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## **FACTORS AFFECTING THE TILLAGE SYSTEMS**

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### **ABSTRACT:**

It is necessary to carry out research work and systemization on the tillage affecting factors for the purpose of appropriate selection of one for growing a particular group of agricultural crops. This systemization allows grading, priority investigation, evaluation and management of tillage systems for obtaining the set goals for maximum yields from the agricultural crops at low production cost.

### **KEY WORDS:**

tillage systems, affecting factors, systemization, management of tillage systems

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## **1. INTRODUCTION**

It is established (Dimitrov P. et al, 2007) that different tillage systems have been used in the agricultural production with the purpose of creating conditions for obtaining maximum yields from agricultural crops grown at low production cost as well as conservation of soil and soil fertility. Many factors affect this cyclic ceaseless process and it is hard to predict them or take non-palliative measures.

This development aims at systemization of the factors affecting tillage with a view to defining a method of grading their effect.

## **2. EXPOSITION. CLASSIFICATION OF THE FACTORS AFFECTING TILLAGE SYSTEMS**

It is well known that as a matter of principle every systemization is conditional. Therefore it is advisable to draw a general conclusion on the types of factors affecting tillage, to have them characterized and graded afterwards.

### **A. FACTORS AFFECTING TILLAGE SYSTEMS WITH A VIEW TO THE FINAL EFFECT**

It is of great importance for the theory as well as for the practice to subdivide the factors affecting tillage systems according to their influence on the final results and the kind of effect – positive, negative or conditional, depending on the circumstances.

#### **• Factors of positive effect**

All factors conducive to obtaining positive effect of a tillage system fall into the group of the factors of positive effect. For example, a basic group of factors of positive effect are as follows: appropriate selection of crop rotation and techniques; properly selected agricultural equipment with a view to the method of operation as well as the basic parameters; the respectively utilized power system which should also be of high technical and technological indexes conformable to the trends for

soil non-packing, low power consumption, etc. Conditions such as: relatively flat terrain; weed-free areas; favorable rainfall and temperature for particular periods, have a positive effect as well. Proper shape and sizing of the fields, appropriate planning and infrastructure, adherence to proper timing and working conditions result in another positive effect on tillage systems.

If all of the above mentioned factors of positive effect are not precisely carried out and observed, they can affect negatively the tillage systems. However, there are several factors which definitely have negative effect and these call for additional measures for diminishing and eliminating them.

● **Factors of negative effect**

Unfavorable or worsened chemical and physical properties of the soil, which are inter-related, are in the first place among the factors of negative effect. For example, soil saturation with sodium water results in decreasing its permeability and increasing its hardness at drying. Calcium decrease in acid soils is conducive to the same results with increase in hydrogen and aluminum, which is furthermore noxious to the plants. A large quantity of hydrogen ions and decrease in organic colloids result in deterioration of the soil quality which brings about hardships with its maintenance.

Another group of factors of negative effect to the tillage systems is the one ensuing from water and wind erosions. In Bulgaria, erosion affects significantly the ecological and economic functions of the soil, both at the places where it occurs and the contiguous areas. According to Ruseva S. (2006) it results in lessening the depth of the root location layer, decrease in the quantity of the nutrient elements and soil moisture supplies; running low on the soil filtering and buffer capacity; depletion of soil organic matter content; loss in bio-development; deterioration of the soil structure, formation of soil crust, etc. The natural and economic conditions in Bulgaria originate preconditions for widely spread soil erosion. For limiting or avoiding it, it is necessary to apply special tillage systems as well as technological combinations of equipment for carrying it out (1; 2; 3).

Overdamping or drying of the arable land has a significant direct and indirect negative effect on the rest of the factors of negative effect such as deterioration of the chemical and physical properties of the soil.

Overpacking of the soil is typical with power tillage carried out in inappropriate moisture conditions. This negative factor has a significant effect on all of the rest factors of negative effect. Without examining its origin it should be mentioned that loosening through tillage which brings about additional rough impact is not the most appropriate way of avoiding the noxious effect of the packing. It is more appropriate to eliminate the reasons for this soil deterioration factor through utilization of various technical and technological solutions (4).

As a factor of negative effect soil humus decrease and respectively the clotting ability of the organic colloids results in deterioration of the soil structure and all negatives ensuing from that.

Using chemicals in agricultural production and especially the mass application of fertilizers might turn not only into a factor of negative effect affecting the different tillage systems but affect the entire eco-system of the country as well. According to Dimov D., P.Dimitrov, B.Kolev (2005) this calls for utilization of alternative techniques which will regenerate and enhance soil fertility through Lumbricus compost.

