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# Change Microbiological Indicators With Introduction Of Rocks On Chernozem Leached.

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**ABSTRACT**

The article presents the results of studies on the change in the number of basic physiological groups of soil microorganisms in the separate and joint application of such rocks as loess-like loam, limestone-shell, apatite and phosphogypsum. The frequency of occurrence and the abundance of micromycetes under maize were also studied according to the variants of the experiment. It has been established that the introduction of rocks increases the number of ammonifiers, microorganisms that convert mineral forms of nitrogen, aerobic nitrogen fixators, cellulose-decomposing microorganisms and microscopic fungi.

**Keywords:** soil microorganisms, leached chernozem, rocks, apatite, limestone-shell rock, phosphogypsum, loess-like loam, ammonifying agents, microorganisms transforming mineral forms of nitrogen, aerobic nitrogen fixators, cellulose-decomposing microorganisms, microscopic fungi.

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## INTRODUCTION

One of the factors that determines the processes of soil formation is the soil microflora [1]. Agricultural use of chernozems affects the number and activity of microbial populations in the soil [2]. The study of the change in the number of microbes in the composition of the soil mass has not only theoretical, but also great practical significance [3]. The microbial association should be considered as the most mobile part of the soil component, which supplies the plants with available forms of nutrients.

***Objective:*** study the effect of the introduction of rocks on the composition and quantity of basic physiological groups of soil microorganisms in chernozem leached.

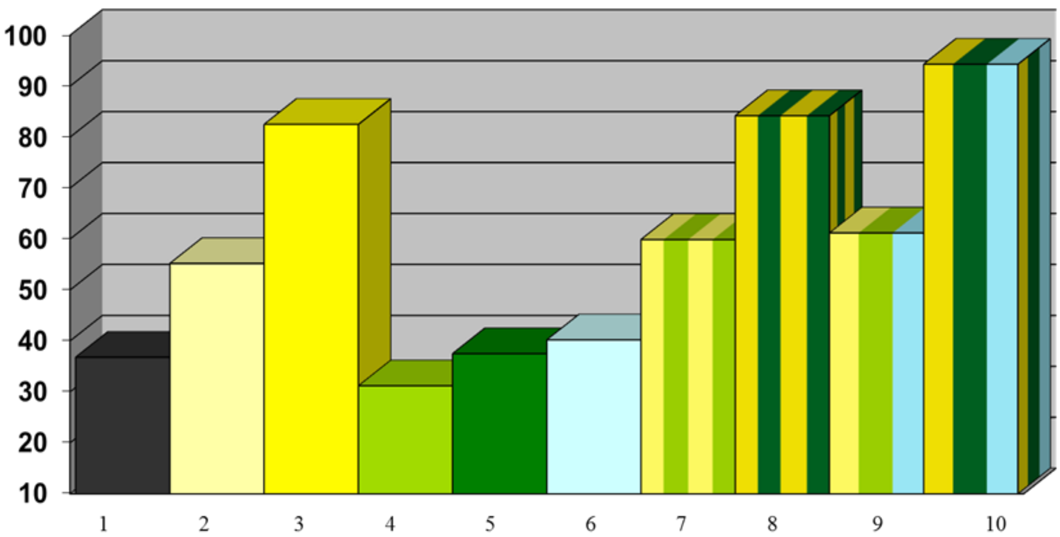
## MATERIAL AND METHODS

Number of microorganisms of different physiological groups by direct counting of grown colonies on different nutrient media:

- substratum MPA - the number of ammonifiers;
- substratum KAA - the number of microorganisms that assimilate mineral forms of nitrogen;
- substratum Getchenson - the amount of cellulose-destroying microorganisms;
- substratum Chapika-Doksa - the amount of microscopic fungi;
- substratum Vinogradskogo - the amount of anaerobic nitrogen fixers.

