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EVALUATION OF QUALITY AMENDMENTS IN ORDINRY CHERNOZEM AFTER INCORPORATION IN THE SOIL A HARVEST OF NTERMEDIATE CULTURE THE VETCH AS A GREEN MASS

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Abstract

Agriculture in the Republic of Moldova accounts for 10-15% of gross domestic product (GDP) and represents the most important branch of production. In agriculture, soil is the main means of production. Agriculture currently practiced in the country faces a number of major problems that seriously affect rural development. Creating a balanced or positive balance of the organic substance in the soil is the main condition for preserving its long-term fertility and avoiding degradation of the arable layer by dehumidification, destructuring and excessive secondary compacting. This can only be achieved by the regular introduction into the soil of organic fertilizers - manure or green fertilizers (Cerbari, 2010; Cerbari et al., 2013). At present the livestock sector is practically destroyed, the number of cattle has decreased 6 times, while the volume of manure produced has decreased by 6 times. According to the statistical directories 3 million tons of manure is produced, of which 1.0-1.5 million tons are used as an energy source, and 1.5-2.0 million tons are dumped in the rubbish, a more serious source of pollution of rural areas. In the soil, according to statistical data, only 10-20 kg/ha/year of manure is introduced, which means nothing. As a result, the balance of humus in the soil became deeply negative -1.0 t/ha/year. The need for this article is dictated by the fact that the recommended procedure has the only real possibility to increase the flow of organic matter to the soil and to form a balanced or weakly positive balance for this organo-mineral natural system that plays the most important role in ensuring the food and environmental security of the country. The situation can only be changed by undertaking a series of legislative, organizational and financial measures. So, the remediation of the quality condition and the increased production capacity of the studied soil is possible only by increasing the flow of organic matter into the arable layer. The use of vetch as a green fertilizer is an effective process to achieve this objective (Cerbari et al., 2013).

Key words*: conservative agriculture, ordinary chernozem, green fertilizer, quality status.*

INTRODUCTION

Soil is an organo-mineral system that can provide a high agricultural production capacity only if it has a permanent flow of fresh organic matter. Creating a balanced or positive balance of the organic substance in the soil is the main condition for preserving its long-term fertility and avoiding degradation of the arable layer by dehumidification, destructuring and excessive secondary compacting. This can only be achieved by the regular introduction into the soil of organic fertilizers - manure or fertilizers (Capcelea, 1996; Cerbari 2011).

In Moldova, the situation regarding the use of organic fertilizers is the following. In order to ensure a balanced or positive balance of the organic substance it is necessary to introduce at least 10 t/ha/year of manure into the soil. In the 90^{s} of the previous century, due to the existing zootechnical sector, about 7-8 t/ha/year of manure was introduced into the arable soil. Combined with respect for crop rotation in which there is a field of leguminous perennial herbs and a field of annual grasses with the participation of leguminous crops, a balanced balance of the organic substance in the soil is ensured.

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a more serious source of pollution of rural areas. In the soil, according to statistical data, only 10-20 kg/ha/year of manure is introduced, which means nothing. As a result, the balance of humus in the soil became deeply negative: -1.0 t/ha/year. Agriculture currently practiced in the country faces a number of major problems that seriously affect rural development. The classical system of soil works has led to a gradual increase in production, but it has also led to the appearance of phenomena of degradation of features, a decrease in the production capacity of agricultural land.

Excessive work has favoured processes to reduce organic soil content, damage to structure, increased erosion hazard; heavy traffic and too often led to increased compaction and, as a result, to trigger other negative phenomena (Cerbari et al., 2013).

MATERIALS AND METHODS

The polygon for the study of the influence of green vines on the properties of common chernozems in Southern Moldova was located on the agricultural territory of Lebedenco in the district of Cahul (Figure 1).

The field works were carried out according to the methodology of pedological field research. Laboratory analyzes were performed according to classical methods and STAS [STAS 17.4.4.02, STAS 28298-89] and Standards [SR SR 7184-3: 2003, SM SR ISO 11272: 2003, SM STAS 7184/16: 2003, SM STAS 8619/3: 2002] existing. The polygon (3 ha) is a land area located on the quasi-horizontal surface of a long elongated ridge. The mixture of vines (80%) and wheat (20%) was sowed on the surface of 3 hectares of heights (Figure 1) in the first decade of September. On April 25, the field was divided into 3 strips with a surface of about 1 ha each (Figure 2): Strip no. 1 - vines cultivated for the production of seed material; Strip no. 2 - vines, busy field, two crops grown and incorporated into the soil as green fertilizer; Strip no. 3 - intermediate culture for use as green fertilizer; after the incorporation into the soil of the meadows in the field sown corn.

Parallel to the varieties of varieties of different destination, in the eastern part of the field a 10-meter-wide blank was sowed with maize to compare the corn harvest on this strip with corn harvest on strip no. 3, sowed with corn after incorporation into the soil of a harvest of vines crop (Figure 2).

