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Acceptance of Increasing the Productivity of Spring Barley

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Abstract

The aim of this research was to develop a model of productive agrocenoses of spring barley through the application of the growth regulators Biroduks, Vitazim, Emistim and Ribav-Extra. Spraying the plants with the growth regulators led to better growth and the development of leaf blades: the leaf area on one plant increased 1.2-1.74 times. The activation of photosynthetic activity using biological products was established. The most developed assimilation apparatus of the plant was developed under the drug Emistim: the leaf area was 69.224 m^2 / ha. The weight of 1000 grains was at its maximum under the influence of Emistim (45.9 g). Less heavy grain was formed by crops under the influence of the Biroduks preparation (45.7 g). In version three, the weight of 1000 grains exceeded the control by 1.9 g. In version five, the increase was 1.4 g. The relationship between the mass of 1000 grains, productive bushiness and yield was a weak straight line (r = 0.19 and r = 0.16, respectively). The increase in yield depended to a greater extent on the number of preserved plants for harvesting (r = 0.98) than on the mass of the grain, the bushiness or the number of grains in the ear. The minimum biological yield was obtained in the control variant and the maximum was with the drug Emistim. Reliability at a 95% significance level was noted on all options. The positive impact on overcoming stressful effects during the growing season of spring barley was most effective when using the drug Emistim.

Keywords: spring barley, plant growth regulator, efficiency.

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1. Introduction

Cultivated plants are not always able to realize potential productivity [1–3]. A number of factors: drought, dry winds, crop diseases, pests, waterlogging are stressful [4–6]. Ways to overcome stress are always relevant [7–9]. One of these ways is the use of active substances or growth-releasing [10–12]. As you know, they are not expensive, affordable, easy to use [13–15]. This is one way to get environmentally friendly products [16, 17].

2. Methods and Equipment

Field research in the Rostov region in 2019 was laid down and conducted. Soil is common black soil. Soils have satisfactory agrophysical properties [18].

Research Objectives:

•to study the effect of growth regulators on the productivity of spring barley;

•to identify economic models for the use of growth regulators.

Scheme of experience:

1. Without plant growth regulator - control option.

2. Bioducts - spraying in the phase of tillering and exit to the tube

3. Vitazim - spraying in the phase of tillering and exit to the tube.

4. Emistim - spraying in the earing phase

5. Ribav-Extra - spraying in the phase of exit into the tube and earing

Spring barley plants were sprayed according to recommendations. The area under the experiments was 500 m^2, the area of each variant was 25 m^2, and the repetition was 4-fold. The link of crop rotation was sunflower - spring barley. Objects of research: spring barley plants of the Leon variety.

Growth Regulators:

Biroduks, Zh Active ingredient: Arachidonic acid. Hazard classes: 4/3.

Vitazim, BP Active ingredient: 1-triacontanol + 24-epibrassinolide. Hazard classes: 3B / 3.

Emistim, P Active ingredient: Acremonium lichenicola symbiotic fungus metabolic products. Hazard class: 3V / 3.

Ribav-Extra, P Active ingredient: L-alanine + L-glutamic acid. Hazard Class: 4/3.

3. Results

The experiments established the influence of meteorological and experimental conditions on the number of leaves in the earing phase of barley (from 11 to 15 pieces). Bioducts and Emistim to a greater extent influenced the growth of barley leaves. This is shown in Table 1.

Spraying plants with growth regulators contributed to better growth and development of leaf blades. The average increase in leaf length was from 0.6 to 2.2 cm, width – from 0.03 to 1 cm. Under the influence of growth regulators, the leaf area on 1 plant increased 1.2-1.74 times.

Table 1: Leaves of spring barley in the earing phase, 2019.

Option	Leaf length, m	Leaf width, m	Number of leaves on a plant, pcs	Leaf area on 1 plant, cm^2
1	0.175	0.0087	11	112.21
2	0.198	0.0096	15	191.03
3	0.183	0.0092	12	135.36
4	0.200	0.0097	15	194.97
5	0.181	0.0090	13	141.89
correlation coefficient, r	0.99	0.69	0.99	0.99

The activation of photosynthetic activity using biological products has been established. The most developed assimilation apparatus of the plant was developed under the drug Emistim, the leaf area was 69.224 m^2 / ha. The survival of plants was 78.9%. In the control variant, a decrease in plant survival to 71.5% was observed, and also the plants had the smallest leaf area per hectare -36103 m^2 / ha. In options 2 and 5, the survival rate was 77.6 and 76.4%, and in option 3 - 74.2%.

The optimal photosynthetic activity in crops occurs when the leaf area to the heading phase is at least 50 thousand m^2 per 1 ha. In our experiments, the optimal conditions were when using Emistim and Bioducts. Correlation analysis showed a strong direct correlation of the area of sowing leaves in the phase of heading and yield (r = 0.95).

Spraying barley crops had a positive effect on productivity in all variants of the experiment. Productive bushiness increased in option 4 by 0.14 compared to control (1.20), in 3 and 4 options by 10%.

An important indicator in the structure of the crop is the mass of a thousand grains, which affects the yield and quality. The weight of 1000 grains was maximum in option 4 under the influence of Emistim - 45.9 g. Less heavy grain was formed by crops under the influence of the Biroduks preparation (45.7 g). In version 3, the weight of 1000 grains exceeded the control by 1.9 g. In version 5, the increase was 1.4 g. This is shown in Figure 1. The relationship between the mass of 1000 grains, productive bushiness and yield are a weak straight line (r = 0.19 and r = 0.16, respectively).

