PERFORMING THE PLOUGHING

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Abstract. *Agriculture, with all its branches, is one of the few economic branches that has a positive energy balance under the conditions in which it must ensure, in quantitative and qualitative terms, the vital element for the existence of an increasing number of people: food. The main ways of reducing energy consumption in agriculture are the choosing properly the energy base in the agricultural holdings; reducing chemical fertilizer consumption in favour of natural ones; reducing herbicides and pesticides technologically; using conservative soil work systems; increasing the energy efficiency of agricultural aggregates; reducing harvest losses; and optimizing mechanization technologies. Ploughing is the basic work of the soil, performed with a plough and consisting in the turning of the furrow, soil aerating, crushing, and levelling. To accomplish this operation, the plough has a long iron that cuts the furrow laterally and detaches it from the rest of the soil, a furrow that breaks the furrow at its lower part and an earth-board that lifts and turns the furrows into smaller soil parts. Ploughing aerates the soil on a certain depth, creating an optimal ratio between the capillary and non-capillary lacunar spaces. It incorporates stubble, plant debris and fertilizers. This is how the soil is enriched in organic matter and restored, to some extent, in humus. The weeds are destroyed by incorporating both vegetal parts and seeds. Some weed seeds incorporated in deeper soil can no longer reach the surface. Good conditions for the accumulation of water in the soil from the falling precipitation are, thus, created. If the water is in excess, more wavy and deeper ploughing reduces excess water.*

Keywords*: agricultural aggregates, tractor steering, ploughing, performing*

INTRODUCTION

Ploughing contributes to improving soil structure. It inserts the furrow under the layer in which the structure is depreciated and brings out a new layer of soil with a better structure. At the beginning of the 3rd Millennium, the tractor remains the fundamental element of the energy base for agriculture. [ANIȘOARA DUMA COPCEA, Casiana MIHUȚ, Daniela SCEDEI, A. OKROS, STOICA I. TRUȚAN, V. CRAIOVEANU, Carolina ȘTEFAN, 2021, ANIȘOARA DUMA COPCEA, R. ILEA, I. CRÎSTA, 2017] Tractors are strongly related to the environment, especially by the direct action on the soil. In terms of the constructive type, tractors will continue to diversify, while increasing their universality, the two trends being imposed by the need for some more and more specialized agricultural work and the increase in the length of use over a year. [ANIȘOARA DUMA COPCEA, R. ILEA., CASIANA MIHUȚ, 2017, COSMINA BOCA, ADRIAN MURA, RADU ILEA, ANIȘOARA DUMA-COPCEA, 2019].The engines equipping agricultural tractors have seen a continuous improvement, namely: common-rail injection system with electronic command and control, increase in injection pressure, exhaust gas recirculation, catalysts use, etc. Transmission is an important assembly of the tractor if we take into account the influence it exerts on the operating parameters and its share of the total cost of tractors (25-30%). Constructive refinement and electronation of the systems will cause automatic gearbox performance that can selectively choose the travel speed. The current millennium tractors will be equipped with gearboxes that typically achieve 20-36 speed gears for ahead.

Wheel tractors will evolve in terms of construction such as increasingly lower tires with lower pressures in order to reduce soil tapping in plants and deep in the soil. [A. LAȚO, I. RADULOV, A. BERBECEA, A. NEACSU, I. LATO, F. CRISTA , L. SMULEAC , M. CORCHES, 2020, K. I. LATO , M. POPA , A. LATO, M. CORCHES, I. RADULOV, A. BERBECEA , F. CRISTA, 2015]

The maximum travel speed of the tractor has a continuous growth tending to generalize at 80 km/h, which will allow transport tractors access to motorways. Tractor steering systems will be improved in the sense of increased manageability. By equipping the tractor with electronic systems and installations, it tends to become a power plant capable of coupling with users who can achieve a wide range of works. As regards the tractor's work equipment, it is necessary to expand it both in front and in the back. The control of the tractor equipment will be continuously refined by entering remote electronic controls. [S. BIRIS, V. VLADUT, N. FAUR, A. CERNESCU, M. MATACHE, O. KABAS, I. VOICEA, S. BUNGESCU, C. POPESCU, 2015, GANGA M., VLADUT V., MANEA D., BIRIS S., BUNGESCU S., 2007]

Important progress will be recorded in the field of operator comfort – cabins fitted with elastic suspension and damping, concentration of orders on a console placed on the right of the seat. Ploughing contributes to controlling diseases and pests of cultivated plants. Through ploughing, diverse pests, larvae, etc. are removed destroyed by sun or birds. Some host-plants for plant diseases are destroyed, the galleries of the pests are destroyed. It improves the activity of the soil microorganisms. Aerobic bacteria that decompose organic matter are multiplied and provide nutritional chemical elements. Achieving these objectives leads to the appreciation of the quality of the ploughing reflected by certain quality indices such as execution period, execution depth, degree of breaking up, aeration index, waving degree, presence of fails, etc.

