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EFFECT OF FERTILIZERS AND ROOT STIMULANTS APPLIED IN THE TREATMENT OF CORN SEEDS

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Abstract: The objective of this study was to evaluate the germination and initial establishment of the MG580PW hybrid in response to the application of fertilizers and biostimulants used in seed treatment. The experiment was conducted in the municipality of Paraúna (GO) in 2025. The seeds were treated according to manufacturers' recommendations and grown in a substrate composed of soil, sand, and commercial material in a 3:2:1 ratio. The experimental design was a completely randomized block design, with four treatments and five replicates. The variables analyzed included germination, shoot and root length, as well as fresh and dry weight, with the data subjected to ANOVA and the Scott-Knott test at the 5% level. The seedlings showed good germination in all treatments, with rates $\geq 80\%$ 5 days after sowing and above 90% in the remaining treatments. Regarding development, no significant difference was observed among the treatments. It is concluded that the products evaluated in this trial promoted the initial vigor and establishment of maize seedlings, highlighting the potential of fertilizers and biostimulants in seed treatment to improve the initial performance of the MG580PW hybrid.

Keywords: bio-inputs; biostimulant; root development; vigor; *Zea mays*.

INTRODUCTION

Corn (*Zea mays* L.) is one of the main crops grown in Brazil, possessing significant economic, social, and food security importance. The country ranks among the world's largest producers of this grain, which is used both for human and animal consumption and as a raw material for various industrial products (EMBRAPA, 2023). The initial development of seedlings is a crucial phase,

as it directly influences crop establishment and the crop's productive potential (FAN-CELLI; DOURADO NETO, 2000).

In corn cultivation, the use of seed treatments has become an established essential practice among growers, serving as one of the factors that directly contribute to crop performance. It is common for seeds purchased on the market to reach the farmer already coated with various products supplied by the industry, such as pesticides, nutrients, and protective polymers. When it comes specifically to the application of nutrients via seed treatment, the goal is to ensure that the plant has adequate access to micronutrients right at the start of development, something especially important when the soil has insufficient levels of these elements. Fertilizers and root stimulants act by supplying essential nutrients and activating enzymatic processes that stimulate cell division and elongation (EPSTEIN; BLOOM, 2006). In addition, these products can increase plant tolerance to stress conditions and improve the utilization of nutrients available in the soil (TAIZ et al., 2017).

Seed vigor and germination are key factors for successful crop establishment. According to Taiz et al. (2017), early plant growth depends on physiological processes related to nutrient uptake and hormonal activity, which can be stimulated by products such as fertilizers and biostimulants. Thus, the use of substances that promote rooting and early vegetative development has proven to be a promising practice for optimizing crop performance.

Considering the importance of this developmental stage for the crop's productive success, this study aimed to evaluate the germination and establishment of the MG580PW hybrid corn in response to the application of fertilizers and rooting agents, both in seed treatment.

METHODOLOGY

The experiment was conducted in the municipality of Paraúna, Goiás, between April and July 2025.

The seeds used were from the MG580PW corn hybrid, produced by Morgan Sementes, which has an early maturity, high yield potential, and good adaptation to the soil and climate conditions of the Cerrado. The treatments followed the doses recommended by the manufacturer (Table 1) and were applied at the time of sowing.

The growing medium was prepared using a mixture of soil, sand, and Ouro Negro commercial potting mix in a 3:2:1 ratio, formulated to ensure good drainage, aeration, and moisture retention—essential factors for healthy root development. The plants were grown in 8-liter plastic pots, perforated at the base to allow excess water to drain and prevent the substrate from becoming waterlogged. Before sowing, the substrate was sieved and moistened to field capacity, ensuring uniform germination conditions. The crop was grown to the V6 stage, at which point the evaluations were conducted.

The experimental design used was a completely randomized block design, with four treatments and five replicates, totaling 20 experimental units. Each experimental unit consisted of a bucket containing growing medium and five corn seeds, sown at a depth of 5 cm. The treatments tested consisted of different biostimulant- and fertilizer-based products, applied according to the manufacturers' instructions. Table 1 presents the characteristics and dosage of each product. The variables analyzed included germination percentage, shoot length, root system length, and total mass (dry and fresh). After collection, the plant material

was rinsed under running water, measured, and taken to the greenhouse at the State University of Goiás (UEG), Palmeiras de Goiás Campus, where it was dried at 65 °C until reaching constant weight. This procedure ensured the standardization and accuracy of dry weight measurements, allowing for a reliable assessment of the treatments' effects on the initial development of the seedlings. The data were subjected to analysis of variance (ANOVA), and the means were compared using the Scott-Knott test at a 5% probability level, using the AgroStat® statistical software.

