THE INFLUENCE OF THE UNCONVENTIONAL TILLAGE SYSTEM UPON FUEL INTAKE IN MAIZE CROP

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Abstract: *This paperwork presents the influence of tillage methods upon fuel consumption, one of the basic requirements of a profitable agriculture. Soil works represent the intervention – usually mechanical – performed upon soil with various tools in order to achieve a proper environment for plant development. We used two tillage systems: the classical system and the unconventional one. Experiments were performed under the pedoclimatic conditions specific to the Banat`s Field at the Banat`s University of Agricultural Sciences and Veterinary Medicine Timişoara – the Didactic Station, during 2007-2008. Taking into account the necessity to eliminate the conventional system`s disadvantages, the elaboration of some alternative soil working technologies to assure the preservation and maintenance of its productive capacity, and also the decrease of energy intake, represents now a necessity in order to develop and strenghten a durable agriculture. Mechanized soil tillage though classical methods becomes more and more doubtful due to a 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. Researches were performed on a plot located in Body I, consisted of an area of 268 ha limited in the North by the brook Beregsău, in the South by the inner land from Timişoara, and in the East and West by the national roads DN 69 Timişoara – Arad, respectively Timişoara – Sânnicolau Mare. The soil profile has the following succession: Ap – Ap – Amk – A/Cyk – CykG – CyGo – CcaGo - $CcaG_0$ – CcaGr. Climatic condition between 2007-2008 were characterized by annual average temperatures between 11°C and 12.7°C, and while rainfall ranged between 395 mm and 592.5 mm. Determinations performed show that fuel consumption decreases with 3.02-3.9 l/t in minimum tillage and direct drill variants, compared to 10.41-12.82 l/t consumed in the classical technology. Compared to classical systems, fuel consumption decreases with 31.3-36.1 l/ha in minimum tillage variants and with 30.4 l/ha in the case of direct drill technology. The unconventional tillage system influences maize production. It is more profitable to obtain yields lower with 90-95% in the unconventional system compared to the classical ones due to the dramatic reduction of fuel intake. Grain maize yields have values between 8450 kg/ha in the minimum tillage variants and 8400 kg/ha in the case of direct drill. Compared to the classical system, yields are lower (94,13-97,12 %). Fuel intake per total technology has the biggest values in both crops under the classical system. In maize crop, fuel savings are between 31.3-36.1 l/ha in the minimum tillage variants and 30.4 l/ha in the case of direct drill.*

Key words**:** *classical tillage, minimal tillage, fuel consumption.*

INTRODUCTION

Mechanized soil tillage though classical methods becomes more and more doubtful due to a high energy intake and to a continuous soil degradation because of the 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 METHODS

Data included in this paper are based on the experimental and production results obtained at the Didactic Station from Banat`s University of Agricultural Sciences and Veterinary Medicine (Timiş county).

Researches were performed on a plot located in Body I, consisted of an area of 268 ha limited in the North by the brook Beregsău, in the South by the inner land from Timişoara, and in the East and West by the national roads DN 69 Timişoara – Arad, respectively Timişoara – Sânnicolau Mare.

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 strongly gleyied vertic chernozem, salinized and alkalised in depth (under 100 cm), extremely profound demi-carbonated on double-layer parental materials, medium fine, medium clayey argyle/medium clayey argyle.

The soil profile has the following succession: Ap – Ap – Amk – A/Cyk – CykG – CyGo – CcaGo - $CcaG_0$ – CcaGr.

Climatic condition between 2007-2008 were characterized by annual average temperatures between 11^{o}C and 12.7^{o}C, and while rainfall ranged between 395 mm and 592.5 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 DISCUSSIONS

Fuel intake is directly related to the mechanical work performed by each agricultural aggregate and depends upon the aggregate`s hourly intake in various working regimes and upon the its operating period.

Tillage system differentiates the fuel consumption depending on aggregate, working depth, resistance to traction and the number of necessary works (RUSU T., 2001).

The analysis of the influence of fuel intake in maize crop (Table 1) show the differences between the experimental variants.

Table 1

Influence of tillage system on fuel intake in maize crop (l/ha)

Technological operation		Tillage system					
		Classical		Unconventional			
		Plough + Disk harrow	Reversible plough + Combined rotating harrow	Heavy disk harrow (two passes)	Heavy disk harrow + Combined rotating harrow	Combined rotating harrow (two passes)	Direct drill
Basic work		31,3	23,5	-	-	-	-
Germinative bed preparation		22,8	11,4	22,8	21,9	18,0	-
Drill		5,4	5,4	5,4	5,4	5,4	42,4
Maintenance, fertilization		10,8	10,8	10,8	10,8	10,8	
Chemical control upon weeds		2,5	2,5	2,5	2,5	2,5	
Harvesting		27,3	27,3	27,3	27,3	27,3	27,3
Other consumption		11,5	11,5	11,5	11,5	11,5	11,5
TOTAL	l/ha	111,6	92,4	80,3	79,4	75,5	81,2
	%	100 (Mt)	82,7	71,95	71,14	67,65	72,75

The bigger fuel consumption was recorded within the classical variants with earth board plough, namely 111.6 l/ha, respectively 92.4 l/ha. A fuel intake of 75.5-80.3 l/ha was recorded within the variants with minimum tillage, and it was 81.2 l/ha in the case of direct drill.

Fuel consumption, analyzed according to the main production obtained, is presented in Table 2.

Table 2

Influence of tillage system on fuel consumption in maize yield (l/t)

Technological variant/ specification	Plough + Disk harrow	Reversible plough + Combined rotating harrow	Heavy disk harrow (two passes)	Heavy disk harrow + Combined rotating harrow	Combined rotating harrow (two passes)	Direct drill
Production t/ha	8,70	8,87	8,19	8,35	8,46	8,40
Fuel intake l/t	12,82	10,41	9,80	9,50	8,92	9,66
Fuel intake %	100	81,20	76,44	74,10	69,57	75,35

Determinations performed show that fuel consumption decreases with 3.02-3.9 l/t in minimum tillage and direct drill variants, compared to 10.41-12.82 l/t consumed in the classical technology. Compared to classical systems, fuel consumption decreases with 31.3-36.1 l/ha in minimum tillage variants and with 30.4 l/ha in the case of direct drill technology.

CONCLUSIONS

The unconventional tillage system influences maize production. It is more profitable to obtain yields lower with 90-95% in the unconventional system compared to the classical ones due to the dramatic reduction of fuel intake.

Grain maize yields have values between 8450 kg/ha in the minimum tillage variants and 8400 kg/ha in the case of direct drill. Compared to the classical system, yields are lower (94,13-97,12 %).

Fuel intake per total technology has the biggest values in both crops under the classical system. In maize crop, fuel savings are between 31.3-36.1 l/ha in the minimum tillage variants and 30.4 l/ha in the case of direct drill.

The maintenance and preservation of soil physical features through the promotion of unconventional tillage, with satisfactory yields and taking into account the significant fuel intake reductions represent a useful solution and a viable alternative, too, for the classical system due to its numerous advantages.

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