## RESULTS AND DISCUSSION

During the flowering phase of maize, the number of ammonifiers on the control was 36.8 million CFU / g. The use of shelly limestone in doses of 6 and 12 t / ha increased the number of these microorganisms in comparison with the control by 1.5 and 2.2 times, respectively. The application of apatite at doses of 1.5 and 3 t / ha and phosphogypsum did not significantly affect the number of ammonifiers. The joint application of rocks had a significant effect on the number of ammonifiers, while the increase was 1.6 to 2.6 times. The greatest difference corresponded to the joint application of rocks at maximum doses (Fig. 1).




HCP$_{05}$ million CFU / 1g=7,8

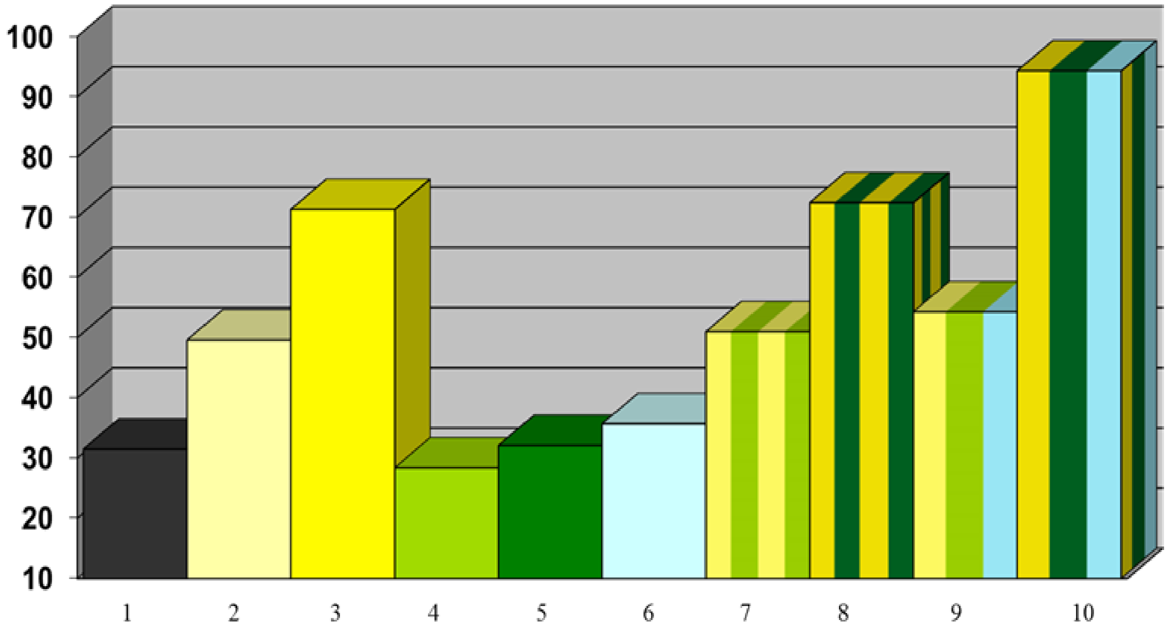
**1**- control;
**2**- shelly limestone – 6 t/ha;
**3**- shelly limestone -12 t/ha;
**4**- apatite - 1,5 t/ha;
**5**- apatite - 3,0 t/ha;
**6**- phosphogypsum - 12 t/ha;
**7**- shelly limestone - 6 т/га + apatite - 1,5 t/ha;
**8**- shelly limestone 12 t/ha + apatite - 3,0 t/ha;
**9**- shelly limestone - 6 t/ha + apatite - 1,5 t/ha + phosphogypsum - 12 t/ha;
**10**- shelly limestone - 12 t/ha + apatite - 3,0 t/ha + phosphogypsum - 12 t/ha

**Figure 1: Number of ammonifiers in the flowering phase of maize according to the experiment options (million CFU / 1g.)**

The increase in the number of ammonifiers is due to better conditions for the development of cultivated plants and the accompanying microflora in these variants as compared to the control.

There is a close metabiotic relationship between soil microorganisms involved in ammonification and nitrification.

When studying the number of microorganisms that convert mineral forms of nitrogen according to the variants of the experiment, the revealed regularity almost completely coincides with the number of ammonifiers (Fig. 2).



