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UNIVERSIDAD CATÓLICA
DE SANTIAGO DE GUAYAQUIL



Effectiveness of Biostimulants as a sustainable solution for improving production of cocoa trees in Ecuador

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1

BIOSTIMULANTS

2

TRIALS IN COCOA

3

RESULTS

Biostimulants: definition

BIOSTIMULANT
Substances or microorganisms applied to plants with the aim of improving nutritional efficiency, tolerance to stress and improve quality, regardless of its content.

CHARACTERISTICS

- Not a nutrition replacement
- Not a CPP replacement
- Better nutrient uptake
- Improve efficiency
- Optimize natural processes
- Stimulate metabolism
- Better resilience to stress
- Production quality

Fertilizers NPK
CROP Protection products
BIO STIMULANTS

2022 International Symposium on Cocoa Research (ISCR), Montpellier, France

Trial in cocoa: Ecuador

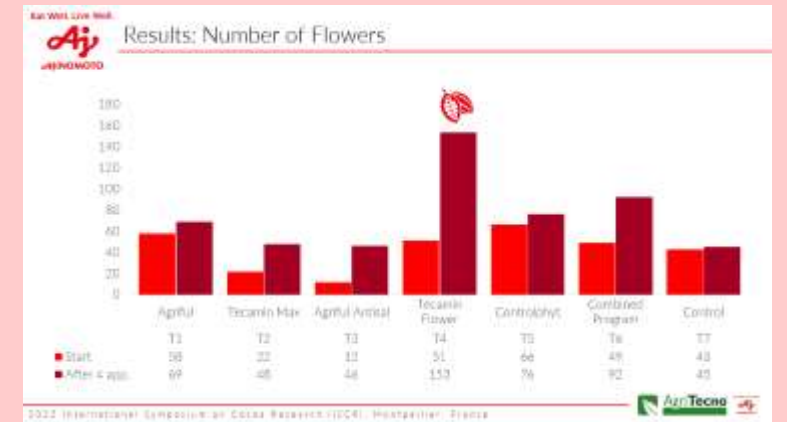
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Trabaja con:
Ing. Agr. Angel Demas Hidalgo Ph.D.
Teacher - Researcher
Faculty of Technical Education for Agricultural Engineering

Guayaquil

Ecuador is a leading country in cocoa production
Specialty: fine aroma cocoa
Volume: 200,000 t / year
Organization: small producers with low yields (99% of the total)
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Biostimulants: definition

BIOSTIMULANT



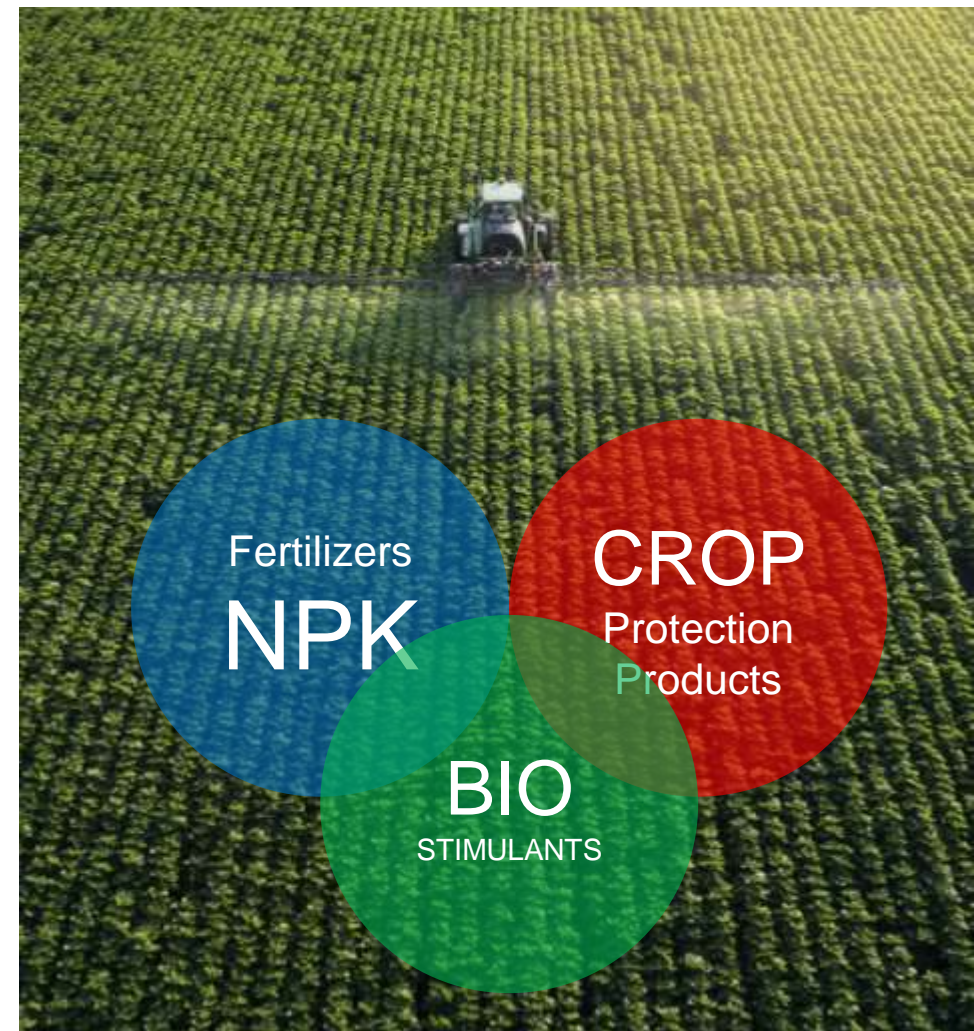
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Biostimulants: sustainable agriculture



