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Response Of the Cocoa Crop to The Application of Foliar Biostimulants for Fruit Set and Setting, City of Vinces

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Abstract

The present research work was carried out during the rainy season in the province of Los Ríos, Vinces canton in the Anchoveta area. The purpose of this study was to evaluate the flowering of the CCN51 cocoa crop (Theobroma cacaco L.), in addition to evaluating the number of fruit set and fruit set with the use of the following foliar biostimulant: biostimulant based on humic acid, biostimulant a amino acid base and foliar fertilizer based on copper oxide. A DBCA experimental design (completely randomized block design) was used with seven treatments and three repetitions. The statistical analysis indicated a significant difference in the number of flowers and fruit set and fruit set between the treatments in the studies. The treatment with the highest number of flowers was T7 with the use of Ferticacao edaphic fertilizer, while the treatment with the highest number of fruit set and fruit set was treatment T6 with the use of the amino acid-based biostimulant accompanied with the foliar fertilizer. copper oxide base.

Keywords: *Flowering, Fruit Set and Setting, CCN-51 Cocoa, Biostimulant, Fertilizer.*

INTRODUCTION

Cocoa has an important role in the Ecuadorian economy and history: together with bananas, they are among the most important primary export products, the cocoa sector employs 5% of the economically active rural population, thus constituting a fundamental base of the economy. familiar from the coast, the Andes and the Amazon area(Abad, Acuña and Naranjo, 2019).

In Ecuador, two varieties of cocoa are mainly produced: the Nacional Above and the CCN-51 and it is produced in 21 provinces that are grouped into 4 production zones, the main producing provinces being Los Ríos, Manabí, Guayas and Esmeraldas.(Cedeño and Jiménez, 2022).

Biostimulants are necessary to achieve a better quality harvest, because they have a direct effect on the metabolism of the plant and in turn provide it with greater resistance to stress, cold or drought, which can cause economic losses to future.

Nitrogen fertilizers are important, because they improve crop production, nutrient absorption in cocoa crops increases rapidly during the first five years after planting and then stabilizes, maintaining that absorption rate for the rest. useful life of the plantation(Morales, Rubí, López, Martínez and Morales 2019).

MATERIALS AND METHODS

The jobThe research focused on the setting and fruit setting of the CCN-51 cocoa crop, in the Anchoveta area, in the Vinces canton, province of Los Ríos, with the application of various biostimulants and foliar fertilizers.TOIn all treatments, the agronomic management that is normally applied was carried out, which is edaphic fertilization based on Ferticacao.

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The research method used was a completely randomized block design DBCA with seven treatments and three repetitions. Analysis using (ANDEVA) was used for statistical evaluation. The Tukey test was used at 5% probability. To select the useful area of each treatment plot, it is necessary to eliminate the edge effect of the plots, therefore, the useful area is made up of 2 cocoa plants.

QFor each treatment, four applications of the different biostimulants and foliar fertilizer were carried out, in which it was carried out every 15 days. For the application of the T5 treatment, which is based on humic acid and boron, the product based on humic acid was first applied. and after 3 days the boron was applied, the same was done for the T6 treatment based on amino acideitherand boron, first the amino acid-based product was applied and after three days the boron was applied. The correct dosages were used for each biostimulant and foliar fertilizer in the productive stage of cocoa cultivation during the development of the research.

Board1. Treatments in studies

Treatments	**Product**	**Dose/HA**	**Dose/ Parcel**
T1	humic acid	2 L/ha	16.20 cc/parc.
T2	Amino acids	100gr/ha	1gr/parc.
T3	Boron	1L/ha	9cc/parc.
T4	Humic acid + amino acids	2 L/ha + 100gr/ha	16.20 cc/parc + 1gr/parc.
T5	Humic acid + boron	2 L/ha + 1L/ha	16.20 cc/parc + 9cc/parc.
T6	Amino acids + boron	100gr/ha + 1L/ha	1gr/parc + 9cc/parc.
T7	absolute witness	-------	-------

Farias, 2023

They were selectedtwoplants in each of the plots with the different treatmentsand repetitions, evaluateandor so, the best treatment with number of flowers and fruit set and setting.

RESULTS

Number Of Flowers in the Study Treatment

Table 2 describes the variable number of flowers. In the first evaluation, the highest number of flowers could be observed in T4 where it was 111.33, followed by T7 with 73.67, T5 with 70.33 and with the lowest flower count were the treatments T1 with 43.67, T2 with 44.67 and T6 with 45.67. For the second evaluation of the number of flowers, greater flowering was observed in the T7 treatments with 264.33; followed by T4 with 215.00; T3 with 207.00; T5 with 203.00; while the treatments that presented the least number of flowering were T1 with 172.33; T2 with 149.67 and T6 with 116.67. It can be detailed that there were no significant differences in the evaluations carried out, on the other hand the coefficient of variation was less than 11% in the evaluation periods as detailed in the table.

Board*2*. Number of flowers

Treatment	N	Number of flowers (3/2/23)		Number of flowers (8/4/23)	
T1	3	43.67	to	172.33	to
T2	3	44.67	to	149.67	to
T6	3	45.67	to	116.67	to
T3	3	70.00	to	207.00	to
T5	3	70.33	to	203.00	to
T7	3	73.67	to	264.33	to
T4	3	111.33	to	215.00	to
CV (T) %		10.33		9.25	

Farias, 2023.

