

Evaluation of MIST N[®], MIST P[®], MIST Zn[®] and MIST B[®] on Maize Crop in the Southwestern Region of Buenos Aires

2021-2022 Season
Darregueira Experimental Field -
Southwestern Agricultural Study

Trial Objective:

To evaluate the impact of the application of MIST N*, MIST P*, MIST Zn* and MIST B* on grain yield and its components in a maize crop in the southwest of Buenos Aires, and to compare it with traditional nutritional alternatives.

Trial Description:

The trial was established in the 2021 Experimental Field of the Southwest Agricultural Study, located near the town of Darregueira (Lat -37.655342; Long -63.105878), on a field called Carahuincul. The soil presented an average depth greater than 80 cm and acceptable chemical parameters for the area (Table 1).

Table 1. Soil parameters at the trial site at sowing time.

Sampling depth (cm)	pH	OM (%)	N-NO3 (ppm)	Available P (ppm)	B (ppm)	S-SO3 (ppm)	Zn
0-20	7,7	2,26	16,1	10,1	0,85	16,8	0,91
20-40			8,2				
40-60	-	-	3,3	-			

References:

pH: potentiometric pH - UpH

OM: Organic Matter - Walkley & Black %

N-NO3: Nitrates - spectrophotometric - ppm

Available P: Available Phosphorus - Bray-Kurtz - ppm

B: Boron - ICP-AES

S-SO₄: Sulfates - spectrophotometric - ppm

Source: IACA Laboratories

The trial followed a randomized complete block design with four replications, with the experimental unit being the plot, which covered an area of 10.4 m² (2.08 m wide × 5 m long). The trial was sown on November 25, 2021, with the hybrid Nucorn 2650 MGRR2 from Nuseed. The planting density was 35,000 plants/ha, which is appropriate for the area and defined according to the environmental potential.

Weed control consisted of the following applications (doses/ha): 08/06/2021: 800 cc 2,4D + 2 L Glyphosate Full + 150 cc Dicamba + adjuvant + oil; 30/09/2021: 2.4 L Glyphosate Full + 360 cc Starane + 1 kg Atrazine + 30 cc Lambda-cyhalothrin + adjuvant; 30/10/2021: 2.5 L Paraquat + anti-drift + oil.

Rainfall during the 2021-2022 summer cropping season is shown in Figure 1. Although high rainfall was recorded in September, a decrease was observed in October and November. After sowing, rainfall of good magnitude was recorded, which favored proper crop establishment. Total accumulated rainfall during the growing season (November-April) was exceptional, reaching 568 mm. It is worth noting that in January (09-15/01/22), very high temperatures were recorded, which, combined with high atmospheric demand and scarce rainfall, could have limited the final crop yield.

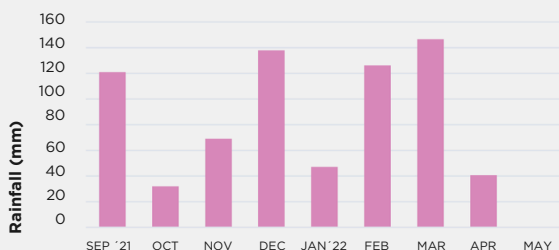


Figure 1. Monthly rainfall recorded in Darregueira. Data source: Coop. La Emancipación and Radio FM Sonidos Darregueira (2021 period); Automatic Weather Station, EEA INTA Bordenave (2022).

SNine treatments were established, following the fertilization models indicated in the protocol previously set by the company (Table 2).

Table 2. Treatments according to type, dose, and timing of fertilizer application.

Treatment	At sowing	V6 stage
1		
2	50 kg/ha DAP	70 kg/ha UREA
3	2 lts/ha Mist P	70 kg/ha UREA
4	50 kg/ha DAP	2,5 lts/ha Mist N
5	2 lts/ha Mist P	2,5 lts/ha Mist N
6	50 kg/ha DAP + 500cc/ha Mist Zn	70 kg/ha UREA
7	2 lts/ha Mist P + 500cc/ha Mist Zn	2,5 lts/ha Mist N
8	50 kg/ha DAP + 600cc/ha Mist B	70 kg/ha UREA
9	50 kg/ha DAP	210 kg/ha UREA

