ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

The Effectiveness Of Mineral And Modified Fertilizers When Growing Avena Sativa.

A Kh Kulikova[1], SN Nikitin[2], GV Saidyasheva[2], and AL Toigildin[1].

[1]Ulyanovsk State Agrarian University named after P.A. Stolypin 1, New Venets blvd., Ulyanovsk, 432017, Russia
[2]Ulyanovsk Research Institute of Agriculture,19, Institutskaya St., settlement of Timiryazevsky, 433315, Ulyanovsk district, Ulyanovsk region, Russia.

ABSTRACT

The article presents the results of studies to assess the influence of mineral fertilizers, biomodified mineral fertilizers and the biological preparation BisolbiFit. on the yield of oats under conditions of leached chernozem of the Middle Volga region. It was found that biomodification of Azofoska with the preparation BisolbiFit made it possible to increase nitrogen utilization rates by 4-8%, phosphorus by 7-16%, potassium by 5–15%, the yield of oats increased by 0.13-0.15 t / ha (in control 2 , 15 t / ha).
Keywords: biomodified fertilizers, oats, coefficients of use of nutrients.

https://doi.org/10.33887/rjpbcs/2019.10.4.16

Corresponding author

ISSN: 0975-8585

INTRODUCTION

A sharp reduction in the use of organic and mineral fertilizers in agricultural technologies necessitates the search for additional sources of nutrients for plants of field crops [1, 2, 3]. There is another side of the intensification of farming - the use of high doses of mineral fertilizers is fraught with negative environmental consequences for the environment and product quality. Therefore, it is important to conduct research aimed at reducing, first of all, the doses of mineral fertilizers with a simultaneous increase in the coefficients of the use of these nutrients. According to a number of scientists, this can be achieved as a result of the use of biological preparations produced on the basis of effective strains of microorganisms [4, 5].

At present, accents are being shifted in the issues of applying biopreparations. If earlier bacterial preparations were applied mainly independently, for pre-sowing treatment of seeds or the processing of vegetating plants [6, 7], now it is proposed to use them directly, applying on mineral fertilizers simultaneously with the sowing of crops (biomodified fertilizer). According to the authors [8, 9], the latter allows one not only to reduce the doses of fertilizers, but also to increase the utilization of nutrients from them.

Objective of the study: to study the comparative effectiveness of mineral and biomodified mineral fertilizers, as well as the biopreparation BisolbiFit when growing oats on leached chernozem of the Middle Volga region.

MATERIALS AND RESEARCH METHODS

The studies were carried out on a stationary plot of the experimental field of the Ulyanovsk Research Institute of Agriculture in 2016–2018 in the grain-fallow crop rotation of the following succession: bare fallow land - winter wheat - spring wheat - barley - oats. The soil of the experimental field is leached chernozem, heavy clayloam with the humus content of 6.43–6.62%, available phosphorus and potassium compounds (according to Chirikov) 214–228 and 101–117 mg / kg of the soil, pH 6.3–6.8 units. The objects of research were:

- the mineral fertilizer of Azofoska with the content of nitrogen, phosphorus and potassium of 15% (NPK);
- the microbiological preparation BisolbiFit, which is based on the strain of rhizosphere bacteria Bacillius Subtilis Ч-13. Bacteria have the ability to synthesize substances that inhibit the development of phytopathogenic fungi and bacteria, as well as substances that stimulate the growth of plants;
- bio-modified fertilizer (NPKm ½ NPKm). For the preparation of biomodified fertilizers, the dry form of BisolbiFit was used at a rate of 4 kg per 1 ton of fertilizers. The biopreparation was applied to the mineral fertilizer on the day it was applied to the soil.

The design of the experiment consisted of 5 variants:

1. Control one without fertilizers
2. BisolbiFit – pre-sowing seed treatment with a dose of 400-600 g / t
3. NPK – Azafoska at a dose of 15 kg AI / ha
4. NPK-treatment of Azofoska granules at a dose of 15 kg AI / ha with a biological preparation
5. ½ NPKm - processing Azofoska granules at a dose of 7.5 kg AI / ha with the biopreparation.

The registration area of the plots is 100 m^2 (4 * 25), replication- three times, the layout of plots is randomized, the organization of field experiments, the selection of soil and plant samples, and observations and laboratory analyzes were carried out according to the appropriate state standards.

RESULTS AND THEIR DISCUSSION

While using fertilizers, it is very important to increase the efficiency of the use of plant nutrients, which depends on a great number of factors. First of all, it is determined by the properties of the fertilizers themselves and the soil into which they are applied, and their possible transformation in it. For example, nitrogen fertilizers are completely soluble and well absorbed by plants. In this regard, the coefficient of

nitrogen utilization from nitrogen fertilizers is not less than 50%. Phosphorus, when applied to the soil even in its soluble compounds (superphosphate) on any soils, quickly turns into inaccessible forms due to chemical absorption and its intake from phosphate fertilizers does not exceed 30%. Potassium from potash fertilizer is more available to plants. It should be noted that the root system of the crops themselves has a different absorption capacity. At the same time, their availability to plants, and, consequently, the coefficients of their use of nutrients from the soil and fertilizers decrease with any deterioration in the physiological state of their development. In some cases, plants may have a deficiency of nutrients even when they are sufficiently present in the soil due to physiological inaccessibility of nutrients observed, for example, during drought, waterlogging and lack of oxygen, high acidity, elevated levels of aluminum and manganese, low content of other biophilic elements and high weed infestation of crops [10].