RESULTS AND DISCUSSION

Maize seedlings showed good germination in all treatments, with rates $\geq 80\%$ at 5 days after sowing (DAS) and above 90% for the other treatments, with the exception of the treatment with Enraize Z, which maintained the result observed at 5 DAS, of 80%. Only the control achieved 100% seed germination (Figure 1).

The germination rates observed in the treatments ($\geq 80\%$ at 5 DAS and above 90% in most cases) indicate that the fertilizers and biostimulants used in this study, although they were less effective than the control, did not compromise the viability of the corn seeds.

The good germination observed in the treatments with Forts and Biozyme suggests that these products, possibly due to their composition of micronutrients and bioactive compounds, do not interfere with seed viability and may even promote more uniform establishment. This is consistent with other studies that evaluated mixed mineral fertilizers in corn seed treatments, in which there was no negative effect on germination or vigor, with values remaining within commercial standards (MACHADO et al., 2023).

Trade name	Composition	Usage Indication	Dose
Biozyme¹	Boron (B); Molybdenum (Mo); Potassium Oxide (K ₂ O).	Mixed mineral fertilizer	200–250 mL/ha
Enraize Zn²	Nitrogen (N), potassium oxide (K ₂ O), boron (B), iron (Fe), manganese (Mn), sulfur (S), and zinc (Zn). Seaweed extract, amino acids, plant growth regulators, and organic carbon.	Mixed mineral fertilizer	100–200 mL/ha
Forts³	Hydrolyzed protein (PH), amino acids (AA), (EA), surfactant (TS) and water (H ₂ O).	Bioestimulant	0.25–0.5 L/ha

¹ Table 1 tsupl.com.br/wp-content/uploads/2023/05/BULA-1.pdf ² Plantae Enraize-Zn-1LITRO 220x120-curvas-FINAL-1.pdf (lavoroagro.com) ³ Forts - Technical Data Sheet – Renovagro

Table 1. Characterization of products used in soybean seed treatment, 2024/25 crop – Palmeiras de Goiás, GO.

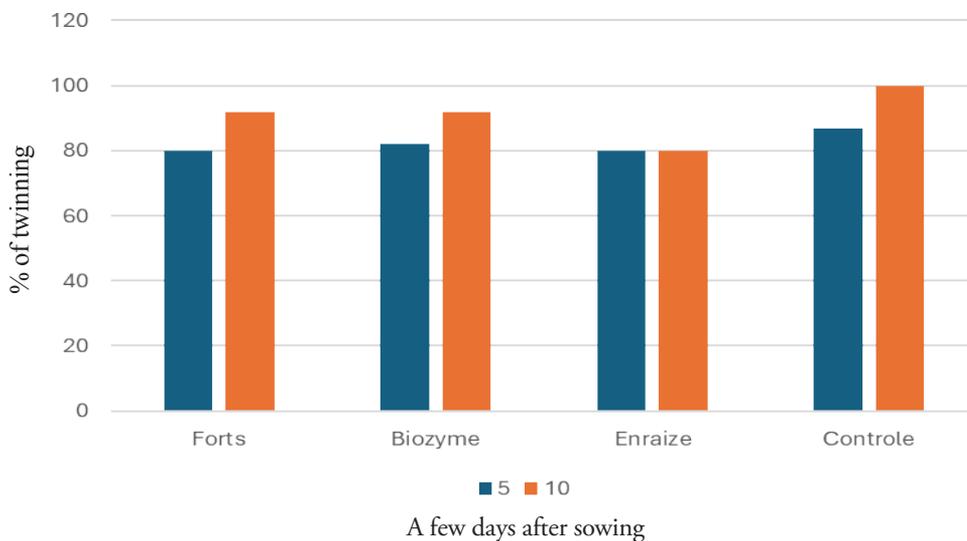


Figure 1. Germination percentage of the MG580PW corn hybrid, subjected to seed treatments with biostimulants and fertilizers.

Source: Author.

On the other hand, the fact that treatment with Enraize Z maintained germination rates up to 10 DAS, while other products exceeded 90%, may reflect differences in the composition or mode of action of this fertilizer/biostimulant. It is possible that the formulation of Enraize Z, with its concentration of micronutrients in corn seeds, has a less favorable effect on the initial germination rate, perhaps by causing an osmotic imbalance or altering water absorption. Studies show that high concentrations of micronutrients, especially zinc and manganese, can interfere with initial water absorption or cause mild osmotic stress, delaying germination, even without affecting the seed's overall viability (MOUSAVI et al., 2019). The results reinforce the idea that the form and dose in which micronutrients are used must be carefully adjusted for each type of product and crop.

