supplied with this element on the entire profile. The Manganese characterizes the soil from the research field as a soil with an average content on the depths 0- 20 cm and 20- 40 cm and smaller on the following depths.

The soil is moderately sub mezobasic on the entire studied depth.

RESULTS AND DISCUSSION

The influence of the basic work of the soil on the bulk density

The determinations performed in the maize crop show that in the conditions of the preluvosoil from Oradea, the smallest bulk density was registered by executing the plough at 25 cm depth. The determinations performed after the preparing of the germinative bed underline a soil more battered in all the other versions, the differences compared to the version ploughed at 25 cm were 5,3% for the work with the disk, 2,3% for the plough made at 12 cm depth and 1.5% for the work with the chisel (Table 1.1)

Table 1.1.

The influence of the basic work of the soil on the values of the bulk density,
Oradea 2016

Version	BD	
	g/cm ³	%
1. Plough 25 cm depth	1.30	100
2. Plough 12 cm depth	1.33	102.3
3. Work with the chisel	1.32	101.5
4. Work with the disk harrow	1.37	105.3

The influence of the basic work of the soil on the total porosity

In the determinations performed after the preparing of the germinative bed of the crop of maize, the greatest value of the total porosity 53% was obtained in the version ploughed at 25 cm, in the version worked with the chisel and in the version ploughed at the depth of 12 cm the values of the total porosity were of 51%, and the version worked with the disk of 49 %. (Table 1.2)

Table 1.2.

The influence of the basic work of the soil on the values of the total porosity (PT), Oradea 2016

Version	TP	
	%	%
1. Plough 25 cm depth	53	100
2. Plough 12 cm depth	51	98,7
3. Work with the chisel	51	99,4
4. Work with the disk harrow	49	97,9

The influence of the basic work of the soil on the resistance to penetration

The determinations performed for the crop of maize show that at the depth of 0-5 cm, the smallest values of the resistance to penetration were obtained in the version ploughed at 25 cm, in the other versions the values being equal. At all the other depths studies the greatest values of the resistance to penetration were obtained by the work with the disk, and the smallest by performing the plough of 25 cm on the depth of 5-10 cm and 10-20 cm and by the performing of the basic work of the soil with the chisel on depths of 20-30 cm and 30-60 cm (Table 1.3)

Table 1.3.

The influence of the basic work of the soil on the values of the resistance to penetration (Mpa), Oradea 2016

Version	Depth – cm -				
	0-5	5-10	10-20	20-30	30-60
1. Plough 25 cm depth	1	1,6	2,1	3,7	5,6
2. Plough 12 cm depth	1,1	1,7	2,5	3,8	5,6
3. Work with the chisel	1,1	1,8	2,5	3,1	5,1
4. Work with the disk harrow	1,1	1,9	2,8	4,1	5,8

The influence of the basic work of the soil on the maize production in the conditions of the preluvosoil from Oradea, 2014

In the conditions of the year 2014, the losses of production compared with the ploughed version at 25 cm depth were greater, very significant statistically in all the cases. (Table 1.4)

Table 1.4.

The influence of the basic work of the soil on the values of the maize production, Oradea 2014

Version	Production		Difference		Statistic significance
	Kg/ha	%	Kg/ha	%	
1. Plough 25 cm depth	5100	100	-	-	Mt
2. Plough 12 cm depth	2500	49	-2600	-51	000
3. Work with the chisel	1990	39	-3110	-61	000
4. Work with the disk harrow	1430	28	-3670	-72	000

LSD 5% 210

LSD 1% 390

LSD 0,1% 670

The influence of the basic work of the soil on the maize production in the conditions of the preluvosoil from Oradea, 2015

The performance of the basic work of the soil with the disk harrow determined a loss of production compared to the version with deep plough of 5250 kg/ha (-62%). Also in the other two versions studies the losses of production compared to the witness were very significant statistically. (Table 1.5)

Table 1.5.

The influence of the basic work of the soil on the values of the maize production, Oradea 2015

Version	Production		Difference		Statistic significance
	Kg/ha	%	Kg/ha	%	
1. Plough 25 cm depth	8400	100	-	-	Mt
2. Plough 12 cm depth	6200	74	-2200	-26	000
3. Work with the chisel	4200	50	-4200	-50	000
4. Work with the disk harrow	3150	38	-5250	-62	000

LSD 5% 180

LSD 1% 370

LSD 0,1% 760

The influence of the basic work of the soil on the maize production in the conditions of the preluvosoil from Oradea, 2016

In 2016 the performance of the basic work of the soil with the disk harrow determined the greatest loss of production compared to the version with deep plough; 5353 kg/ha (-53%). Also in the other two versions studies the losses of production compared to the witness were very significant statistically. (Table 1.6)

Table 1.6.

The influence of the basic work of the soil on the values of the maize production,
Oradea 2016

Version	Production		Difference		Statistic significance
	Kg/ha	%	Kg/ha	%	
1. Plough 25 cm depth	10100	100	-	-	Mt
2. Plough 12 cm depth	8080	80	-2020	-20	000
3. Work with the chisel	6060	60	-4040	-40	000
4. Work with the disk harrow	4747	47	-5353	-53	000

LSD 5% 260; LSD 1% 410; LSD 0,1%

825

CONCLUSIONS

The researched were performed in the period 2014-2016 at the Agricultural Research and Development Station Oradea in a stationary experiment placed in year 1995.

The purpose of the researches was the establishing of the possibilities of reducing the expenses with the basic work of the preluvosoil from Oradea at the crop of maize. The preluvosoil from Oradea has a high content of clay (31,5%) in the horizon Ap.

Compared to the version ploughed at 25 cm depth, in the versions in which the basic work of the soil was the work with the chisel, the work with the disk harrow or the plough executed at the depth of 12 cm, the degree of battering of the soil increased; following the values of the total porosity have decreased and those of resistance to penetration have increased. The greatest differences were registered in the version worked with the disk harrow.

For the crop of maize the best version of basic work of the soil was that with autumn plough at the depth of 25 cm, compared to this depth in all the other versions studies were registered losses of production very significant statistically in all the years studies; the greatest losses (-72% in 2014; -62% in 2015 and 53% in 2016) were registered in the version worked with the disk harrow.

The evolution of the characteristics of the soil and the differences of production very significant statistically obtained in the two years studies show that in the conditions of the preluvosoil from Oradea, for the culture of maize the best version for the basic work of soil, is the autumn ploughing executed at the depth of 25 cm.

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