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References

1. Veselovskyi I.V., Lysenko A.K., Manko Yu.P. Atlas-vyznachnyk burianiv. K.: Urozhai, 1988. 72 s.

2. Zherebko V.M. Vid choho zalezhyt efektyvnist vykorystannia zasobiv zakhystu roslyn. Contemporary agricultural technology. 2013. №3. Pp. 32-34.

3. Hamaiunova V.V., Tuz M.S. Vplyv elementiv tekhnolohii vyroshchuvannia na produktyvnist sortiv horokhu v pivdennomu Stepu. Zbirnyk naukovykh prats NNTs «Instytut zemlerobstva NAAN». 2016. Vypusk 1. S. 46-57.

4. Zadorozhnyi V.S., Karasievych V.V., Movchan I.V., ta in. Zakhyst bean type burianiv. «2016: Zernobobovi kultury ta soia dlia staloho rozvytku ahrarnoho vyrobnytstva Ukrainy». Materials mizhnarodnoi naukovoi konferentsii 11-12 serpnia 2016. Vinnytsia: Dilo, 2016. S.71-72.

5. Ivashchenko O.O., Remeniuk S.O., Ivashchenko O.O. Problemy potentsiinoi zasmichenosti gruntu v Ukraini. Visnyk ahrarnoi nauky. №8. 2018. S. 58-62.

6. Kaminskyi V.F. Znachennia sortu v suchasnykh tekhnolohiiakh vyroshchuvannia zernobobovykh kultur. Fodder and fodder production. 2006. № 57. pp. 84–94.

7. Nidzelskyi V.A. Dynamika rostu horokhu zalezhno vid pohodnykh umov roku. Naukovyi zhurnal «Roslynnytstvo ta gruntoznavstvo». 2015. № 210. S. 67-74.

8. Okrushko S.Y. Otsinka rehuliuvannia prysutnosti burianiv v ahrofitotsenozakh horokhu posivnoho. Polish Journal of Science, 2020. № 27. Vol. 1. C. 4-9.

9. Overchenko B.P., Danyliuk L.I. Produktyvnist horokhu zalezhno vid teplo- i volohozabezpechenosti. Visnyk ahrarnoi nauky. 1994. № 6. S. 16-18.

10. Sichkar V.I. Suchasnyi stan i perspektyvy vyroshchuvannia zernobobovykh kultur na nashi planeti. Zernobobovi kultury ta soia dlia staloho rozvytku ahrarnoho vyrobnytstva Ukrainy: mizhnar. science. conf., August 2016: thesis add. Vinnytsia: Dilo, 2016. S. 15-16.

11. Trybel S.O. Suchasnyi stan khimichnoho metodu zakhystu roslyn. Zakhyst and quarantine plants. №1. 2014. P.1-4.

12. Fysiunov A.V. Sornыe rastenyia. M .: Kolos, 1984. 320 s.

13. Cherniuk A.P. Perspektyvy ta tekhnolohiia vyroshchuvannia horokhu. Naukovi pratsi Instytutu bioenerhetychnykh kultur i tsukrovykh buriakiv: zb. nauk. pr.K.: FOP Korzun D.Iu., 2013. Vyp.18. S. 69-72.

14. Shkatula Yu.M., Palamarchuk A.V. Vplyv herbitsydiv na zaburianenist ta urozhainist nasinnia horokhu. Silske hospodarstvo ta lisivnytstvo. 2015. № 2. pp. 102–110.

15. Tsykov V.S., Tkalich Yu.I. Shkodochynnst sehetalno-ruderalnykh burianiv. Biuleten Instytutu silskoho hospodarstva stepovoi zony NAAN Ukrainy. Dnipropetrovsk. 2014. № 6. S. 38-41.

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Razanov S.F.,
Doctor of Agricultural Sciences, Professor
ORCID: 0000-0002-4883-2696
Piddubna A.M.,
Postgraduate
ORCID: 0000-0002-0204-1338
Husak O.B.,
Postgraduate
ORCID: 0000-0001-7900-9902
Michchenko B.D.
Master
Vinnytsia National Agrarian University,
Vinnytsia
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ECOLOGICAL EFFICIENCY OF INCREASING YIELD OF AGRICULTURAL CROPS BY BEE POLLINATION

Abstract

The ecological efficiency of increasing the yield of agricultural crops due to bee pollination has been studied. It was found that in the period from 2000 to 2016, 175.6 mg of lead and 56.2 mg of cadmium per 1 hectare of agricultural land in the territory of Vinnytsia region; of them with nitrogen fertilizers – 47.4 % and 3.7 %; with phosphorus – 29.2 % and 16.5 %; with potassium – 23.3 % and 80 %. During the cultivation of winter rape and sunflower on the area of 405370 ha with mineral fertilization in order to increase their yield, 908.2 kg of lead and 214.5 kg of cadmium got into the soil. The increase in yields of these crops due to bee pollination against the

background of reduced use of mineral fertilizers led to a reduction of up to 30% of soil contamination with lead and up to 25 % of costs.

