



SOYBEAN TRIAL 436

(Sillon & Asoc).

Introduction

By the year 2050, the global population is expected to reach 9 billion people, exhausting the planet's capacity to provide sufficient energy, freshwater, and food. Current crop production levels are not adequate to feed the projected population and meet this growing demand. This projection, together with paradigm shifts in agricultural production due to climate change and the loss of water resources, poses a major challenge for modern agronomic management.

In this context, protein production plays a fundamental role in human nutrition. Considering the crucial importance of soybean in the national economy, it becomes essential to ensure the continuity of its production, industrialization, and commercialization. This involves, among other aspects, guaranteeing a balanced fertilization of crops — accounting for both soil nutrient supply and external inputs — to meet the crop's basic nutritional requirements, promote natural physiological processes, and achieve high productivity without depleting soil resources. It also implies monitoring and managing any variable that could affect crop productivity (Ploper, 2011) and enhancing the plant's natural physiological processes to obtain stable, high-yielding crops across different environments.

Methodology:

The trial was conducted at the Experimental Field of the Sillon & Associates Sanitary Center, located in San Jerónimo Norte (Central Santa Fe), coordinates 31°33'58"S, 61°04'58"W.

The plot followed a barley crop as a predecessor, with a chemical fallow before sowing that included the application of 2 L of paraquat and 1 L of 2,4-D on October 30, achieving adequate weed control.

Pre-emergence treatments consisted of 2.5 L of ammonium glufosinate, along with residual products: 0.65 L of sulfentrazone and 1.65 L of S-metolachlor.

Sowing was carried out on December 17, using soybean variety 50i9, at a density of 20 plants per linear meter, and 52 cm row spacing, with an experimental cone-type planter.

Cumulative rainfall during the month preceding sowing was 160 mm, ensuring adequate soil moisture at planting time.

The seed lot was previously analyzed for germination power and fungal load. The base seed treatment used was Apron Maxx RFC (2.5 g Fludioxonil + 3.75 g Metalaxyl-M) at a dose of 100 cc per 100 kg of seed.

Throughout the experiment, integrated pest management (IPM) practices were maintained, applying insecticides and fungicides according to the respective economic thresholds for each case to ensure unbiased yield results.

Active ingredients used:

- Lepidoptera and thrips (defoliating caterpillars and Caliothrips phaseoli): Application of 60 cc/ha of Novaluron (18.8 g) + Emamectin benzoate (14.7 g) at the R2 phenological stage, when thresholds reached 4 caterpillars >1.5 cm, including *Helicoverpa* sp., and 27 thrips nymphs per leaflet, with observed feeding damage and 25% total defoliation (defoliated, scraped, or silvered leaves).
- Hemiptera (stink bug complex): Application of Imidacloprid 25% + Bifenthrin 5% at 250 cc/ha during the R4 stage, when thresholds reached 1 adult of *Piezodorus guildinii* and 1 *Anticarsia gematalis* >1.5 cm.

All plots were treated uniformly with these IPM-standard active ingredients to avoid statistical bias among experimental treatments.

The application protocol is presented in Table 1, and application conditions are detailed in Table 2.

	Seed	Sowing	V6 -V8	R1
Treatment 1	—	—	—	—
Treatment 2	—	100 Kg/ha SPT	1,5lt/ha Mist BLC	1,5lt/ha Mist BLC
Treatment 3	300 cc/100 kg of seed of Mist VL	100 Kg/ha SPT	—	—
Treatment 4	—	3 lt/ha Mist P	1,5lt/ha Mist BLC	1,5lt/ha Mist BLC

Table 1. Application protocol

Application date	12/18/2021	Sowing			
		TIME	TEMPERATURE	HUMIDITY	WIND SPEED
START		20,00 hs	21	85%	3 km/h SO
END		21,30 hs	20	87%	2 km/h SO

Table 2. Application conditions at sowing

Application date	1/20/2021	V7			
		TIME	TEMPERATURE	HUMIDITY	WIND SPEED
START		19,00 hs	25	74%	4 km/h SO
END		19,30 hs	24	78%	4 km/h SO

Table 3. Application conditions at V7 stage.

