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SOIL PRESERVATION THROUGH THE PERFECTIONING OF ITS BASIC WORKS

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Abstract: *The classic technology of soil work for sowing presents many advantages, but also important drawbacks, regarding the destruction of the soil structure, the excessive subsidence, erosion etc., but also of big power consumption (the ploughing includes 30...35% from the total energetic consumptions in agriculture). The new technologies of sowing in unplough lands or partial prepared, remove these disadvantages, but require the strict achievement of agro technical rules, for which the Romanian agriculture isn't prepared to accept them. Also, the optimization of the deep soil loosening work influence positive as much his features, and the economic results obtained to his cultivation. These aspects are analyzed in the paper on the strength of some authors' researches.*

Keywords: *environmental protection, minimum tillage, no tillage, soil*

1. INTRODUCTION

Quality sowing has to ensure a good germination of the seeds, an explosive and uniform emergence, a normal growth and development of the plants, with an early covering of the land, offering to these ones the possibility to defeat in competition the weeds.

For thousand years, the sowing process had taken place in compliance with the same technology, that is the land was as a preliminary put in readiness by specific works of ploughing and stirring, subsequently the seed was incorporated at the necessary depth and covered, so that it should make contact with the soil in order to germinate and emerge under the form of plants as vigorous as possible [1].

As against this situation, deemed normal, during the last decades of the past century, in the context of the concept of durable agriculture, more and more criticisms rose as regards the classic sowing technology. The mechanical working of the soil by means of traditional methods is increasingly put under the mark of interrogation because of its great energy consumption and its continuous degradation by excessive compaction, erosion, destruction of the structure and of the texture, diminution of the humus etc; respectively the decrease of its fertility. In this framework there appeared and developed the conservative technologies for the preparation of the sowing, in which the plough is given up, the remains of the crop not being removed from the soil, forming a layer which protects and enriches it in humus and in other substances necessary for the development of the plants. The soil stirred without the turning of the furrow keeps its natural bedding; no less fertile soil is brought to the surface of the soil from the depths, with rocks or provided with salt. Moreover, the natural environment of the earthworms, whose action is beneficial for the soil as it contributes to the creation of the colloidal structure and of the soil particles undergoes almost no modification [2].

2. MATERIAL AND METHODS

The conservation technologies include no tillage, direct seed, minimum tillage, reduced tillage, and, as a general rule, the working systems which don't incorporate the vegetable remains from the previous crop, leaving them at the surface of the soil or the systems which work the soil upon the entire working width at a single pass.

These technologies are currently applied upon more than 50 million hectares, especially in the U.S.A., Brasilia, Argentina, Canada and Australia. Throughout Europe, the surface worked in a conservative system is estimated at about 1 million hectares, and in Romania this issue is timidly approached in the framework of certain scientific researches [3].

If the situation in this field in Romania could be explained by the destabilizations which have taken place in agriculture since 1990, it seems difficult to comprehend the European farmers' reticence towards the sowing technologies in non-ploughed land, farmers who cannot invoke the material hardships or the lack of information. This means that the application of these technologies is in connection with a series of other factors which, unless correctly solved, may annul the theoretical advantages of the system in question [4].

The basic factors which condition the application of the conservative technologies for the working of the soil and for the sowing may be:

- the technical factors;
- the agro-technical factors;
- the biological factors;
- the socio-economic factors etc.

The technical factors refer to the sowing equipment in non-ploughed land, which must wholly fulfill the requirements imposed by national norms, such as: the observance of the quantity of seed distributed upon the unit of area (maximum non-uniformity 2%); the degree of non-uniformity upon the working width of the sowing on a horizontal land (3%); the incorporation depth, which may vary with ± 1 cm for the seeds buried at more than 4 cm and with ± 0.5 cm for the seeds buried at less than 4 cm; the distance between the beds must be rigorously equal, as the one of the seeds upon the bed. A modern broadcast seeder should be able to distribute quantities comprised between 1.5...400 kg/ha, according to the culture, to the biological and cultural value of the seeds, to the specific agro-technical requirements etc.

Moreover, the sowing outfit in non-ploughed land must make the soil loose upon a narrow strip (4...5 cm) at the necessary depth, the seeds must be incorporated, then covered and brought to safe contact with the soil. Often times, the land is covered with vegetable remains, which must be chopped finely so that they should not get in the way of the incorporation and covering of the seeds.

