



# THE INFLUENCE OF BIOLOGICAL PREPARATIONS AND THEIR MIXTURES ON SOIL AGROCHEMICAL PROPERTIES IN WINTER WHEAT



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## Introduction

As the number of people around the world increases, so does the need for food. Agriculture is becoming more and more intensive to meet food needs. New, heavy machinery is emerging, using large amounts of fertilizers and pesticides, which help to grow a good harvest. However, all these measures also have a negative impact on the main means of agricultural production, the soil.

## Results

**Table 1.** The influence of biological preparations and their mixtures on the content of water-soluble carbon ( $\text{g kg}^{-1}$ ), organic carbon, total phosphorus (%), mobile humic substances (MHS), and acids (MHA) (%)

Biological preparations and their mixtures (Factor B)	$C_{\text{soluble}} \text{ g kg}^{-1}$	$C_{\text{org.}}$	$P_{\text{total}} \%$	MHS %	MHA %
Compensatory nitrogen 8 kg t of straw, without biological preparations (control)	0.204a	1.17c	0.059a	0.337a	0.190a
Ruinex 1 l ha	0.201a	1.33ab	0.050a	0.280b*	0.139b
Penergetic k 200 ml ha	0.196a	1.41a	0.060a	0.258b	0.139b
Azofix 1 l ha	0.210a	1.23bc	0.049a	0.330a	0.195a
Ruinex 1 l ha + Penergetic k 200 ml ha	0.229a	1.38ab	0.056a	0.317a	0.181a
Ruinex 1 l ha + Azofix 0.5 l ha	0.217a	1.39ab	0.056a	0.279b	0.149b
Penergetic k 200 ml ha Azofix 1 l ha	0.210a	1.27b	0.058a	0.276b	0.146b
Ruinex 1 l ha + Penergetic k 200 ml ha Azofix 0.5 ha	0.205a	1.48a	0.058a	0.261b*	0.147b
Ploughless tillage (disking) (Factor A)					
Compensatory nitrogen 8 kg t of straw, without biological preparations (control)	0.203a	1.19b	0.054a	0.339a	0.187a
Ruinex 1 l ha	0.222a	1.32ab	0.051a	0.307ab*	0.181ab
Penergetic k 200 ml ha	0.212a	1.35a	0.055a	0.276b	0.144b
Azofix 1 l ha	0.233a	1.24b	0.048a	0.315a	0.168ab
Ruinex 1 l ha + Penergetic k 200 ml ha	0.206a	1.35a	0.056a	0.299ab	0.165ab
Ruinex 1 l ha + Azofix 0.5 l ha	0.224a	1.29b	0.053a	0.288ab	0.151ab
Penergetic k 200 ml ha Azofix 1 l ha	0.210a	1.29b	0.048a	0.238b	0.148ab
Ruinex 1 l ha + Penergetic k 200 ml ha Azofix 0.5 ha	0.214a	1.47a	0.054a	0.330a*	0.168ab

Note: The differences between the means of the variants (A-no-tillage or ploughless tillage) marked with an asterisk (\*) are significant. The differences between the means of the variants (B-biological preparations) marked with the same letter (a, b, c ...) are significant ( $P < 0.05$ ).

## Methodology

A two – factor field experiment in 2017/2019 was carried out at the Vytautas Magnus University Experimental Station on the winter wheat 'Sailor' crop test fields. Biological preparations and their mixtures was applied using different tillage technologies. Treatments of the experiment: Factor A: different tillage technologies; Factor B: bio-preparations and their mixtures .

## Conclusions

The use of biological preparations and their mixtures, in many cases, increased the content of water-soluble (labile) carbon in the soil compared to the use of compensatory nitrogen to stimulate straw mineralization. The content of labile carbon was particularly increased by mixtures of two preparations (*Ruinex + Penergetic k*, *Ruinex + Azofix* and *Penergetic k + Azofix*) using both tillage technologies. The combination of the three preparations increased the content of soluble carbon by 5.4% more in ploughless technology, in no-tillage – only 0.5%. The use of one-component biological preparations in ploughless tillage also increased the content of water-soluble carbon, and in no-tillage – reduced it but insignificantly.

The organic carbon content of the soil was not significantly affected by tillage technology, and the use of biological preparations and their mixtures increased the organic carbon content of the soil. The total phosphorus was not significantly affected by the tillage technology or the biological preparations used, only the tendency was observed that the loosening of the soil promotes its relaxation and accessibility to plants.

Significant reductions in MHS and MHA were found in the crop of no-tillage technology compared to the use of nitrogen. These substances were particularly reduced by the use of a mixture of all three preparations without their incorporation into the soil, using a no-tillage technology.