● **Factors of conditional effect**

All factors related to the agricultural intensification can be assigned to this group of factors. They are as follows: establishing production of high-yield crop varieties, pre- and catch-crops, melioration and mainly hydro-melioration,

chemicals, fertilization and high degree of process mechanization. In this case, it is possible to have the soil formation process intensified but this means running some risk. Intentional or unintentional mistakes might result in the opposite effect. If the entire process is not based on scientific approach, it can be quite dangerous.

#### **B. FACTORS AFFECTING THE TILLAGE DEPENDING ON THE POSSIBILITY FOR CHANGING AND CONTROL**

The herein discussed factors affecting the tillage systems can be conditionally divided into controlled (controllable), uncontrollable and conditionally controlled.

##### **● Controlled factors**

Almost all factors brought about or to some extent dependent on the man's activity can be classified as controlled. For example, among the ones of positive effect are such as the structure and crop rotation, adherence to appropriate terms and working conditions, etc. Disrupting the soils chemical and physical properties which bring about negative effect can be prevented or corrected in appropriate manners of control.

##### **● Uncontrollable factors**

In agriculture there are some datum which are formed in the course of time such as the shape and the size of the fields and areas, infrastructure, etc. which are hard to change. Natural datum as slope gradient, rainfalls, temperatures, etc., can not be changed either.

##### **● Conditionally controlled factors**

Conditionally controlled factors are the factors on which can be exerted partial influence such as decrease in water and wind erosion, overpacking, crop overgrowing with weeds, intensification and the degree of the process mechanization, etc.

The aim is to create better conditions for the plant development, for preserving soil fertility and higher effectiveness through control on the factors affecting the tillage systems.

#### **C. FACTORS AFFECTING THE TILLAGE SYSTEMS DEPENDING ON THE PARTICULAR CONDITIONS**

The factors which are discussed could be also divided into groups depending on the particular objective and subjective conditions related to a specific agricultural farm. In this respect they can be of soil-and-climatic, terrain, infrastructural, business and economic character. In reference to that the factors can be reviewed as ones at a given moment and of strategic importance. Examining them in this manner can serve for specifying the policy in that respect.

#### **D. FACTORS WHICH MIGHT BE RISKY FOR THE TILLAGE EFFECTIVENESS**

Failure to use the factors of positive effect and the hardships in ignoring the ones of negative effect might be risky for the short-term result as well as for the long-term planning. However, it is not to the same extent for all the factors. In order to specify it, it is necessary to have it examined. The factors related to the deteriorating processes, pollution, and decrease in the soil organic matter, loss in bio-variety, salinity, acidity and overpacking of the soil (6). Less risky are the factors resulting in improved conditions but in case they do not adhere to the requirements they turn into risky ones as well.

### 3. CHARACTERISTICS OF THE FACTORS AFFECTING THE TILLAGE SYSTEMS

Several characteristics can be pointed out from the above classification and the description of the separate factors affecting the tillage systems:

- ✚ implementation of factors of positive effect requires clear investment purposes accompanied by respective detailed research;
- ✚ decrease in the negatives of the factors of negative effect is bound to the soil deterioration processes and the main goal of the tillage system is to avoid that;
- ✚ there is a particular interrelation between the separate factors of positive effect and the factors of negative effect;
- ✚ the reciprocal effect of the factors is sometimes a two-way one and it results in a multiple effect;
- ✚ it is easier to predict the effect of the controlled factors than that of the uncontrolled ones;
- ✚ through implementation of appropriate measures, the reciprocal correspondence of the level of the factors ensures higher tillage effectiveness;
- ✚ for more rational solution it is necessary to carry out a quality evaluation of the effect of the factors on the tillage systems.

The very evaluation of the effect of the factors on the tillage systems should be a complex one and should be carried out from the following points of view:

- ✚ technological – weather the separate factors affect the growing technique or not and to what degree, is it necessary to change techniques, are the techniques for growing different crops within the crop rotation compatible; what are the acceptable compromises;
- ✚ technical – if there are technical solutions for affecting the separate factors and their indexes (technological, operational and power ones).

The control of the factors affecting the tillage systems should be preceded by a detailed research and evaluation as well as by setting clear possible problems which are to be resolved in due course. Major problems ensuing from the specificity of the particular conditions, such as soil erosion decrease; compensation of the water deficit, avoiding causes of worsening the soil characteristics, e.g. overdamping and overpacking, should be resolved along with the basic problems, such as protecting and improving the soil fertility and ensuring sustainable development.

For proper selection of adequate tillage system in particular conditions it is necessary to consider all factors along with grading them according to their effect and significance. The purpose of the grading is to respond with priority to the requirements of the most specific ones which have the greatest effect in particular conditions.

### 4. CONCLUSION

On balance we can draw the following conclusions:

- ✚ The performed systemization of the factors affecting the tillage systems presents a possibility for grading them, priority research, evaluation and control for achieving the set goals.
- ✚ The results from the analyses present a good basis for developing methods for selecting a tillage system for particular conditions.

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