Optimizing all parameters of agricultural machinery (aggregates) in order to reduce consumption of materials and energy in operation is an essential goal for all units that use these aggregates

MATERIAL AND METHODS

Agricultural aggregates, moving on the ground, consume a large amount of energy, which asks for determining the scientific basis of constructive and exploitation parameters at which energy consumption is minimal. A series of factors, among the most important are farm size, destination, relief and soil and climate conditions, availability of capital and, last but not least, price: quality ratio. In addition to these objective factors, the choice of the energy base is also determined by various agricultural grant policies at national level. A particularly important aspect related to the choice of the tractor is given by operating, maintenance, and repair costs. For the ploughing, we have chosen the Romanian-made tractor U-650 m as a source, a tractor that creates the possibility of mechanized execution of all the works provided in the mechanization technology. Ploughing the land with a plough remains the basic work in plant culture in most areas, despite the increasing use of complex aggregates that execute a lot of works lately. The main subassemblies of a plough are the plough frame, plough body, and support wheel. The type of plough used is chosen so that it achieves the best work quality, and the tractor loading is 80-85% of its nominal power.

The PP-3-30 plough works in aggregate with the U-650 M tractor, ploughing 30 cm deep in the soil on flat or slope lands up to 6^{o}, with a 30 cm plough body width. [POPA D., ILEA R., BUNGESCU S., ALEXANDRA BECHERESCU, 2015, P. ȘERAN, C. CREȚ, Anișoara DUMA COPCEA, CASIANA MIHUȚ, 2019].

In order to prepare the ploughing unit, the following operations are carried out: adjusting the tractor's gauge at 1,600 mm; installing the tractor's lateral tyrants at the middle clamping points, and mounting the central tyrant in the middle or lower point; adjusting the

working width of the first body by crossing the crankshaft to the plough; adjusting the working depth by acting the copy wheel bolt; adjusting the parallelism of the frame with the surface of the land, acting the central tyrant longitudinally and the vertical direction transversally; adjusting the position of the disc knife whose circumference must be located 30-50 mm above the coulter edge plane; correcting the direction of the socket rods with the tractor's forward direction, acting on the threaded stem of the fore-carriage.

The setting is correct when the working width is equal to the constructive width of the PP-3-30 plough, i.e., 90 cm.

Each plough body is attached to the plough frame through a shear safety mechanism, a screw which, when the plough body is overloaded, scissors and allows it to rotate in a longitudinal vertical plane around the other fastening screw for bypassing the obstacle. To note that only the original screws delivered by the manufacturer will be used for replacement.

RESULTS AND DISCUSSIONS

Ploughing aims at deep aeration in order to allow water supply and to create an aero-hydric regime necessary for the growth of plant roots and the activity of microorganisms. It is also aimed at destroying weeds and incorporating of vegetal debris.

Ploughing is executed when the land allows for high-quality work with low energy consumption.

Ploughing will be performed in autumn, at a depth of 28-30 cm. There is a good incorporation of vegetal debris without fail.

The energy source in the creation of an aggregate is the tractor. It makes up all agricultural aggregates, being the essential element in a mechanization technology. Agricultural practice has proven that the correct choice of a tractor is fundamental to the economic success of an agricultural holding.

The type of plough used is chosen so that it achieves the best quality of the work, and the tractor loading is 80-85% of its nominal power.

The PP-3-30 plough works in aggregate the U-650 M tractor, ploughing at a depth of up to 30 cm on flat or slope lands up to 6^{o}, with a 30 cm plough body width.

Ploughing can be executed at quality parameters required if ploughs with blade plough boards are used. By the specifics of the construction of these blades and the way in which they interact with the soil, it is possible to shred the excessive soil layer, i.e., avoiding the clogging of the plough with excessive moist soil, favouring the ploughing in any period of the year.

The behaviour of ploughs equipped with blade plough boards, but also the proper quality of the ploughing supports, in an undisputed manner, the use of this type of plough on such a soil category.

CONCLUSIONS

The use of the most appropriate mechanization, application of chemicals, application of most appropriate fertilization technologies, the use of high-productivity hybrids suitable for these technologies have a great economic efficiency in the sense that production is higher even if current expenses per ha are high. Also, the use of non-volatile herbicides reduces fuel consumption and the number of passes per ha.

In addition to choosing the most economical mechanization technology variants, there are other important means of reducing expenses per ha. To reduce energy consumption per ha, the following are recommended:

- Performing daily maintenance;

- Performing work machinery settings to comply with agricultural aggregate use techniques;
- Choosing the working speeds of aggregates according to each work and agricultural land type;
- Observing plough board and part movement by alternating plots, or the two-plot loop-free method;
- Purchasing a reversible plough for the ploughing;
- Observing the rectangular shape in determining plots.

Therefore, obtaining high production per area unit with reduced costs strictly requires compliance with culture technologies by using well-adjusted and optimally operated aggregates in such a way that fuel consumption is as low as possible.

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