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Dynamics of cellulolytic microorganisms on the virgin soil and arable black soils of the central Ciscaucasia.

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ABSTRACT

This article presents the results of many years of research related to the study of seasonal population dynamics of cellulolytic microorganisms in different subtypes of chernozems of the Central Caucasus.

Keywords: central Caucasus, cellulolytic microorganisms, black soil, virgin, arable land, winter wheat.

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INTRODUCTION

Cellulose, which is one of the main components of organic residues, has a significant influence on the formation of the biological properties of the soil. During the conversion of fiber involved fungi, bacteria and actinomycetes [1, 5-10]. The activity of microorganisms, destroying the cellulose is carried out under conditions sufficient nitrogen. Thus bacteria requires more abundant nitrogen saturation of soil than fungi [2, 3]. Mikromitcety decomposing cellulose, it is very diverse, but the bulk of them develops slowly and does not use a significant amount of nitrogen.

MATERIALS AND METHODS

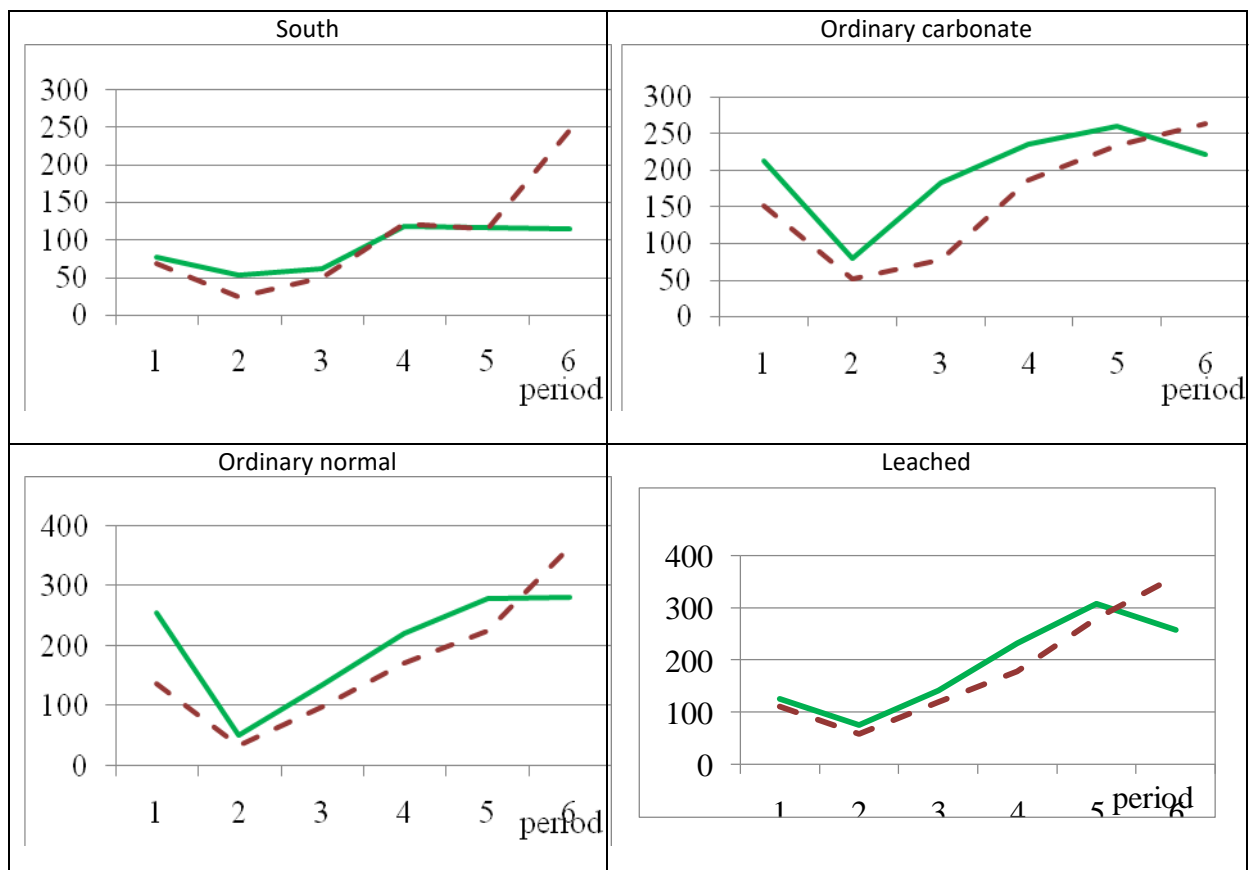
The object of our research are the main subtypes of chernozems of the Central Pre-Caucasus: the southern, ordinary, leached (formed on loess-like loam), and alkaline, solonetsous (formed on eluvium Maikop clays of marine origin) conjugate sections of virgin land and arable land.