Application date	2/4/2021	R1			
		TIME	TEMPERATURE	HUMIDITY	WIND SPEED
START		20,00 hs	22	80%	5 km/h SO
END		20,30 hs	21	82%	6 km/h SO

Table 4. Application conditions at R1 stage.

Results

01. CLIMATE:

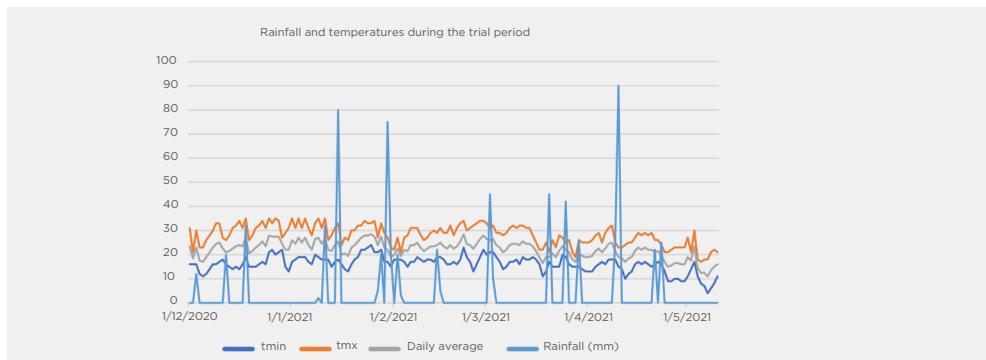


Figure 1. Temperatures and rainfall from 30 days before sowing until harvest.

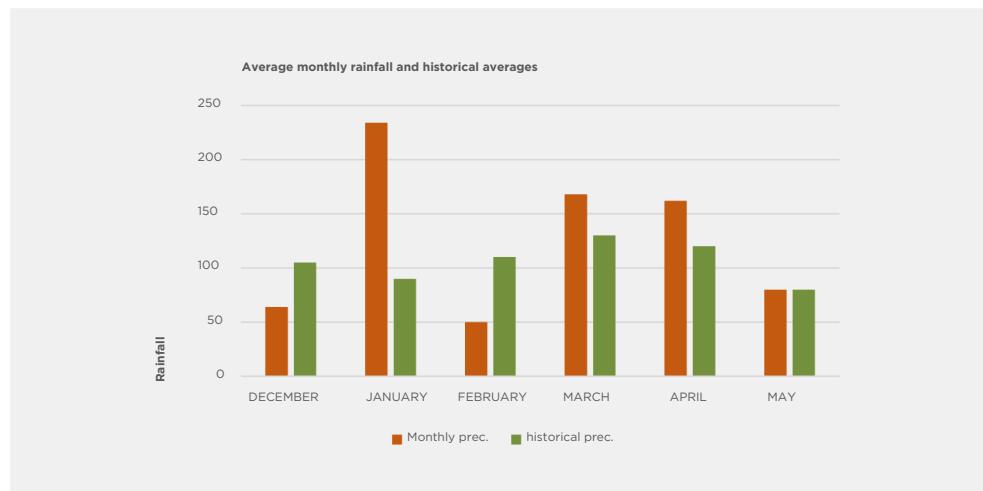


Figure 2. Average monthly rainfall compared with the historical record.

Figures 1 and 2 show that, for the site under analysis, rainfall was below historical levels during the months of December and February. In the remaining months, rainfall remained above the historical average for the period evaluated. Temperatures stayed within the expected range, with minimum extremes of 12°C and maximum extremes of 37°C during the crop cycle.

The total accumulated rainfall throughout the crop cycle did not differ from the annual historical average, and therefore no continuous stress conditions were observed. However, alternating periods of water deficit and excess, along with high temperatures—mainly during the establishment stage—generated physiological stress, which was reflected in the plant count.

During the critical period between R3 and R5 (from February 27 to March 30), no continuous stress conditions were recorded that could have caused limitations in crop growth and development.

2. EMERGENCE CURVES

TREATMENT	7 DDA	S.D	14 DDA	S.D	21 DDA	S.D	28 DDA	S.D
T1	16,5	A	18,25	A	21,75	A	21,5	A
T2	21,375	A	22,875	A	22,5	A	23,125	A
T3	19,875	A	20,5	A	22,625	A	23,125	A
T4	21,625	A	20	A	20,75	A	20,625	A

Table 1. Percentage of emergence at 7, 14, 21 and 28 days after sowing (DAS). Different letters indicate statistically significant differences according to Fisher's LSD test at $\alpha = 0.05$.