The analysis of variance conducted for the morphometric characteristics of corn revealed significant differences for the parameters above-ground dry weight (MSPA) and root dry weight (MSRAIZ). For MSPA,

the best performances were observed in the treatments with Biozyme and Enraize Z. Regarding MSRAIZ, Enraize presented the highest value, followed by the treatments with Biozyme and Forts, which did not differ statistically from one another (Table 2).

The results obtained for above-ground dry matter (AGDM) and root dry matter (RDM) indicate that the fertilizers and biostimulants applied in seed treatment differentially influenced the initial development of maize. The superiority observed in the treatments with Biozyme and Enraize Z for ABDM suggests that these products promoted greater vegetative vigor, possibly due to the presence of bioactive compounds that regulate physiological processes linked to growth, such as enzymatic activation, protein synthesis, and cell division. Studies demonstrate that biostimulants formulated with plant extracts and signaling molecules can enhance the metabolic efficiency of seedlings, resulting in greater accumulation of above-ground biomass in the early stages (DU JARDIN, 2015).

Treatment	Variables					
	CPA	MFPA	MSPA	CRAIZ	MFRAIZ	MSRAIZ
Biozyme	94.20A	42.16A	3.24A	45.3A	8.71A	6.33B
Enraize Z	114.0A	39.80A	3.83A	48.8A	10.26A	7.81A
Forts	152.8A	41.16A	2.24B	45.3A	9.09A	6.03B
Control	108.2A	38.15A	2.87B	50.2A	7.94A	4.81C
Average	117.3	40.47	3.04	47.9	9.00	6.24
F	0.95 ns	0.24 ns	2.81*	0.86 ns	1.14 ns	2.99*
CV	97	42.29	50.44	20.96	45.06	36.00

Means followed by the same letter in the column do not differ statistically from each other according to the Scoot-Knoott test; NS: not significant; *: significant at 5%. Source: Authors.

Table 2. Analysis of variance and comparison of means obtained in plants of the MG580PW corn hybrid, subjected to different seed treatments, for the parameters above-ground length (CPA), fresh above-ground mass (MFPA), dry above-ground mass (DSMP), root length (RL), fresh root mass (FRM), and dry root mass (DRM) determined at V12.

The increase in dry mass is a significant indicator of growth, as it reflects the amount of organic matter effectively accumulated by the plant following metabolic processes such as photosynthesis, structural carbohydrate synthesis, and tissue formation (TAIZ et al., 2017). Thus, when a treatment results in higher MSPA or MSRAIZ, it means that that management practice allowed the plants to convert metabolic resources into growth more efficiently.

When considering dry root mass, the higher values recorded with Enraize Z underscore the product's ability to stimulate root growth, a characteristic attributed to its content of rooting-promoting compounds, seaweed extracts, and carbon. A more developed root architecture increases water and nutrient uptake and is directly associated with the initial vigor of the crop, as reported by Machado et al. (2023), who observed a significant increase in root growth of seedlings treated with biostimulants in seeds. The intermediate performance of Biozyme and Forts, which did not differ statistically from one another, indicates that both also contributed to initial establishment, albeit to a lesser extent. The absence of statistical differences in shoot length, root length, and fresh weight suggests that the biostimulants may have influenced tissue density and quality more intensely than simply the elongation of the structures. Considering plant length, this is one of the morphological parameters most sensitive to environmental variations and less related to physiological vigor than dry mass (LI et al., 2022). Plants may have similar lengths but thicker, denser structures with a higher content of structural compounds—resulting in greater dry mass.

Similarly, fresh mass is highly associated with tissue water content, which may not reflect significant differences in structu-

ral growth. Plants with higher dry mass may exhibit fresh mass similar to others if there is efficient water regulation or more compact tissues. Studies indicate that biostimulants often induce an increase in dry matter without proportionally altering lengths or fresh weight, due to improved metabolic efficiency and the accumulation of organic matter rather than just water (YAKHIN et al., 2017).

CONCLUSION

Corn seed germination was satisfactory in all treatments. Regarding initial development, Biozyme and Enraize Z promoted greater dry matter accumulation, indicating more efficient growth and the formation of more developed tissues, even without differences in the length of the structures or in fresh biomass. Enraize Z also stood out for increasing root dry matter, reinforcing its action as a rooting agent.

It is concluded that the applied products favored the initial establishment of the MG580PW hybrid, contributing to greater seedling vigor, especially during the root stage.

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