MOVING TO A SUSTAINABLE AGRICULTURE

- 1** Optimize nutrients use efficiency → Reduction of NPK
- 2** Improve soil health microflora / structure → Counter soil erosion
- 3** Provide better resilience to stress → Water scarcity
Climate changes
- 4** Upgrade plant defence against pathogens → Reduction of Agrochemicals



Biostimulants: plant extracts



OBTAINING THE RAW MATERIAL

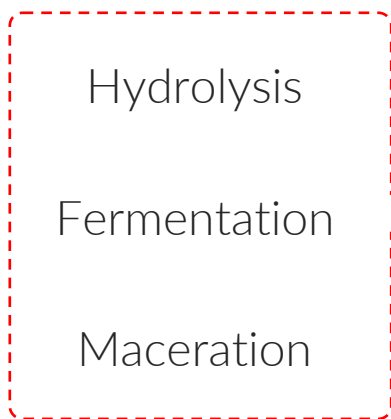
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Plant extract



2

Extraction process



3

Concentration
Low temperature

- Peptides & amino acids
- Organic acids
- Nutrients
- Sugars
- Vitamins

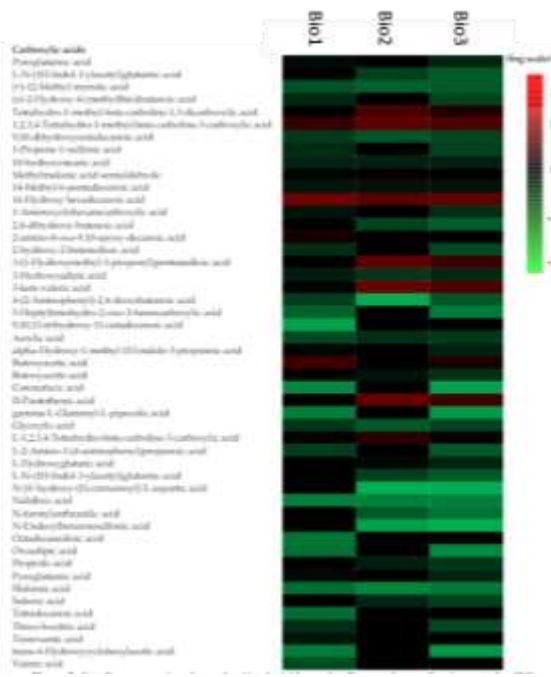
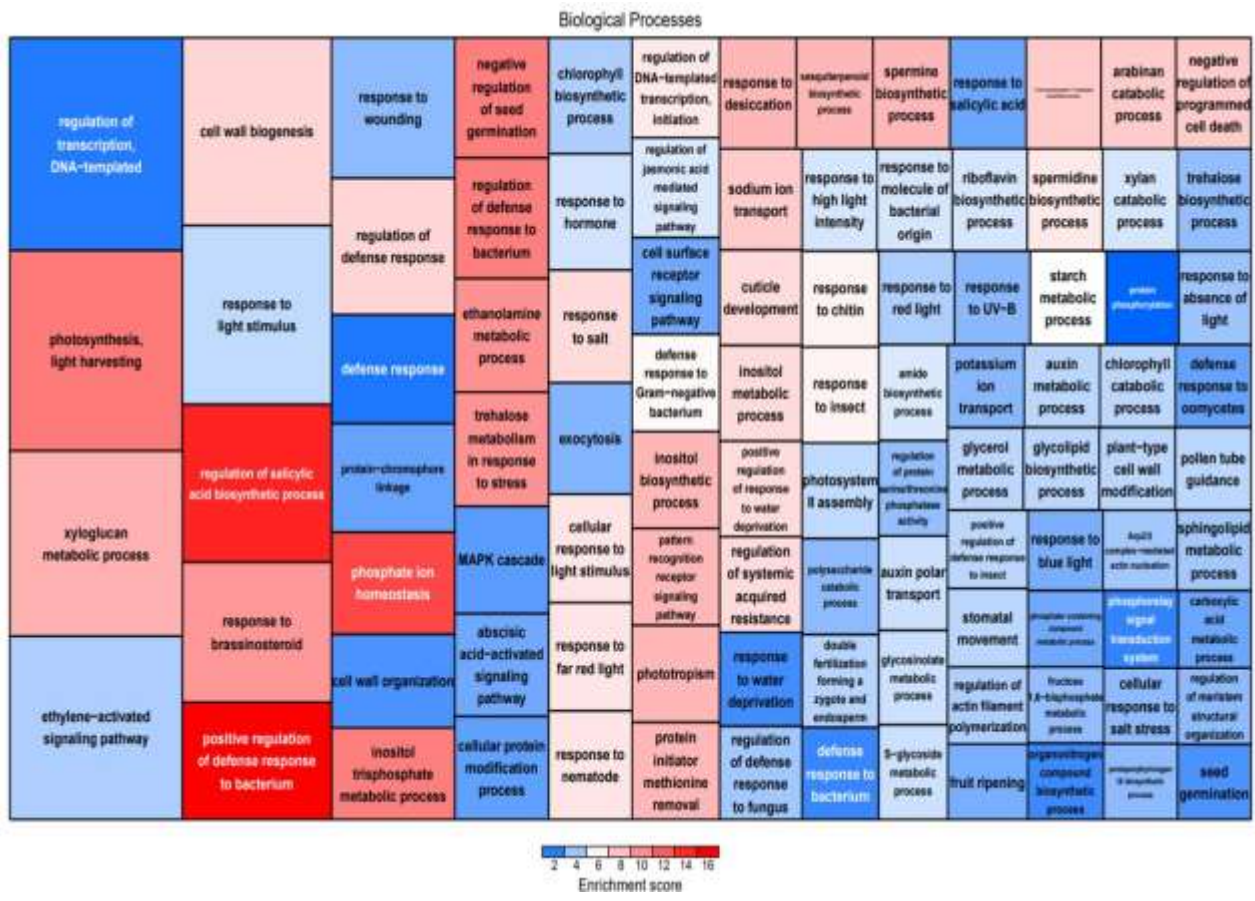
R&D Innovation
Exclusive extraction technology

**BIOSTIMULANT
EXTRACT**





Biostimulants: composition & mode of action



CHOOSING THE MOST SUITABLE EXTRACTS

BIOSTIMULANT EXTRACT



4

Need analysis

Observation of the **needs** of each crop and the **phases** on which we want to act to provide the most **appropriate extracts**

5

Custom formula

Seaweed extract
Micronutrients
Macronutrients
Vitamins
Metabolic activators

6

Optimization

Know-how to choose the extract that meets the needs of the **final product** & addition of **exogenous substances**

Biostimulants: selection for cocoa

Product	Type	Mode of action
Agriful	Root Biostimulant & Soil health	Mixture of various extracts (Fermentation / Soaking) Transcriptomic: Phosphate use efficiency / Stress reliever Metagenomic Prebiotic: Promote health microflora
Agriful Antisal	Root Reduction of Salt soil content	Calcium with amino acids extracts
Tecamin Max	Foliar Growth stimulator Stress reliever	Exclusive fermentation extract with amino acids Transcriptomic : Nitrogen use efficiency / Stress reliever Targeted analysis : Increase NUE enzymes and metabolites – reduce ROS production
Tecamin Flower	Foliar Flowering and Fruit setting	Extracts biostimulant + Boron + Seaweed extracts Transcriptomic : Increase production of trehalose & phosphate a sugar signalling molecule activating flowering process – Antistress action