When calculating the utilization of nitrogen, phosphorus and potassium from various fertilizers, we used the method proposed by B.Ya. Yagodin [10], which shows the share of their intake by plants of the total amount of the nutrient introduced with fertilizer to create a yield increase. This coefficient is rather conditional, since it does not take into account the supply of the soil itself with nutrients, but it makes it possible to evaluate the processes and conditions of plant nutrition. The data to calculate the coefficients of use of nitrogen, phosphorus and potassium by oat plants from mineral fertilizers are given in table 1.

Table 1 – Coefficients of use of nitrogen, phosphorus and potassium from fertilizers,%. Mean values for 3 years (2016–2018).

№	Variant	Coefficient of use of fertilizers		
		N	P	K
1	Control	-	-	-
2	BisolbiFit	-	-	-
3	N $_{15}$P$_{15}$ K$_{15}$	59	32	58
4	N $_{15}$P$_{15}$ K$_{15}$ м	67	39	63
5	½ N$_{15}$P$_{15}$K$_{15}$ м	63	48	73

The data obtained demonstrate that the rate nitrogen utilization from Azofoska reaches 59%. In variants where biomodified Azofoska was introduced, it was 67 and 63%. Thus, biomodification additionally increased the utilization of nitrogen by 4–8% relative to the variant which was not treated with the biopreparation. A similar pattern was observed in the use of phosphorus and potassium from fertilizers, where the corresponding coefficients increased by 7–16% and 5–15%. Phosphorus from fertilizers was absorbed significantly less to form the yield of oats than nitrogen and potassium.

It has been found that the active colonization of plant roots by the bacteria *Bacillus Subtilis* improves the development of root hairs and their absorptive capacity increases. The latter contributes to a more efficient use of plant nutrients from the soil and fertilizers, which makes it possible to reduce fertilizer doses by 30–40% and additionally involve biogenic nutrients in agrocenosis [7].

The dose of the complex fertilizer used in the experiments was low and amounted to 15 kg only of the active substance of each element (nitrogen, phosphorus, potassium). Nevertheless, it had a positive effect on the formation of crop yields, the increase of which amounted to 0.13 t / ha. Biomodification of it made it possible to reduce the dose of Azofoska 2 times and get the same increase of 0.13 t / ha (Table 2).

Table 2 – Yield of oats depending on fertilizer application, mean values for 2016–2018

№	Variant	Yielding capacity t/ha	Deviation from the norm	
			t/ha	%
1	Control	2,15		
2	BisolbiFit	2,20	0,05	2,3
3	N $_{15}$P$_{15}$ K$_{15}$	2,28	0,13	6,0
4	N $_{15}$P$_{15}$ K$_{15}$ м	2,90	0,15	7,0
5	½ N$_{15}$P$_{15}$K$_{15}$м	2,28	0,13	6,0
LSD $_{05}$				

CONCLUSIONS

- Biomodification of complex fertilizer of Azofoska with the preparation BisolbiFit increased the coefficients of nitrogen utilization in growing oats on leached chernozem by 4–8%, phosphorus by 7–16%, potassium 5–15%.
- The increase in the yield of oats from half of the dose of biomodified Azofoska is the same as that from the full dose of it, and amounted to 0.13 t / ha (6%).

REFERENCES

[1] Artyushin, A.M., Tolstousov, V.P., Khalitov, A.Kh. Mineral fertilizers and their application doses. –M .: Kolos, 1967. –p. 255.

[2] Bondarenko, A.N., Zvolinsky, V.P. The study of biopreparations based on associative nitrogen-fixing microorganisms in the cultivation of spring grain crops in the Astrakhan region // Agrochemical Bulletin, 2012. - №2. -pp. 22-23.

[3] Kulikova, A. Kh., Nikitin, S. N., Toigildin, A. L. Biopreparations in the spring wheat fertilization system // Research Journal of Pharmaceutical, Biological and Sciences, 2017. –Vol. 8. –№1. - pp.1796-1800.

[4] Biopreparations in agriculture (methodology and practice of using microorganisms in crop production and feed production). - M .: 2005. – p.154

[5] Junge, H., Krebs, P., Kilian, M. Strain selection, production and formulation of the biological plant vitality enhancing agent FZB24 *Bacillius subtilis.* // Pflanzenschutz-Nachrichten Bayer, 1, 2000. –pp. 94-104

[6] Zavalin, A.A. Vinogradova, L.V., Dukhanina, T.M., Vaulin, A.V., Chistotin, M.V., Sologub, D..B., Gabibov, M., Lekomtsev, P.V., Pasynkov, A.V. Geographical regularities of effect of inoculation with associative diazotrophs on the productivity of cereals // Plant Microbial Interactions: Positive interactions in relation to crop production and utilization. Aspects of Applied Biology 63, 2001. –pp. 123–127.

[7] Chebotar, V.K., Zavalin, A.A., Kiprushkina, E.N. The effectiveness of the biopreparation Extrasol / - M .: All-Russian Research Institute of Agriculture, 2007. – p. 216.

[8] Gavrilova, Yu.A. The efficiency of application of complex biomodified mineral fertilizers for barley on sod-podzolic light loamy soil: Abstract of the PhD thesis in Agricultural Sciences: 06.01.04. –Moscow, 2018. –p.20.

[9] Chebotar, V.K., Zavalin, A.A., Aritkin, A.G. Application of biomodified mineral fertilizers: –M .: ARRIA: – Ulyanovsk: USU, 2014. – p.142

[10] Yagodin, B.A. Agrochemistry. M: Agropromizdat, 1989. - p. 656