There were no statistically significant differences among treatments at 7 DAS (Figure 3). However, from an agronomic standpoint, all treatments showed higher emergence than the control. Starting with the second evaluation (14 DAS), a slight decrease in plant population was observed for T4, which remained until the end of the evaluations. Although no statistically significant differences were detected among treatments throughout the evaluation period, the highest plant stands were achieved by T2 and T3—both of which received SPT fertilization at sowing—followed by the control and T4, which showed the lowest number of plants per meter.

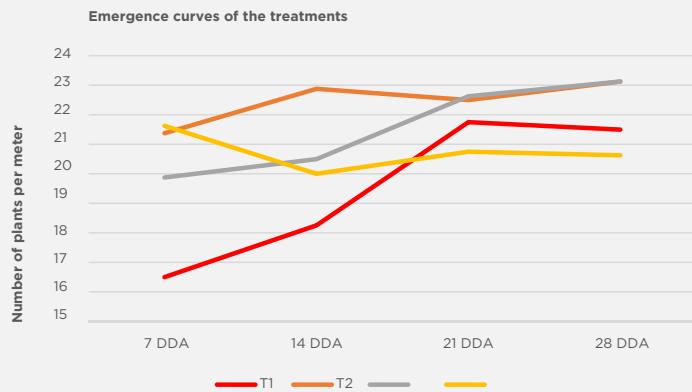


Figure 3. Emergence curves for the different treatments.

3. CROP HEALTH ANALYSIS

TREATMENT	Plant height with Septoria symptoms	S.D.	SPAD units	S.D.	GREEN AREA (%)	S.D.
T1	21,5	A	35,5	A	60	B
T2	37,5	A	38,9	B	71,25	A
T3	37,5	A	40,93	B	61,25	B
T4	40	A	38,8	B	76,26	A

Table 2. Crop health analysis. Different letters indicate statistically significant differences according to Fisher's LSD test at $\alpha = 0.05$.

The main disease present at the R3 growth stage was Septoria glycines (Figure 4), with the untreated control showing symptoms on an average of 30% of plant height. Following this stage, all plots received a fungicide application (triazole + strobilurin mix). The parameter used for disease assessment was "plant height with symptoms," which quantifies the vertical progression of the pathogen from the soil surface upward.

At R3, no statistically significant differences were detected among treatments. However, the absolute control (no fertilization) exhibited the lowest height of Septoria symptoms. This can be attributed to its reduced growth and shorter plants, where limited foliar tissue restricts pathogen advancement—even in the case of necrotrophic pathogens.

Crop physiological status was assessed through SPAD readings (Figure 5) and green leaf area percentage (Figure 6) during grain filling. SPAD values differed significantly between the control and all fertilized treatments, with higher readings in fertilized plots. Green area percentage also showed significant differences, separating treatments into two groups: the control and T3 with the lowest values, and T2 and T4 with the highest values. Both T2 and T4 correspond to treatments where Mist BLC was applied at V7 and R1.

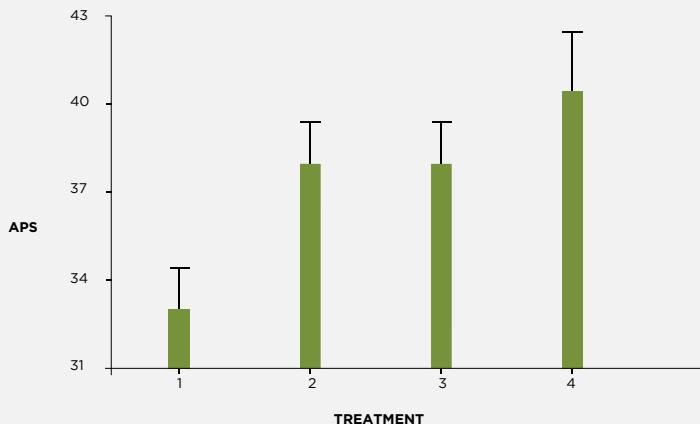


Figure 4. *Septoria glycines* APS.

