







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

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BIOSTIMULANTS TRIALS IN COCOA









Biostimulants: definition

BIOSTIMULANT



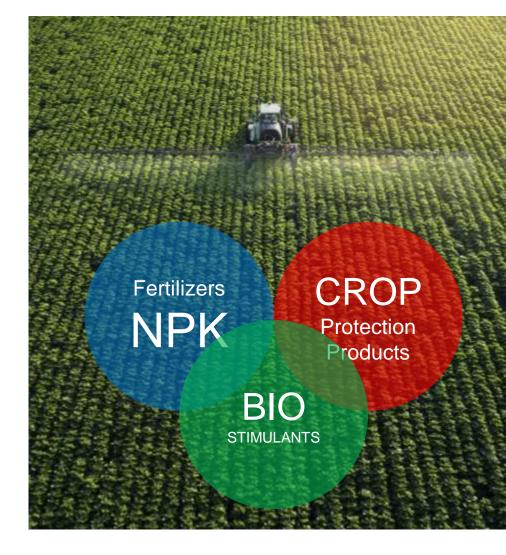
Substances or microorganisms applied to plants with the aim of improving nutritional efficiency, tolerance to stress and improve quality, regardless of its content.

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







Biostimulants: sustainable agriculture



MOOVING TO A SUSTAINABLE AGRICULTURE

- Optimize nutrients use efficiency Reduction of NPK
- 2 Improve soil health microflora / structure Counter soil erosion
- Provide better resilience to stress

 Water scarcity Climate changes
- Upgrade plant defence against pathogens Reduction of Agrochemicals







Biostimulants: plant extracts



Plant extract

Extraction process

Concentration

Low temperature

BIOSTIMULANT EXTRACT





Hydrolysis

Fermentation

Maceration

Peptides & amino acids

Organic acids

Nutrients

Sugars

Vitamins

R&D Innovation

Exclusive extraction technology



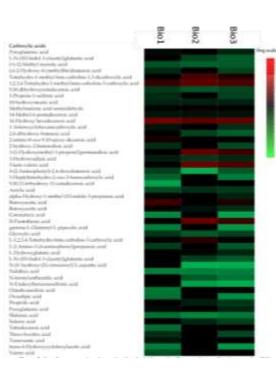


Biostimulants: composition & mode of action

Biological Processes

regulation of transcription, ONA-templated	cell wall biogenesis	response to wounding	regulation of seed germination	chlorophyli biosynthetic process	regulation of DNA-templated transcription, initiation	response to desiccation	sangularparoid Broyreletic pricess	spermine biosynthetic process	response to salicylic sold		arabinan catabolic process	negative regulation of programmed cell death
			regulation of defense response to	response to hormone	regulation of joemorals acid mediated signaling pathway	sodium ion transport	response to high light intensity	molecule of bacterial	riboflavin biosynthetic process	spermidine biosynthetic process	xylan catabolic process	trehaiose biosynthetic process
photosynthesis, light harvesting	response to light stimulus	regulation of defense response	bacterium	response to salt	cell surface receptor signallog	cuticle	response	origin response to	response to UV-B	starch metabolic	protest .	response to
		defense response	ethanolamine metabolic process		defense response to Gram-negative bacterium	inositoi metabolic process	t to chitin response to insect	amido biosynthetic process	potassium	process auxin metabolic process glycolipid	chiorophyti catabolic process	dotense response to convoctes
	regulation of salicytic acid biocynthistic process response to brassinosteroid		trehalose metabolism	exocytosis					transport glycerol			
xyloglucan metabolic process		protein-chromophere Sologe	in response to stress	inositol positive regulation of reports to water	photosysten It assembly	phosphoton	and the second second	biosynthetic	THE RESERVE OF THE PARTY OF THE	pollen tube guidance		
		phosphate ion homeostasis coll wall organization	MAPK cancade	cellular response to light stimulus	esponse to patient	regulation of systemic	Son.	auxin polar	regulation of defense response	response to blue light	Apil 1 complete resolution activities (completion)	sphingolipid metabolic process
			abscisic		signaling acquired resistance	horses	transport	stomatal movement		phosphorolog in grad bereatherine	cathonylis scill metasolis	
ethylene-activated signaling pathway			acid-activated signaling pothway	response to far red light	phototropism to war	response to water deprivation	double fertilization forming a zygote and	glycosinolate metabolic e	regulation of actin filament	fractions I A-triagmosphoto metabolite	cellular response to	regulation of marksters structural
	positive regulation of defense response to becterium	inositol trisphosphate metabolic process	cellular protein modification process	response to sematode	protein initiator methionine removal	regulation of defense response to fungus	defense response to becterium	S-glycosida matabolic process	polymerization fruit ripening		sait stress	organization seed germination











