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DATE: 03/20/2025

Raisan®

Biostimulant Defense inducer

Crop: potato

Varieties: Spunta

Location: Mar del Plata

APPLICANT: RAISAN SA

RESPONSIBLE: SUSTAINABLE DEVELOPMENT SRL

CAMPAIGN: 2024–2025

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1. INTRODUCTION

At the national level, potato production is distributed over an area of 80,000 hectares, with a estimated annual production volume of 3 million tons. The main provinces Producers according to the planted area in 2023/2024 are: Buenos Aires 57%, Córdoba-San Luis 28.8%, Tucumán 7.7%, Mendoza 5.3%. The rest of the area is covered by Jujuy, Santa Fe, San Juan, Chubut and Rio Negro

In the case of Buenos Aires and, specifically, the southeastern part of Buenos Aires, the productive ranking during 2024/2025 is headed by the town of Balcarce, with an area of 8,728 hectares, followed by Lobería with 8,420 hectares, Tandil with 6,534 hectares and General Alvarado with 5,993 planted hectares (FENAPP, 2025).

With the rise of small and medium-sized potato processing companies, along with the already consolidated in the region, producers in the southeast of the province of Buenos Aires anticipate a Greater demand for potatoes in the coming years will stimulate an increase in planted area. within the sector. At the same time, large companies are focusing on producing potatoes more sustainable way, encouraging producers to adopt new input technologies more environmentally friendly, without compromising productivity.

Raisan® is a natural product formulated with chitosan, a biodegradable, non-toxic polymer. Non-toxic and non-polluting, extracted from the shell of crustaceans. Its active ingredient is a derived from chitin, the second most abundant polymer in nature. Among its effects are Highlights: stimulates the natural defense mechanisms of plants (SAR System: Resistance Systemic Acquired) causing biochemical and structural changes, stimulates the production of roots, produces a more balanced development of the aerial and root system, produces an effect vaccine caused by the activation of the plants' own self-defense systems, acts As a disease protector, it produces increases in crop yield and quality.

AIM

To evaluate the agronomic efficacy of the biostimulant RaiSan® in potato cultivation, determining its impact on plant growth, development and productivity, as well as on the quality of the tubers.

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2. MATERIALS AND METHODS

1. Protocol

a. Location and description of the lot

The trial was carried out during the 2024-2025 campaign in the town of Mar del Plata (Figure 1).

The planting was carried out on November 9, 2024, the variety used was Spunta and the density of

plantation was 4 tn ha-1 .

Figure 1. Trial location. Mar del Plata. 2024-2025 campaign.

b. Treatments evaluated and application

Table 1 presents the evaluated treatments, products, time and dose of application.

proposed by the applicant company. The equipment used for the applications was a backpack

CO2, with a 6-point boom at a distance of 0.5 m from each other with 110-015 hollow cone tablets and pressure

The working pressure used was 2.5 bar (Figure 2). The application equipment was calibrated prior to each application.

One of the applications to check the amount of broth dispensed. For this, an average was obtained

of two repetitions of the volume sprayed by the peaks at one time. The time was then calculated

required spraying per treatment according to the area of the plot and the speed of

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applicator advance. The application volume worked with was 100 l/ha. The dates of application and timing are presented in Table 2.

Table 1. Treatment identification, product used, timing and application rate. Variety Spunta. Locality of Mar del Plata. 2024-2025 campaign.

Treatment	Product	Moment	Dose (l ha- 1)	Observations
6	Commercial witness			Producer management (with insecticide and fungicide at planting time)
7	RaiSan 2.5	At the time of planting	5	Applications are made according to the producer's management (with insecticide and fungicide at the time of planting)
		Along with the application of the pre-emergent herbicide	5	
		20 days after the second application (before 45 days)	5	
8	RaiSan 2.5	At the time of planting	5	No insecticide or fungicide at planting time
		Along with the application of the pre-emergent herbicide	5	
		20 days after the second application (before 45 days)	5	
9	RaiSan 2.5 + pre-emergent RaiSan Copper	At the time of planting	5	Applications are made according to the producer's management (with insecticide and fungicide at the time of planting)
		Along with the application of the herbicide	2	
		20 days after the second application (before 45 days)	2	

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Observations:

1. The solution used for the preparation of RaiSan® 2.5 broth was 1% product.
   Regarding water, in the case of RaiSan® 12.5 the solution used was 0.25% and for the
   RaiSan® copper at 0.5%. The pH was verified and corrected, if necessary.
   between 4 and 5. For the treatment with *Trichoderma* it was verified that the pH was between 5 and
   6.
2. 1 l ha-1 of Punto 35 (Imidacloprid 35%) and 3 l ha-1 of Acronis were used for planting.
   (Pyraclostrobin 5% + Methylthiophanate 45%). It was fertilized with 100 kg ha-1 of MAP pre-planting
   and 550 kg ha-1 of DAP to the plantation. The pre-emergence herbicide applied was Sencorex (1.2 l
   ha-1).

