CULTIVATING MAIZE IN UNCONVENTIONAL SOIL WORKING SYSTEMS

CULTIVAREA PORUMBULUI ÎN SISTEM NECONVENȚIONAL DE LUCRARE A SOLULUI

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Abstract: *In this paper we present the impact of maize cultivation method on some soil physical features and on yield. We used two soil working systems – the classical one and the unconventional (conservative) one. Trials were carried out in the soil and climate conditions of the Banat Plain at the SCDA Lovrin (Timis County) between 2007 and 2008. Starting from the necessity of removing the disadvantages of the conventional system, developing soil working alternative technologies that ensure the conservation and maintenance of the soil productive capacity as well as the diminution of the energy consumption are nowadays basic requirements of development and of sustainable agriculture.*

Rezumat: *Lucrarea prezintă influenţa metodei de cultivare a porumbului asupra unor însuşiri fizice ale solului şi producţiei obţinute Au fost utilizate două sisteme de lucrare a solului: sistemul clasic şi sistemul neconvenţional (conservativ). Experienţele s-au desfăşurat în condiţiile pedoclimatice din Câmpia Banatului pe teritoriul SCDA Lovrin, jud.Timiş, între anii 2007-2008. Pornind de la necesitatea eliminării dezavantajelor sistemului convenţional, elaborarea unor tehnologii alternative de lucrare a solului, care să asigure conservarea şi menţinerea capacităţii productive a acestuia, precum şi reducerea consumului de energie, reprezintă astăzi cerinţe de bază în vederea dezvoltării şi edificării unei agriculturi durabile.*

Keywords: *minimal works, physical features, yield.*
Cuvinte cheie: *lucrări minime, proprietăţi fizice, producţii.*

INTRODUCTION

Mechanical work of the soil through traditional methods is more and more questioned because of the high-energy consumption and of continuous degradation of the soil in its arable layer by erosion and excessive setting.

It is well known that the classical system of processing the soil (tillage with an earth board plough) has, besides its extraordinary contributions to social progress, seriously prejudiced the environment and its vital resource – soil – leading to a steady diminution of its fertility.

The disadvantages attributed to the classical soil work system, an intensive system that includes compulsory earth board plough tillage, resulted in the appearance and rapid spread of the concept of soil conservation.

The concept of soil conservation comprises a set of activities, measures, and technologies that compete in maintaining soil's fertility without sensibly diminishing yields and with important production cost cuts.

The new technologies of mechanising soil works in the conservative system comprise several processing methods: minimum tillage, mulch tillage, ridge tillage, and no-tillage or direct drill.

MATERIAL AND METHOD

Data included in this paper are based on the experimental and production fields at the S.C.A. Lovrin (District of Timiş).

S.C.A. Lovrin is located in the north-western part of the Banat, 45 km from Timişoara, its geographical position being defined by $45^{0}57'$ northern latitude and $20^{0}44'$ eastern longitude.

The lands of the Station are part of the Mureşului Plain, its relief being generally, plane, with altitudes between 86-92 m above the Adriatic Sea level. Ground water is 0.5-5 m deep in the soil, the highest levels being in April-May and the lowest ones early in winter.

The climate is specific to the Banat's Plain, more open to western winds and to the influence of the Mediterranean and Atlantic currents, which makes it moister.

Experimental plots were set on a typical chernozem, weakly gleyied, with a pH in the arable layer (0-27 cm) of 6.9 and a humus content of 3.55%.

The profile of the typical chernozem weakly gleyied weakly demi-carbonated, medium clayey argyle/medium clayey argyle on medium fine carbonate loess deposits is of the Ap-Amk-Ack-Cca-Cgo type.

Climate conditions between 2007-2008 was characterised by annual averages between 10.5^{0}C and 12.4^{0}C, while rainfall ranged between 395.8 mm and 585.9 mm.

