Thesis Summary: Sweet Peppers, Quevedo University – Ecuador, 2022

Time

- Planting date: 09/19/2021
- First harvest: 12/27/2021
- Published: 2022

Location

Quevedo State Technical University

Faculty of Agricultural Sciences

“La María” Campus, State Technical University of Quevedo, Los Ríos, Ecuador.

Details

- Author: Velásquez Intriago María Eliana
- Director: Ing. Agric. Leonardo Gonzalo Matute, M.Sc.
- The thesis aimed to investigate the efficacy of Kyminasi Plants Crop Booster (KPCB) technology in boosting plants growth and health parameters. It was performed in a microsprinkler irrigation system, implemented in two pepper fields, one treated with KPCB and one Control. Each of these fields had three (3) varieties, with four (4) repetitions each.
- Weed control: weeds were removed manually every 15 days, using hand tools.

Species

- Pepper (Capsicum annuum L.)
- Varieties: Cubanelle, Marconi, and California Wonder.

Area

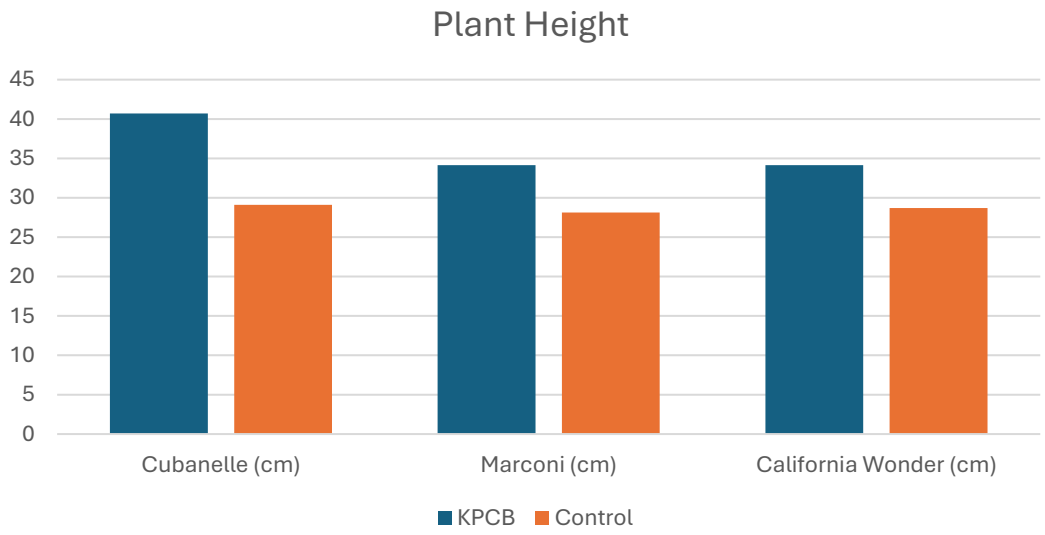
The trial was conducted on an area of 86.4 m^2.

Results

Plant Height

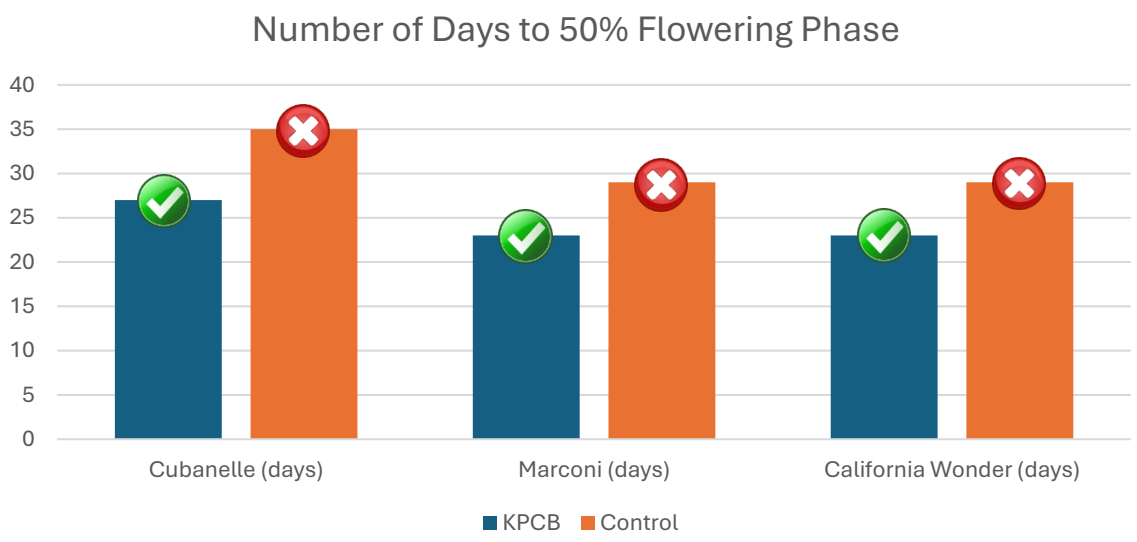
The largest difference in plant height was obtained in the peppers of Cubanelle variety, where plants treated with KPCB achieving 40% bigger height. In the Marconi and California Wonder varieties the gains in plant height were 21% and 19%, respectively.

