INFLUENCE OF CONSERVATIVE SOIL WORK IN MAIZE: FUEL CONSUMPTION

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Abstract. *Soil "conservative work" is a generic expression, which refers to a multitude of methods of work, from direct sowing to the aerating and mobilising the entire soil profile, excluding the turning of furrows and the burning of stubble, allowing the maintenance of plant debris on the surface of the soil or close to the surface of the soil and/or the preserving the soil to reduce erosion and improve soil-water relation. The transition from conventional soil to conservative systems was not simple and it gave rise to a multitude of questions to which relevant, scientifically well-founded rhetoric was required, some of which were obtained through fundamental and applicative research carried out under specific local conditions. The large-area implementation of conservative soil systems is not yet nearly resolved even in countries with very high technological potential and solid specialized knowledge. Conservative agriculture aims to increase agricultural production by optimising the use of agricultural resources contributing to reducing widespread land degradation through integrated management of available soil, water and biological resources combined with extreme raw materials. Soil works primarily result in changes in physical attributes that further influence the chemical and biological properties of the soil. It should be pointed out that the technique and time (period) during which soil works are carried out are subject to plant requirements, the purpose for which it is cultivated, as well as to ecological, climate, soil and relief conditions. The unconventional soil work system includes ways of superficial soil processing, namely: heavy disc harrowing, combined rotary grape work, work with the cultivator and the work with the chisel. Unlike the classical system, only soil works are different, the other technological elements (fertilization, herbicide) remain the same. Vegetable debris that remains on the ground at a share of 15-30% being incorporated into the soil according to the variant used. In 2019, there was a consumption of 105.00 l/ha for the control variant, and for variants with minimum tillage, values between 91.00-99.00 l/ha were recorded.*

Key words: *soil, conservative work, combined, exploitation*

INTRODUCTION

The *purpose* of the research is to accumulate data on soil works, interventions (operations) carried out with agricultural tools and machinery to alter its attributes and direct its vegetation factors (water, air, heat, nutrients and biological activity), thus creating optimal conditions for the development of cultivated plants. [ALINA-MADALINA LATO, și colab., 2016, AURELIA MIHUȚ, și colab., 2018]

The *object* of the research is soil works in an unconventional system on a personal property land (vertosol) located in Sântana, Arad County, Romania.

Soil work has been an integral part of agriculture since the beginning and served several important purposes: preparing the germination bed, reducing soil compaction in order to increase aeration and better development of the plant root system, reducing the degree of weeding, incorporating fertilizers and amendments, managing plant debris. [NIȚĂ LUCIAN-DUMITRU, 2007, L NIȚĂ, și colab., 2018, LUCIAN NITA, și colab., 2019]

MATERIAL AND METOHD

Studies were carried out in a field in Sântana, Arad County, on a vertosol.

Under the notion of "unconventional soil work system" were included ways of superficial soil processing: heavy disc harrowing, combined rotary grape work, work with the cultivator and the work with the chisel. [OKROS A., și colab., 2014, OKROS ADALBERT, 2015]

The studies carried out started from the work of the soil in the classical system "furrow turning" considered the control, compared to various new soil work systems, "unconventional systems", being used variants with minimum tillage.

The *unconventional soil work system* includes ways of superficial soil processing, namely: heavy disc harrowing, combined rotary grape work, work with the cultivator and the work with the chisel. [R. ILEA, și colab.,2017, TONEA CORNELIA, 1996]

Unlike the *classical system*, only soil works are different, the other technological elements (fertilization, herbicide) remain the same. [ȚĂRĂU D., 2003, MIHUȚ CASIANA, 2014]

Vegetable debris that remains on the ground at a share of 15-30% being incorporated into the soil according to the variant used. [ADALBERT OKROS, și colab., 2018]

Studying and expanding minimum tillage systems is important due to the need to reduce production costs and the risks of soil degradation, compaction and erosion.