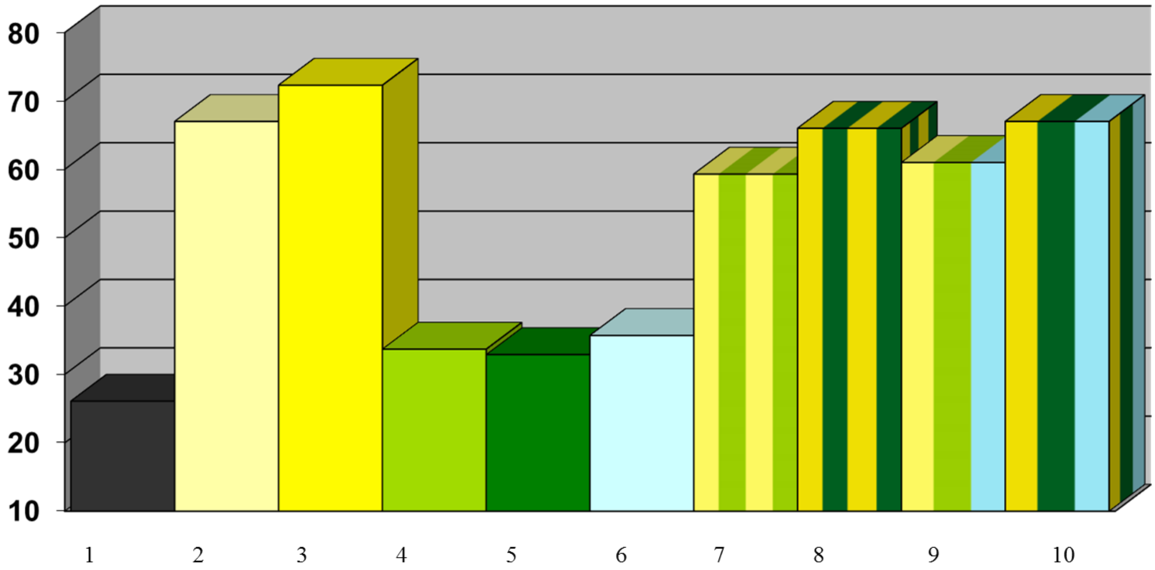

HCP05 million CFU / 1g=5,7

**1**- control;
**2**- shelly limestone – 6 t/ha;
**3**- shelly limestone -12 t/ha;
**4**- apatite - 1,5 t/ha;
**5**- apatite - 3,0 t/ha;
**6**- phosphogypsum - 12 t/ha;
**7**- shelly limestone - 6 т/га + apatite - 1,5 t/ha;
**8**- shelly limestone 12 t/ha + apatite - 3,0 t/ha;
**9**- shelly limestone - 6 t/ha + apatite - 1,5 t/ha + phosphogypsum - 12 t/ha;
**10**- shelly limestone - 12 t/ha + apatite - 3,0 t/ha + phosphogypsum - 12 t/ha .

**Figure 2: Number of microorganisms converting mineral forms of nitrogen into the flowering phase of maize according to the experiment options (million CFU / 1g.)**

To date, it has been established that many free-living bacteria - representatives of about 30 species - can fix molecular nitrogen. In the conditions of Central Ciscaucasia, Azotobacterchroococcum is most common in soil.

The number of aerobic nitrogen fixators at the control was 26.1 thousand KOE / g (Figure 3). When shelly limestone was applied in doses of 6 and 12 t / ha, the number of these microorganisms increased 2.6 and 2.8 times, respectively, compared to the control. The application of apatite in doses of 1.5 and 3 t / ha and phosphogypsum provided an insignificant increase in the amount of this group of microorganisms in 1,3-1,4 times. With joint application of rocks, the number of microorganisms of the genus Azotobacter increased 1.8-1.9 times, especially in the case of shelly limestone - 12 tons / ha, apatite 3.0 tons / ha and phosphogypsum 12 tons / ha.