Key words: *heavy metals, lead, cadmium, concentration, bee pollination, nitrogen fertilizers, phosphorus fertilizers, potassium fertilizers.*

I. Literature review

The intensification of modern agriculture in the conditions of Vinnytsia and Ukraine as a whole leads to intensive pollution of natural ecosystems with various toxicants, in particular, and heavy metals, the concentration of which in some cases exceeds acceptable levels. At the same time, there is a tendency to reduce the content of humus in soils, which over the past 25 years has decreased by an average of 5.3 percentage points, primarily due to crop failure by a sharp decrease in crops and low levels of organic fertilizers. At the same time, there is a need to restore soil nutrients, which is solved mainly by applying mineral fertilizers to the soil [1, 4].

Significant sources of heavy metals entering the environment in Ukraine are enterprises of the metallurgical and mining industries, which have led to man-made soil contamination with heavy metals. It is known that the scale of environmental pollution by heavy metals over the past few decades is growing rapidly. According to the Institute of Soil Science and Agrochemistry. O.N. Sokolovsky currently heavy metals contaminate about 20% of agricultural land in Ukraine.

A large amount of heavy metals enters the soil with precipitation, especially in areas near industrial centers. In the soils around these enterprises, a significant excess of permissible concentrations of such metals was found. The environment is also polluted by non-ferrous and ferrous metallurgy enterprises, the production of mineral fertilizers, and the machine-building industry, and the application of organic fertilizers.

Intense pollution of the environment with such metals has created serious problems for the safe agricultural use of soils, especially near highways, large industrial cities and metallurgical enterprises. After all, it is known that the soil is of great sanitary and hygienic importance for animals, whose existence is closely linked to this object of the natural environment. It is important for the functioning of the agroecosystem and human life.

Once in the soil, these metals together with organic components form slowly moving complexes. It is known that the organic matter of the soil binds such metals more strongly, nor its mineral components. At the same time, it should be noted that lead and copper are more strongly fixed in organic matter, while cadmium is weaker. Fixation of such metals in the soil to some extent depends on the amount of oxides, calcium and phosphorus [5].

From the soil part of the lead and cadmium passes into plants through the root system. It has been proven that plants can accumulate heavy soil metals in large quantities. The intensity of migration of these elements in plants largely depends on their botanical origin [2, 3, 6].

Due to migration and transformation, such metals affect the components of almost all ecological systems. The intensity of migration and transformation of heavy metals in plants is significantly affected by lead and cadmium.

The use of mineral fertilizers promotes the constant entry of heavy metals into the soil and their inclusion in the soil cycle crop food. Under conditions of high inflow of heavy metals into the soil with the use of food products made from food raw materials grown in these conditions, leads to their accumulation in tissues and organs of living organisms, causing a number of disorders at the cellular, organ and body levels in general.

Heavy metals, getting into the tissues of living organisms interact with thiol groups of various macromolecules of the body, blocking them, which subsequently leads to the loss of proteins of many reactions and metabolic disorders.

The entry of heavy metals into the body for a long period of time has a negative effect on its hematopoietic organs, and also enhances the formation of free radicals, which leads to lipid oxidation.

It is established that cadmium poisoning causes a violation of protein synthesis and enzymatic processes. At the same time, it should be noted that cadmium causes a violation of nucleic acid metabolism and disrupts DNA synthesis.

Some of the lead circulates in the blood plasma in the form of albuminates, is found in the liver, kidneys, but mainly accumulates in bone and cartilage.

Lead lactate, which penetrates nerve and muscle cells easily, plays a key role in the mechanism of lead toxicity. Fast-growing tissues have been shown to be most sensitive to lead. Lead intoxication in childhood prevents the peak of bone mass, which can provoke osteoporosis in the future.

It is proved that heavy metal poisoning leads to increased morbidity and reduced life expectancy, there is an increased stillbirth rate. The consequence of environmental pollution is a reduced level of immunity, increased morbidity and mortality. The constant supply of heavy metals to the body leads to stress, as well as to hidden changes in metabolism.

