

Wheat Nutrition

2015_INTA San Antonio de
Areco, Buenos Aires

Introduction

Fertilization with elements such as nitrogen (N), phosphorus (P), and sulfur (S) has frequently produced significant yield increases in wheat. For this reason, their use is recurrent across different regions and production systems.

Currently, new technologies are being developed with the potential to improve productivity and increase nutrient use efficiency. In this regard, seed treatment and foliar fertilization with hormones, amino acids, enzymes, and other nutrients such as zinc, copper, manganese, magnesium, as well as nitrogen under optimized production schemes, can provide additional yield and quality benefits in the harvested product.

For a more rational use of these inputs, it is necessary to generate information on the magnitude and stability of the response, appropriate doses, optimal timing of application, and nutrient composition to be applied, in addition to developing diagnostic criteria that allow identification of environments with the highest probability of response.

Foliar fertilization at the beginning of the stem elongation stage has a greater effect on yield and a lesser effect on grain protein increases. The opposite occurs toward the end of stem elongation, when it is already too late to modify grain number, the main component of yield.

The application of a foliar fertilizer can be carried out together with agrochemicals for crop protection, since most formulations are compatible and generally improve the absorption of defensive agrochemicals such as fungicides.

The objective of this trial was to quantify the effect on yield of foliar fertilization schemes with mineral nanoparticles.

Materials and Methods

The study was conducted in a wheat production field located in San Antonio de Areco (Buenos Aires, Argentina), with predominance of Typic Argiudolls, during the 2015 season.

The Don Mario Fuste variety was sown on July 21. The experimental design was a randomized block design with 3 replications. Treatments are detailed in Table 1.

Mist fertilizers based on calcium, magnesium, and sulfur, supplied by Kioshi Stone, were used.

Order	Treatment Mist	Dose L/ha	Application timing
1	Control		
2	Ca y Mag	2 x 1.5	Z 23 - Z39
3	S	2 x 1.5	Z 23 - Z39
4	S	3	Z 39
5	Ca y Mag	3	Z 39

Table 1. Treatment details.

*: Growth stages of wheat according to Zadoks, J.C., Chang, T.T., Konzak, C.F. (1974).

At sowing, composite soil samples (0 to 0.2 m) were taken to determine total organic carbon, pH in water, and texture (Table 2). N-NO₃ was determined to a depth of 40 cm. Soil N levels (Ns) up to 40 cm depth were estimated from N-NO₃ contents (0-20 cm + 20-40 cm) and considering an average bulk density of 1.3 Mg m⁻³ (Table 2).

Property	Unit	Value
Ph	pH Water (1:2,5)	5,9
CE	CE dS.m-1	0,3
C	Cg.kg-1	15,8
N	Ng.kg-1	1,7
Pe	Pe mg.kg-1	10,5
N-NO3 (0-20)	N-NO3 mg.kg-1	8
N-NO3 (20-40)	N-NO3 mg.kg-1	6
N-NO3 (0-60)	kg.ha-1	44,2
Clay	g.kg-1	259
Sand	g.kg-1	132
Silt	g.kg-1	608

Table 2. Surface soil properties.

