# STUDIES CONCERNING MECHANIZATION OF SOIL WORKS IN WHEAT CULTURE

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***Abstract:*** *The tillage system has been representing one of the major technological elements used to interfere in order to increase plant production and, lately, more and more in order to optimize the relationship between production – benefit – the preservation of fertility and resources. The conventional system, in addition to its advantages, has repercussions and disadvantages. Thus, the large number of works and repeated field crossings with agricultural tractors and machines adversely affects agro physical features (surface and depth compaction, soil structure degradation, humus content reduction), agro biological (reduction of living creatures and biological activity) leading to decreasing the natural fertility of the soil in the long term and in some areas the phenomenon of erosion is accentuated. Through its nature and functions, soil represents a live organism recrossed by energetic flows, which intercondition each other, governed by natural laws that seem to be in an apparent equilibrium. The complexity of the energetic flows within the agricultural production process imposes a certain drastic control upon inputs and outputs at each production loop and the avoidance of the possibly exhausted resources, like soil and water. Starting from the necessity of eliminating the disadvantages of the conventional system, the development of alternative soil technology to ensure the preservation and maintenance of its productive capacity as well as the reduction of energy consumption are today basic requirements for the development and building of a sustainable agriculture. New technologies for mechanization of soil works in a conservative system include several processing systems: minimum tillage, mulch tillage, no-tillage or direct drill. In recent years, the mechanized soil conservation works has been successfully applied to our country, especially in the farms with modern agricultural machinery. The studies in this paper refer to the minimum works for the wheat culture under the conditions of Mercina-Caraș Severin. The high-productivity agricultural aggregates used in mechanized works have allowed them to be achieved in optimum sowing time. The variants of working the land with the heavy disc harrow, combined rotating-action harrow, total-processing cultivator contribute to the amelioration of soil's physical features, as resulted from the evolution of these features during the experimental cycle. However, within their application, we must take into consideration the soil's technological features, which depend on texture, structure, humus content, and land exposure and weather conditions.*

***Key words*****:** *wheat, agricultural aggregates, minimal tillage, fuel, economic indexes.*

## INTRODUCTION

In the last years, Romania's agriculture has undergone many transformations, one of which is the transition from state to private agriculture. As in the more developed countries, we also aim at increasing the productivity of labor through the mechanization of agriculture and its scientific practice, resulting in both ecological agriculture and efficient agriculture in the production of large productions. Agriculture has been, since ancient times, and will remain the essential source of food and clothing for the entire population of the globe.

The intensive use of agricultural machinery ensures the increase of labor productivity in agriculture, it makes possible, in parallel with the extension of mechanization that each agricultural producer can feed through an increased number of people. It is expected that in the coming years, agriculture will experience a reduction in the labor force and an increase in the surface of agricultural farms. In recent years, in our country, in many places, we have moved from small farms of 50-100 ha to farms larger than 1000-2000 ha.

Addressing future agricultural issues involves the use of high performance tractors as well as complex aggregates capable of solving the high volume of mechanized work on time and with increased efficiency.

The dynamics of agriculture endowment with mechanical means is continuously ascendant, the current concerns being directed towards increasing the number of agricultural machinery and equipments as well as improving them. The modern technical equipment of agriculture demands a thorough training and a high professional level of all those who use this equipment. The provision of modern and sustainable agriculture according to the experience of the leading countries in this field is done with a wide range of machinery and installations, of which the machines that constitute the energy base are of great importance and economic efficiency. For Romania, which has great agricultural potential through land area per capita and favorable pedoclimatic conditions, it is important to increase labor productivity by increasing the degree of mechanization in agricultural holdings.

The development of alternative soil technology to ensure the preservation and maintenance of its productive capacity as well as the reduction of energy consumption per unit of surface area is today a necessity for the development of sustainable agriculture.

The researches revealed the unfavorable effect of intensive soil processing through the classic (conventional) system on its erosion. This has led to the development of research into new soil conservation technologies in conservation. The concept of soil conservation includes a set of activities, measures and technologies that help to maintain its fertility status for an unlimited period. This concept will develop in the future because soil is the most important means of human existence that ensures the production of agro-food products, raw materials for the industry of renewable energy sources, and maintaining its biological capacity is a necessity imposed by the very existence of social life.

## MATERIAL AND METODS

The conventional agricultural system, applied in Romania in the 20th century, relied on a high degree mechanization and chemistry, led to a spectacular production enhancement. But the numerous, abusive interventions upon the arable land favored the processes of intense oxidation, and consequently the diminish of the soil organic substance content, the deterioration of soil structure and the increase of the erosion. The difficult traffic and the great number of changes led to the enhancement of the compactation phenomena and as a result to the starting for other negative phenomena and to the loss of soil fertility.

The difficulties due to the classic tillage system (conventional), which is an intensive system and it includes obligatory plough-land with the mould board plough, have determined the apparition and the quick extension of the soil preservation concept.

The excessive mechanization of agricultural works tends to be replaced by minimum works (minimum tillage) exerted only in moments of maximum efficacy. Through combined technical interventions carried out in the proper moment, we can avoid the lack of equilibrium that can appear in the agricultural systems caused by the excessive soil ramming. Among these, we can mention the degradation of soil structure, the reduction of fertility and the disturbance of the microbiological processes within soil.