In the experimental setting we tested the following variants:

Classical system:

- V_1 (control) – tillage (depth = 20 cm) with a PP-4(3)-30 plough + harrowing (two times) with a GD-3.2 disk harrow.
- V_2 – tillage with a PRP-3-35 reversible plough + harrowing with a GRC-2.5 combined rotating harrow

Unconventional system:

- V_3 – heavy disking with a GD-6.4 disk harrow (two times);
- V_4 – harrowing with a GD-6.4 harrow + GRC-2.5 combined rotating harrow;
- V_5 – GRC-2.5 combined rotating harrow (two times);
- V_6 – direct drill.

RESULTS AND DISCUSSION

Physical, physical and mechanical, and hydro-physical features of the soil determine the limits of the physical and edaphic environment within which physical and chemical plant maintenance and nutrition occur, i.e. the porous and poly-phase environment in which both the three phases (solid, liquid, and gaseous) and the intermediary phases resulted from biological and physical and chemical activities intertwine.

Cultivation technologies influence the main physical features (bulk density Da, total porosity PT, setting degree GT) as well as yields.

Table 1

Influence of soil working system on bulk density (Da, g/cm^3)

Depth (cm)	Soil working system					
	Classical		Unconventional			
	V_1	V_2	V_3	V_4	V_5	V_6
0-10	1,18	1,21	1,31	1,30	1,27	1,30
10-20	1,32	1,33	1,36	1,37	1,39	1,35
20-40	1,44	1,37	1,41	1,46	1,44	1,41
40-60	1,42	1,44	1,45	1,47	1,43	1,46

Table 2

Influence of soil working system on total porosity (PT, %)

Depth (cm)	Soil working system					
	Soil working system		Unconventional			
	V_1	V_2	V_3	V_4	V_5	V_6
0-10	53	54	49	49	51	49
10-20	48	48	47	46	45	48
20-40	44	46	45	44	44	47
40-60	44	44	44	43	44	51

Table 3

Influence of soil working system on setting degree (GT, %)

Depth (cm)	Soil working system					
	Classical		Unconventional			
	V_1	V_2	V_3	V_4	V_5	V_6
0-10	-0,58	-3,86	3,97	3,97	0,05	3,97
10-20	5,93	5,93	7,89	9,85	11,34	5,93
20-40	12,55	9,68	11,59	13,52	13,59	7,66
40-60	12,55	12,55	14,70	16,25	13,55	-3,86

The unconventional system aims at making agricultural production process efficient, at preserving and increasing soil fertility. Getting even yields or yields diminished with 5-10% compared to the classical system is considered more profitable, due firstly to the diminution of expenses on tillage, which has the greatest share in the classical system.

The soil working system and climate conditions have influenced yields in maize (Table 4).

Table 4

Influence of soil working system on yield in maize

No.	Specification	Soil working system					
		Classical		Unconventional			
		V_1	V_2	V_3	V_4	V_5	V_6
1	Standard grain yield (kg/ha)	8700 (Mt)	8870	8190	8350	8450	8400
2	Relative yield (%)	100,00	101,95	94,13	95,97	97,12	96,55
3	Difference in yield (kg/ha)	100,00	+170	-510	-350	-232	-300
4	Significance of differences	-	-	-	-	-	-

DL 5% = 506,37 kg/ha; DL 1% = 682,61 kg/ha; DL 0,1% = 906,01 kg/ha.

CONCLUSIONS

1. Working the superficial layer (0-12 cm) with a heavy disk harrow and with a rotating harrow leads to values of bulk density equal to those in the classical system. Measurements confirm that minimal soil work and no-tillage result in a more set soil that did not negatively influence crop development.
2. Total porosity in all variants is within optimal values for the type of soil in the experimental field, significant differences being recorded only in the superficial layer (0-10 cm).
3. Values in setting degree confirm moderate setting of the soil correlated with physical features of the soil without becoming a limiting factor of the development of plant root system.
4. Grain maize yield has values between 8,190-8,450 kg/ha in minimal work

variants, and 8,400 kg/ha in no tillage. Compared to the classical system (8,700 kg/ha in the control), yields are lower (94.13-97.12%) in the variants with minimal work, and 96.55% in no tillage variants.

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