SECTION: AGRICULTURAL SCIENCES

ENVIRONMENTALLY SAFE APPROACHES TO SUNFLOWER CULTIVATION

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An important area of modern crop production is the preservation and enhancement of soil fertility through effectively utilizing post-harvest residues of cereal crops [1]. In particular, in the case of winter wheat, the accumulation of stubble in the soil may affect its physicochemical properties and the biological activity of microorganisms. Various microbiological preparations based on bacterial and fungal strains capable of accelerating organic matter mineralization are being developed and applied to optimize decomposition [2].

Biodestructors typically contain certain groups of microorganisms (various Bacillus species, Trichoderma, etc.), enzymes (cellulases, xylanases), and auxiliary substances that facilitate the rapid breakdown of the lignocellulosic complex. Applying such preparations directly in the field—spraying or incorporating residues into the soil—can increase microbial activity and accelerate plant material decomposition. As a result, the number of pathogenic microorganisms that may negatively affect subsequent crops is reduced [3].

Sunflower is a crop with a reasonably well-developed root system, and it is sensitive to soil fertility and the presence of residues from a preceding crop. According to several researchers who have studied the influence of winter wheat residues on sunflower productivity, using biodestructors speeds up stubble decomposition and improves soil fertility [4]. Rapid decomposition of organic matter facilitates better access to sunflower's nutrients, ultimately influencing its yield formation.

Modern markets offer a wide range of commercial biopreparations (so-called “biodestructors”) that differ in composition and mechanisms of action. Some research indicates that combining bacterial cultures with enzyme additives or fungal components (for example, with a complex of Trichoderma spp.) can enhance residue decomposition compared to single-culture preparations [5]. Significant product differences are usually explicitly revealed under field conditions with various soil and climatic characteristics, underscoring the need for regional studies.

Thus, the literature suggests that applying destructors of biological origin (bacterial or fungal) promotes increased mineralization of residues, particularly those of winter wheat, reduces the risk of pathogen development, and positively affects sunflower productivity.

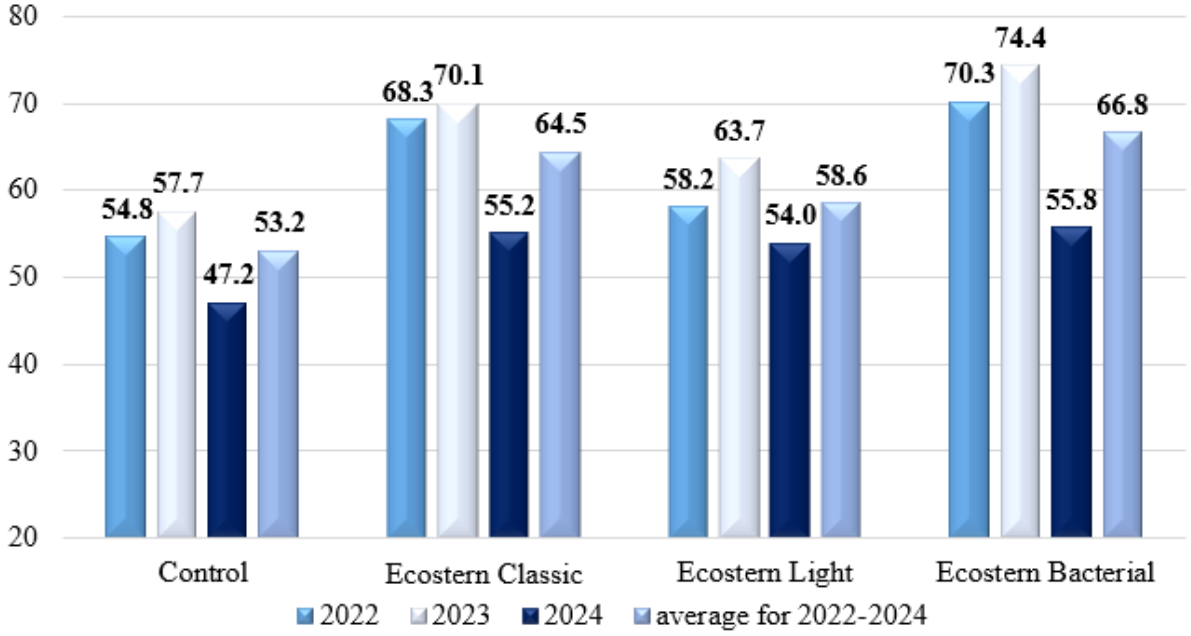

Figure 1. Rate of decomposition of winter wheat crop residues depending on the application of biodestructors in sunflower crops at the onset of head formation, %

