



Effect of biostimulator on maize (*Zea mays* L.) yield, phenological parameters and yield-forming elements

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Abstract

Maize is one of the crops grown in the largest area in Hungary. Its sown area hovered around 1.2 million hectares for 2 decades, and is currently 1 million hectares, but a decrease is expected due to the drought conditions of 2021 and 2022. Its yield potential and profitability are particularly good, making it a popular plant among farmers. Maize is a nutrient-demanding plant, so it is important to maintain the appropriate level of macro and micro elements. In addition to high fertilizer prices and increasing restrictions on mineral nitrogen fertilization, interest in alternative supply sources of nitrogen, a nutrient that largely determines crop yield, is growing in agriculture. The increasingly strict European regulations and the sustainability efforts of agricultural development and production companies emphasize the importance of innovation, the development of biological products and those that help the sustainable development of the Hungarian economy in the long term. The experiment was set up in 2023 at the experimental site of the Department of Irrigation and Melioration, Institute of Environmental Sciences, Hungarian University of Agriculture and Life Sciences. During the experiment, we set up 4 different treatments and continuously performed plant bonification, where we monitored the rate of plant development, plant height, and the time of flowering. We measured the yield average, the relative chlorophyll content (SPAD), and after harvesting the yield-forming elements, as well as a content analysis in our laboratory with our NIR Infratec content analysis device. During the processing of the results, statistically verifiable differences were found in many of the examined parameters, and the yield levels were between 9.9 and 11.2 tons/hectare.

• Introduction

Maize is one of the crops grown in the largest area in Hungary. Its sown area hovered around 1.2 million hectares for 2 decades, and is currently 1 million hectares, but a decrease is expected due to the drought conditions of 2021 and 2022. Its yield potential and profitability are particularly good, making it a popular plant among farmers. Maize is a nutrient-demanding plant, so it is important to maintain the appropriate level of macro and micro elements. In addition to high fertilizer prices and increasing restrictions on mineral nitrogen fertilization, interest in alternative supply sources of nitrogen, a nutrient that largely determines crop yield, is growing in agriculture. The increasingly strict European regulations and the sustainability efforts of agricultural development and production companies emphasize the importance of innovation, the development of biological products and those that help the sustainable development of the Hungarian economy in the long term

• Material and method

The experiment was set up in 2023 at the experimental site of the Department of Irrigation Development and Reclamation, Institute of Environmental Sciences, Hungarian University of Agriculture and Life Sciences. The soil of the experimental area is deep carbonate chernozem meadow soil.

The experimental area can be fully irrigated using different irrigation methods. The experiment was irrigated 4 times during the growing year, adapted to the phenological state of the given plant and the moisture content of the soil, typically with water doses of 25-30 mm

The pre-crop of corn was wheat. Corn was sown on May 5, 2023, with a seed count of 72,500/ha. The corn hybrid P9415 was used in the experiment. During the experiment, we set up 4 different treatments and continuously performed plant bonification, where we monitored the rate of plant development, plant height, and the time of flowering. We measured the yield average, the relative chlorophyll content (SPAD), and after harvesting the yield-forming elements, as well as a content analysis in our laboratory with our NIR Infratec content analysis device. The harvest was carried out with a plot combine, and the yield results of each treatment were measured per plot. The obtained data were corrected to 14% moisture and recorded in t/ha.