Percentage Of Fruit Set and Setting (%)

Table 3 describes the percentage of fruit set and setting variable. In this evaluation, a higher percentage of fruit set and fruit set could be observed in T6 (biostimulant based on amino acid + boron), where it showed an average of 41.27% in fruit set and fruit set; followed by T1 (biostimulant based on humic acid) with 20.11%; T7 (absolute witness) with 17.14; T2 (amino acid) with 16.56% and the treatment that presented the lowest

percentage of fruit set and fruit set were treatments T5 (humic acid + boron) with 14.97% and finally treatment T4 (humic acid + amino acid) with 13.42. It can be detailed that there were no significant differences in the evaluations carried out; on the other hand, the P-value was 0.32 in the evaluation period as detailed in the table.

Table 3. Percentage of fruit setting and setting

Treatment	N	% fruit set and fruit set		
T3	3	10.91	TO	
T4	3	13.42	TO	
T5	3	14.97	TO	
T2	3	16.56	TO	
T7	3	17.14	TO	
T1	3	20.11%	TO	
T6	3	41.27%	TO	
Pv %		0.32		

Farias, 2023

Evaluate the Best Treatment Applied According to the Results Obtained

ANDTable 4 describes that in the first evaluation dated April 8, it was observed that the best treatment with the highest number of fruits is T6 (amino acid + boron) with 6.00; while the treatment that showed the lowest number of fruits was T5 (biostimulant + boron).ANDIn the second evaluation with the date of July 15, it can be seen that the treatment with the highest number of fruit was T6 with 47.67, while the treatment with the least fruit was T4 with 18.00. In addition, the crop was given agronomic management, normally of the edaphic application based on Ferticacao, phytosanitary management and pruning. It can be detailed that there were no significant differences in the evaluations carried out; on the other hand, the coefficient of variation was less than 20% in the evaluation period as detailed in the table.

Table 4.Nnumber of Fruit

Treatment	N	Number of fruits (8/4/23)			Number of fruits (7/15/23)	
T5	3	2.00	TO		33.00	TO
T1	3	3.33	TO	b	28.67	TO
T3	3	3.67	to	b	23.00	TO
T2	3	3.67	to	b	24.33	TO
T4	3	4.00	to	b	18.00	TO
T7	3	5.33	to	b	30.00	TO
T6	3	6.00		b	47.67	TO
CV (T) %		0.36			16.56	

Farias, 2023

TO economic analysis of the cost of the treatments under study

ANDFigure 1 shows the costs of one ha/year of cocoa production, which details the cost of each of the treatments, resulting in the treatment with the highest production costs per year being T5 (humic acid + boron) with $1457 and the treatment with the lowest production costs is the T7 treatment with $1316.

costos fijos (Jornales)	P.U	Cantidad/año	$ Total/año	T 1: acido humico	T 2: aminoacidos	T 3: boro	T4: acido humico + aminoacidos	T5: acido humico + boro	T6: aminoácido + boro	T7: absoluto
realizacion de corona (jornal)	12	4	48	48	48	48	48	48	48	48
Aplicación de fertilizante edafico	12	4	48	48	48	48	48	48	48	48
jornal de poda	0.20	1020	204	204	204	204	204	204	204	204
foliar organico	12	2	24	24	24	0	24	24	24	0
Foliar quimico	12	2	24	0	0	24	0	24	24	0
fungicida Foliar	12	2	24	24	24	24	24	24	24	24
control de maleza	12	2	24	24	24	24	24	24	24	24
herbicida	12	2	24	24	24	24	24	24	24	24
cosecha	12	24	288	288	288	288	288	288	288	288
total de costos fijos				684	684	684	684	708	708	660
Costos Varsable										
Fertilización edafica (ferticacao)	52	12 sacos/año	624	624	624	624	624	624	624	624
Bioestimulante acido humico	12	4 lt/año	48	48	0	0	48	48	0	0
Aminoácido	6	200 gr/ año	12	0	12	0	12	0	12	0
Boro	7.50	2 lt/año	15	0	0	15	0	15	15	0
Bomba de mochila	15	2	30	30	30	30	30	30	30	0
fungicida	8	2lt/año	16	16	16	16	16	16	16	16
herbicida	8	2lt/año	16	16	16	16	16	16	16	16
total de costos variable				734	698	701	746	749	713	656
Gastos totales (total de costos fijos + total de costos variable)			1469	1418	1382	1385	1430	1457	1421	1316

DISCUSSION

According to the results obtained in the study trial, it was observed that of the total number of flowers that bloomed, not all the flowers were fertilized, this is consistent withGomez (2021),who argued that Approximately only 10% of flowers are pollinated; and the flowers that do not are aborted as a natural mechanism of the plant. Of the total pollinated flowers, less than 5% develop into mature fruits.

Using the data obtained, the treatment with the best results was the treatment with amino acid and boron oxide, since a greater number of fruit set and setting was obtained compared to the other treatments under study, this coincides withPinaranda (2017)who emphasizes that the use of amino acids in agriculture helps fruit set, yield and quality of production, also agrees(Quiroga, Fischer and Melgarejo (2018)who mention that Boron helps in the processes of floral development, fruit setting and increases production yield. The deficiency of this element causes low production, infertility of flowers and premature fall of flowers and fruits.

CONCLUSIONS

With the data obtained in the study, it was observed that there is no marked difference between the treatments, resulting in the treatment with the highest number of flowers being T7 (absolute control), however, in the end, the treatment that obtained the highest number of flower buds and fruit set was T6 (amino acid + boron).

Various biostimulants and fertilizers were used to help flowering, budding and fruit set in the cocoa crop. The product that gave the best results was the amino acid + boron. However, the product that showed the least amount of fruit set was T4 (acid humic + amino acid).

Through the economic analysis, it was determined that the treatment that generates the greatest expense for one hectare/year in cocoa cultivation was the T5 treatment with $1,457, but at the same time this treatment did not show the greatest number of fruits.

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CONFLICT OF INTEREST

Authors declare that there is no conflict of interest.

AUTHORSHIP CONTRIBUTION

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