Biostimulants: formulation



CHOOSING THE MOST SUITABLE EXTRACTS

BIOSTIMULANT EXTRACT

Need analysis

Custom formula

Optimization



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

Seaweed extract

Micronutrients

Macronutrients

Vitamins

Metabolic activators

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				
Agri ful	Root Biostimulant & Soil health	Mixture of various extracts (Fermentation / Soaking) Transcriptomic: Phosphate use efficiency / Stress relieve Metagenomic Prebiotic: Promote health microflora				
Agri ful Antisal	Root Reduction of Salt soil content	Calcium with amino acids extracts				
Tec amin 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				
Tec amin Flower	Foliar Flowering and Fruit setting	Extracts biostimulant + Boron + Seaweed extracts Transcriptomic : Increase production of trehalose & phosphate a sugar signelling molecule activating flowering process - Antistress action				



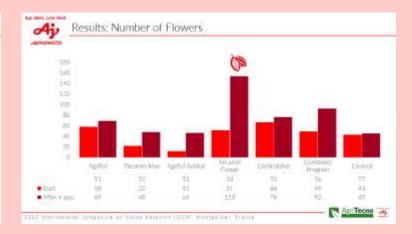




BIOSTIMULANTS TRIALS IN COCOA









Trial in cocoa: Ecuador





Trials done by

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Teacher - Researcher

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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)

Management: 80% use agrochemical products and only a few meet in associations.



Trial in cocoa: Trial characteristics



Location	Hacienda Acessa 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, T6Applied 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	
Т3	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	
Т6	Combined Program (T1+T2+T3+T4+T5)	3 L/ha 5 L/ha	See above	e above 14 (T1, T3) 3 (T2, T4, T5)		
T7	Absolute Control	Х	X		X	