Soil sampling and laboratory studies conducted in seasonal dynamics on the main phases of winter wheat growing season: autumn, spring tillering, booting, flowering, milk ripeness, after harvesting the culture. On the virgin areas of research carried out in the same terms as in the arable. Plants on virgin presented forb-grass associations, on arable land sown winter wheat.

Sampling was carried out from the area of plants rhizosphere on virgin soil in a layer of 0-8 cm, winter wheat from a layer of 0-20 cm by the standard methods. The number of aerobic nitrogen-fixing bacteria was determined on a selective medium Getchinson followed by direct counting of the colonies [4].

RESULTS AND DISCUSSION

Analyzing the seasonal population dynamics of cellulolytic microorganisms (Figure 1) on the southern black soil, we found that in the virgin lands of the studied parameters in the fall of 74 thousand. CFU per 1g and decreases the spring period 1.5 times.



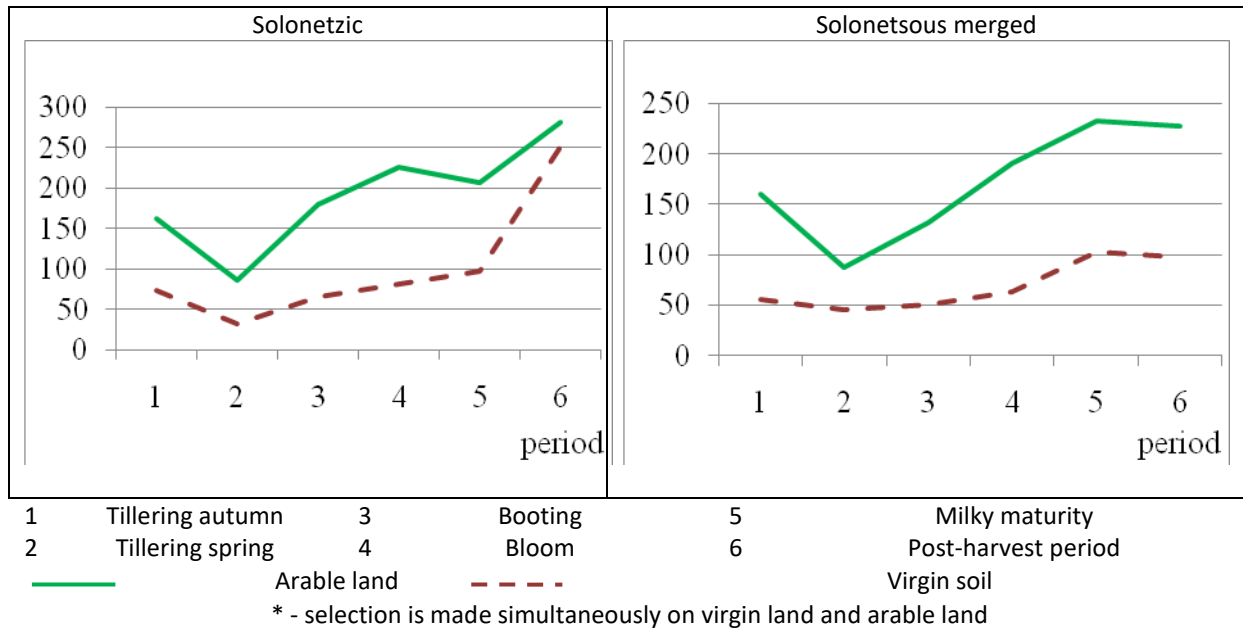


Figure 1: Seasonal population dynamics of cellulolytic microorganisms on average over the phases of the growing season during the years of research, thousands CFU / 1g