The conventional soil cultivation system, in which land is emerging, needs to be further practiced, but it needs to be improved by diversifying the energy base, the construction and working process of the plows, the execution of the plowing when the soil has the optimal humidity, associated with the alternation of the depth as part of appropriate crop rotation.

Compared to the classic system, only soil works are different, the other technological elements (fertilization, herbicide) remain unchanged.

The results comprised in this paper are founded on the experiments carried out on the fields from Mercina - Caraș Severin County in the autumn of 2015 year. The study refers to minimal works in wheat culture. Mechanized works were performed by S.C. DJ&B Agro Comerț SRL Oravița. The agricultural mechanized works were carried out with the following agricultural aggregates:

- fertilizer machine Sulky DPX Prima with John Deere 6190R tractor (figure 1);
- chisel plows depth Horsch Tiger 8 AS with John Deere 8285R tractor (figure 2);
- disc harrows Lemken Gigant 12 with John Deere 8285R tractor (figure 3);
- sowing machine Vaderstad Rapid 600 with John Deere 6190R tractor (figure 4).

Figure 1: Tractor John Deere 6190R with fertilizer machine Sulky DPX Prima


Figure 2: Chisel plows depth Horsch Tiger 8 AS

Figure 3: Tractor John Deere 8285R with disc harrows Lemken Gigant 12

Figure 4: Tractor John Deere 6190R with sowing machine Vaderstad Rapid 600

The agricultural aggregates used in the soil works have high working capacity, correspond to the agro technical requirements, and perform quality works in the optimal period.

The types of tractors used were chosen according to the technological process of the works and following the indicators: power, weight, maneuverability, parcel dimensions, energy consumption of agricultural machinery and the state of the land.

In the execution of mechanized agricultural works, the optimal option is always chosen, which is appreciated by the minimum value of the number of aggregates taking part in the execution of the work or after the minimum amount of time, respectively after the fuel consumption.

Three fertilization works were carried out: a basic fertilization work before to the preparation of the land and two fertilization works in the vegetation. The preparation of the terrain with the disc harrow was achieved by two passes of the aggregate on the field.

## RESULTS AND DISSCUSIONS

In the experimental setting we tested the following parameters, for each agricultural mechanized work: fuel consumption, working width, working depth, hourly productivity, daily productivity, payroll value, fuel value, repay value, maintenance value, direct expenditure, ancillary expenditure, total expenditure. Currency papers were prepared, for each mechanized work. The results of the determinations are summarized in Table 1.

*Table 1*

The exploitation and economics indexes of mechanical works at wheat culture

| No. crt | Parameter | The aggregate of: | | | | TOTAL (lei) |
|---|---|---|---|---|---|---|
| | | Fertilized JD 6190 + Sulky DPX (3 works) | Scarified JD 8285 + Horsc T 8 | Soil tillage JD 8285 + Lemken 12 (2 works) | Sowing JD 6190 + Vaderstad 6 | |
| 1 | Power of engine tractor [HP] | 190 | 320 | 320 | 190 | - |
| 2 | Fuel consumption [liters/hour] | 32 | 54 | 54 | 32 | - |
| 3 | Working width [m] | 24 | 7,5 | 12 | 6 | - |
| 4 | Working depth [cm] | - | 20 | 10 | 5 | - |
| 5 | Hourly productivity [ha/h] | 18 | 4,4 | 10 | 3 | - |
| 6 | Daily productivity [ha/day] | 150 | 35 | 80 | 24 | - |
| 7 | Fuel consumption [liters/ha] | 3 x 3 | 18 | 10 x 2 | 6 | 53 |
| 8 | Payroll value [lei/ha] | 7 | 9 | 8 | 5 | 29 |
| 9 | Fuel value [lei/ha] | 45 | 96 | 110 | 33 | 284 |
| 10 | Repay value [lei/ha] | 9 | 7 | 16 | 7 | 39 |
| 11 | Maintenance value [lei/ha] | 9 | 8 | 18 | 7 | 42 |
| 12 | Direct expenditure [lei/ha] | 70 | 120 | 152 | 52 | 394 |
| 13 | Ancillary expenditure [lei/ha] | 16 | 28 | 36 | 12 | 92 |
| 14 | **Total expenditure [lei /ha]** | **86** | **148** | **188** | **64** | **486** |

## CONCLUSIONS

Taking into account the results obtained from the studies carried out on the mechanized works for the wheat culture in the Mercina area, the following conclusions can be drawn:

Fuel consumption for fertilized, scarified, soil tillage and sowing works is 53 liters / ha, corresponding to the consumption for the plowing and soil tillage of classical technology.

Fuel costs (284 lei/ha) represents 72% of direct expenditure and 58% of total expenditure.

The optimal mechanization technology consists in the judicious correlation of agricultural works and aggregates throughout the technological process to obtain the product with the lowest labor and energy consumption.

The modern mechanization technologies have great economic efficiency due to the following aspects:

- the works are carried out in a short time, so that the optimal period of the technological work is respected;
- reducing the number of aggregates required;
- the number of crossings on the ground is reduced;
- the degree of soil compaction is reduced;
- reducing fuel consumption.

In order to reduce fuel costs, it is necessary to subsidize diesel fuel, taking into account that mechanized agricultural work takes place in the field.

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