The lowest values were observed in the control variant (without destructor) (53.2% on average over three years). In contrast, the application of biopreparations resulted in a noticeably higher stubble decomposition rate, ranging from 58.6% (Ekostern Lite) to 66.8% (Ekostern Bacterial) (Fig. 1). Ekostern Classic, with a rate of 64.5%, also markedly exceeded the control. The comparisons, showing substantial differences of 4.8–6.1% (depending on the year), indicate statistically significant differences between the biodestructors and the control while confirming the superior ability of Ekostern Bacterial to accelerate the breakdown of plant residues.

Using destructors helps increase the intensity of plant residue decomposition compared to the control (Fig. 2).

We constructed a correlation-regression model (Fig. 3) to examine the relationship between the decomposition intensity of winter wheat residues, influenced by the application of decomposers in a sunflower crop at the beginning of head formation, and yield. The coefficient of determination in our study was analyzed using the Chaddock scale, indicating a very close relationship.

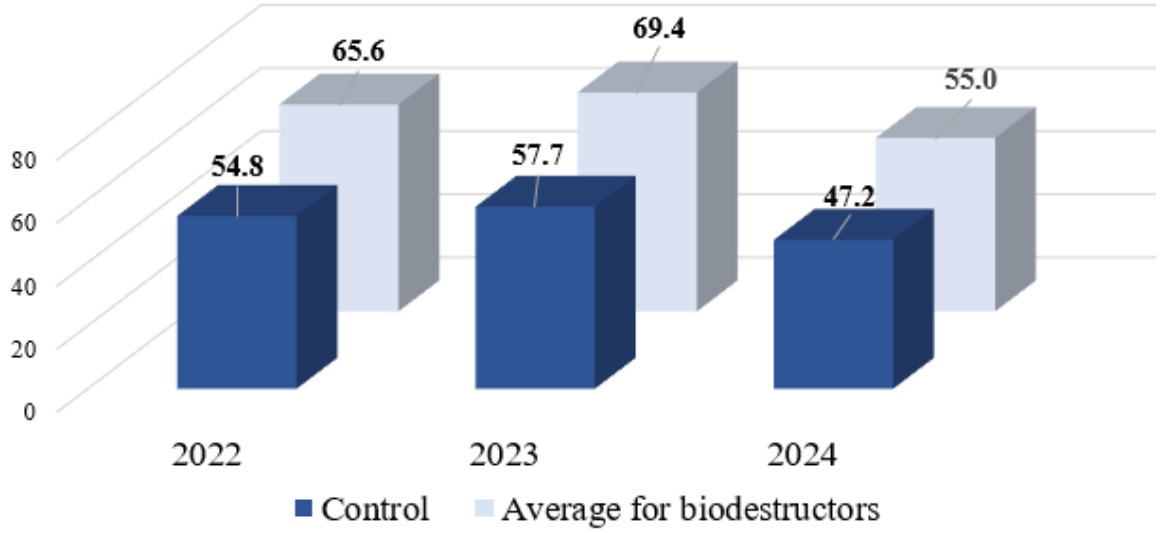

Figure 2. Decomposition intensity of plant residues compared to the control

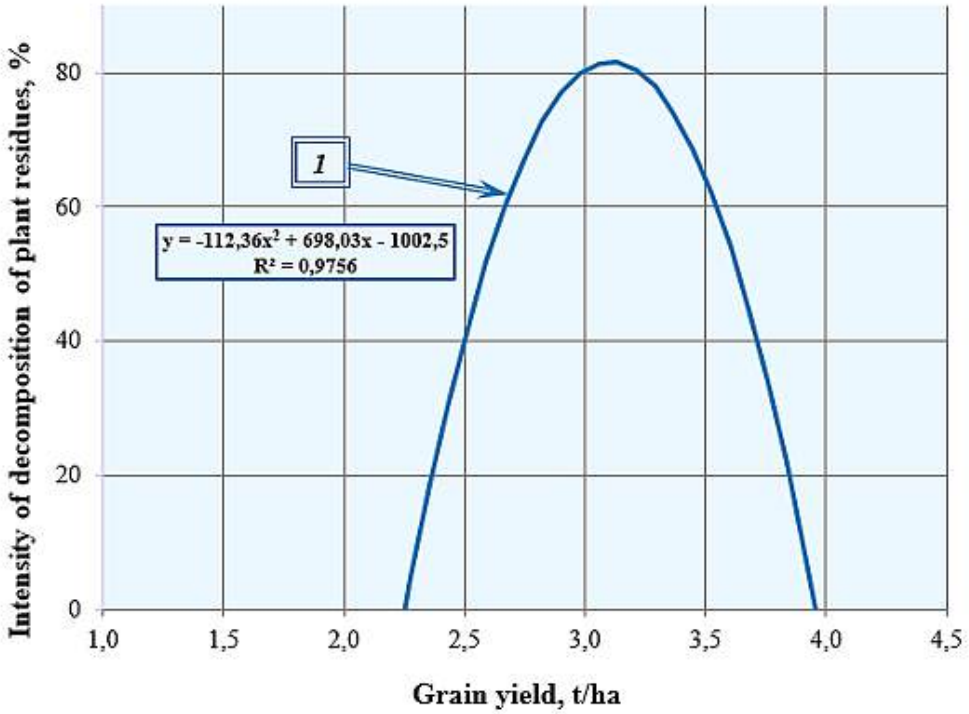

Figure 3. Correlation-regression model between the decomposition intensity of winter wheat plant residues, depending on using decomposers in a sunflower crop at the beginning of head formation, and yield

Thus, the application of biopreparations (Ekostern Lite, Ekostern Classic, Ekostern Bacterial) compared to the control variant without the destructor shows significantly higher decomposition rates of plant residues. Of the three preparations studied, Ekostern Bacterial gave the best results (66.8% versus 53.2% in control), with the difference according to LSD_{05} (4.8–6.1%, depending on the year) confirming the statistical reliability of the data.

The correlation-regression model we constructed confirmed a strong relationship between the decomposition intensity of winter wheat stubble after the application of decomposers in sunflower crops and the increase in grain yield (according to the