In terms when on an arable land wheat held booting phase, on virgin land, an increase of researched index more than 2 times. This increase (up to 119 thousand. 1g CFU) and continues until the moment when on an arable land winter wheat held flowering phase. Further, the number of microbes does not change significantly.

On arable land there was the same pattern, with the exception of post-harvest period. At this time, the number of cellulolytic organisms, and increases the maximum to 248 thousand. CFU/1g. The difference between the maximum and minimum index, which refers to the phase of spring tillering, is 9.9 times.

A similar pattern is observed on chernozems ordinary and leached. We can only note that these subtypes of chernozems in the summer post-harvest period, the number of microorganisms highest compared to other phases of the growing season. The only exceptions are the years in which at this time manifested soil drought. On chernozem ordinary solonetzic number cellulolytic microflora in the virgin lands is very dynamic in terms of research. Not observed any regularities and the number of micro-organisms may decline at a time when the winter wheat takes place critical phase of development. In addition, the obtained value in the virgin lands significantly exceeds the same indicator on an arable land. On the black soil arable ordinary solonetsous can be observed decrease in the number of cellulolytic microorganisms in the post-harvest period. This is not consistent with the identification of patterns in other subtypes of chernozems. These differences can only be explained by significant differences in terms of the physical properties of the soil in different subtypes. Chernozems solonetzic and especially solonetsous fusion formed on eluvium Maikop clays have a narrow range of optimum moisture content, so little draining or waterlogging leads to a drastic reduction in the appearance of aeration and anaerobic.

The average number of cellulolytic microorganisms for research data (Figure 2) on the southern black soil has some differences. So, in 2006, the number of microbes in the virgin lands was 159 thousand CFU/1g and increased plowing another 80 thousand. CFU/1g. In the remaining years of research as a significant difference was not observed. In addition, in 2007 and 2010 the number of cellulolytic microorganisms on virgin soil was not plentiful and above than in the arable land. Minor differences observed in the average number of years of research.

On ordinary chernozem carbonate non recorded significant difference between virgin and arable land by years of research and as a consequence, the mean values for all of the year, but their number is on virgin soil was not significantly higher than in the arable land.