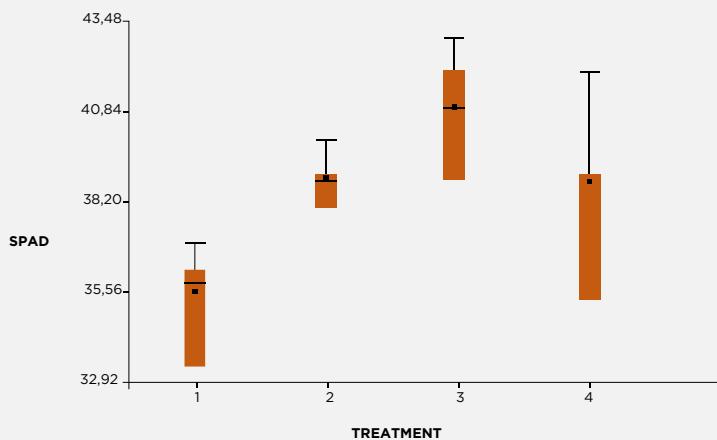


Figure 5. SPAD units.

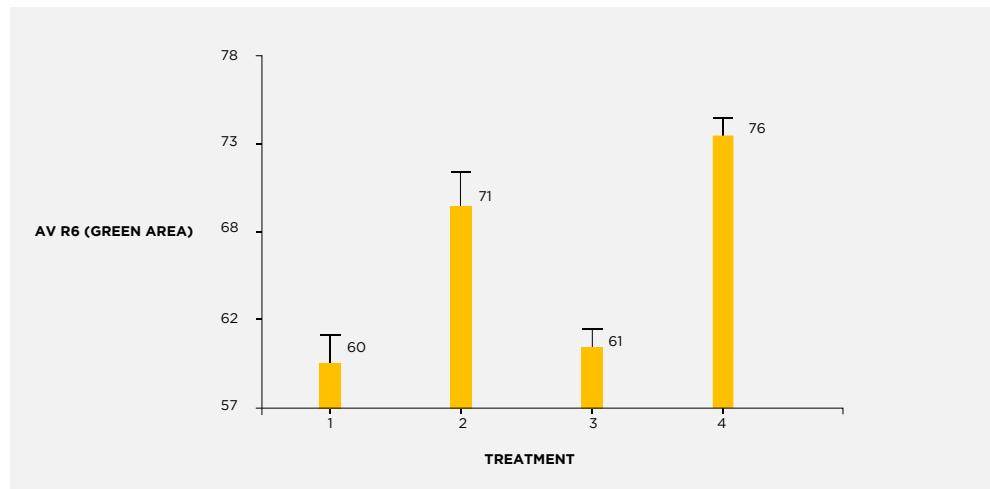


Figure 6. Green area.

4. ANALYSIS OF YIELD COMPONENTS

TREATMENT	PI/m2	S.D.	Pods/plant	S.D.	Yield	S.D.	Thousand kernel weight (TKW)	S.D.
T1	16,5	A	71,69	A	1936	B	82,63	AB
T2	21,375	A	68,49	A	2155	B	83	A
T3	19,875	A	72,84	A	2042	B	78	AB
T4	21,625	A	54,94	A	2402	A	81,88	AB

Regarding the yield components analyzed, the number of plants at harvest showed no statistically significant differences. However, all fertilized treatments achieved a greater number of plants than the control by the end of the crop cycle. Similarly, no statistical differences were found in the number of pods per plant, and no specific treatment stood out for this variable.

In terms of yield (Figure 7), treatment T4 outperformed the others, producing 400 kg/ha more than the control. The remaining treatments did not differ significantly from each other, although T2 and T3 yielded more than the control; T2 exceeded the control by 200 kg/ha, and T3 by 100 kg/ha. With respect to Thousand Kernel Weight (Figure 8), T2 showed the highest value, although the differences compared to the other treatments were small.

