Original article

**Agroecological efficiency of soil bioactivation**

**in the mineral nutrition system of winter wheat against the background**

**of green manure aftereffect**

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***Abstract.*** In the article, an agroecological assessment of the effectiveness of the pre-sowing application of a consortium of useful groups of soil microorganisms as a means of increasing the biological activity of the soil was carried out. The studies were carried out against the background of the aftereffect of green manure and increasing doses of mineral fertilizers. The authors set a goal to establish the degree of influence of soil bioactivation on the indicator of soil respiration intensity, the content of soil organic matter and the yield of winter wheat. The positive effect of soil enrichment with microorganisms on the biological activity of the soil manifested itself in the form of an increase in the intensity of soil respiration by 19.6–27.3%. As a result of the study, reliable data were obtained on a close correlation between the biological activity of the soil and the yield of winter wheat (r=0.994). The reception provided a significant increase in absolute control in numbers from 33.7 to 110.5%, depending on the level of supply of mineral fertilizers in the soil. Also, an average increase in soil organic matter was achieved – 0.13%. This method can be recommended as an effective means of increasing the biological activity and increasing the productivity of winter wheat.

***Keywords:*** Green manure, microorganisms, soil respiration, organic matter, productivity

**REFERENCES**

1. Borisova E.E. The use of green manure in the world. *Vestnik NGIEI* [Bulletin of NGIEI]. 2015. No. 6(49). Pp. 24–33. (In Russian)

2. Timiryazev K. A. *Sochineniya* [Essays]. Vol. 3. Moscow: Selkhozgiz, 1936. 451 p. (In Russian)

3. Dovban K. I. Briefly about green manure. *Zemledelie* [Agriculture]. 1996. No. 3. Pp. 45–46. (In Russian)

4. Strelnikova E.A., Gorlova L.A., Bochkareva E.B., Trubina V.S. Oilseed cabbage crops – a promising highly effective green manure. *Mezhdunarodnyj zhurnal gumanitarnyh i estestvennyh nauk* [International Journal of the Humanities and Natural Sciences]. 2018. No. 12–1.
Pp. 125–131. (In Russian)

5. Maltsev V.F., Kayumov M.K. *Sistema biologizacii zemledeliya Nechernozemnoj zony Rossii* [The system of biologization of agriculture in the Non-Chernozem zone of Russia]. Moscow: Rosinformagrotekh, 2002. 576 p. (In Russian)

6. Konovalova L.K., Okorkov V.V., Vinokurov I.Yu. Comparative assessment of the economic efficiency of the use of organic fertilizers and green manure. *Vladimirskij zemledelec* [Vladimir farmer]. 2019. No. 3. Pp. 43–47. DOI:10.24411/2225-2584-2019-10081. (In Russian)

7. Akinchin A.V., Kuznetsova L.N., Linkov S.A. Formation of yield and quality of corn silage depending on the methods of basic soil treatment and fertilizers. *Kukuruza i sorgo* [Corn and sorghum]. 2012. No. 3. Pp. 18–21. (In Russian)

8. Shapkina G.S. Selection of crops for intermediate crops. *Zemledelie* [Agriculture]. 1990.
No. 10. Pp. 36–37. (In Russian)

9. Vasiliev A.A. The influence of green manure on the phytosanitary state of potato agroecosystems. *Permskij agrarnyj vestnik* [Perm agrarian bulletin]. 2014. No. 3(7). Pp. 3–10. (In Russian)

10. Karpukhin M.Yu., Chulkova V.V., Chulkov A.V., Batyrshina E.R. Biological properties of podzolized chernozem using various green manure crops according to the system of organic farming in the Middle Urals. *Vestnik Kurganskoj GSKHA* [Bulletin of the Kurgan State Agricultural Academy]. 2022. No. 3(43). Pp. 16–25. DOI: 10.52463/22274227\_2022\_43\_16. (In Russian)

11. Leshkenov A.M., Zanilov A.Kh., Krylova M.F. Influence of soil biological activity on organic matter content against the background of increasing doses of mineral fertilizers. *Zemledelie* [Agriculture]. 2022. No. 7. Pp. 25–29. DOI: 10.24412/0044-3913-2022-7-11-15. (In Russian)

12. Anan’eva N.D., Sus’yan E.A., Gavrilenko E.G. Features of determination of carbon in soil microbial biomass by the method of substrate-induced respiration. *Pochvovedenie* [Eurasian Soil Sci]. 2011. No. 11. Pp. 1327–1333. (In Russian)

13. Mishustin E.N., Emtsev V.T. *Mikrobiologiya* [Microbiology]. Moscow: Agropromizdat, 1987. 368 p. (In Russian)

14. Zvyagintsev D.G. *Pochva i mikroorganizmy* [Soil and microorganisms]. Moscow: Izdatel'stvo Moskovskogo universiteta, 1987. 256 p. (In Russian)

15. Zanilov A.Kh., Yakhtanigova Zh.M. Comparative evaluation of the effect of bacterial preparations on the respiratory and cellulose-decomposing activity of the soil. *Belgorodskij agromir* [Belgorod agroworld]. 2014. No. 6(87). Pp. 13–17. (In Russian)

16. Subke J.A., Ingima I., Cotrufo M.F. Trends and methodological impacts in soil CO2 efflux partitioning: A metaanalytical review. Glob Change Biol. 2006 No. 12. Pp. 921–943. DOI:10.1111/j.1365-2486.2006.01117.x49.

17. Leshkenov A. M., Zanilov A. Kh. Influence of soil bioactivation on the efficiency of mineral and organo-mineral fertilizer systems and productivity of winter wheat. *News of the Kabardino-Balkarian Scientific Center of RAS*. 2021. No. 2(100). Pp. 39–49. DOI: 10.35330/1991-6639-2021-2-100-39-49. (In Russian)

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