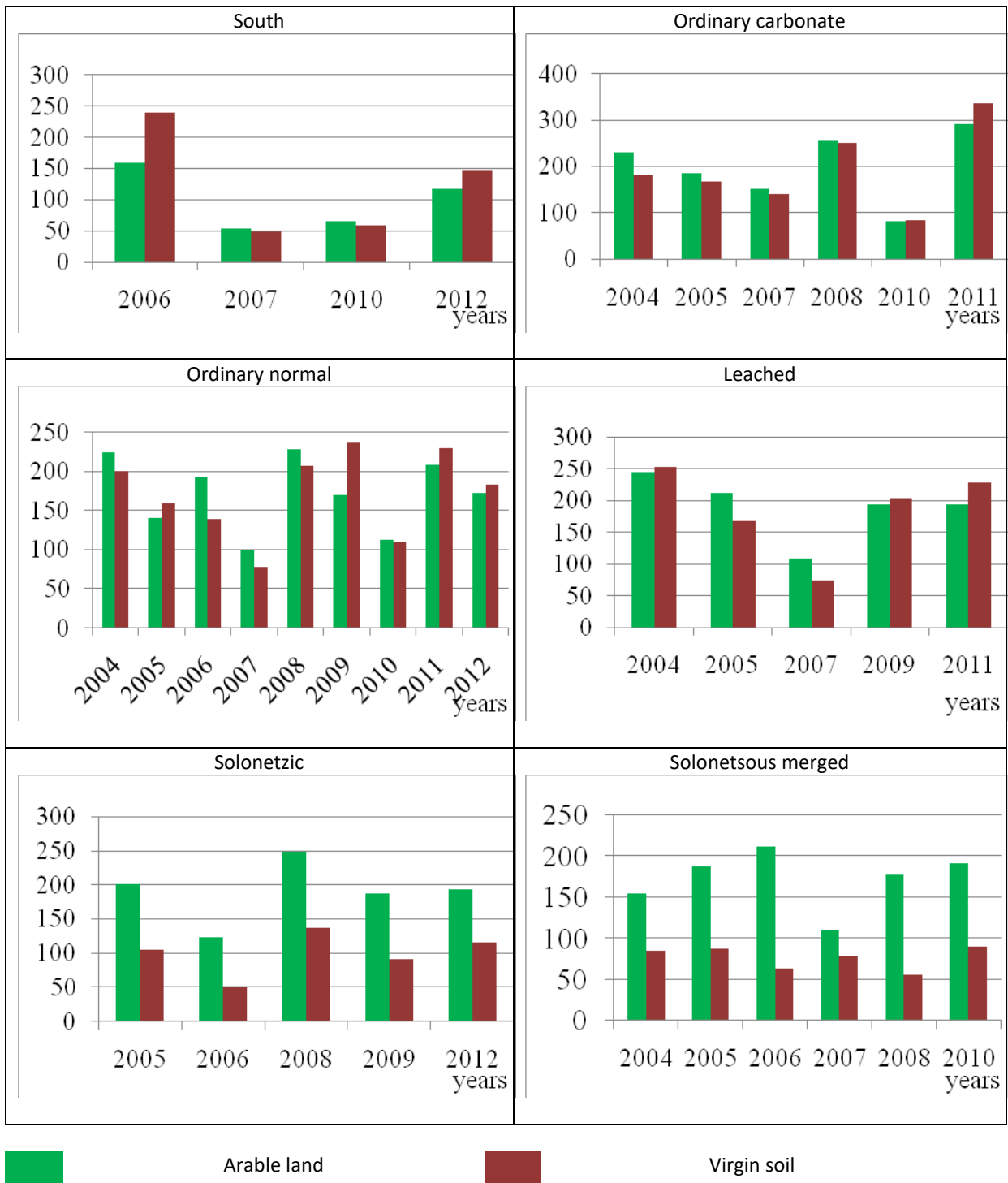


Figure 2: Average number of vegetation cellulolytic microorganisms for years, thousands CFU / 1g.

A similar situation is found in the normal chernozems and leached. On chernozems ordinary solonetzic and solonetsous fusion number of cellulolytic microorganisms in all the years of research on virgin soil is higher than on an arable land with a difference of 2-3 times. Therefore, the main processors of cellulose, which are fungi, feel more comfortable in the virgin lands in conditions more favorable in terms of moisture and physical properties. They are strict aerobes and grow better in more aerated conditions of virgin land.

CONCLUSION

Thus, the presence of moisture is the decisive factor in the development of this physiological group of microorganisms. On chernozems calcareous, ordinary, normal and leached observed the same pattern, but with a significant difference between the minimum and maximum values. Number of cellulolytic microorganisms on virgin soil in the various years of research varies on southern chernozem from 53 to 159 thous. CFU / 1 g, on an ordinary carbonate from 83 to 337 thous. CFU / 1 g, on an ordinary normal from 78 to 237 thous. CFU / 1 g, on leached from 73 to 252 thous. CFU / 1 g, on saline from 51 to 136 tys. CFU / g 1 and on chernozem solonetsous fusion from 56 to 90 thousand. CFU / 1 g. On the arable land under various crops is an increase in the number of microorganisms on the average 1.2 - 1.6 times on chernozems southern, common and leached. At solonetzic and solonetsous merged chernozems number of study groups of microorganisms, on the contrary, below 1.5 - 3.8 times.

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