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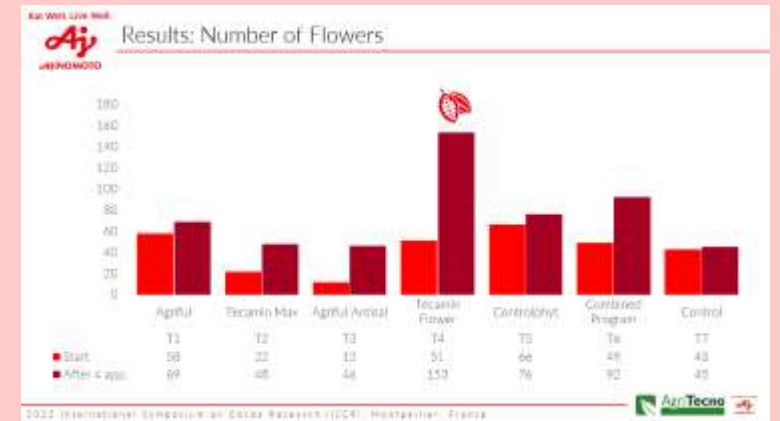
Trial in cocoa: Ecuador

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Trial in cocoa: Ecuador



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DE SANTIAGO DE GUAYAQUIL

Trials done by
Ing. Agr. Ángel Llerena Hidalgo Ph. D.
Teacher - Researcher
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A photograph of a man wearing a blue and white plaid shirt, blue jeans, and a cap, standing in a cocoa field with trees and pods visible in the background.

Ecuador is a leading country in cocoa production

Specialty: fine aroma cocoa

Volume: 200,000 t / year,

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Trial in cocoa: Trial characteristics



Location

Hacienda Acesa Leasing S.A.
Km 58 de la Via a Playas,
Provincial del Guayas
2°22'25.7"S 80°18' 52.2"W

Soil

Clayey
Average temperature: 28° C
pH: 6.7-6.8
Average anual rainfall: 600 mm

Irrigation

Microsprinkler

Experimental Design

DBCA Random blocks
Products applied with motor pump

Treatments:

- Applied to the ground: T1, T3, T6
- Applied to the foliage: T2, T4, T5, T6

Trial in cocoa: Treatments



Treatment	Product	Dosis	Period of treatment	No. Application	Application
T1	Agriful	5 L/ha	Every 15 days	14	Soil
T2	Tecamin Max	3 L/ha	Vegetative growth & stress	3	Foliar
T3	Agriful Antisal	5 L/ha	Every 15 days	14	Soil
T4	Tecamin Flower	3 L/ha	Pre flowering and during flowering period	3	Foliar
T5	Controlphyt PK	3 L/ha	PK	3	Foliar
T6	Combined Program (T1+T2+T3+T4+T5)	3 L/ha 5 L/ha	See above	14 (T1, T3) 3 (T2, T4, T5)	Foliar and Soil
T7	Absolute Control	X	X		X