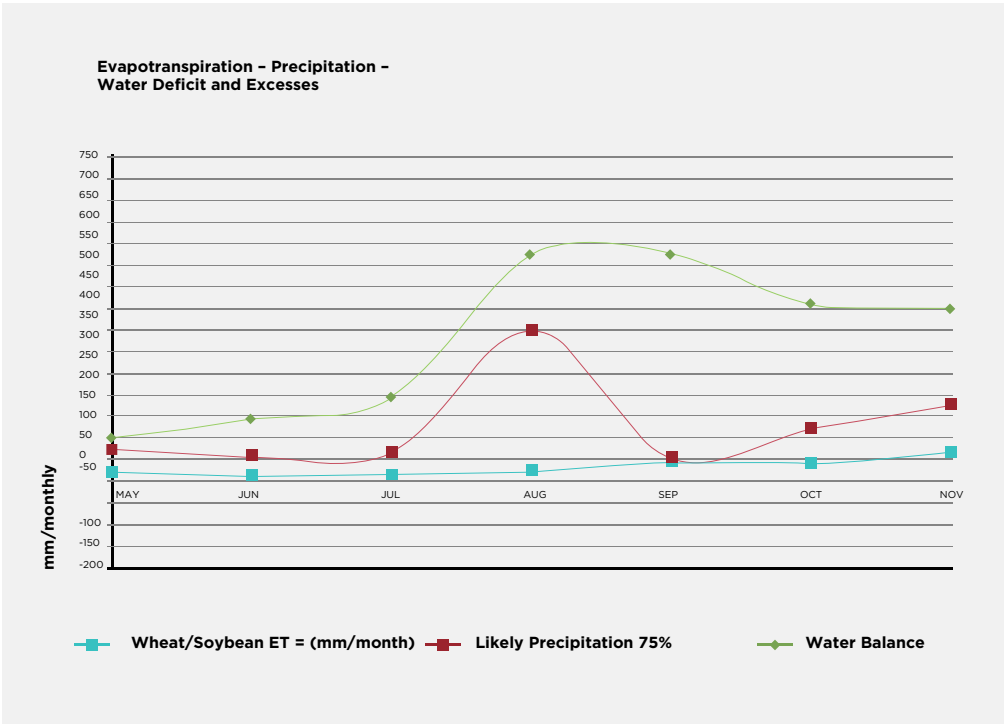


Figure 1. Crop evapotranspiration, precipitation, and water balance in wheat.

Results

Table 3. Number of plants, number of spikes, thousand grain weight, and yield of the treatments.

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Treatments	N° pl/m2	N° spikes/m2	weight 1000	Yield kg/ha
T	288	545	38 a	3722 a
Ca (x2)	285	556	37 a	3760.67 a
Ca	285	550	38 a	3827.33 a
S (x2)	288	576	37 a	3920.33 a
S	290	580	38 a	4191 a

Different letters indicate significant differences ($p \leq 0.05$).

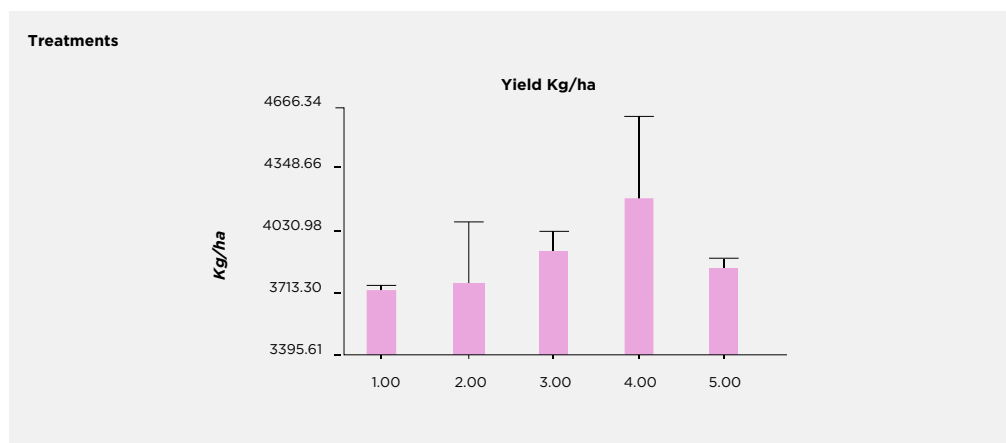


Figure 2. Yield and variability of the treatments.

Observations

- As shown in Figure 1, the wheat season presented a good amount of available soil water during most of the crop development. The heavy rainfall at the beginning of August (+300 mm) affected the crop, causing some plant losses and nutrient leaching.
- Yields of the treatments were good, favored by moderate to low temperatures during grain filling. The maximum treatment yield was 4191 kg/ha and the minimum was 3722 kg/ha, with a difference of 12.6% compared to the untreated control, a value within the range obtained in other foliar fertilizer trials.
- The products were easy to apply, did not produce visible phytotoxic effects, and no clear visual differences were observed among treatments during crop development.
- Although there were no statistically significant differences among treatments, a trend toward higher yields with the use of foliar fertilizers was observed. Within these, the best results were obtained with a single application dose (Z39), and the sulfur-containing fertilizer achieved the highest yield per hectare.



Administrative office and sales department:

Centenario Uruguayo 957 Lanús Este,
Provincia de Buenos Aires

Production Plant:

Parque Industrial Benito Juárez.

Phone numbers:

(+54) (11) 4230.2507

(+54) (11) 4058.3319