Figure 2. Application equipment. Spunta variety. Mar del Plata. 2024-2025 campaign.

Table 2. Treatment application date. Variety: Spunta. Location: Mar del Plata.
2024-2025 Campaign.

Time of application	Application date
To the plantation	09/11/2024
With the pre-emergent herbicide	11/22/2024
20 days after the second application	12/15/2024

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c. Distribution of treatments in the trial

A strip experimental design was used. The surface area of each experimental unit was 51 m2. (4 grooves * 0.85 meters between furrows * 15 meters long). Between each treatment, 1 meter of damping. Figure 3 shows the sketch showing the distribution of treatments in the lot.

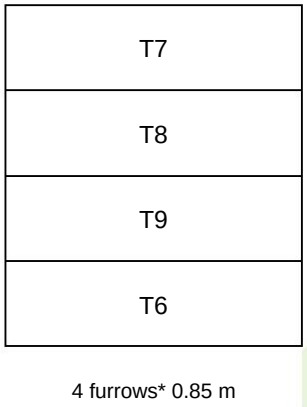

Figure 3. Sketch of the trial. Spunta variety. Mar del Plata. 2024-2025 season.

d. Evaluations

At 20 and 30 days after planting (ddp) the biostimulant effect was evaluated through the determination of the percentage of crop emergence and sprouting vigor evaluated from the diameter of the aerial stems. Three samples of 3.52 linear meters were taken for each treatment.

At 60 days a day, the number of stolons and stems per plant was counted. Three sampling of 3.52 linear meters for each treatment.

At crop maturity, yield was estimated (Figure 4). Three samplings were taken. of 3.52 linear meters per treatment. The total number of tubers produced was counted, number of commercial tubers and size distribution was performed to determine the discard percentage. Any tuber smaller than 50 mm is considered discarded. Finally, The dry matter content was determined. To do this, 5,050 kg of tubers were weighed in the air and immersed in water and the specific weight of the sample is calculated. From this value, by a conversion table, the percentage of dry matter in the sample is obtained (Figure 5).

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Figure 4. Yield estimate: tuber harvesting and weighing. 2024-2025 crop season.

Peso específico	% MS
1,060	16,1
1,061	16,2
1,062	16,3
1,063	16,5
1,064	16,8
1,065	17,0

Figure 5. Left: Basket balance for weighing the sample in air and water. Right:
Table extract to obtain the percentage value of dry matter of the sample from the weight sample-specific. 2024-2025 campaign.

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f. Statistical analysis

The results obtained were analyzed using the statistical program Infostat®. The comparison between the treatment means was performed using the minimum difference test significant (LSD Fischer) with a significance level ÿ 0.05, when the ANOVA was significant.

3. RESULTS

a. Biostimulant effect: percentage and emergence vigor

In the Spunta variety, 20 days after planting, the average emergence percentage of the trial was 64.5%, while at 30 dap it reached 70.4%. Although no significant differences between treatments at any of the evaluation times (p-value 20 ddp = 0.9239 and p-value 30 ddp = 0.6018), the control treatment (T1) was the one with the lowest percentage average emergence rate (Figure 6). The low average emergence rate of the trial was This was due to the fact that the seed purchased by the producer suffered rot caused by the fly seed, affecting the normal and complete emergence of the crop.

