

# Epin Plus and Epin-Extra - effective instruments for spring wheat

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**Abstract.** A comparison experiment was done on the effective of the new organic-mineral fertilizer Epin Plus and the plant growth regulator Epin-Extra. Epin Plus contains: nitrogen, phosphorus, potassium, boron, folic acids, 24-epibrassinolide. Epin-Extra contains 24-epibrassinolide. In the field experiment, spring wheat was grown for three years. During the growing season, the plants were sprayed with Epin-Extra and Epin Plus. Field experiment treatment includes: control, with the application of fertilizers and spraying of wheat during the growing season with Epin Plus in dose of 50 ml/ha, 70 ml/ha, 100 ml/ha, with spraying of plants with Epin-Extra at dose of 50 ml/ha. It was found that the maximum grain yield was recorded in the treatment with Epin Plus (70 ml/ha), which was 28.6% more than from control, 21.7% more than the treatment with fertilizer application, 12.2 % compared to the Epin-Extra treatment (50 ml/ha), 22% more than the Epin Plus treatment (50 ml/ha) and 20.2% more than the Epin Plus treatment (100 ml/ha). It was recorded in the control treatment grain protein was 12.9%, and in the Epin Plus treatment (70 ml/ha) – 15.8%. The gluten content of wheat grain in the Epin-Extra (50 ml/ha) and Epin Plus (70 ml/ha) treatment was 33.50 - 35.80%, in other treatment 30.5 - 31.95%.

## 1 Introduction

In modern agricultural technologies for growing of crops, it is necessary to take into account the all complex factors that influence the production of high yields and quality of product: climatic conditions, the provision of soil with essential plant nutrients, doses and time of fertilizer application, use of pesticides and agrochemicals, timely agro technical methods for growing crops [1-3]. Therefore, it is important to improve the sowing of agricultural crops, search for alternative sowing technologies through use of complex mineral fertilizers that can meet the needs of plants with macro- and microelements, and it is also necessary to use biologically active substances that affect the increase in plant immunity during the growing season. Biologically active substances (BAS) and plant growth regulators (PGR) are capable to activate biochemical processes in cells, improving the growth and development of plants, increasing crop yields by 20–30%, and also increasing resistance to stress in unfavorable environmental conditions. BAS and PGR are

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used in very low doses, therefore, their use is economically beneficial, they are also non-toxic to beneficial insects, and are quickly destroyed in the soil and in the plant [4-7].

Its further use for production of various products depends on the quality indicators of wheat grain: moisture, color, protein content, quantity and quality of gluten. Therefore, at each stage of technological production, quality control of the resulting raw materials is necessary. Several studies of the effect of mineral and organic fertilizers on wheat have shown that increasing the doses of fertilizers applied to the crop does not always increase the protein content in the grain and improve its quality, which is differ due to the genetic characteristics of different varieties and growing conditions [8-9].

The objective of the research was to compare the effectiveness of the new organo-mineral fertilizer Epin Plus and the plant growth regulator Epin-Extra on the yield and grain quality of spring wheat variety Zlata when grown under field experience in the Central region of the Russian Federation.

## 2 Method and materials

The experience was done during 2021-2023 years, at the Field Experimental Station of the Federal State Budgetary Educational Institution of Higher Education RGAU-Moscow Agricultural Academy named after K.A. Timiryazev (Central region of the Russian Federation). The objects of the study were: spring wheat variety Zlata (the variety is approved for cultivation in the regions of the Russian Federation: northern, northwestern, central) and two drug Epin-Extra and Epin Plus. Epin-Extra has proven itself positively for many years on field of vegetable and fruit in Russia [10]. The active ingredient of Epin-Extra is 24-epibrassinolide, the drug increases crop yields, quality of the products and increases plant immunity. The new organomineral fertilizer Epin Plus contains a complex of substances: 2.0% nitrogen, 2.1% phosphorus, 3% potassium, 0.64% boron, fulvic acids, 24-epibrassinolide 0.012 g/l. Thus, both Epin Plus and Epin-Extra contain the plant hormone 24-epibrassinolide; in our studies, Epin-Extra was taken to compare the effect with Epin Plus.

