

THE INFLUENCE OF THE SOIL TILLING SYSTEM ON THE PRODUCTION AND ECONOMIC EFFICIENCY OF THE CORN CULTURE IN THE SOMESAN PLATEAU

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Abstract: *The knowledge about the influence that soil tillage has on the agricultural production and profit has been the permanent concern of both scientific research and farmers. Soil tillage has an evident impact on the soil and production, but without a constant value and a certain size, as the relation with the surrounding environment always interferes, especially the weather conditions, the status of the ecological determinants and the cultivated technology applied. The crop level depends on the degree to which each factor and all of them together come close to the optimum values requested by the biology of the plants, so that the corn production recorded in the experimental years in the area of the Somesan Plateau is connected to the soil tiling system and the climatic conditions. This paper follows the line of the present and future attempts of transforming the technologies by the rationalization of some of their components, respectively by replacing one soil tilling system with another one, with the final purpose of preserving the soil and obtaining efficient and sufficient productions. The high balance of soil tillage expenses in the corn culture technology motivates the rationalization of the soil tillage with the purpose of reducing the fuel consumption and introducing new soil tillage alternatives with the chisel, paraplow and rotary harrow which lead to making the cultivation technology more productive, an increase in profit for the surface unit and a decrease of the production costs in the area. The new soil tilling systems recommended for different climate and soil areas and actual local conditions constitute alternatives which eliminate the risk factors and their negative consequences on the agricultural agro-ecosystems. The increase in the fuel prices and the necessity of reducing the energetic input with the purpose of increasing the economic efficiency of the soil cultivation was another cause which led to major changes in the concept of soil tillage. This paper is designed as an experiment with the four tilling systems in which the production and economic efficiency is observed for corn, which has the highest balance in the area in the arid years conditions which we have been facing lately. The analysis of the corn production by the tillage system confirms the above mentioned, with productions between 3656 hg/ha and 4504 kg/ha. The analysis of the recorded corn production confirms the inefficiency of the use in the conditions of the Somesan Plateau of the rotary harrow and chisel, as highly significant negative differences with limits between 583–738 kg/ha have been recorded comparatively to the classical plowing alternative.*

Key words: soil tillage, production, economic efficiency

INTRODUCTION

The production of each cultivated plant is the result of the interaction of all the factors which participate one way or another to the formation of the crop. The level of the crop is in direct connection to the degree in which every factor comes close to the optimum values required by the biology of the plant.

This global condition is rarely met in the natural life environment of the plants, but it can be improved by associating different practices: the way of preparing the soil, the sowing period, the density and the equipment used, the culture rotation, the soil or hybrid choice, the fertilizing and the application methods, control of the weeds, diseases and pests, so that the “offer of the place” is as close as possible to the biology of the cultivated plant.

To a large extent, the relationship between the soil tilling system and the production depends on the previous state of the soil and the precipitation level. The classical soil tilling system based on plowing with the mouldboard plough generally ensures the highest crops, exploiting however the natural fertility and exhausting the soil resources.

When elaborating the alternative soil tilling systems not only the immediate results (high productions) must be targeted, but also the long-term ones, which ensure the durability of the system in time.

Soil tillage manifests its superiority as the main economical means of lasting agricultural production through the use of mechanical means, of water, being the leverage of the agricultural production profitability, closely connected to the economic requirements.

The specialized literature from Romania – (Lazureanu A., 1999, Gus P., and colab. 1998; Sandoiu D.I., 2000; Jitareanu G., 2006), offers enough examples concerning the Romanian researchers' preoccupation for finding out the role that soil tillage has on production and profit with the cultivated plants.

MATERIAL AND METHODS

The results presented in this paper were obtained in the experimental fields of the agrotechnics discipline from the Jucu region in Cluj, on argic-stagnic Faeoziom soil, with a humus content of 3,8% and 6,5 pH. From a climatic point of view, the hilly area where the experiments took place is characterised by medium annual precipitations between 550-650 mm. The thermal regime of the area is characterised by annual average temperatures between 8,0-8,2°C.

The aim of the research was determining the influence of the soil tilling system on the production and the economic efficiency of the corn culture.

The experimental factor was the following:

- Factor A – Tillage system:
- a₁ – worked with reversible plough
 - a₂ – worked with chisel
 - a₃ – worked with paraplow
 - a₄ – worked with rotary harrow

RESULTS AND DISCUSSIONS

The recorded corn culture production in the arid years conditions at Jucu, Cluj county, varies by the soil tilling system. For the corn culture, the productions were between 3656 kg/ha and 4504 kg/ha.

As level of production, this is relatively low in all the research alternatives, regardless of the tilling system, as the climatic conditions were less favourable, with a high thermic regime, with annual average temperature 1-20°C over the multiannual average specific to the region, while the rainfall regime was deficitary, the precipitation amount being situated with 50-100 mm during the vegetation period, comparatively to the multiannual average of cca. 600 mm a year. Even in less favourable climatic conditions, but on a soil with very good fertility for corn, the soil tilling system was not able to compensate for the limitative effect of the climatic conditions.

