IMPORTANCE

The soil is the main mean of production in agriculture and it is not reproducive and this is why it must be managed with great care this task being of great importance for every country and their specialists. The achieving of this goal impose the better knowing of the soil of people that work with it because its best using ensure larger yields in any climate.

The improving of the fertility status of the soil is imposed by the need of increasing the yield. Agriculture modernization has conducted to a multitude of harmfull effects to the environment.

The conventional system of tillage (based on plowing) along with a high degree of chemisation have conducted to spectacular increase of the yield yet, meanwhile, there have been noticed some drawbacks.

High number of tracks upon the soil by tractors and various machineries harm the soil features as: structure, surface and deep compaction, decreasing of the soil humus content, decreasing of the biological activity that, finally, conduct to the decreasing of the soil natural fertility.

The maintaining of the soil natural fertility has been promoted by researchers in order to respect the sustainable agriculture principles.

THE GOAL AND THE OBJECTIVES OF RESEARCHES AND THE RESEARCHING METHODS

The goal of the researches on the features of the preluvosoils from the hilly zone of Oltenia and their evolution under the influence of tillage in the context of the sustainable agriculture can be summarized as follows:

- the continuing of previous researches regarding the fertility features (chemical, physical and hydrical) of preluvosoils;
- the analysis of the conventional tillage system on wheat and maize yield;
- The establishing of some tillage variants with conservative system as an alternative to the conventional tillage system;
- the emphasyzing of positive effects on yielding properties of the reddish preluvosoils in order to maintain the fertility under the influence of the tillage system;
- the evaluation of the posibilities of promoting the non conventional tillage system in Oltenia Plain in the reddish preluvosoil zone.
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The research objectives

The objectives of the researches have been the following:

- the characterization of the conditions and the genesis process of the preluvosoils from the hilly zone of Oltenia

- the identification, delimitation and the study of the preluvosoils from this area;
- the establishing of the morphological, physico-mechanical and chemical features of these soils;
- the analysis of the influence of tillage on the physical features of the reddish preluvosoils;
- the knowing of the evolution of physical features of the reddish preluvosoils that are influenced by the no till and minimmum tillage systems;
- the analysis of the influence of the conservative tillage systems by two variants (minimmum and no tillage) on the level of wheat and maize yield;
- posibilities of soil conservation as a result of no tillage;

The biological material and the researching method

The thouroughly researches have ben focused on the preluvosoils that are most encountered within the studied zone as follows: typical, molic, vertic, reddish, stagnic, sandy and rodic preluvosoils.

In order for all preluvosoil types to be comprised within the study there were used the maps and pedological papers made by OSPA Dolj.

Every soil profile was characterised morphologically establishing the following features: the depth of the horizons, the colour, the texture, the structure, the porosity, the compactity, neoformations and the bedrock.

There have been taking soil samples that were transported to the Pedology Laboratory where there have been made physico-mechanical, hydrophysical and chemical analyses. All these data have been written in tables and charts that are easy to read.

In order to establish the yielding capacity of the soils and their suitability for different crops there was made the evaluation operation both in natural and recovered conditions by different measures in function of various soil types.

The soil evaluation in natural conditions demonstrates that the preluvosoils, excepting the stagnic one have an average fertility because the evaluation marks are around 50 points and the favorability class is V.

The evaluation after reclaiming measures have shown an increase of the yielding capacity by 20 – 30 points. By reclaiming all soil types tend to a middle or high fertility status.

By experimental analysis of the tillage on the main physical features of the soil there were needed: field and laboratory determinations, soil samples and the interpretation of the results. There have ben researched the evolution of the crops on the entire vegetation period in order to monitorize the yield.

The researches took place at Didactical Research Station of Banu Maracine, near Craiova, on a reddish preluvosoil within 2004-2007 period.

The reddish preluvosoil where the experiment was located has the following soil profile: Ao-AB-Bt_1-Bt_2-C. Roughly speaking, the reddish preluvosoil has an average humus content and nutrients. The soil reaction is low acid, the pH value is between 6.06 and 6.47.

The physical features were researched with wheat and corn crops in two stationary experiments. There were used suitable varieties for the zone, namely, Dropia crop kind with wheat and Florencia corn hybrid.

The stationary experiments have had the following variants:

- V_1 (Control) – deep plow (21-25 cm) + disc harrowing;
- V_2 – shallow plow (13-17 cm);
- V_3 – disc harrowing (two tillages);
- V_4 – no till;
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The set up of the experiment was made using the Zade method with three replications.