RESULTS AND DISCUSSIONS

The necessity of this article is dictated by the fact that the recommended method presents the only real possibility to increase the flow of organic matter to the soil and to form a balanced or poorly positive balance for this organo-mineral natural system that plays the most important role in ensuring the food and environmental security of the country.

The high cost of chemical fertilizers and their negative effects on the environment have convinced the human community to seek an alternative to the existing farming system (Cerbari, 2010; 2011; Cojocaru, 2018; Toncea, 1999).

Figure 1. The location of the research polygon

The physical, chemical and biological degradation of chernozems, soils occupying about 80% of the land surface of the agricultural land, leads to the expansion of the desertification processes of the land and to stop the increase of the agricultural production volume in the country. The existing agricultural system does not ensure that soil quality is maintained in the future and leads to worsening economic and environmental conditions in the country (Cerbari et al., 2013).

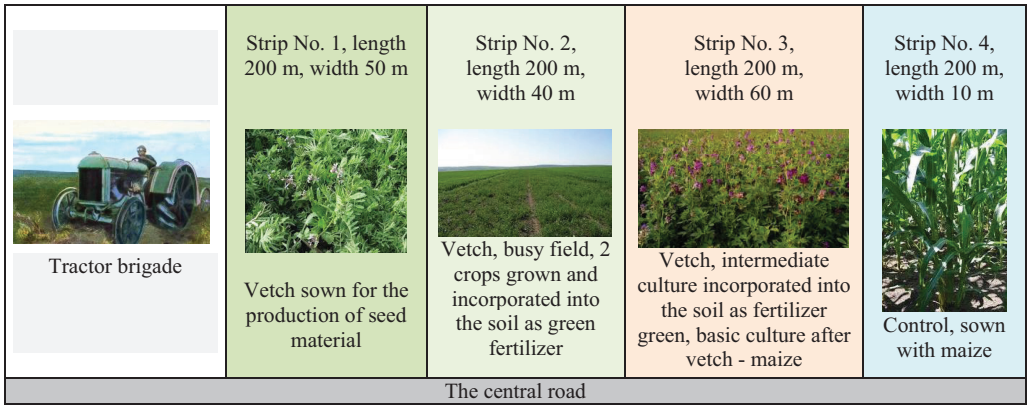

Figure 2. Scheme of experience located on the territory of Lebedenco commune, Cahul district

The overcoming of this situation is possible through the gradual implementation of a sustainable agriculture system, based primarily on the use of natural processes, on the biological and renewable resources of the household and only secondly on the resources procured. The situation can only be changed by undertaking a series of legislative, organizational and financial measures. This serves as a motivation for the fact that in order to reduce the dehumification processes, damage to the structure, strong compaction of the arable soil layer and increase of the soil erosion resistance, it is recommended 5 field crop, a field occupied with a leguminous sidney crop, autumn and spring varieties (2 varieties of vetches incorporated into the soil as a green fertilizer on each field once every 5 years). The structure of the crop can be as follows: Field covered with vines → Maize → Autumn wheat → Autumn wheat or barley → Sunflower. This process, used in the framework of any agricultural system, will lead to the remediation of soil quality and the increase of its production capacity (Capcelea, 1996; Cerbari, 2010; 2011; Cojocaru et al., 2018).

The research envisaged the creation of a single polygon to study the processes of remediation of the quality of common chernozems in Southern Moldova under the influence of green fertilizers, but in 2013 the possibility was created for organizing the second unpredicted research polygon. This polygon was organized in Central Moldova on the territory of Ivancea commune, Orhei rayon for cambic chernozems - soils with physical characteristics more difficult than those of ordinary chernozems in Southern Moldova, formed under other conditions.

The state of the crop on the sown field with vetches on 25.04.2013 is presented in Figure 3 and Figure 4. The introduction of ground vermicelli in the soil and the preparation of the ground for sowing was done by talking with a disk with a disk (Figures 5 and 6). Sowing maize (basic crop) was done on April 29, 2013.

Figure 3. Field sown in autumn with vetch on April 25, 2013

On both polygons, some preliminary results on the influence of green vetches on the quality of soils and on the size of the basic crop crops were obtained.

The study of the initial soil quality of the soil of the research polygon was carried out between september 4-5 of 2012, until the basic soil work was carried out. After performing the basic soil work by discussing at a depth of about 12 cm and subsoiling at a depth of 35 cm with the combined aggregate (Figure 5) and sowing the meadows (10.09.2012), over 10 days, the apparent density of the 0-35 cm, loosened through the underlay. Of all semi-graphs located on the territory of the polygon, soil samples were collected for laboratory analysis.

Figure 4. The state of the vetch at 25.05. 2013 and the distribution of the crop roots on the soil profile as a result of using the Mini-Till system with its underlayment

Figure 5. Incorporating the green mass of vetch by disking

In the spring of 2013, in the centre of the polygon, where the semi-profile 102 was 50 cm deep, repeated until the incorporation of the vetch vegetable mass into the soil, a soil profile with a depth of 120 cm was placed.