The soil of the field experimental station is soddy-podzolic, light loamy, agrochemical characteristics of the soil: pH (KCl) =5.5, available nitrogen content 45.9 mg/kg, phosphorus content (P<sub>2</sub>O<sub>5</sub>) 261.20 mg/kg, potassium content (K<sub>2</sub>O) 127.4 mg/kg. The content of potassium and phosphorus in the soil is high for the Central region of the Russian Federation, and nitrogen is low, so before sowing wheat, nitrogen was added to the soil at the rate of 60 kg/ha (fertilizer - ammonium nitrate).

Field Experimental treatment:

- Control – no fertilizers;
- N60 (with nitrogen fertilizers);
- N60 (with the application of nitrogen fertilizers) + spraying during the growing season with Epin-Extra (50 ml/ha);
- N60 (with the application of nitrogen fertilizers) + spraying during the growing season Epin Plus (50 ml/ha);
- N60 (with the application of nitrogen fertilizers) + spraying during the growing season Epin Plus (70 ml/ha);
- N60 (with nitrogen fertilizers) + spraying during the growing season with Epin Plus (100 ml/ha);

Every year, in the fall, experimental field, fall plowing was done to a depth of 20-25 cm, then in early spring seed were sown to a depth of 4-6 cm, Before sowing, ammonium nitrate is applied to the plots at the rate of 60 kg/ha. The experiment was arranged on randomized complete block design, with 4 replication. The total planting area is 0.1 hectares. The wheat seeding rate is 5.5 million units/ha. Spraying of wheat plants Epin-

Extra and Epin Plus was done 2 times during the tillering and boating stages, the flow rate of the working fluid was 300 l/ha. During the tillering stage, herbicide was applied (Alison 25 g/ha + Magnum 10 g/ha).

Climatic conditions of 2021 – 2023 during growing season (May - August) was characterized by moderate air temperature, which on average was 17.5 - 22.5 0C during plant growth and development, the HTC was characterized by values of 1.1 -1.3 - sufficient moisture.

The main indicators of wheat grain quality, as well as the statistical analysis of data, was done by using of generally accepted methods. To assess grain quality, the method of near-infrared spectroscopy (SpectraStar XT device) and the capillary electrophoresis method (Kapel-205 device) were used.

The analysis were carried out on the basis of the UC KP "Service Laboratory for Complex Analysis of Chemical Compounds" of the Russian State Agrarian University - Moscow Timiryazev Agricultural Academy. The obtained experimental data were processed by using statistical methods and Excel program, the least significant difference (LSD) was calculated.

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### 3 Result and discussion

During the analysis of yield data, it was found that application of nitrogen fertilizers, on average significantly increased the number of spike/plants (1.4 - 1.6 pcs), number of grains/spike (1.4 - 6.4 pcs), 1000 grains weight (1 .5 g) than control treatment. The use of instruments on wheat during the growing season was found to be effective. In treatment with Epin-Extra, the number of spike increased about 2.6 - 3.1 pcs, while in treatment with Epin + (70 ml/ha) by (4.3-4.9 pcs), in the same treatment the amount of grain is (3.9 - 8.5 pcs) and (6.2 – 10.1 pcs), 1000 grains weight (4.5 – 5.2 pcs) and (5.6 – 6.0 pcs) relative to control treatment respectively. There was a significant difference between all the treatment; the most effective in the experiment were: Epin-Extra (50 ml/ha) and Epin Plus (70 ml/ha). The highest grain yield was observed in the treatment with Epin Plus (70 ml/ha), which amounted to 38.7 q/ha compared to the control treatment that was 30.1 q/ha, which is correspondingly more about 28.6%. On Epin Plus plots (70 ml/ha), grain yield was higher about 21.7% compared to the treatment with nitrogen fertilizers, about 12.2% compared to the Epin-Extra treatment (50 ml/ha), by 22% compared to the Epin Plus treatment(50 ml/ha) and by 20.2% relative to the Epin Plus option (100 ml/ha), (Table 1).