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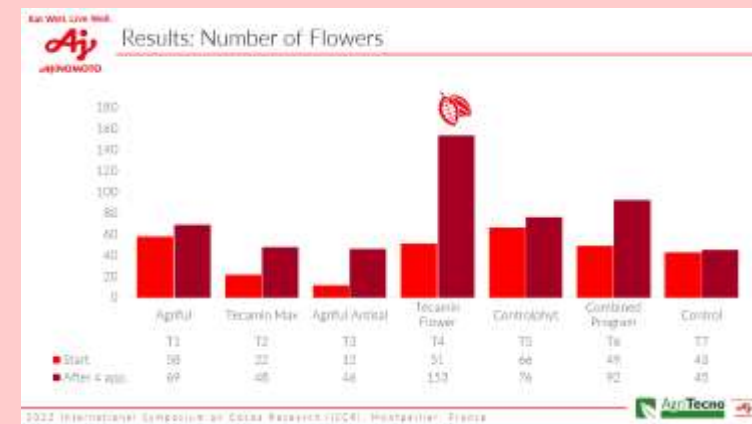
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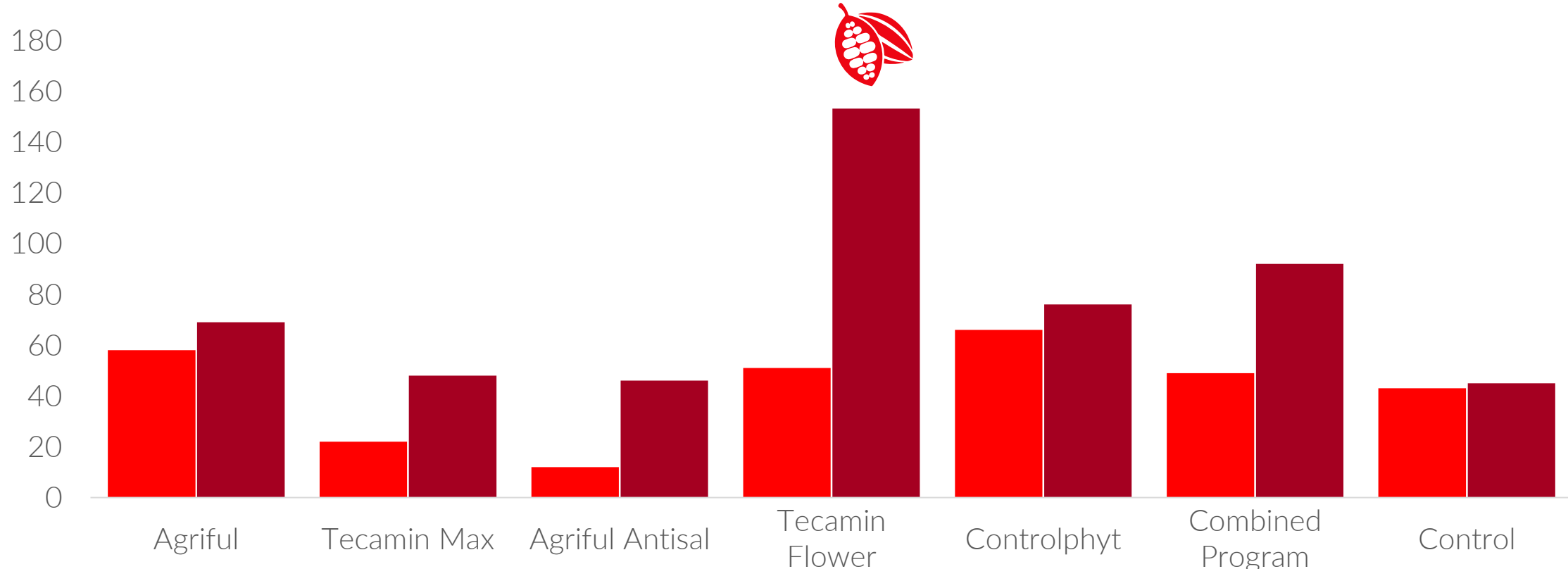