Figure 6. Field prepared by disking for sowing the basic crop after incorporation into the soil of the green vetch mass

In the soil samples from this profile, more detailed researches of the properties of the studied soil were carried out. At the same time in harvested soil micromonolites the content of the roots of vetches was appreciated, and in the laboratory - the chemical composition of roots and green vetch.

Field research to assess the size of the crop of basic crops (maize) and changes in soil quality on line no. 3 (broth culture) were performed on 26.09. 2013.

The basic soil work was carried out with a combined aggregate (Maximulch aggregate, Agroisem International), which passes the soil at a depth of 35-40 cm and prepares the top of the loose sowing layer (Figure 7).

Figure 7. Technique for Implementing the Mini-Till Soil System in Combination with subsoiling to work the land polygon basic of research

The initial state of the attributes of the common chernozem on the South Moldovan polygon was assessed by field research of the

morphological characters of the 4 semiprofiles and the soil profile 102 (located on the 2nd line), harvesting the soil samples and analyzing them in laboratory. Profile picture 102 is shown in Figure 4.

Next, we describe the profile of the studied soil.

Ordinary arable chernozem is characterized by a profile of the type: **Ahp1 - Ahp2 - Ah - Bhk1 - Bhk2 - BCk1 - BCk2 - Ck**. Efervescence - from a depth of 47 cm. Carbonates in the form of efflorescences - from 48 cm, pseudomics - from 63 cm. The following genetic horizons were highlighted and studied on the soil profile.

Ahp1 (0-20 cm) - arable layer of dark gray to brown color weak, wet, clay-loam, glomerular-bulgarian structure, layer 0-12 cm tilted by discussion, layer 12-20 cm inhomogeneous loosened by subsoiling, medium and large pores very frequent, many roots of vines and organic scraps, gradual passage.

Ahp2 (20-35 cm) - the newly built compact partially sloping layer (60-70%) by underlay, dark gray with a dull brown, wet, clay-loam, glomerular-bulgarian structure, porosity, different pores, many roots of vetch in the loose spaces of this layer, clear passage.

Ah (35-47 cm) - substrate to the arable layer, continuation of humus accumulation horizon, wet, dark gray with light brown, luteum-clay, glomerular natural structure, compact, medium and small frequent pores, frequent thin and medium roots, larvae, coprolite, passage gradually on the next horizon.

Bhk1 (47-70 cm) - continuation of the humerus profile, beginning of the passage to the parental rocks, wet, dark brown, clay-clay, glomerular structure, aggregates of 1-3 cm, compact, small and medium-sized pores, thin roots, larvae, coprolite, of carbonates in the form of efflorescences, gradual passage.

Bhk2 (63-81 cm) - the humerus profile, the lower part of the horizon to the rocks, the brown, the clay-clay, the weakly structure, the small, compact, small and fine pores, the rare thin roots, the larva beds, the moderate effervescence, in the form of efflorescences, the transition to the next gradual horizon.

BCk1 (81-93 cm) - the upper part of the parental soil poorly modified by the pedogenesis process, yellow with brown hue, loam-clayey, very weak structure, compact, frequent fine pores, pseudomics carbonate, very thin roots, larva beds, switching to the next gradual horizon.

BCk2 (93-110 cm) - the lower part of the parental soil poorly modified by the pedogenesis process, yellow with a very low brown hue, loam-clayey, the massive compact structure, frequent fine pores, the accumulation horizon of the pseudomics and bieloglass carbonate neoformations, the concrete and crotovine the transition to the next gradual horizon.

Ck (>110 cm) - yellow parental rocks virtually unchanged by the pedogenesis process, rare pseudomics, concretes of $CaCO_3$, compact, easily crushed, frequent fine pores.

The soil of the research polygon is characterized by very favorable lute-clayey texture. The dust behaves in the soil as well as the microstructural elements, ensuring a more favorable physical condition of the soil (lower resistance to plowing, lower cohesion between the soil particles, maturity humidity ensures better shredding at the work of the ground).

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The values of the chemical properties of the studied soil are typical for the common chernozems in South Moldova. As a negative factor, it is necessary to highlight the obvious dehumification of the arable layer of the common research chernozems, which has negative action on all the features and processes in the soil.

So, the remediation of the quality condition and the increased production capacity of the studied soil is possible only by increasing the flow of organic matter into the arable layer. The use of the meadow as a green fertilizer is an effective process for achieving this genre.

CONCLUSIONS

The estimation of the size of the green vetch mass harvest was carried out on 25.04.2013 on 1 m^2 surface micro-polygons in five repetitions.

The results of the individual measurements of the green vetch harvest were as follows: 1 - 30 t/ha; 2-29 t/ha; 3-28 t/ha; 4-29 t/ha; 5-32 t/ha. Average harvest of green vetch mass on 25.04. 2013 turned out to be 81.5% from the wet mass of the meadow. So, 5.6 t/ha of absolutely dry vetch meal with a nitrogen content of 4.1% was incorporated into the soil, which is equal to about 230 kg/ha of biological nitrogen, of which 60% is a symbiotic nitrogen (from the atmosphere).

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