HCP$_{05}$ million CFU / 1g=4,7

**1**- control;
**2**- shelly limestone – 6 t/ha;
**3**- shelly limestone -12 t/ha;
**4**- apatite - 1,5 t/ha;
**5**- apatite - 3,0 t/ha;
**6**- phosphogypsum - 12 t/ha;
**7**- shelly limestone - 6 т/га + apatite - 1,5 t/ha;
**8**- shelly limestone 12 t/ha + apatite - 3,0 t/ha;
**9**- shelly limestone - 6 t/ha + apatite - 1,5 t/ha + phosphogypsum - 12 t/ha;
**10**- shelly limestone - 12 t/ha + apatite - 3,0 t/ha + phosphogypsum - 12 t/ha .

**Figure 3: Number of aerobic nitrogen fixators in the phase of flowering corn from the experiment options (thousand CFU / 1g)**

Cellulose is the main component of plant residues. In the soil, cellulose is destroyed by representatives of different groups of microorganisms: fungi, actinomycetes and bacteria.

In all variants of the experiment the amount of cellulose-destroying microorganisms was higher than in the control (Figure 4). The smallest difference was found in the application of shelly limestone in doses of 6 and 12 t / ha (1.1 and 1.3 times, respectively) and apatite at doses of 1.5 and 3 t / ha (1.4 and 1, 2 times respectively). The introduction of phosphogypsum caused an increase in the number of microorganisms studied by 1.5 times and amounted to 163.5 thousand CFU / g. The greatest number of cellulosolytics (261.6 thousand CFU / g) was observed with the joint application of rocks in maximum doses.

Being an integral part of the microbial community of soils, microscopic fungi are characterized by a low population size. Their main function is the decomposition of organic residues.

On control, the number of micromycetes was 156.5 thousand CFU / g soil. The introduction of rocks did not significantly affect the amount of the group of microorganisms studied. An exception was the joint introduction of rocks on the 10th variant, when the number of micromycetes increased 2.4 times and amounted to 371.6 thousand CFU / g (Fig. 5).

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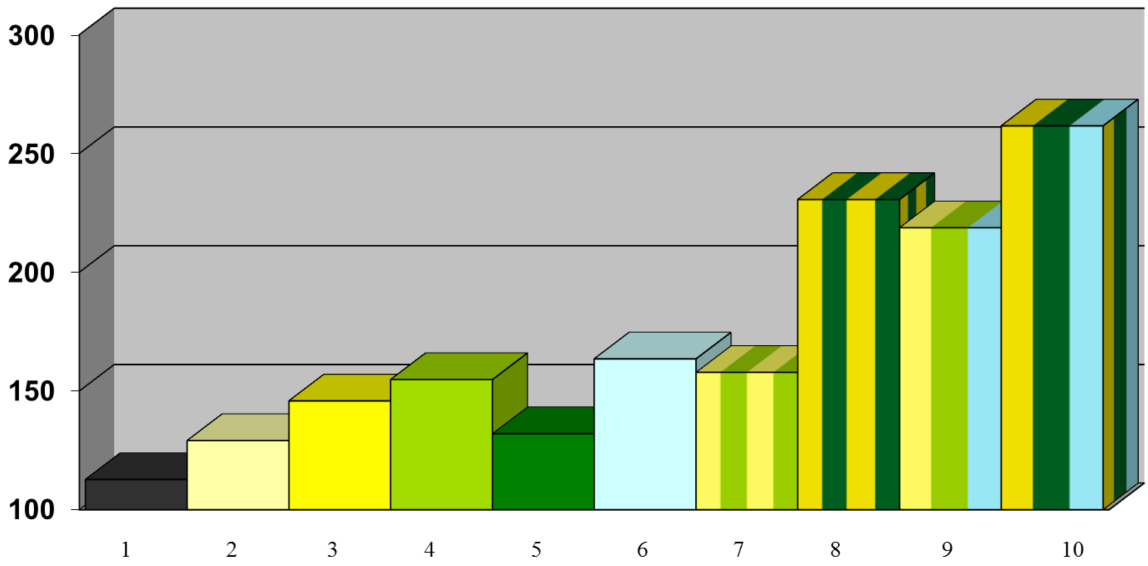
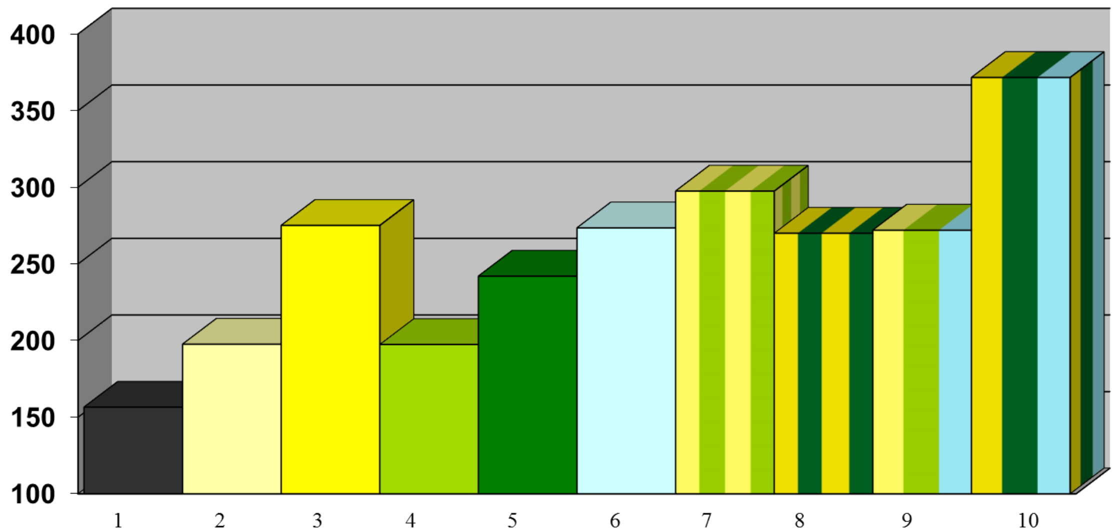



