



STUDY ON SOIL PROCESSING UNDER THE ACTION OF KNIFE – CHISEL WORK ORGANS

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Abstract : *Soil processing plays an essential role and its quality depends on a good plant's development. The soil processing process has immediate positive effects by eliminating the compact layer from the surface, good weed control and even pest damage control, increasing the water infiltration rate in the soil and reducing excess water, rapidly stimulating plant growth and development.*

Nowadays, the transition from conventional soil works to conservative systems has an important component in the limelight, namely the soil processing. Conservative systems are based on a less intense soil cultivation, carried out by different methods, without turning the furrow and only under conditions of preserving the soil surface of a certain amount of vegetal debris, being considered for this reason ecological protection strategies.

Keywords: *soil treatment, working organs, knife-chisel, conventional systems*

1. INTRODUCTION

Soil is considered to be one of the most complex natural systems of the planet, a key component of the geographic environment, a biological complex that is constantly transforming. Through its qualitative traits, it influences the intensity of processes in the agricultural ecosystem. Conservation of favorable attributes is a fundamental condition for the sustainable use of its resources [3]. The soil characteristics are in a state of equilibrium relative to the environment, but the cultivation of agricultural land influences the direction of evolution, either to increase fertility or to degrade it [4].

In Romania most soils are compacted with medium or heavy texture, poor drainage and often with a waterproof layer of soil [2]. Over the last half century, a conventional agricultural management system has been generalized, without taking account of local climate and soil conditions, which has led to severe processes of physical degradation of soils such as the destructuring or compacting of those [1], [4].

The essential quality of the soil is its fertility that is the specific capacity that enables it to provide nutrients in appropriate and balanced quantities for plant growth, when a number of specific conditions are favorable: light, humidity, temperature, structural state of the soil etc. Due to soil degradation, harvest losses can reach up to 30% [2].

Among the ways adopted so far to alleviate the negative effects of the soil processing process can be enumerated: the optimization of aggregate pathways for soil treatment, reduction of soil works, reduction of aggregate weight, the development of some culture technologies with few works [2], [3]. Less used as a solution to the situation is optimizing the shape of the work organs of the soil-processing machines. Also, the improvement of the kinematic regimes of processing processes is little approached.

2. MATERIAL AND METHOD

The working organ that moves into the ground, at the depth established, splits the ground and changes its position. Under the action of tension resulting from the splitting of the soil, its profile breaks and rarifies. Thus, it raises the level of the soil surface. In the case of cohesive soils, the rupture caused by the cleat effect of the work piece is oriented transversely outward [1].

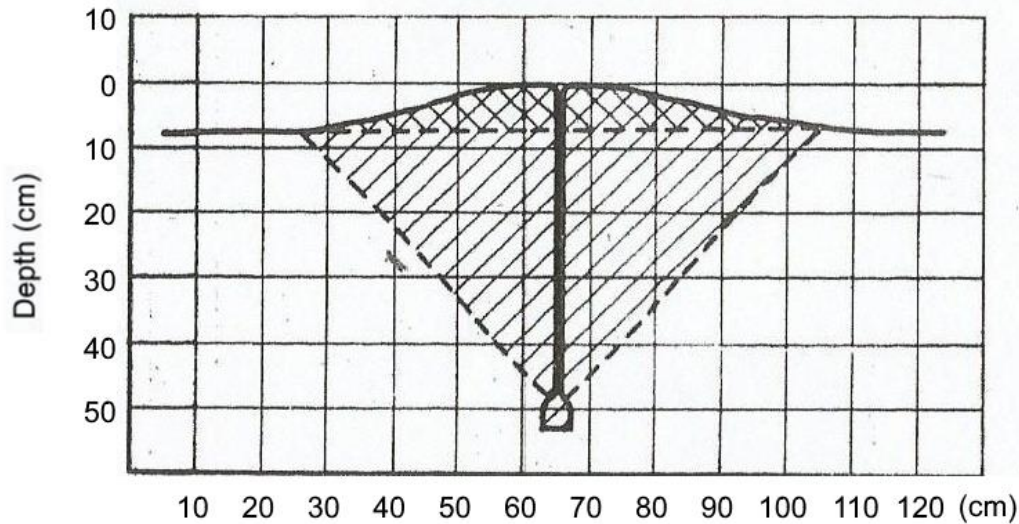


Figure 1: The process executed by the work piece [3]

In case of non-cohesive (sandy) soils, the rupture lines limiting the dislocated profile are near the vertical line. At different soil types, the working process is influenced by a multitude of factors. Even on the same type of soil, afforestation is significantly influenced by soil condition (water content, subsequent mechanical processing etc.). Also, the different parameters of the working organs have different effects in terms of the soil processing process [3].