Within these experiments there were researched the following physical features:

- bulk density (g/cm^3);
- total porousity (TP % v/v);
- compaction degree (CT % v/v);
- penetration resistance (PR kgf/cm^2);

Results

Bulk density with the winter wheat crop

Of the analysis of the bulk density in two vegetation stages (fall, after sowing and at harvest) there can be emphasized the following:

- with the conventional variants where the annual plow has been made there was recorded a better soil loosening within the shallow soil layer, the first 20 cm. There was noticed that with the plow tillage since the sowing till the harvest of the wheat crop, little by little, the soil was compacted in the first 10 cm and the bulk density has increased from 1.19 g/cm^3 to 1.23 g/cm^3.

- the same evolution of the bulk density has been recorded with the shallow plow tillage;

- a higher value of the bulk density has been recorded with disc harrow variant on the 10-20 cm depth, probably due to the fact that the disc harrowoing tillage was made up to 10-12 cm;

- with the direct drilled variant, on the 0-10 cm there was recorded the highest value of the bulk density, of 1.38 g/cm^3 in autumn and at harvest, this parameter was of 1.37 g/cm^3.

- on the 20-40 cm depth the values of the bulk density have been close one another and not influenced by tillage;

- the bulk density has expressed a tendency of increasing during the vegetation period with all variants;

- the values of the bulk density are specific at harvest to the soil type;

- the evolution of the bulk density has not harm the development of the crop;

Bulk density with the winter wheat crop

With the corn crop the evolution of the bulk density under the influence of tillage has been reserched on three vegetation stages: 5-6 leaves, grain formation and at harvest. There have been extracted the following conclusions:

- the bulk density has expressed the same tendency of increasing on depth of the soil on the entire vegetation period with all variants;
- with the direct sown variant there were recorded the highest values of the bulk density yet they are specific to the soil type that are in the experimental field;
- higher values of the bulk density that were recorded in 2007 were influenced by the lack of rainfall;

Total porousity – with the winter wheat crop

Due to the fact that the total porosity is influenced by the bulk density there were recorded the same variation:

- the lowest value of the total porousity was recorded with the direct drilled variant, of 49% that is almost equal to the one found after the vegetation period with the other variants (50-48%).

- the values of the total porousity decreases as the vegetation period pass. On the 0-10 cm depth there were recorded values of 54-50% with the classic variant; 51-48% with disc variant and 49-48% with the conventional variant.

Total porousity – with the corn crop

The values of the total porousity decreases with the progress of the vegetation period and from surface toward beneath:

- among the two tillage systems, classic and no till, the differences appear only on 0-20 cm depth due to tillage;
- both on 0-20 cm depth with no till and 20-60 cm with the other variants the values of the total porousity are correlated with the soil texture.
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The compaction degree with the winter wheat crop

The compaction degree is correlated with the total porousity and the soil texture:

- with all researching years, the disc harrowed variant, under the 20 cm depth there can be observed an increasing of the compaction degree to 12.0 that indicates a moderatelly compacted soil;
- this fact is due to the limited depth of the disc harrowing.

- Under the 40 cm depth the compaction becomes more obvious, the soil becoming strong compacted (14.1%).
- acest fapt se poate datora lucrării de discuit care nu atinge această adâncime, dar şi datorită trecerii agregatelor, solul se tasează la acest nivel.

The penetration resistance with the wheat crop

The soil penetration resistance is dependent by the soil tillage in the following way:

- the highest values of the penetration resistance with the determinations made in fall were recorded with the direct drilled variant, of 31.0 kgf/cm^2;
- with all other variants, where the soil surface has been mobilised the penetration resistance was highly reduced reaching 7.38 kgf/cm^2 and, respectively, 3.69 kgf/cm^2.
- The values recorded with the no till variant are not limitative for the root system;
- The values of the penetration resistance increase as the vegetation period progress;
- Within the subarable layer the values of the penetration resistance have almost the same values with a slow increase with the disc harrowd variant that can be explained by machinery compaction
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The penetration resitance with the corn crop

With the corn crop, the values of the penetration resistance have been determined during the vegetation period in june and at harvest:

- the values recorded on 0-10; 10-20 and 20-40 cm depths are small and middle and do not limit the development of the root system;
- under the 40 cm depth the values of the penetration resistance are middle that can conduct to the poor growing of the root system.
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The influence of the tillage system on the winter wheat yield on the reddish preluvosoil

During the 2004-2005 year the highest yield was recorded by the plowed variant, of 3531 kg/ha. With all other variants the yield was smaller: with the shallow plow the yield was of 3,475 kg/ha, with a minus of 56 kg/ha that is not significant; with the disc harrowed variant there were obtained 3,444 kg/ha, the difference of 87 kg/ha being negatively significant. The lowest yeld was obtained with the direct drilled variant, of 3,275 the negative difference over the control variant of 256 kg/ha being very significant.