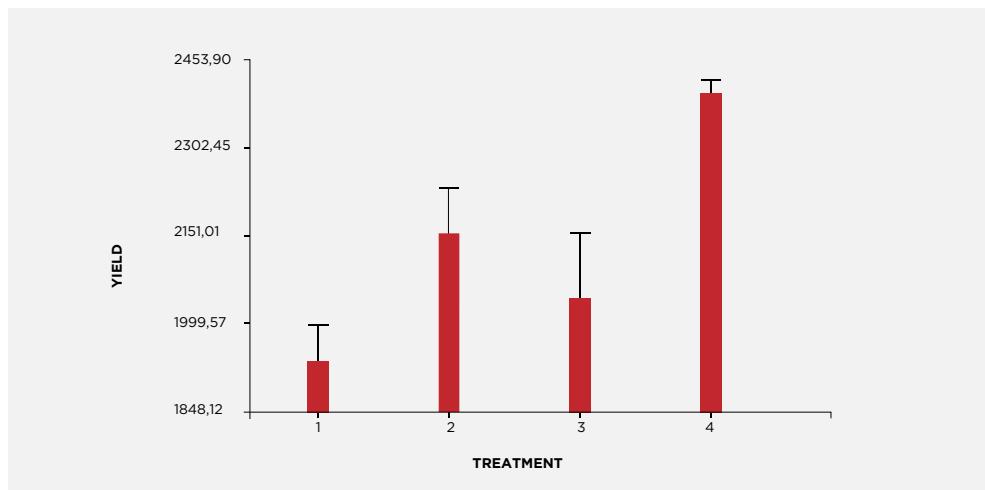


Figure 7. Yield (kg/ha)

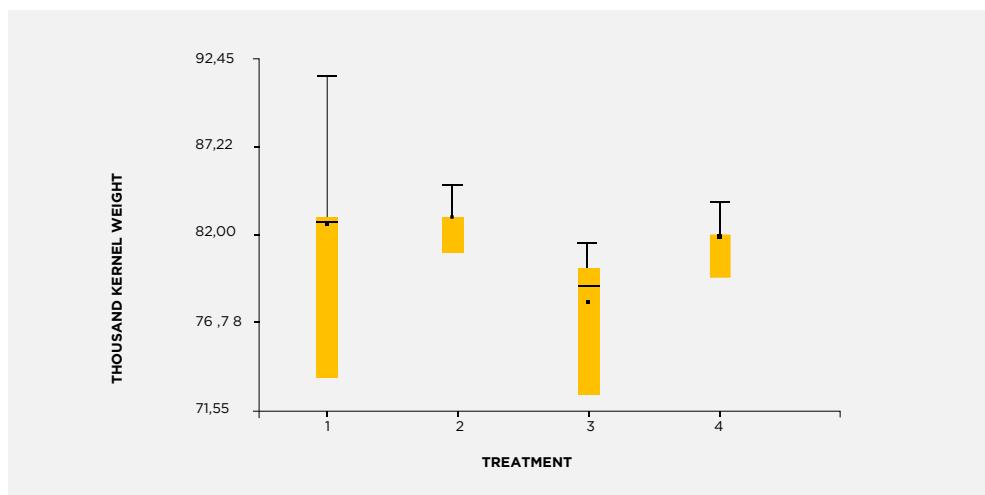


Figure 8. Thousand kernel weight (TKW)

Conclusions

- At the beginning of the crop cycle, T3 (300 cc of Mist IV/100 kg of seed) achieved a good stand establishment from 14 DAS, reaching the highest plant counts by 28 DAS.
- Regarding the general crop development, no major differences were observed among treatments; however, the treatments with 1.5 L/ha of Mist BCL applied at V7 and R1 showed the best overall crop performance.
- In terms of yield components, T4 (3 L/ha of Mist P at sowing + 1.5 L/ha of Mist BCL at V7 and R1) stood out as the highest-yielding treatment. Treatments 2 and 4, both with Mist BCL applications at V7 and R1, reached a higher number of plants at harvest, accompanied by a lower number of pods per plant (compensatory effect). Additionally, the superior yield of T4 can be attributed to a higher number of grains, since no differences in grain weight were observed compared to the remaining treatments.

ANALYSIS OF VARIANCE

New table: 27/07/2021 - 11:03:31 - [Version: 30/04/2020]

Analysis of variance

MEAN 7 DAS

Variable	N	R ²	Adj R ²	CV
MEAN 7 DAS	16	0,30	0,13	18,09

Table of Analysis of Variance (Type III SS)

S.V.	SS	df	MS	F	p-value
Model	66,80	3	22,27	1,73	0,2142
TREATMENT	66,80	3	22,27	1,73	0,2142
Error	154,56	12	12,88		
Total	221,36	15			

Test: Fisher LSD Alpha=0,05 LSD=5,52925

Error: 12,8802 df: 12

TREATMENT	Means	n	S.E.
4	21,63	4	1,79 A
2	21,38	4	1,79 A
3	19,88	4	1,79 A
1	16,50	4	1,79 A

Means followed by the same letter are not significantly different (p > 0.05).