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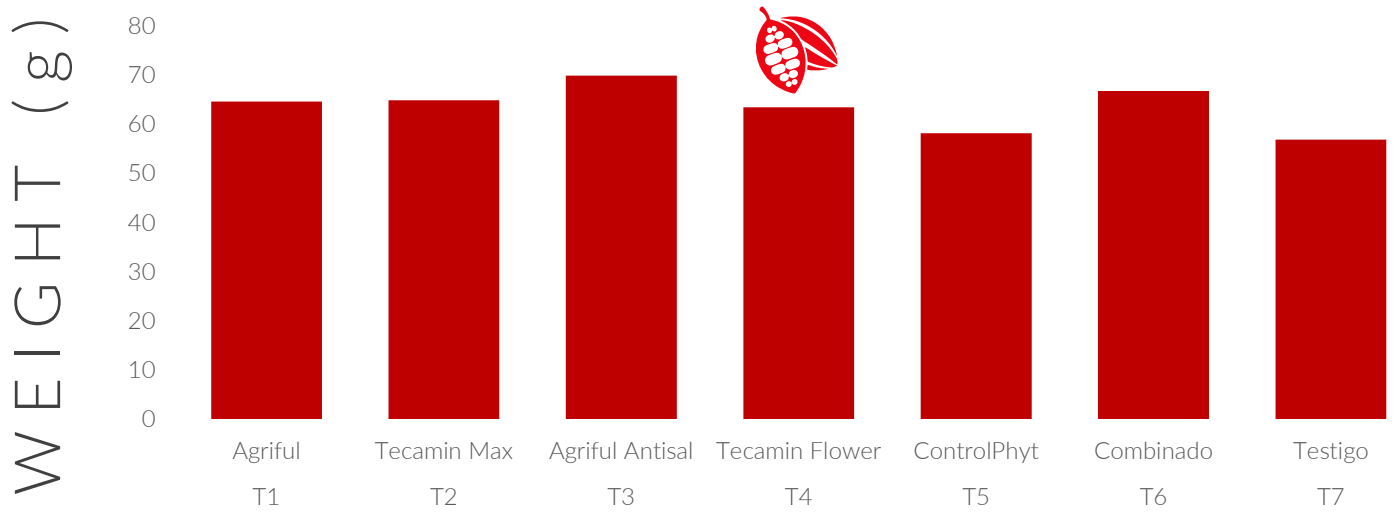
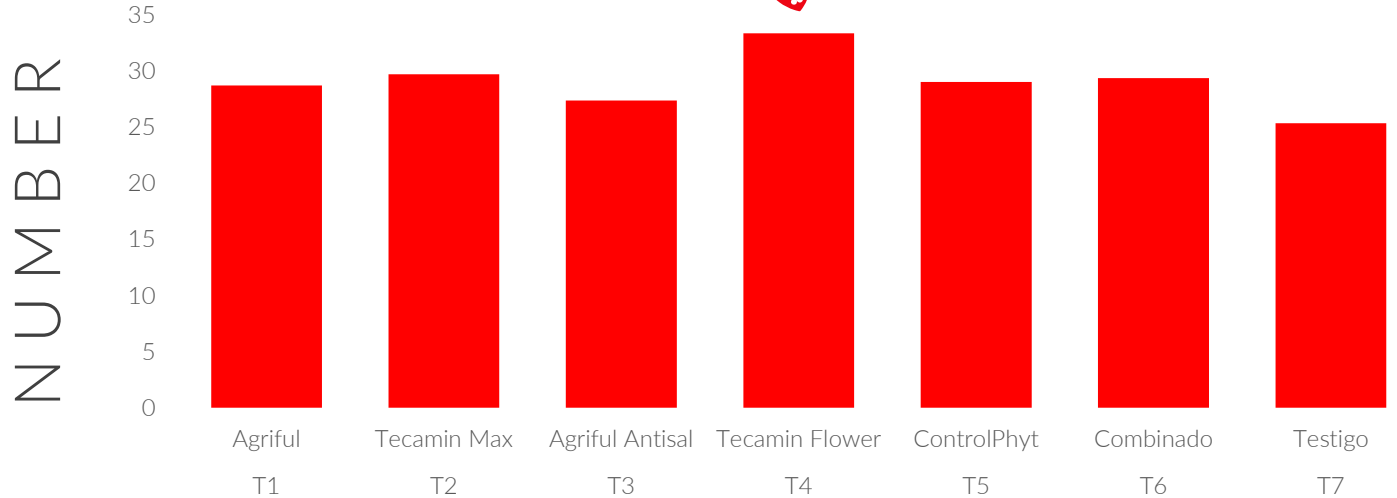
Results: Number of Flowers