Under such conditions, there is a need to limit the use of mineral fertilizers in modern conditions of intensive agriculture and to develop measures to increase the yield of agricultural plants through environmentally friendly technologies.

The purpose of research study of the effectiveness of reducing soil contamination with heavy metals through the use of bee pollination of crops.

II. Methodology

The ecological efficiency of bee pollination research was determined by establishing the level of heavy metals entering the soil due to the increase in

crop yields with mineral fertilizers and bee pollination.

Accumulation of lead and cadmium in bee nests (honey, perga, honeycomb) was determined by atomic absorption method.

Chemical methods of increasing crop yields included the use of mineral fertilizers, and biological pollination of these crops by honey bees.

Research on this topic was conducted in the conditions of agricultural production of Vinnytsia region, Ukraine.

III. Analysis and results

Analysis of the use of mineral fertilizers (Table 1) in the Vinnytsia region over the years showed that the amount of nitrogen fertilizers per 1 ha ranged from 14 kg to 72 kg, phosphorus – from 2 to 20 kg and potassium fertilizers – from 3 to 20 kg.

Table 1

Use of mineral fertilizers during 2000 - 2016

Years of research	Mineral fertilizers, kg/ha in current weight			
	Nitrogen	Phosphorus	Potassium	Total by years
2000	14	2	3	19
2005	27	3	9	39
2009	44	7	12	67
2010	39	20	21	80
2015	54	20	17	91
2016	72	18	20	110
Total for years of research	250	70	82	406
On the average on 1 hectare for the investigated period	41.6	11.6	13.6	67.6

On average, 41.6 kg of nitrogen fertilizers were applied to the soil per 1 ha during the accounting period; phosphorus – 11.6 kg and potassium fertilizers – 13.6 kg. At the same time, it is necessary to note the tendency to increase the level of use of mineral fertilizers.

Analysis of the supply of lead with mineral fertilizers (Table 2) shows that in 2000 in agricultural soils per 1 hectare got 45,8 mg of lead, in particular, with nitrogen fertilizers – 61.1 %, phosphorus fertilizers – 19.2 % and potassium – 19.6 %. In 2005, 94.2 mg/ha of lead entered the soil with mineral fertilizers, of which 57.3 % with nitrogen fertilizers, 14.0 % with phosphorus fertilizers and 28.6 % with potassium fertilizers. In 2009, 154.8 mg/ha of lead was received, with nitrogen fertilizers – 56.8 %, with phosphorus – 19.9 % and potassium – 23.2 %. In 2010, 229 mg of lead per 1 ha fell into the soil, of which 34.0 % with nitrogen – 38.4 % with phosphorus - and 43.9 % with potassium. In 2015, 247 mg of them entered the soil: nitrogen – 43.7 %, phosphorus – 35.6 % and potassium – 20.6 %. In 2016, 283.2 mg of lead, 50.8% – nitrogen fertilizers, 27.9 % – with phosphorus and 21.2 % – with potassium fertilizers got into the soil.

That is, there is a clear trend to increase the intensity of lead with mineral fertilizers in recent years. The highest amount of lead in the soil came with nitrogen fertilizers.

Table 2

Receipt of heavy metals with mineral fertilizers in agricultural soils appointment, mg/ha

Years of research	Receipt of heavy metals with mineral fertilizers							
	Nitrogen fertilizers (ammonium nitrate)		Phosphorus fertilizers (simple superphosphate)		Potassium fertilizers (potassium chloride)		Together	
	Pb	Cd	Pb	Cd	Pb	Cd	Pb	Cd
2000	28	0.7	8.8	1.6	9	9	45.8	11.3
2005	54	1.35	13.2	2.4	27	36	94.2	39.7
2009	88	2.2	30.8	5.6	36	63	154.8	70.8
2010	78	1.95	88	16.0	63	51	229	68.9
2015	108	2.7	88	16.0	51	51	247	69.7
2016	144	3.6	79.2	14.4	60	60	283	78
On the average on 1 hectare for the investigated period	88.3	21	51.3	9.3	41	45	175.6	56.2

In 2000, 11.3 mg of cadmium got into the soil per 1 ha (Table 2), of which 6.2 % with nitrogen fertilizers; phosphorus – 14.2 % and potassium – 79.7 %. In 2005, the soil received 39.7 mg, of which 3.45 % – with nitrogen fertilizers; 6.5 % – with phosphorus and 91 % – with potassium fertilizers. In 2009, the soil received 70.8 mg/ha of cadmium, in particular, 3.1 % – with nitrogen; 7.9 % – with phosphorus and 90 % – with potassium fertilizers. In 2010, 68.9 mg of cadmium per soil per hectare; 2.8 % – with nitrogen fertilizers; 23.3 % – with phosphorus fertilizers and 2.8 % – with potassium. In 2015, the soil with mineral fertilizers received 69.7 mg, of which 3.8 % – with nitrogen fertilizers; 22.9 % – with phosphorus fertilizers and 73.1 % – with potassium fertilizers. In 2016, the soil received 78 mg/ha of cadmium; with nitrogen fertilizers – 4.6 %; phosphorus – 18.5 % and potassium – 76.9 %.