The increase in yield in the experiment depended to a greater extent on the number of preserved plants for harvesting (r = 0.98) than on the mass of grain, bushiness and the number of grains in the ear. An inverse weak correlation was established between productivity and the number of grains in an ear (r = -0.04). A comparative characteristic of the increase in the biological productivity of barley to the control is presented in Table 2.

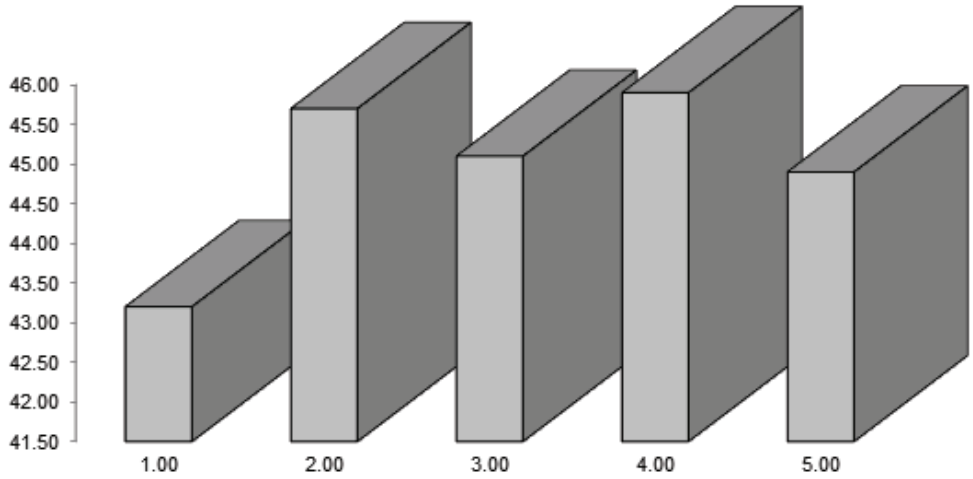

Figure 1: Mass of 1000 grains of spring barley (2019), gram

TABLE 2: Biological productivity of spring barley, 2019

Option	Biological productivity, t / ha	Increase	
		t / ha	%
1	2.80		
2	3.80	1.00	35.9
3	3.56	0.76	27.1
4	3.97	1.17	41.9
5	3.42	0.62	22.2
The smallest significant difference at 95 percent of the significance level		0.27	7.6

The minimum biological yield was obtained in the control variant, the maximum with the drug Emistim. Reliability at a 95% significance level is noted on all options.

The elements of the structure of the barley crop are influenced by plant growth and development regulators.

Economic indicators of spring barley cultivation are presented in Figure 2.

4. Discussion

Elements of the structure of the crop are affected by plant growth and development regulators. Correlation analysis showed a strong direct relationship between the area of the leaves of the crop in the phase of heading and harvest (r = 0.95). An inverse weak relationship was established between the crop and the amount of grain in the ear (r = -0.04). The relationship between the mass of 1000 grains, the productivity of bushiness and productivity is a weak straight line (r = 0.19 and r = 0.16, respectively). An economic

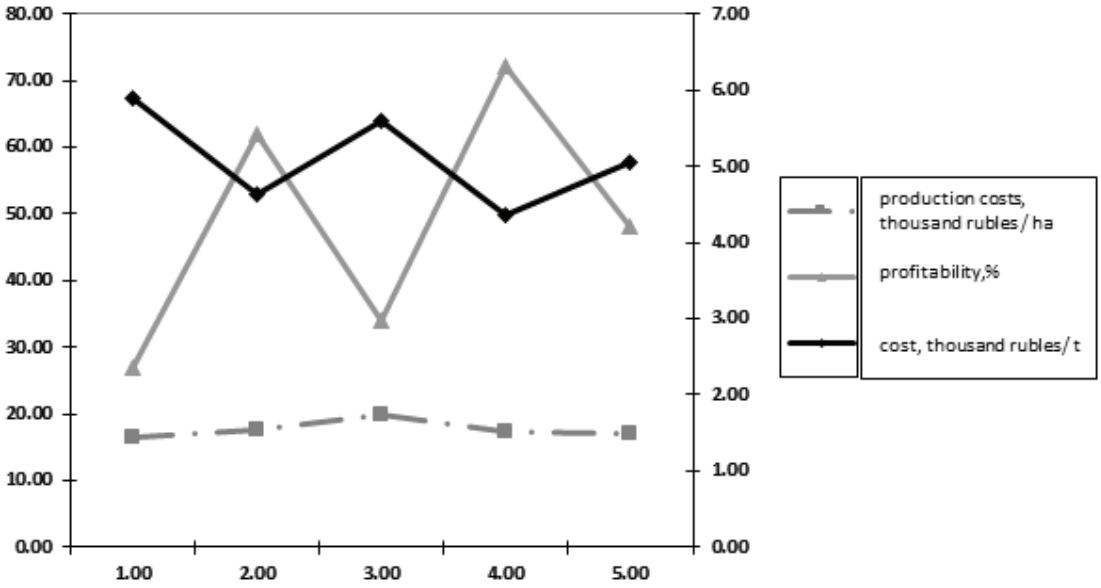

Figure 2: Economic indicators of spring barley cultivation using growth regulators, 2019

assessment of costs showed that the highest costs were with Vitazim (21% higher than in control) due to the high price of the drug. The high cost of production was in control - 5892 rubles, 4 and 2 options at 26 and 21% lower, respectively. Profitability at the level of 72% was observed on the variant with the use of the drug Emistim.

5. Conclusion

The positive impact on overcoming stressful effects during the growing season of spring barley was most effective when using the drug Emistim.

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Conflict of Interest

The authors do not have a conflict of interest for publication.

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