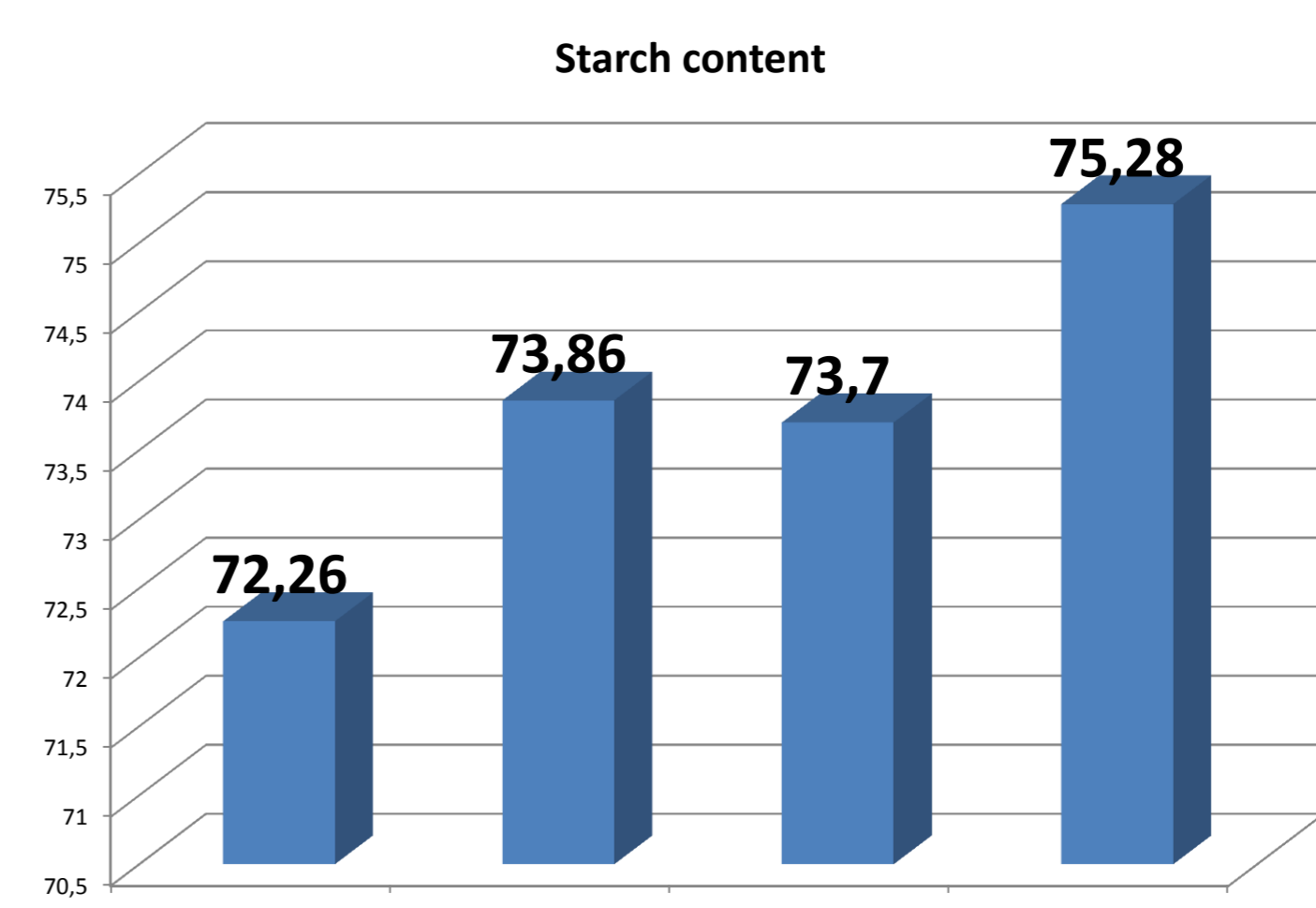
Treatment	Dose	Treatment time	Nutrient supply
1.Untreated			N 100%
2.Untreated			N 100% - 30 kg N/ha
3.Utrisha N	333 g/ha	BBCH 14-16	N 100%
4.Utrisha N	333 g/ha	BBCH 14-16	N 100% - 30 kg N/ha

• Results and discussions

During the processing of the results of the experiment, the use of the biostimulator brought positive results in a number of tested properties. We found statistically verifiable differences in perhaps the most important value-measuring property for farmers. The yield results were as follows:

Treatment	Replication	Yield kg/parcell	Yield t/ha
4	1	55	10,19
	2	53,8	9,96
	3	52,5	9,72
	4	57,1	10,57
	5	51,1	9,46
	Average		9,98
3	1	56,2	10,41
	2	57	10,56
	3	52,1	9,65
	4	55	10,19
	5	53	9,81
	Average		10,12
2	1	58,9	10,91
	2	59,1	10,94
	3	60	11,11
	4	59,2	10,96
	5	55,8	10,33
	Average		10,85
1	1	62,1	11,50
	2	61,2	11,33
	3	61	11,30
	4	58,2	10,78
	5	58,5	10,83
	Average		11,15

We took a sample of the harvested crop and analyzed it in the Department's laboratory with our Infratec 1275 NIR device. The effect of each treatment, especially on the starch content, is shown in the following graph.



• Conclusions

From the results obtained during the experiment, the effect of biostimulators on the value measuring properties of corn can be clearly verified. These differences can be verified statistically. However, in order to eliminate the vintage effect and soil effect, it is definitely important to continue the experiment, if possible by further combining the treatments. After all, it can be seen that when examining the parameters of the content, we did not achieve growth at all nutrient levels. Here, it is definitely necessary to prove the positive or possibly negative effect of the biostimulator in the future.