HCP05 million CFU / 1g=16,2

**1**- control;
**2**- shelly limestone – 6 t/ha;
**3**- shelly limestone -12 t/ha;
**4**- apatite - 1,5 t/ha;
**5**- apatite - 3,0 t/ha;
**6**- phosphogypsum - 12 t/ha;
**7**- shelly limestone - 6 т/га + apatite - 1,5 t/ha;
**8**- shelly limestone 12 t/ha + apatite - 3,0 t/ha;
**9**- shelly limestone - 6 t/ha + apatite - 1,5 t/ha + phosphogypsum - 12 t/ha;
**10**- shelly limestone - 12 t/ha + apatite - 3,0 t/ha + phosphogypsum - 12 t/ha
.

**Figure 4: Number of cellulose-decomposing microorganisms in the phase of flowering corn (thousand CFU / 1g.)**




HCP05 million CFU / 1g=15,6

**1**- control;
**2**- shelly limestone – 6 t/ha;
**3**- shelly limestone -12 t/ha;
**4**- apatite - 1,5 t/ha;
**5**- apatite - 3,0 t/ha;
**6**- phosphogypsum - 12 t/ha;
**7**- shelly limestone - 6 т/га + apatite - 1,5 t/ha;
**8**- shelly limestone 12 t/ha + apatite - 3,0 t/ha;
**9**- shelly limestone - 6 t/ha + apatite - 1,5 t/ha + phosphogypsum - 12 t/ha;
**10**- shelly limestone - 12 t/ha + apatite - 3,0 t/ha + phosphogypsum - 12 t/ha
.

**Figure 5: Number of microscopic fungi in the flowering phase of maize (thousand CFU / 1g.)**

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Thus, as a result of the conducted studies it was revealed that the number of microorganisms of the physiological groups under study underwent various changes in all variants of the experiment in comparison with the control. The introduction of rocks affects the increase in the number of soil microflora.

## CONCLUSION

Thus, there was a significant reduction in the variation rates of the Shannon micromycete diversity coefficient on the control and the variants with the shelly limestone application compared with the other variants of the experiment, respectively from 0.94-1.09 to 1.42-2.11, indicating a better ecological sustainability of the soil system when most of the rocks are introduced.

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