The effect of the working process is best determined by the percentage of pores resulting from soil processing. At a given state of the soil, the ratio between solid and gaseous components is determined. Gaseous components are found in and between the earth bulges, and the gas filled spaces are considered pores. The ratio of gaseous and solid components is "the proportion of pores"[1]. In the case of knowing the specific gravity and the soil density, the total proportion of the pores is determined by the relation:

$$P_t = \frac{F_s - T_s}{F_s} 100 [\%] \quad (1)$$

Where, F_s – the specific weight of the soil
 T_s – soil density (dry)

The soil effect of the soil treatment process is:

$$l = \frac{P_{tu} - P_{te}}{P_{tu}} 100 [\%] \quad (2)$$

Where, P_{tu} - the total proportion of pores of the treated soil
 P_{te} - the total proportion of pores of the untreated soil

For the soil treatment effect, the relative elevation of the soil surface is also a reference. Thus, increasing the proportion of pores means:

$$\Delta P = \frac{\Delta h}{h + \Delta h} 100 [\%] \quad (3)$$

Where, h – depth of work
 Δh – raising the surface of the soil

Much of the resistance to advancing is given by resistance to the working organ. Therefore, careful consideration should be given to geometric shape and its weight. Resistance to soil processing cannot be determined exactly. Soil structures are different and the physical state changes continuously under the action of climatic elements. The resistance of the vertical knife changes once with the mounting angle of it. From experimental attempts it was found that if the angle of the knife formed with the horizontal shrinks, then the resistance to movement decreases. Also, we obtain a similar result from the bending of the front knife [1], [2].

3. RESULTS AND DISCUSSIONS

A feature of the soil processing process is the ability of the work organs to mix layers and reverse some soil layers. In figure 2 it can be seen how the soil particles move up and side in front of the work body and an empty

space appears behind it [5]. Immediately after the work piece passes, some of the mobilized soil falls behind the knife, allowing mixing with other soil layers.

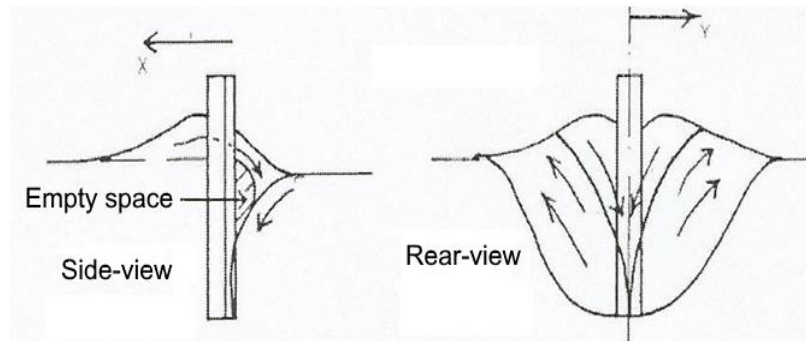


Figure 2: The movement of soil particles at the passage of a knife - chisel operating organ [5]

The shape, width and angle of inclination of the workpiece strongly influences the movement of soil particle mixing. The horizontal transport movement of the soil particles, the soil discarding in the lateral and the soil volume left behind, all tend to increase once with the width of the working organ. Throwing the soil laterally on both sides increases with the forward speed.

4. CONCLUSIONS

- Soil cultivation by bending is used to make a change in soil structure in the compact horizon, increasing the water storage capacity.
- Soil cultivation by bending is a process by which it is deeply roughened without being overturned and also at different depths.
- Soil treatment must be carried out in optimum humidity conditions, when it is between 60-90% from the active humidity range. At a humidity of less than 60%, the soil is too dry, resulting in massive bulbs and high energy consumption. When the humidity is higher than 90% the working process is reduced to a simple cutting of the soil by the working organs.
- The most suitable work pieces are those with a narrow curved shape that reduces the pulling force by 12-15% compared to the straight ones.

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