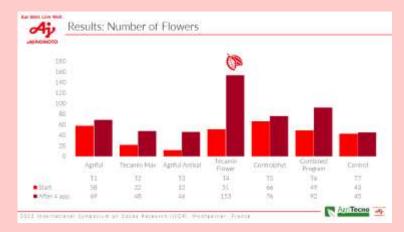




BIOSTIMULANTS TRIALS IN COCOA

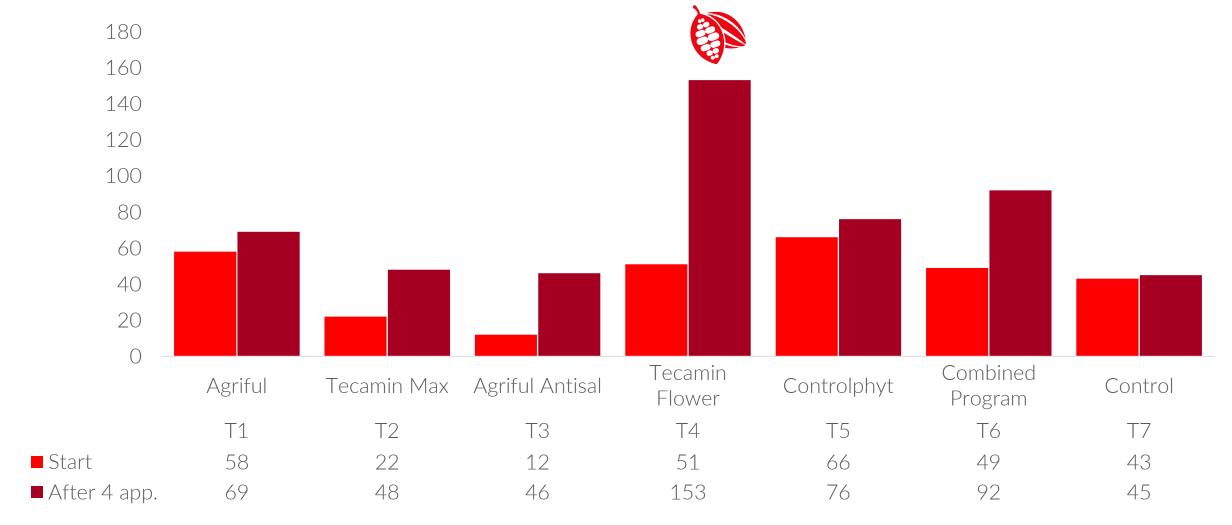






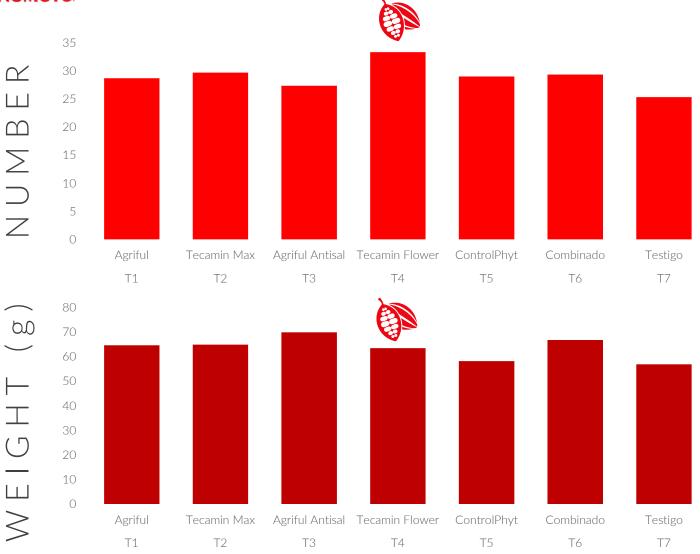


Results: Number of Flowers





Results: Fruits



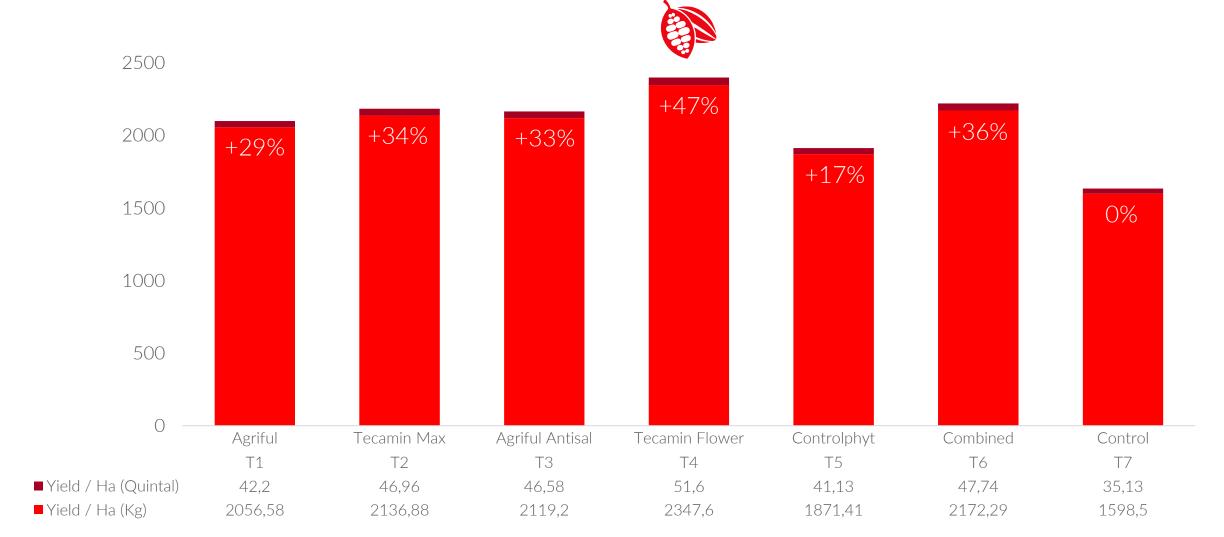
Treatment	Products	Fruit Number	Fruit Weight (g)	Yield / Plant (g)
T1	Agriful	28.67	64.57	1 851.11
Т2	Tecamin Max	29.67	64.83	1 923.39
Т3	Agriful Antisal	27.33	69.79	1 907.47
Т4	Tecamin Flower	33.33	63.40	2 113.06
T5	Controlphyt	29.00	58.08	1 684.44
Т6	Combined	29.33	66.66	1 955.26
Т7	Control	25.33	56.80	1 438.79







Results: Yield





Results: Conclusion



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.

- 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.







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