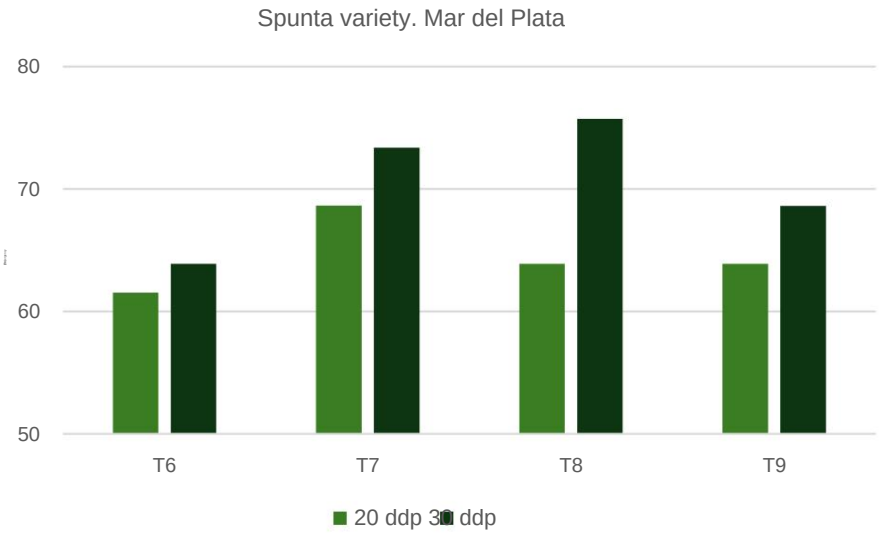

Figure 6. Average emergence in percentage based on the treatments evaluated at 20 and 30 ddp. 2024-2025 Campaign.

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In the Spunta variety there were no significant differences between treatments for stem diameter. evaluated at 20 and 30 days after planting the potato crop (Table 3). However, the Treatment T1 had the smallest average stem diameter, demonstrating that the treatments with Raisan®, In general, they promote greater vigor in early stages of crop development.

Table 3. Average percentage of stem diameter at 20 and 30 days after planting.

2024-2025 Campaign.

Treatment	Stem diameter (mm)	
	20 ddp	**30 ddp**
T6	6.0	12.0
T7	7.7	13.7
T8	7.3	12.0
T9	8.3	14.7
p-value	**0.64571**	**0.3088**

[1] probability value significant if p ÿ 0.05

b. Incidence of *Rhizoctonia solani*

In the Spunta variety, there was no presence of *Rhizoctonia solani* 30 days after planting.

c. Number of aerial stems and stolons

Table 4 presents the average results of the number of stems and stolons per meter at the 60 days after planting. There were no significant differences between treatments for the variables evaluated. T8 and T9 produced on average the highest number of stems per meter and the lower production of stolons. The low number of stems per meter is attributed to rotting of caudate mother tubers by the seed fly, affecting the number of plants per meter and consequently the number of stems.

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Table 4. Number of aerial stems and stolons per meter at 60 days after planting.

2024-2025 Campaign.

Treatment	Stems/m	Stolons/m
T6	5.1	3.3
T7	5.2	3.2
T8	5.7	3.0
T9	5.7	2.4
p-value	**0.9375** [1]	**0.7696**

[1] probability value significant if p ÿ 0.05

d. Performance

Figure 7 presents the total yield results, in tons per hectare, by treatment. The Spunta variety yielded an average of 37.3 tons ha-1 . Raisan® treatments exceeded T1, although they did not differ statistically (p-value=0.1016). T7 was the one that had the greatest It had a yield that exceeded the T1 by 12.3 tons, followed by the T8, which yielded 8.7 tons more than the witness. commercial. Given the conditions of Spunta cultivation, these results demonstrate the effects of Raisan® 2.5 as a bactericide, enhancing its effects with the addition of fungicides and insecticides to the plantation.

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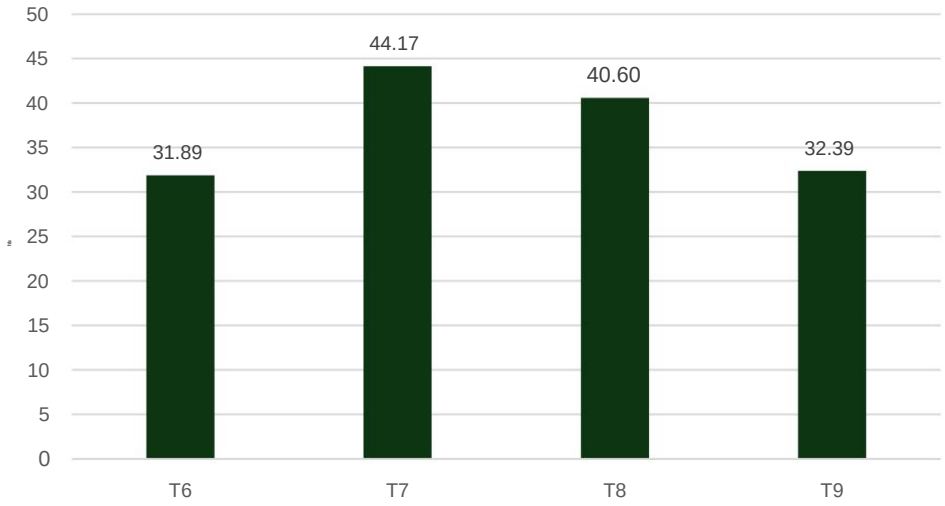