**Table 1.** Morphological indicators of plants and yield of spring wheat, average indicators for 2021 – 2023 years.

Treatment		Number of spike, pieces.		Number of grain, pieces.		1000 grain weight, pieces		Grain yield, q/ha
Dose of fertilizer	processing according to vegetation	main stem	side stem	main stem	side stem	main stem	side stem	
No fertilizer	No processing	21.5	16.0	14.4	8.6	32.0	25.3	30.1

<b>N60</b>	<b>No processing</b>	23.1	17.4	20.8	10.0	33.5	25.6	31.8
<b>N60</b>	<b>Epin-Extra (50 ml/ha)</b>	24.5	18.6	22.9	12.5	36.5	30.5	34.5
<b>N60</b>	<b>Epin Plus (50 ml/ha)</b>	23.0	17.5	21.0	10.7	34.4	26.6	31.8
<b>N60</b>	<b>Epin Plus (70 ml/ha)</b>	26.4	20.3	24.5	14.8	37.6	31.3	38.7
<b>N60</b>	<b>Epin Plus (100ml/ha)</b>	24.0	17.7	20.5	10.9	34.5	30.0	32.2
<b>LSD<sub>0.05</sub></b>		0.6	0.5	0.6	0.4	0.7	0.7	1.5

Near-infrared spectroscopy (NIR) is one of the modern methods of physic-chemical analysis, that allows you to determine the main indicators of wheat grain quality within a few minutes (Table 2).

**Table 2.** Indicators of spring wheat grain quality, average values for 2021 – 2023 years, % of absolutely dry matter.

<b>Treatment</b>		<b>Moisture</b>	<b>Protein</b>	<b>Fat</b>	<b>Cellulose</b>	<b>Gluten</b>	<b>Ash</b>
<b>Dose of fertilizer</b>	<b>processing according to vegetation</b>						
<b>No fertilizer</b>	<b>No processing</b>	13.33	12.90	2.25	2.15	30.50	1.45
<b>N60</b>	<b>No processing</b>	12.40	13.55	2.38	2.30	30.50	1.50
<b>N60</b>	<b>Epin-Extra (50 ml/ha)</b>	12.0	14.50	2.65	2.62	33.50	1.50
<b>N60</b>	<b>Epin Plus (50 ml/ha)</b>	12.10	13.50	2.30	2.30	31.95	1.40
<b>N60</b>	<b>Epin Plus (70 ml/ha)</b>	12.10	15.80	2.95	2.70	35.80	1.60
<b>N60</b>	<b>Epin Plus (100ml/ha)</b>	12.30	13.45	2.40	2.40	31.10	1.50
<b>LSD<sub>0.05</sub></b>		0.50	0.55	0.10	0.10	1.30	0.05

Grain moisture content should be no more than 14%. The grain obtained in the experiment (moisture 12 - 13.33%) corresponded to the quality indicator in all treatment of the experiment. The minimum moisture content was in the Epin-Extra treatment (50 ml/ha) 12%. The application of mineral fertilizers and instruments contributed to increasing of protein in grain by an average of 0.6 - 2.9% compare to the control. In control, protein content in grain was 12.9%, and in the Epin Plus treatment (70 ml/ha) – 15.8%. The fat

content did not have a significant difference in control (2.25%) than to Epin Plus (50 ml/ha) (2.30%), in other treatment there was an average increase of 0.15 - 0.7% compare to the control. The cellulose content in spring wheat grain was higher in the treatment Epin Plus (70 ml/ha) - 2.70% and Epin-Extra (50 ml/ha) - 2.62%, in other treatment was 2.15 - 2.40%. The quality of baked bread depends on the gluten content in the grain; in our studies, in all of treatments there was a high value of this indicator; in the treatment Epin-Extra (50 ml/ha) and Epin Plus (70 ml/ha) it was 33.50 – 35.80 %, in other treatment 30.5 – 31.95%. The ash content did not more 1.60%.

## 4 Conclusion

The application of mineral fertilizers in combination with Epin-Extra and Epin Plus is effective in obtaining high yields of spring wheat grain and in improving its quality. The maximum grain yield was recorded in treatment with Epin Plus (70 ml/ha), which amounted to 38.7 q/ha, that 28.6% more than to control treatment 30.1 q/ha. On Epin Plus plots (70 ml/ha), grain yield was higher by 21.7% compared to the treatment with the application of nitrogen fertilizers without the use of instruments (N60), by 12.2% compared to the Epin-Extra treatment (50 ml/ha), by 22% relative to the Epin Plus treatment (50 ml/ha) and 20.2% than to the Epin Plus treatment (100 ml/ha). The use of mineral fertilizers and instruments contributed to increasing in protein content of grain by an average of 0.6 - 2.9% relative to the control. In all treatment there was a high value of gluten, in the Epin-Extra (50 ml/ha) and Epin Plus (70 ml/ha) treatment, it was 33.50 - 35.80%, in the other treatment 30.5 - 31.95%.

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