Variety	Treatment		Gain
	KPCB	Control	
Cubanelle (cm)	40.70	29.10	**40%**
Marconi (cm)	34.15	28.12	**21%**
California Wonder (cm)	34.15	28.70	**19%**



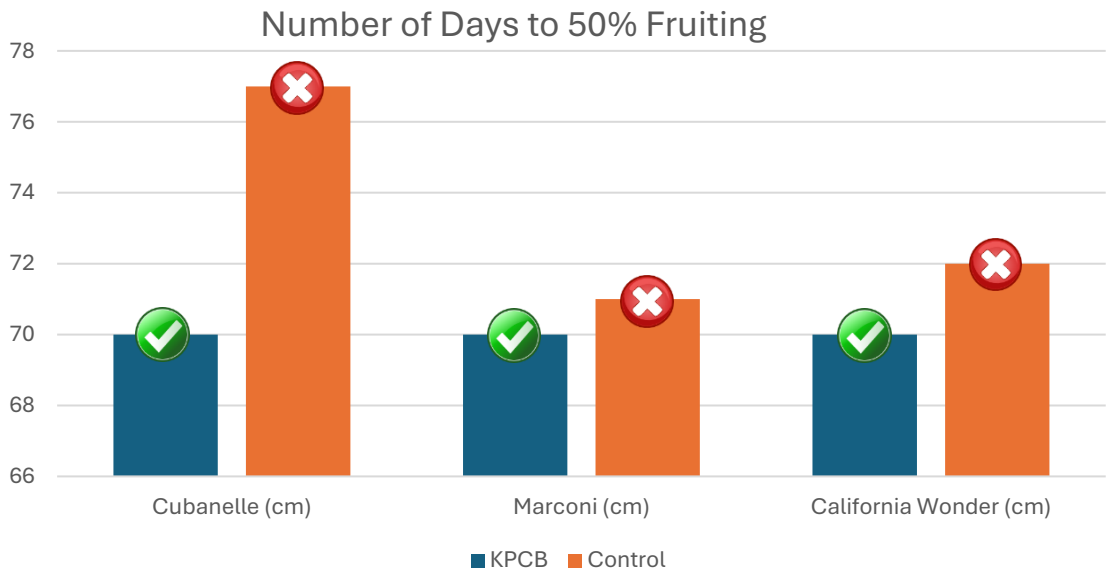
Number of Days to 50% Flowering

Variety	Treatment		Gain
	KPCB	Control	
Cubanelle (days)	27	35	**23% faster**
Marconi (days)	23	29	**21% faster**
California Wonder (days)	23	29	**21% faster**



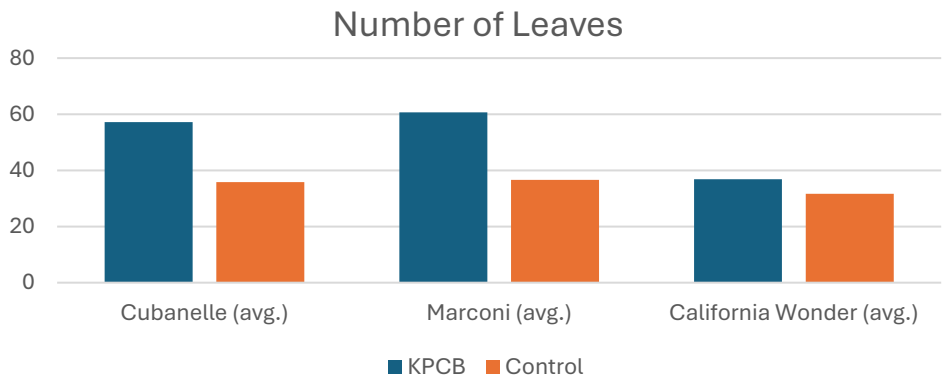
Number of Days to 50% Fruiting

Variety	Treatment		Gain
	KPCB	Control	
Cubanelle (days)	70	77	**9% faster**
Marconi (days)	70	71	**1% faster**
California Wonder (days)	70	72	**3% faster**