Solid fertilizers applied at sowing were incorporated together with the seed. Liquid applications at sowing and at the V6 stage (Ritchie et al., 1982) were carried out with a professional backpack sprayer with a constant-pressure CO₂ cylinder and a 2 m wide boom. The V6 application was performed on November 18, 2021, with a spray volume of 100 L/ha. Harvest was carried out manually on June 2, 2022, across the entire plot surface, and ears were then processed using an experimental stationary thresher. Grain yield was adjusted to 14.5% moisture. The measured variables were evaluated through analysis of variance (ANOVA) using the Infostat® statistical package (Di Rienzo et al., 2020). The significance level used was 0.05 (α).

3. Results and Discussion:

The average yield of the trial was 6679 kg/ha (CV 10.5%), with a maximum for T7 of 7005 kg/ha and a minimum of 5939 kg/ha for the control treatment (T1). Although no significant differences were recorded for the grain yield variable among the evaluated treatments ($p = 0.3955$), a trend was observed placing T1 (Control) and T3 below the other nutritional alternatives, which were above 6500 kg/ha (Figure 2).

All treatments (T2 to T9) involving phosphorus at sowing showed a positive and variable response in yield compared to the control, within a range of 6-18%. This indicates that the initial phosphorus levels were below the response threshold for maize in the area. On the other hand, treatments that included zinc or boron in their formulation did not show productive advantages in this experiment (T6, T7, and T8), possibly because the initial levels of these micronutrients were within the sufficiency range.

The maize crop requirements for zinc and boron are 53 and 20 g/t, respectively (Reussi Calvo et al., 2015).

The grain yield obtained was consistent with the nutrient availability in the soil (initial + fertilization strategy used), also considering that yield may have been negatively influenced by high temperatures (heatwave) and lack of rainfall between January 9 and 15. These conditions likely caused crop stress and reduced nutrient use efficiency of the fertilizers applied at V6 (January 18, 2022), thus decreasing final yield.

The results obtained are consistent with those reported by Melin et al. (2022) in the late maize low-density network in Carhué, where they achieved an average yield of 5185 kg/ha, with maximum values of 6700 kg/ha. The average grain moisture at harvest was 17.06%, with no significant differences among treatments ($p = 0.96$).

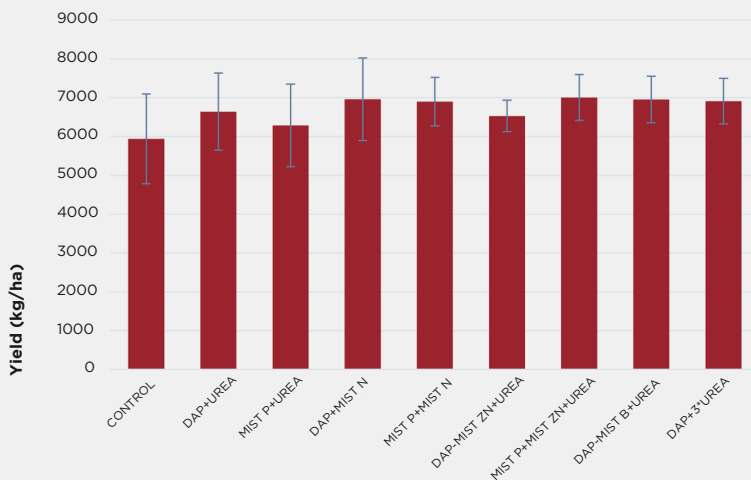


Figure 2. Maize grain yield (kg/ha) for each of the evaluated treatments, in the trial conducted in Darregueira, southwest of Buenos Aires Province, 2021/22 season.