MEAN 14 DAS

Variable	N	R ²	Adj R ²	CV
MEAN 14 DAS	16	0,26	0,08	15,69

Table of Analysis of Variance (Type III SS)

S.V.	SS	df	MS	F	p-value
Model	43,67	3	14,56	1,42	0,2850
TREATMENT	43,67	3	14,56	1,42	0,2850
Error	122,94	12	10,24		
Total	166,61	15			

Test: Fisher LSD Alpha=0,05 LSD=4,93124

Error: 10,2448 df: 12

TREATMENT	Means	n	S.E.
2	22,88	4	1,60 A
3	20,50	4	1,60 A
4	20,00	4	1,60 A
1	18,25	4	1,60 A

Means followed by the same letter are not significantly different (p > 0.05).

MEAN 21 DAS

Variable	N	R ²	Adj R ²	CV
MEAN 21 DAS	16	0,26	0,08	15,69

MEANS 21 DAS 16 0,08 0,00 13,55

Table of Analysis of Variance (Type III SS)

S.V.	SC	df	MS	F	p-value
Model	8,92	3	2,97	0,34	0,7985
TREATMENT	8,92	3	2,97	0,34	0,7985
Error	105,69	12	8,81		
Total	114,61	15			

Test:Fisher LSD Alpha=0,05 LSD=4,57221

Error: 8,8073 df: 12

TREATMENT	Means	n	S.E.
3	22,63	4	1,48 A
2	22,50	4	1,48 A
1	21,75	4	1,48 A
4	20,75	4	1,48 A

Means followed by the same letter are not significantly different (p > 0.05).

MEAN 28 DAS

Variable	N	R ²	Adj R ²	CV
MEAN 28 DAS	16	0,10	0,00	17,11

Table of Analysis of Variance (Type III SS)

S.V.	SC	df	MS	F	p-value
Model	18,55	3	6,18	0,43	0,7336
TREATMENT	18,55	3	6,18	0,43	0,7336
Error	171,56	12	14,30		
Total	190,11	15			

Test:Fisher LSD Alpha=0,05 LSD=5,82540

Error: 14,2969 df: 12

TREATMENT	Means	n	S.E.
3	23,13	4	1,89 A
2	23,13	4	1,89 A
1	21,50	4	1,89 A
4	20,63	4	1,89 A

Means followed by the same letter are not significantly different (p > 0.05).

New table : 27/7/2021 - 16:25:55 - [Version : 30/4/2020]

Analysis of variance

APS

Variable	N	R ²	Adj R ²	CV
APS	16	0,49	0,36	8,75

Table of Analysis of Variance (Type III SS)

S.V.	SC	df	MS	F	p-value
Model	118,75	3	39,58	3,80	0,0399

TRATAMIENTO	118,75	3	39,58	3,80	0,0399
Error	125,00	12	10,42		
Total	243,75	15			

Test:Fisher LSD Alpha=0,05 LSD=4,97244

Error: 10,4167 df: 12

TREATMENT	Means	n	E.E.	
4	40,00	4	1,61	A
3	37,50	4	1,61	A
2	37,50	4	1,61	A
1	32,50	4	1,61	B

Means followed by the same letter are not significantly different (p > 0.05).

New tabla_1 : 27/7/2021 - 16:41:07 - [Version : 30/4/2020]

Analysis of variance

Variable	N	R ²	Adj R ²	CV
SPAD	16	0,59	0,49	4,85

Table of Analysis of Variance (Type III SS)

S.V.	SC	df	MS	F	p-value
Model	60,62	3	20,21	5,78	0,0111
TREATMENT	60,62	3	20,21	5,78	0,0111
Error	41,98	12	3,50		
Total	102,60	15			

Test:Fisher LSD Alpha=0,05 LSD=2,88153

Error: 3,4981 df: 12

TREATMENT	Means	n	E.E.	
3	40,93	4	0,94	A
2	38,90	4	0,94	A
4	38,85	4	0,94	A
1	35,50	4	0,94	B

Means followed by the same letter are not significantly different (p > 0.05).