	T1	T2	T3	T4	T5	T6	T7
■ Start	58	22	12	51	66	49	43
■ After 4 app.	69	48	46	153	76	92	45



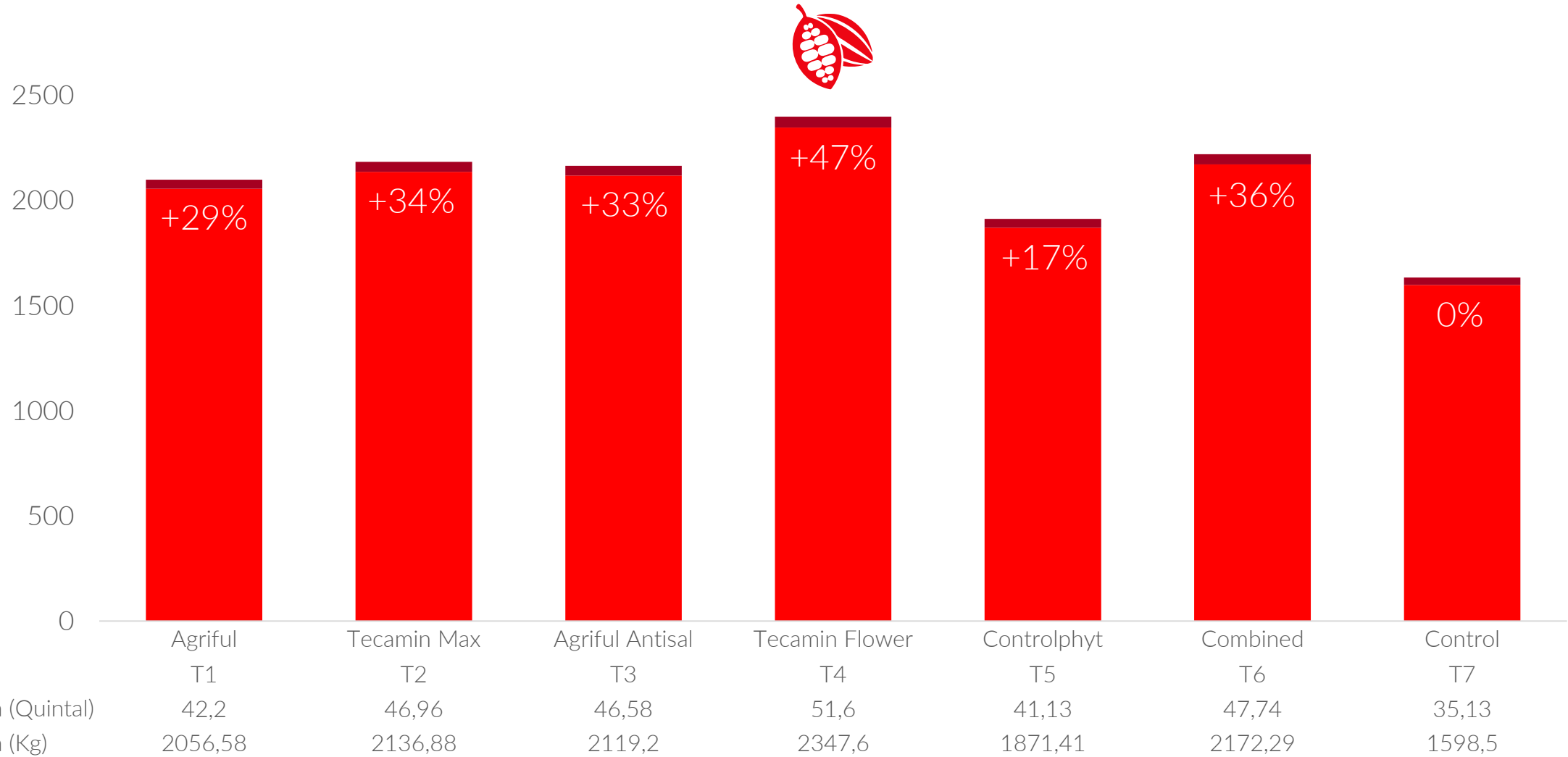
Results: Fruits



Treatment	Products	Fruit Number	Fruit Weight (g)	Yield / Plant (g)
T1	Agriful	28.67	64.57	1 851.11
T2	Tecamin Max	29.67	64.83	1 923.39
T3	Agriful Antisal	27.33	69.79	1 907.47
T4	Tecamin Flower	33.33	63.40	2 113.06
T5	Controlphyt	29.00	58.08	1 684.44
T6	Combined	29.33	66.66	1 955.26
T7	Control	25.33	56.80	1 438.79



Results: Yield



Results: Conclusion



RESULTS

- 1 Biostimulants increased cacao yield (vs control).
- 2 **Tecamin Flower** obtained the best yield, increasing flowers, fruits and grains. This product is focused on improving flowering key period in cocoa production.

GENERAL CONCLUSION

- ❖ Biostimulants are considered as part of solution to improve agriculture sustainability and a essential partner to move to Smart agricultura.
- ❖ Fully aligned with Sustainable Development Goals (SDGs).
- ❖ Possibility to reduce agrochemicals and fertilizers to make cacao production more sustainable and environmental friendly.
- ❖ A Good partner to improve production of small scale farmer and include them in global value chain.