Analysis of variance

Variable	N	R ²	R ² Aj	CV
Yield	36	0,48	0,25	10,50

ANOVA table (Type III SS)

S.V	SS	df	MS	F	P-value
Model	11089881,52	11	1008171,05	2,05	0,0688
Block	6747673,17	3	2249224,39	4,57	0,0114
Treat.	4342208,35	8	542776,04	1,10	0,3955
Error	11812896,20	24	492204,01		
Total	22902777,72	35			

Adjusted means, standard error, and number of observations

Error: 492204,0082 gl: 24

Treatment	Adjusted mean(kg/ha)	N	Std. Error
1	5938,84	4	350,79
3	6284,42	4	350,79
6	6531,53	4	350,79
2	6641,18	4	350,79
5	6898,50	4	350,79
9	6909,06	4	350,79
8	6949,76	4	350,79
4	6958,47	4	350,79
7	7005,08	4	350,79

The thousand grain weight (TGW) remained constant across all evaluated treatments, with a high average value of 376 g and CV = 5.55% (Figure 3). The stability recorded for this variable indicates that yield differences under the different nutritional strategies are mainly due to changes in the number of kernels per row and not to their weight, as confirmed by Capurro et al. (2015) in their study.

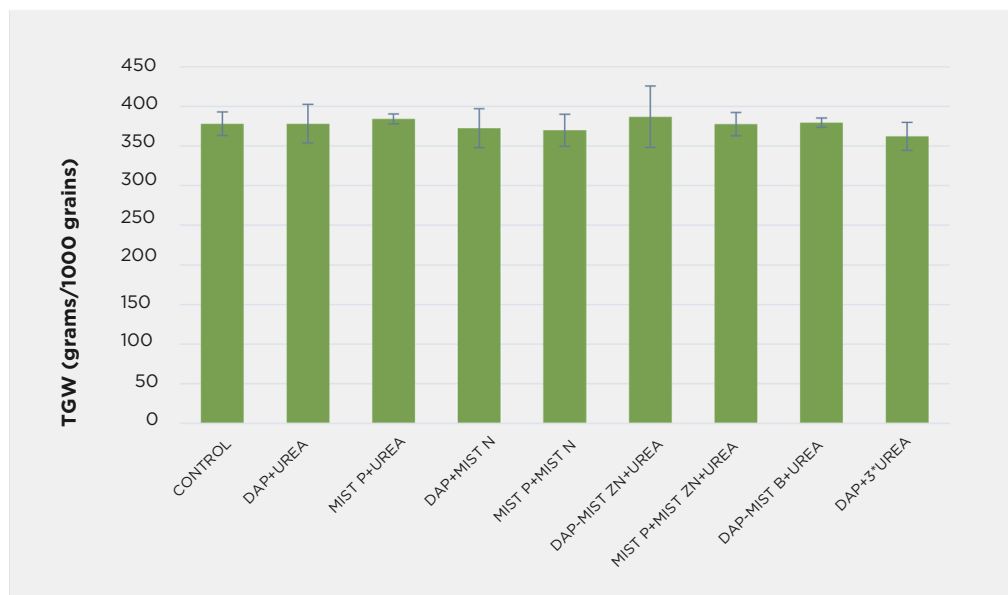


Figure 3. Thousand grain weight (TGW) of maize for each of the evaluated treatments, in the trial conducted in Darregueira, southwest of Buenos Aires Province, 2021/22 season.

Analysis of variance

Variable	N	R°	R° Aj	CV
PMG	36	0,23	0,00	5,55

ANOVA table (Type III SS)

S.V	SS	df	MS	F	P-value
Model	3094,42	11	281,31	0,64	0,7750
Block	1301,86	3	433,95	0,99	0,4134
Treat.	1792,56	8	224,07	0,51	0,8353
Error	10499,89	24	437,50		
Total	13594,31	35			

Adjusted means, standard error, and number of observations

Error: 437,4954 gl: 24

Treatment	Adjusted mean(kg/ha)	N	Std. Error
9	362,25	4	10,46
5	370,00	4	10,46
4	372,50	4	10,46
7	377,75	4	10,46
1	378,25	4	10,46
2	378,25	4	10,46
8	379,50	4	10,46
3	384,25	4	10,46
6	387,00	4	10,46

Considerations:

All fertilization strategies evaluated (T2 to T9) showed a trend towards higher yields compared to the control treatment (T1), with no statistically significant differences found among treatments. The yield response to the application of treatments ranged between 6 and 18% and was mainly due to changes in the number of kernels per row, since the thousand grain weight (TGW) remained constant across treatments. It is considered relevant to continue conducting this type of experiment in successive years to better understand the behavior of the different products under diverse climatic conditions.

References

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