We have to notice that the technical aspect of the sowing in non-ploughed land is practically solved throughout the world, an important number of companies carrying out research and building competitive sowing outfits (NOKKA-TUME - Finland, HUARD, SULKY, KUHN - France, GASPARD - Italy, JOHN DEERE - U.S.A., HOWARD, DUTZI and AMAZONE - Germany, BALDAN - Brasilia etc.). It has been ascertained that many companies producing such technical outfits are situated in Europe. In Romania the broadcast seeder SCN-17 for stalk cereals has been accomplished by the society SC MECANICA CEAHLĂU, S.A. - Piatra Neamt, in collaboration with INMA - Bucharest.

3. RESULTS AND DISCUSSION

As a general rule, the broadcast seeders for non-ploughed land possess the same constructive structure as those for land worked by classic technologies (Figure 1), the main distinction referring to the attachment in front of the machines of some batteries with staggered disks (Figure 2) with a view to stirring the soil and to accomplishing some mechanisms for the incorporation of the seeds and for their covering, more solid than the ones for normal sowing.

The disk cutters may be flat, indented or corrugated (chamfered), the disks with intermittent bit penetrating more easily the soil, with a better cutting of the vegetable remains and with the elimination of the possibility of their pulling along in front of the disks. We also distinguish among outfits endowed with one, two or three disks for stirring the soil on the band which is to be sown.

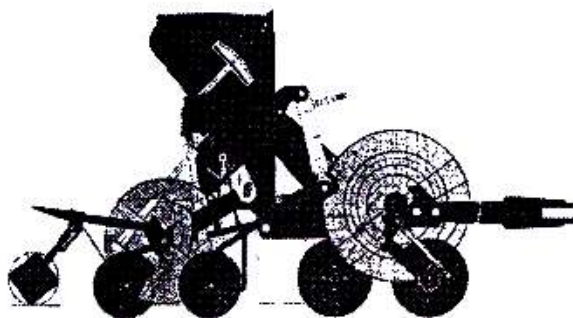


Figure 1: Sowing outfit for non-ploughed land

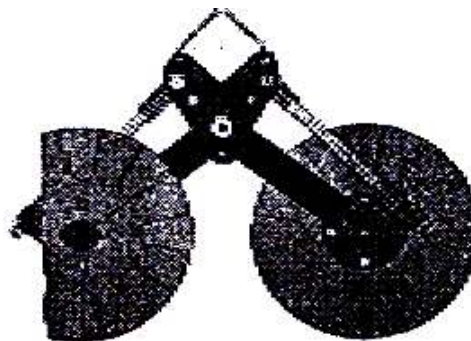


Figure 2: Battery of disks for stirring the soil

The outfit for directly sowing the soil with disk cutters stirs the soil in a small degree, and the bottom of the furrow is even slightly sunk. This aspect constitutes an advantage in the dry areas, due to the loss of a minimal

quantity of water from the soil and to the driving of the water to the seed through the slightly sunk layer of soil from the bottom of the furrow.

The alternative to the system of stirring with disks are the chisel knives, which accomplish a stronger stirring and mixing of the soil, which leads to greater water losses. By means of a more intensive mixing, there also takes place a richer growth of the weeds, and in case of larger quantities of vegetable remains, the running of the equipment is no longer safe.

From the experimental research there has come out that the sliding-shares of the normal broadcast seeders don't possess a satisfying stability while they run, for which reason there is recommended their replacement with double disk shares, more solid and more reliable. For a safe covering of the seeds, very good results have been produced by the spur wheels fitted in the blades of the equipment for seed incorporation.

The agro-technical factors which may influence the sowing in non-ploughed land are the most numerous and the most important for the success of the activity and they take into consideration the compatibility of the soils with the respective cultures, the rotation of the cultures, the combating of the weeds and of the harmful insects etc. If we take into consideration the different types of soils (Figure 3) we may notice that in the soils which contain in the upper horizon rocks which overtop 30...50 mm in diameter, the activity of sowing becomes difficult, as the disks which make the soil loose are exposed to the deformations or to the breaks (a situation which is specific to the hill area, that is for 30...35% of the tillable surface of the country).

However, the most difficult problem is the scientific rotation of the cultures, so that, at the same time with the process of retaining the water and the nutritive substances within the soil, the weeds should be fought against as efficiently as possible. It has been acknowledged that one of the major advantages of the classic working of the soil consists precisely in the active combating of these weeds, which stands for an important disadvantage as regards the conservative works of the soil. In order to fight against the weeds in this latter situation, there is required an increased quantity of herbicides, a fact which contradicts the principles of the ecological agriculture (durable).