Figure 7. Total yield in tons per hectare depending on the treatments evaluated. 2024-2025 Campaign.

e. Number of tubers and size distribution

Table 5 presents the average number of total and commercial tubers produced by treatment, as well as the percentage of discarded. Any tuber is considered discarded less than 50 mm in diameter. There were no significant differences between treatments. T7 produced the greater number of total and marketable tubers, explaining the higher total yield. Without However, the percentage of discards (tubers < 50 mm) was similar to that produced in the control commercial.

Figure 8 shows the distribution of tuber sizes (% of total tubers). by caliber.

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Table 5. Average number of total and commercial tubers and percentage of discards depending on of the treatments evaluated. 2024-2025 Campaign.

	Tubers		Discard
Total Treatment		**Commercials**	**%**
T6	60.0	52.3	12.8
T7	78.0	68.3	12.4
T8	77.3	66.0	14.7
T9	68.0	58.0	14.7
p-value	**0.5594**	**0.5158**	

[1]probability value significant if p ÿ 0.05

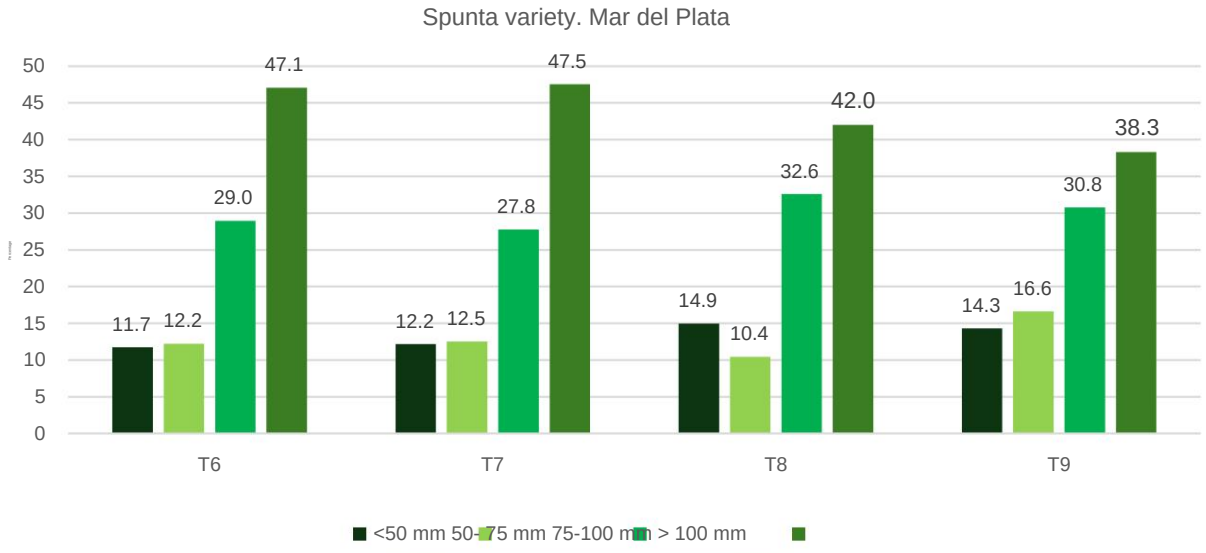

Figure 8. Percentage distribution of tubers by caliber (mm) depending on the treatments evaluated. 2024-2025 Campaign.

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f. Dry matter content

The percentage of solids for the Spunta variety varied between 16.1 and 17.1%, with T7 being the highest. dry matter content presented (Table 6).

Table 6. Solids content (%MS) based on the treatments evaluated. 2024-2025 campaign.

Treatment	% MS
T6	16.8
T7	16.7
T8	17.1
T9	16.1

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CONCLUSIONS

Raisan® as a biostimulant in potato cultivation proves to be a promising tool to optimize crop yield, size and health in a sustainable manner.

In this test the performance of the product on pathogen control was highlighted, being a alternative to the use of fungicides and bactericides. Furthermore, it promotes emergence and production. of stems.

As far as performance feedback is concerned, larger scale trials should be conducted. to be able to draw more concrete conclusions. In the Spunta variety, the response was 12.3 tons.