Table 3

Intensity of accumulation of heavy metals in the soil during the cultivation of winter rape and sunflower

The main honey-bearing agricultural crops	Amount of fertilizers, kg/ha		Total sown area, ha	Gross input into the soils of heavy metals, kg	
	active substance	physical weight		Pb	Cd
Nitrogen fertilizers (ammonium nitrate)					
Winter rape	80	222	159420	70.7	3.5
Sunflower	45	125	245950	61.5	1.54
Phosphorus fertilizers (double superphosphate)					
Winter rape	60	300	159420	411	38.2
Sunflower	45	225	245950	238	44.3
Potassium fertilizers (potassium chloride)					
Winter rape	90	150	159420	71.7	71.7
Sunflower	45	75	245950	55.3	55.3
Together			405370	908.2	214.5

Analysis of the intensity of soil contamination by heavy metals (Table 3) showed that when growing winter oilseed rape and sunflower with an area of 405,370 ha in the soil in 2018 with mineral fertilizers got up to 8.2 kg of lead and 214.5 kg of cadmium.

During the cultivation of winter rape, 50.9 % of lead and 52.8 % of cadmium got into the soil, while during the cultivation of sunflower these indicators were in the range of 39.1 % and 47.2 %.

During the cultivation of winter rape (Fig. 1,2) 553.4 kg of lead and 113.4 kg of cadmium got into the soil, of which 12.7 % and 3.1 % – with ammonium nitrate, 74.3 % and 33.7 % – with double superphosphate and 13.0 % and 63.2 % – with potassium chloride.

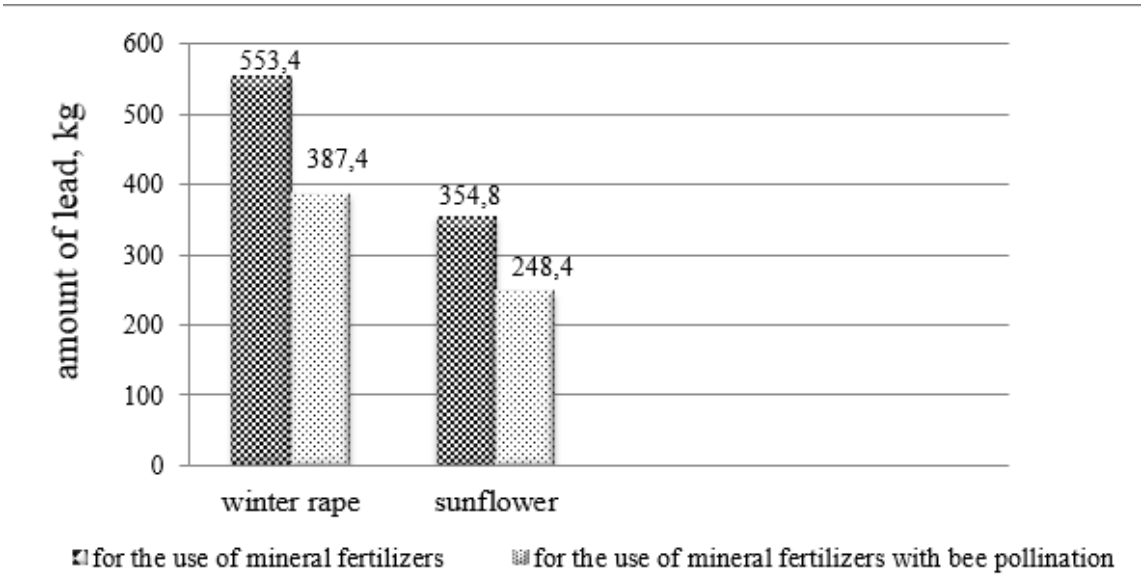

Fig. 1. Efficiency of reduction of soil pollution by lead by bee pollination of winter rape and sunflower

During the cultivation of sunflower in the soil got 354.8 kg of lead and 101.1 kg of cadmium, of which 17.3 % and 1.52 % – with ammonium nitrate, 67.1% and 43.8% – with double superphosphate and 15.6 % and 54.7 % – with potassium chloride.