In the years of less favourable climatic conditions for the corn culture, the amount of rainfall being lower, the levels of crops over 4000 kg/ha and reaching 4504 kg/ha can be found, in the paraplow soil tilling system alternative. One first analysis of the recorded productions for the corn culture confirms the inefficiency of using the rotary harrow and the chisel in the conditions of the Somesan Plateau, as very significant negative differences have been recorded comparatively to the classical alternative, with limits between 583-738 kg/ha.

In the third soil tilling alternative, even if the highest production is recorded comparatively to the classical alternative, the crop increase is practically close to the classical one, with a plus of 110 kg/ha, which confirms the fact that the soil tilling system doesn't achieve higher increases in limited climatic conditions. The significance of the differences recorded as compared to the classical alternative leads to the idea of the inefficiency of the soil tilling method with the rotary harrow or the chisel in the conditions of arid years.

Table 1

Corn crop production varying with the soil tillage system

Soil tillage system	Production kg/ha	Production %	Difference ±	Differences significance
Reversible plough (a1)	4394	100	Mt.	Mt.
Chisel (a2)	3811	86,7	-583	000
Paraplow (a3)	4504	102,5	110	*
Rotary harrow (a4)	3656	83,2	-738	000

DL (p 5%) = 93 kg/ha;

DL (p 1%) = 140 kg/ha;

DL (p 0,1%) = 225 kg/ha

Table 2

Significance of production differences evaluated through Duncan test

Soil working variant	Corn production (kg/ha)	Classification
a ₄	3656	A
a ₂	3811	B
a ₁	4394	C
a ₃	4504	D

The analysis of productions by multiple comparisons separates two groups: the first one with productions lower than 3811 kg/ha, and the second one with productions higher than 4394 kg/ha and reaching 4504 kg/ha.

The analysis of the the corn culture economic efficiency (fig.1) by the soil tilling system highlights the influence of soil tillage, regarding the main production, the production cost and the total profit. The main production value varies between 1715 lei/ha and 2126 lei/ha, in close connection to the level of recorded productions, determined and influenced by the soil tilling system. In relation to the low medium level of the crop from the analysis of the economic efficiency, it follows that for all soil tilling alternatives, the production costs were lower than the value of the production, which means achieving profit. Differences occur regarding the size of the profit comparatively to the witness alternative. Thus, for the witness alternative the profit is 242 lei/ha, being exceeded only by the paraplow soil tilling (a₃) alternative. Values lower than the profit recorded with the classical system were noticed with the rotary harrow and the chisel soil tilling alternatives. The profit is minimal with the chisel alternative and maximal with the paraplow alternative. These differences can be explained by the soil compaction as a result of the draught periods in the experimental years.

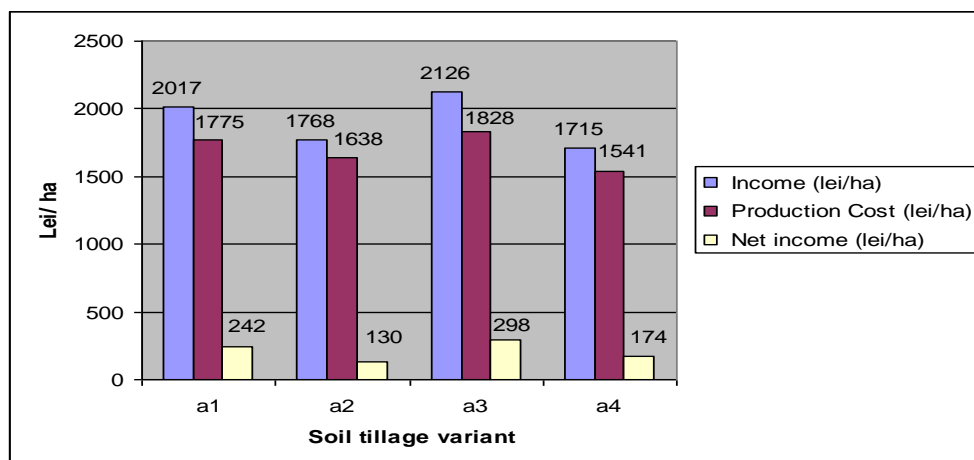


Fig. 1 The economic efficiency of corn in relation to soil tillage system

CONCLUSIONS

The corn productions recorded in the experimental years is in relation to the soil tilling system and the climatic conditions of the Somesan Plateau area, with productions between 3656 hg/ha and 4504 kg/ha.

Comparatively to the witness alternative, the classical soil tilling system by plowing with the reversible pough, only in the paraplow tilling system a crop plus was recorded, with a significant difference of production, the increase being of 2,5 %.

The analysis of the productions recorded with the corn culture confirms the inefficiency of using the rotary harrow and the chisel in the conditions of the Somesan Plateau, as very significant negative differences have been recorded comparatively to the classical plowing alternative, with limits between 583–738 kg/ha.

Concerning the economic efficiency aspect for the corn culture, from the three soil tilling alternatives, with chisel, paraplow and rotary harrow, in the soil conditions specific to the Somesan Plateau, in arid years, we recommend the classical plowing system, with a profit of 242 lei/ha, and the paraplow unconventional tilling system, with a profit of 298 lei/ha.

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