AV R6 (GREEN AREA)

Variable	N	R ²	Adj R ²	CV
AV R6 (GREEN AREA)	16	0,83	0,78	5,37

Table of Analysis of Variance (Type III SS)

S.V.	SC	df	MS	F	p-value
Model	742,19	3	247,40	19,00	0,0001
TREATMENT	742,19	3	247,40	19,00	0,0001
Error	156,25	12	13,02		
Total	898,44	15			

Test:Fisher LSD Alpha=0,05 LSD=5,55935

Error: 13,0208 df: 12

TREATMENT	Means	n	E.E.	
4	76,25	4	1,80	A
2	71,25	4	1,80	A
3	61,25	4	1,80	B

<u>1</u>	60,00	4	1,80	<u>B</u>
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Means followed by the same letter are not significantly different ($p > 0.05$).

New table : 27/7/2021 - 17:35:07 - [Version : 30/4/2020]

Analysis of variance

Thousand kernel weight

Variable	N	R ²	Adj R ²	CV
Thousand kernel weight	16	0,22	0,02	5,34

Table of Analysis of Variance (Type III SS)

S.V.	SC	df	MS	F	p-value
Model	63,38	3	21,13	1,12	0,3806
TREATMENT	63,38	3	21,13	1,12	0,3806
Error	226,88	12	18,91		
Total	290,25	15			

Test:Fisher LSD Alpha=0,05 LSD=6,69896

Error: 18,9063 df: 12

TREATMENT	Means	n	E.E.
2	83,00	4	2,17 A
1	82,63	4	2,17 A
4	81,88	4	2,17 A
3	78,00	4	2,17 A

Means followed by the same letter are not significantly different ($p > 0.05$).

YIELD

Variable	N	R ²	Adj R ²	CV
YIELD	16	0,61	0,52	7,42

Table of Analysis of Variance (Type III SS)

S.V.	SC	df	MS	F	p-value
Model	479064,96	3	159688,32	6,36	0,0079
TREATMENT	479064,96	3	159688,32	6,36	0,0079
Error	301109,76	12	25092,48		
Total	780174,72	15			

Test:Fisher LSD Alpha=0,05 LSD =244,04880

Error: 25092,4800 df: 12

TREATMENT	Means	n	E.E.
4	2402,40	4	79,20 A
2	2155,20	4	79,20 B
3	2042,40	4	79,20 B
1	1936,80	4	79,20 B

Means followed by the same letter are not significantly different ($p > 0.05$).

Plants per square meter

Variable	N	R ²	Adj R ²	CV
Plants per square meter.	16	0,10	0,00	17,11

Table of Analysis of Variance (Type III SS)

S.V.	SC	df	MS	F	p-value
Model	6837120000,00	3	2279040000,00	0,43	0,7336
TREATAMENTO	6837120000,00	3	2279040000,00	0,43	0,7336
Error	6324480000,00	12	5270400000,00		
Total	70081920000,00	15			

Test:Fisher LSD Alpha=0,05 LSD=111847,60105
Error: 5270400000,0000 df: 12

TREATMENT	Means	n	E.E.
3	444000,00	4	36298,76
2	444000,00	4	36298,76
1	412800,00	4	36298,76
4	396000,00	4	36298,76

Means followed by the same letter are not significantly different (p > 0.05).
pods/plant

Variable	N	R ²	R ² Adj	CV
pod/plant	16	0,32	0,15	17,89

Table of Analysis of Variance (Type III SS)

S.V.	SC	df	MS	F	p-value
Model	814,86	3	271,62	1,89	0,1851
TREATMENT	814,86	3	271,62	1,89	0,1851
Error	1724,23	12	143,69		
Total	2539,08	15			

Test:Fisher LSD Alpha=0,05 LSD=18,46763
Error: 143,6854 gl: 12

TREATMENT	Means	n	E.E.
3	72,84	4	5,99 A
1	71,69	4	5,99 A
2	68,49	4	5,99 A
4	54,94	4	5,99 A

Means followed by the same letter are not significantly different (p > 0.05).



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