The integrated combating of the weeds stands for the optimal solution, but it implies the insertion in the system of rotation of the cultures of some vast and extremely vast surfaces so that the weeds eradicated during one year should not do over again in following year out of the seeds carried by the wind from the neighboring lands. However, it seems that until reaching this desideratum in Romania, and even in Europe, some time has still to pass. Moreover, the agriculture is obliged to produce what the market demands, to be efficient, an aspect which do not always harmonized with the scientific rotation of the cultures.

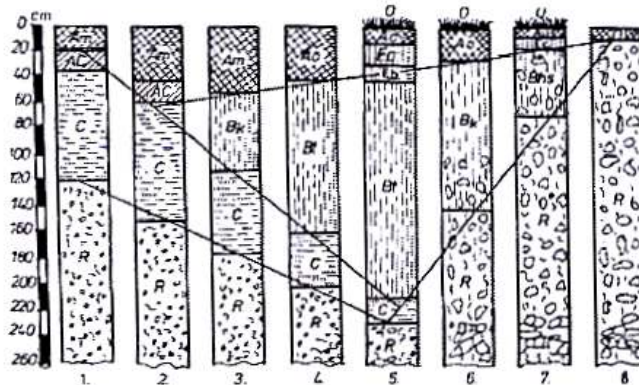


Figure 3: The section in the depth of the soil

Another aspect of an agro-technical nature belongs to the corresponding putting in readiness of the fields upon which the sowing on conservative principles is to be accomplished. This is about the insurance of the surface flatness, their settlement for irrigations and draining, so that the sowing outfit should be provided with the working conditions by whose means the basic requirements imposed by the norms should be fulfilled. Unlike in the framework of the well-developed European countries, in Romania this aspect practically fails to have been approached, and until it has been solved, a significant period of time has to elapse.

There is incumbent to the scientific research the role of determining the "suitability" of the soils with the sowing in a conservative system, and especially to convey the most efficient solutions for a rotation in compliance with the necessities of this system.

The biological factors which have to be taken into consideration when adopting the conservative system belong to the possible different adaptability of the varieties of a certain species to the germination and afterwards the development within the soil which has been worked only upon narrow strips. It is also important that the vegetable remains from a certain culture should not hinder the process of working the respective strips by means of the normal equipment fitted in the broadcast seeders. For instance, a variety of the corn species, whose stem

reaches in the lower part up to 35...50 mm in diameter will raise more difficult working problems than the variety of the corn species whose stem is of only 10...20 mm, sustaining at the same time an equal number of corn, cobs (and even greater) and being susceptible of being cultivated at a denser density of the plants upon the hectare. This means that the sowing in a conservative system needs varieties of a light germination, endowed with strong weeds and stems of reduced dimensions, characterized by an increased adaptability to the climate and soil of the respective area.

The socio-economic factors refer to support offered by the State to the promotion, at least in an experimental variant, of the soil working in a conservative system. Also, by the agricultural policies promoted by the State, the large-dimension farms have to be encouraged, as these ones are able to allow correct rotations of the agricultural cultures, so that the immediate economic advantage offered by the lack of tillage should be maintained by normal subsequent works, optimal plant densities and final competitive crops.

There has been specified that the system of conservative working of the soil is favored by the remaining on the soil of a part of the vegetation of the previous culture, which has nonetheless to be finely chopped and uniformly spread across the field. This means that the cropping machines have to be provided with chopping tools for the vegetable remains, an aspect which leads to the rise of their constructive complexity and to the cost of the work.

In conclusion, we may state that the issue of the soil working in a conservative system must be approached as a facet of the integrated management of the agro-systems, which deals simultaneously with distinct directions, correlated however among themselves, such as: biological management, ecological management etc., all of them related nonetheless to the classic management (of the production, financial, of the human resources, of the waste etc).

4. CONCLUSION

> The traditional method of working the soil is increasingly criticized because of the high cost, of the excessive compaction of the fertile layer, of the predisposition to erosion, of the structure destruction, of the diminution of the humus content, of the useful micro- fauna destruction etc.

> The method of working the soil in a conservative system partially eliminates these disadvantages, but its application is conditioned by a series of technical, agro-technical, biological, socio-economic factors etc.

> At the present moment in Romania, only the technical aspect afferent to the sowing in non-ploughed land is almost solved, while some of the other factors have not been even approached so far.

> The activity of working the soil in a conservative system has to be accomplished on the basis of the integrated management of the agro-systems, by the involvement of the scientific research of the upon the farmers, the producers of agricultural equipment and even upon the political factors.

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