Due to the application of the variants of the unconventional soil work system, the studies carried out lead to significant reductions in fuel consumption per surface unit and per production unit. [CASIANA MIHUȚ, și colab., 2012, CASIANA MIHUȚ, și colab., 2018,]

In view of these differentiation conditions, the concrete objectives of soil work may be as follows:

-Fixing physical, chemical and biological attributes, together with creating optimal conditions for seed incorporation, their germination, and subsequent plant growth;

-Maintaining and enhancing soil fertility by periodically restoring the landing of the ploughing layer and incorporating into the soil the remaining vegetable debris after harvesting plants, manure, green fertilizers, mineral fertilizers, amendments, etc.;

-Eliminating or decreasing the negative properties of soils affected by limiting factors (excess moisture, salinization, drought, erosion) by improving the internal drainage of the soil, fragmentation of hardpan, shredding of the crust, favouring the salt washing process;

-Controlling weeds as well as some diseases and pests that have development cycles in relation to the soil;

-Depolluting soil by intensifying the activity of microorganisms, favouring oxidation processes.

The calculus of the fuel consumption of agricultural aggregates shall be determined with the relationship:

where:

C_{ha} is fuel consumption per ha;

C_h^n is the hourly fuel consumption of the tractor engine at the nominal operating mode in kg/h;

λ_c is the correction coefficient taking into account incomplete loading of the engine during work, consumption when driving in idle and stationary of the aggregate with the engine in operation.

The determinations in the field were carried out with the fuel consumption unit FLOWTRONIC – 217 connected to the D-110 fuel supply system that equips the 65 HP tractor.

When carrying out mechanised agricultural works, fuel consumption is directly linked to mechanical work carried out by each agricultural aggregate, depending on the hourly consumption of the aggregate at different working arrangements but also on their service life.

Fuel consumption according to the soil work system in grain maize (l/ha) in 2019 depending on each variant of soil work used differs only in terms of the *basic work in variant 1* (plough + star harrow) the cost is 24.50, i.e. less than in variants V_2, (31.50), V_3 (34.50), V_4 (36), V_5 (39.5), and V_6 (37.50).

When preparing the germination bed + herbicide (V_1) the cost is 21, unlike the other variants: V_2 (31.50), V_3 (34.50), V_4 (36), V_5 (39.5), and V_6 (37.50).

Fuel consumption for each technological operation (l/ha) relating to each variant of soil work excluding V_1 remains the same.

In 2019, there was a consumption of 105.00 l/ha for the control variant, and for variants with minimum tillage, values between 91.00-99.00 l/ha were recorded.

RESULTS AND DISCUSSIONS

Soil works according to classical technology are complex activities based on high energy expenditures and limiting the production of profitable productions, since proper execution must also be done in the optimal period.

Given the prolonged energy crisis, farmers have found new solutions to prepare the soil by carrying out several works while modifying the existing machine assembly.

Where energy consumptions required by the preparation of the land and the maintenance of crops were not limiting factors, the continuous degradation of the structure, the surface compaction and the layering of the soil profile and erosion due to climate conditions have been as many reasons for changing the approach of mechanised works technologies.

The method of soil processing by conservative working technology has gradually been imposed not as meaningless but as an eco-pedologic necessity, on certain areas being the only option reproduced by the blurring of the lasting, remnant effects of intensive work system.

The influence of the minimum tillage method is found in the modification of some variable soil attributes at the level of productions and profit made at the surface unit, through the level of energy inputs and harvests obtained.

The show made with the soil blade plough represents the largest fuel user (Diesel) of all mechanized technological operations, especially since the soil has a medium-smooth or fine texture and the working depth increases. Replacing it, even partially, and returning to the basic work even after only two to three years, under the conditions of preservation of production results, is an alternative to the solution to reducing fuel consumption.

The results obtained in the experimental cycle show that the values obtained in the variants with minimum tillage are lower than those obtained in the classical version.

The economic efficiency of the direct sowing technology used in grain maize consists in obtaining productions close to those obtained in the classic system but with lower technological costs.

CONCLUSIONS

The large-area implementation of conservative soil systems is not yet nearly resolved even in countries with very high technological potential and solid specialized knowledge.

The studies carried out started from the work of the soil in the classical system “furrow turning” considered the control, compared to various new soil work systems, “unconventional systems”, being used variants with minimum tillage.

The *unconventional soil work system* includes ways of superficial soil processing, namely: heavy disc harrowing, combined rotary grape work, work with the cultivator and the work with the chisel.

Unlike the *classical system*, only soil works are different, the other technological elements (fertilization, herbicide) remain the same. Vegetable debris that remains on the ground at a share of 15-30% being incorporated into the soil according to the variant used.

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