During the 2005-2006 year the yields have been between 4,530 kg/ha with the plowed variant and 4,024 kg/ha with the direct drilled variant. In comparison with the control variant the other variants have recorded decreasing of yield,

namely, 116 kg/ha that is significant with the shallow plowed variant and 310 kg/ha, very significant with the disc harrowed variant. With the direct drilled variant the reduction of yield has been of 506 kg/ha that is very significant, too.

The 2006-2007 year has been a dry year that was not favorable to the winter wheat crop. The yields were very small, of 2,141 kg/ha with the deep plowed variant and only 1,628 kg/ha with the direct drilled variant. With the second variant there were obtained 2,033 kg/ha and with the disc harrowed variant, of 1,826 kg/ha. Over the control variant there were minuses of yield of 108 kg/ha with V_2 that is significant, of 315 kg/ha with V_3 that is very significant and 513 kg/ha that is very significant, with the direct drilled variant.

The average yield in 2004-2007 period is 3,401 kg/ha with deep plowed variant, 3,307 kg/ha with shallow plowed variant, 3,163 kg/ha with disc variant and only 2,976 kg/ha. The decrease is 12.5% and the yield one is of 425 kg/ha that is very significant.

The influence of the tillage system on the corn crop yield on the reddish preluvosoil

In 2005 the corn yield was of 4,422 kg/ha. With the shallow plowed variant there were obtained 4,309 kg/ha resulting a 113 kg/ha minus that is not significant. With the disc variant there was recorded a yield of 4,145 kg/ha, 277 kg/ha less than the control variant.

The lowest yield was obtained with the direct drilled variant, of 4,027 kg/ha. The yield loss is 395 kg/ha that is very significant.

The 2006 year was more favorable to the corn crop, with more rainfall. The corn yield has been of 4,750 kg/ha with the shallow plow and of 4,363 kg/ha with disc variant. With the direct drilled variant the yield was of 4,098 kg/ha, 652 kg/ha less than control that is very significant.

The 2007 year was not favorable for the corn crop because of drought. The corn yields have been low. With the first variant the yield was of 1,915 kg/ha and with the shallow plowed one of 1,711 kg/ha. By disc harrowing the yield was 1,506 kg/ha with a loss of 409 kg/ha that is distinct significant.

The average of the three years show that with control variant the corn yield was 3,696 kg/ha and with shallow plow variant there were obtained 3,534 kg/ha, with disc harrow the yield was 3.338 kg/ha and with the direct drilled variant it was 3.103 kg/ha. The yield reduction was very significant, of 593 kg/ha.

The level of the yield was correlated with the rainfall quantity, 2007 being very dry with harmfull efects on both crops.

RECOMMENDATIONS

In order to rise the yielding capacity of researched preluvosoils we recommend the following:

- due to the fact that by cropping the soil loses continually humus: organic fertilization by manure, vegetal debris (straw, stalks, pulses trash), green manure; crop rotation including pulses; banning the burning of straw, etc.;

- because in the hilly zone the soil erosion is present we recommend special antierosional cropping systems;

- because with the soils with a high degree of fine material (over 30%) there are needed deep tillage;

- some soils from hilly zone acidify there is need to reclaim them by neutralising their reaction, at least every few years;

- in order to maintain and rise the yielding capacity of soils and to obtain efficient yields there is recommended chemical fertilization according with the agrochemical analyses.

After the experimentation of several tillage we recommend:

- when apply different tillage systems we have to consider the technological features of the soil as: texture, structure, humus content, slope, clime, machinery;
- we have to know the way the soil react to the modern agriculture constraints in order to avoid the diminishing of its yielding potential;
- the tillage system must ensure the prevention of harmfull influence by avoiding compaction;
- in order to ensure the rentability there is need the choosing of the best varieties that are adapted to the local clime and soil conditions from central Oltenia;
- on the soils with high clay content and without irrigation there is not recommended the wide row crops as corn;
- the crops with shallow root system can give good results with no tillage;
- a special atention must be paid to the direct drilling system and to pests;
- the direct driller has to work properly on dry soil as well as on wet soil when vegetal debris are present on the soil surface;
- even though the yield with the direct drill system is lower, we have to consider the fuel saving and soil features improving;
- taking account of the advantages and drawbacks of both systems we propose that the classic systems to altern the new ones and in the future the new systems to replace the classic ones.