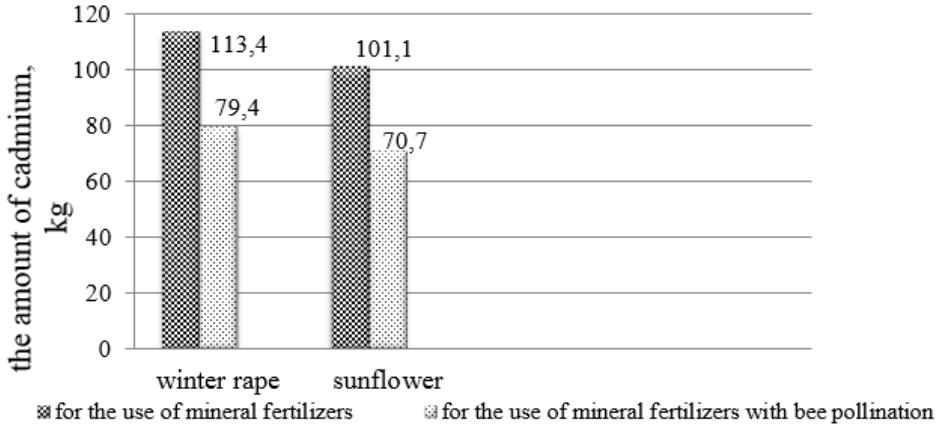

Fig. 2. The effectiveness of reducing soil contamination with cadmium

Increasing the yield of agricultural plants due to bee pollination against the background of reducing the use of mineral fertilizers makes it possible to reduce the supply of lead and cadmium in the soils of Vinnytsia region when growing winter rape by 166 kg and 106.4 kg, sunflower – by 34.0 kg and 30.3 kg, respectively.

The analysis of economic efficiency showed that increasing the yield of winter rape and sunflower for bee pollination, reduces the cost of using mineral fertilizers by 25 %.

IV. Conclusion and discussion

Analysis of the use of mineral fertilizers in the Vinnytsia region over the years of research (2000-2016) showed that the amount of nitrogen fertilizers per 1 ha in the active raw material ranged from 14 kg to 72 kg, phosphorus - from 2 to 20 kg and potassium fertilizers – from 3 to 20 kg, as a result of which 908.2 mg of lead and 214.5 mg of cadmium per 1 ha.

When growing winter rape and sunflower, 0.006 kg of lead and 0.001 kg of cadmium are added to the soil per 1 ha.

Increasing the yield of winter rape and sunflower by bee pollination makes it possible to reduce the use of mineral fertilizers by up to 30 %, which limits the inflow of lead to soil to 30 % and cadmium to 30 % and reduce costs to 25 %.

References

1. Bilyavsky Y.A, Krivich N.Ya., Beregova G.A. The content of heavy metals in the gray-podzolic soil under winter wheat, depending on fertilizer systems and methods of basic cultivation in crop rotation. Bulletin of the SAAU. 2001. № 2. pp. 44-51.

2. Hyrlia L.M. Phytoremediation is an effective way to reduce the content of heavy metals in soils. Scientific works of the Black Sea State University. Petra Mogili. Mykolaiv. 2011. Volume 152. Vip. 140. pp. 58–59.

3. Govorina V.V., Rakinov N.G., Sopheak Lin Keo, Sidorenkova N.K. Content and distribution of cadmium, lead and nickel in spring wheat plants depending on the level of mineral nutrition and heavy metal pollution. Agrochemistry. 2007. № 3. pp. 61–67.

4. Kryvich N.Ya., Bilyavsky Y.A., Mandzyk J.P., Gaevsky M.M. The content of heavy metals in the soil under winter wheat and its productivity depending on fertilizer systems and methods of basic cultivation. Bulletin of the State Automobile Inspectorate. 2004. № 1. pp. 63–68.

5. Tkachuk O.P., Zaitseva T.M., Dubovyi Y.V. Influence of agricultural toxicants on agroecological condition of soil. Collection of scientific works of Vinnytsia National Agrarian University. Agriculture and Forestry. Vinnytsia: VNAU. 2017. № 6 (Volume 2). pp. 102–109.

6. Tkachuk O.P. The use of perennial legumes to reduce the content of heavy metals in the soil. Balanced nature management. 2015. № 4. pp. 138–140.

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