Chaddock scale, the coefficient of determination indicates a very high degree of correlation). This makes it possible to recommend using decomposers to activate the decomposition of plant residues, improve the soil nutrient status, and increase the yield of crops.

References

1. Panfilova A., Gamayunova V. (2019). The effect of stubble biodestructor on the nutritive regime of the soil. Journal of Lviv National Environmental University: Agronomy, 23. P. 229–233. DOI:10.31734/agronomy2019.01.229
2. Гамаюнова В. В., Хоненко Л. Г., Бакланова Т. В., Пилипенко Т. В. (2023). Сівозміна як захід ресурсозаощадження та екологічної рівноваги Південного регіону України в повоєнний період. Climate-smart agriculture: science and practice: Scientific monograph. Riga, Latvia: Baltija Publishing. С. 361–394. DOI: https://doi.org/10.30525/978-9934-26-389-7-18
3. Сидякіна О. В. Ефективність біодеструкторів у сучасних агротехнологіях. *Таврійський науковий вісник* № 119. (2021). С.123–129. DOI https://doi.org/10.32851/2226-0099.2021.119.16
4. Гамаюнова В.В., Хоненко Л.Г., Коваленко О.А., Бакланова Т.В., Сидякіна О.В. (2024). Ресурсоощадні заходи поліпшення родючості грунту та збільшення продуктивності рослин шляхом використання соломи. Scientific multidisciplinary monograph «*Science in the context of innovative changes*». С. 230–251.
5. Panfilova A., Belov Ya. (2022). The influence of the stubble biodestroyer and the main tillage method on the nutrient regime of the soil // Ukrainian Black Sea Region Agrarian Science, 26(3), P. 47–54. URL: https://doi.org/10.56407/2313-092X/2022-26(3)-4

ДЕНДРАРІЙ ЯВОРІВСЬКОГО НПП ЯК ОСЕРЕДОК БІОРІЗНОМАНІТТЯ ТА ЕКОЛОГО-ПРОСВІТНИЦЬКОЇ ДІЯЛЬНОСТІ

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Досліджено видовий склад та санітарний стан насаджень дендрарію, особливу увагу приділено рідкісним видам та ролі дендрарію у формуванні екосистемної рівноваги та еколого-просвітницької діяльності. Підкреслено значення дендрарію як елементу культурної та природної спадщини, екологічну, естетичну та наукову цінність насаджень, а також визначено основні напрямки їх подальшого розвитку.

Важливими елементами зелених зон міських територій є дендрарії, що сприяють збереженню біорізноманіття, покращенню екологічної ситуації та