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# REACTION OF CORN HYBRIDS TO BIOSTIMULATOR APPLICATION

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**Abstract**: *Corn is a cereal crop with undeniable productive potential. Its great adaptability, as well as the presence of hybrids with different durations of the growing season, determine its wide distribution. Ensuring stable yields in a dynamically changing climate is proving to be a major challenge for sustainable agriculture. The current study aims to establish whether treatment with plant stimulators can help the crop to improve corn performance under drought conditions. The experiment was arranged according to the randomized complete block method in three replications and a plot size of 25 m$^2$. Three corn hybrids were included in the trial: DKC4949 (FAO 390), P8523 (FAO 260), and P9537 (FAO 390). The plant biostimulator Biostart was applied as a seed treatment and the product Naturamin WSP was applied twice during the vegetation period. The following parameters have been estimated: grain yield (GY); mass of grain per cob (MGC); cob weight (CW); cob length (CL); test weight (TW); 1000 grains weight (TGW) and crude protein (CP). The results showed that treatment with plant stimulants increased productivity in individual hybrids between 5% and 14%, with the highest yields realized by hybrid P8523 after Naturamine WSP application. The least pronounced is the effect of the application of Biostart in a hybrid P9537.*

## • Introduction

Maize (*Zea mays* L.) is an important food, feed and industrial crop (Zhang et al., 2014). Due to its high yield potential under frequent extreme weather conditions, corn is expected to provide more yields in the upcoming years (Ahmad et al., 2021). Nowadays, the modern hybrids allow the farmers to improve the productivity of the crop by increasing planting density (Hernández et al., 2014; Lindsey et al., 2015) or by applying plant growth regulators (PGR) and biostimulators (Zhang et al., 2014). Plant growth stimulators are essential for the aims of sustainable agriculture and can improve crop performance in dynamically changing environmental conditions (Bailey-Serres et al., 2019). Inoculating maize with AMF typically results in increased growth (Sawers et al., 2017). Nonetheless, the extent of this effect varies based on factors such as genotype, crop rotation, tillage, and fertilization (López-Carmona et al., 2019; Sarabia et al., 2017). The present study aims to investigate the reaction of three different maize hybrids to the application of stimulators of organic origin but different compositions and to compare their effect on maize productivity.

## • Material and method

In two consecutive years, 2022 and 2023, a field experiment was set in the North-Eastern part of Bulgaria with three maize hybrids: DKC4949 (FAO 390), P8523 (FAO 260), and P9537 (FAO 390). The study was arranged according to the randomized complete block design in three replications with a plot size of 25 m$^2$. The effect of two plant biostimulators have been investigated: Biostart (*Bacillus subtilis, Paenibacillus azotofixans, Bacillus megaterium, Bacillus mucilaginosus, Bacillus mycoides, Trichoderma viride* (more than 1 x 10^9 cfu/g); mycorrhiza fungie 1 x 10^7 cfu/g) applied in a dose of 0.4 g per 100 kg seeds as a seed treatment and product Naturamin WSP (free amino acids – 80%; total nitrogen – 12.8%; organic nitrogen – 12.8%) applied in a doze of 300g ha$^{-1}$ as e leaf treatment twice in BBCH 10-19 in a distance of 10 days. The following characteristics were reported: grain yield (GY); mass of grain per cob (MGC); cob weight (CW); cob length (CL); test weight (TW); 1000 grains weight (TGW), and crude protein (CP) content.

## • Results and discussions

Table 1. Grain yield of maize

| Hybrid | Treatment | Grain yield,t ha$^{-1}$ | | |
|---|---|---|---|---|
| | | 2022 | 2023 | Average |
| DKC4949 | Control | 11.4$^{b}$ | 11.8$^{a}$ | 11.6$^{b}$ |
| | Biostart | 12.4$^{c}$ | 13.2$^{C}$ | 12.8$^{c}$ |
| | Naturamin WSP | 12.3$^{c}$ | 12.9$^{b}$ | 12.55$^{c}$ |
| P8523 | Control | 12.3$^{c}$ | 12.6$^{b}$ | 12.45$^{c}$ |
| | Biostart | 13.4$^{d}$ | 13.9$^{c}$ | 13.65$^{d}$ |
| | Naturamin WSP | 13.9$^{e}$ | 14.3$^{d}$ | 14.05$^{d}$ |
| P9537 | Control | 10.2$^{a}$ | 10.7$^{a}$ | 10.45$^{a}$ |
| | Biostart | 10.7$^{a}$ | 11.3$^{a}$ | 11$^{a}$ |
| | Naturamin WSP | 11.0$^{a}$ | 11.8$^{a}$ | 11.4$^{a}$ |
| LSD 5% | | 0,83 | 1,10 | 0,97 |

Table 2. Independent influence of the factors on the grain yield of maize

| Factors | Source of variance | 2022 | 2023 | Average |
|---|---|---|---|---|
| Hybrid | DKC4949 | 12$^{b}$ | 12.63$^{b}$ | 12.32$^{b}$ |
| | P8523 | 13.2$^{c}$ | 13.6$^{b}$ | 12.88$^{b}$ |
| | P9537 | 10.63$^{a}$ | 11.26$^{a}$ | 10.95$^{a}$ |
| LSD | 5% | 0.78 | 0.82 | 0.80 |
| | 1% | 1.09 | 1.10 | 1.10 |
| | 0.1 % | 1.15 | 1.18 | 1.17 |
| Treatment | Control | 11.3 | 11.7 | 11.5 |
| | Biostart | 12.16$^{ns}$ | 12.8$^{ns}$ | 12.48$^{ns}$ |
| | Naturamin WSP | 12.4$^{b}$ | 13$^{b}$ | 12.66$^{b}$ |
| LSD | 5% | 0.78 | 0.82 | 0.80 |
| | 1% | 0.94 | 1.10 | 1.10 |
| | 0.1 % | 1.09 | 1.18 | 1.17 |

$^{a, b, c,}$ significance at 5, 1, and 0,1%; $^{NS}$ non-significant

## • Conclusions

The current study found that the applied biostimulators have a positive effect on the yield and its elements by the three maize hybrids included in the study. The action of the stimulators depends on the hybrid, because hybrids coming from the same selection centre react unambiguously and achieve a better result when treated with Naturamin WSP, while hybrid DKS4949 responds better to pre-sowing treatment with the bacterial preparation Biostart. The bacterial product Biostart contributed to maximum crude protein content by all hybrids and can be recommended for sustainable agricultural production.