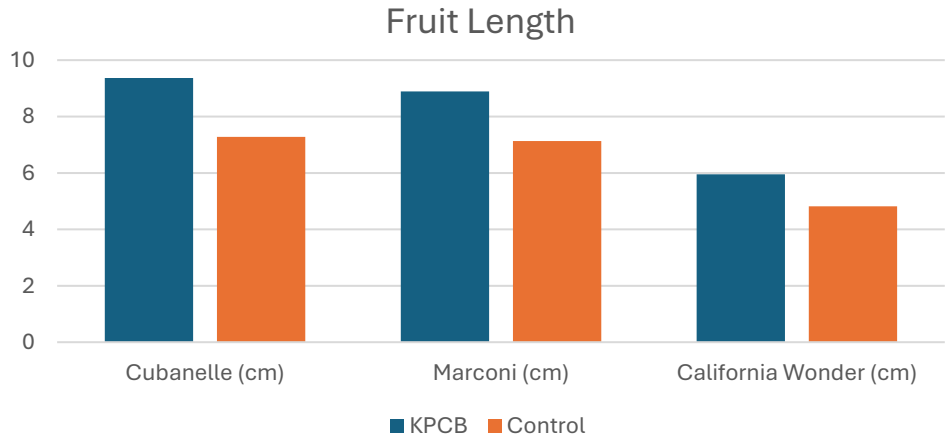
Number of Leaves

Variety	Treatment		Gain
	KPCB	Control	
Cubanelle (avg.)	57.20	35.85	**60% more leaves**
Marconi (avg.)	60.70	36.65	**66% more leaves**
California Wonder (avg.)	36.85	31.65	**16% more leaves**



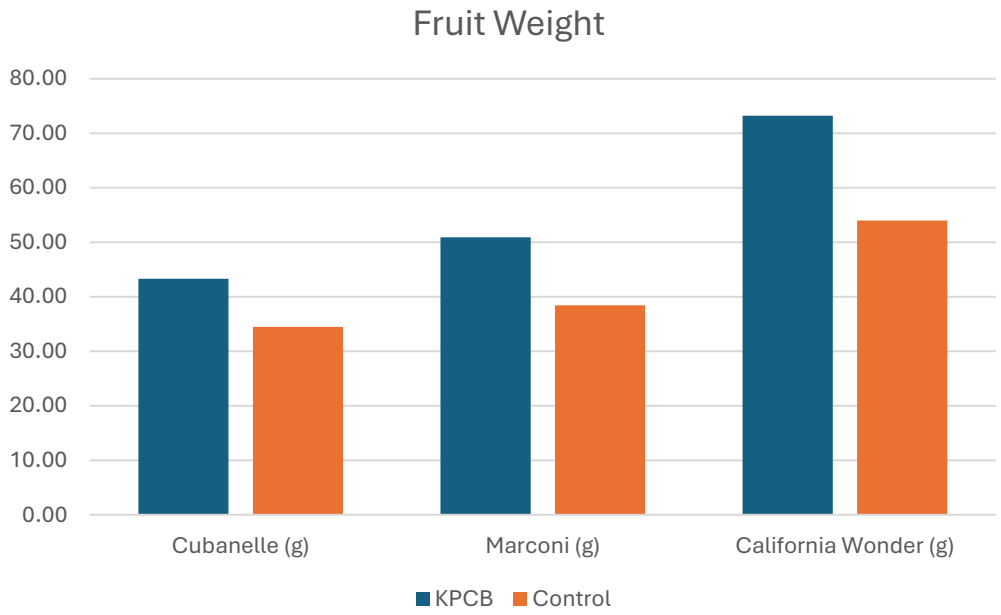
Fruit Length

Variety	Treatment		Gain
	KPCB	Control	
Cubanelle (cm)	9.4	7.3	**29% longer**
Marconi (cm)	8.9	7.1	**25% longer**
California Wonder (cm)	6.0	4.8	**23% longer**



Fruit Weight

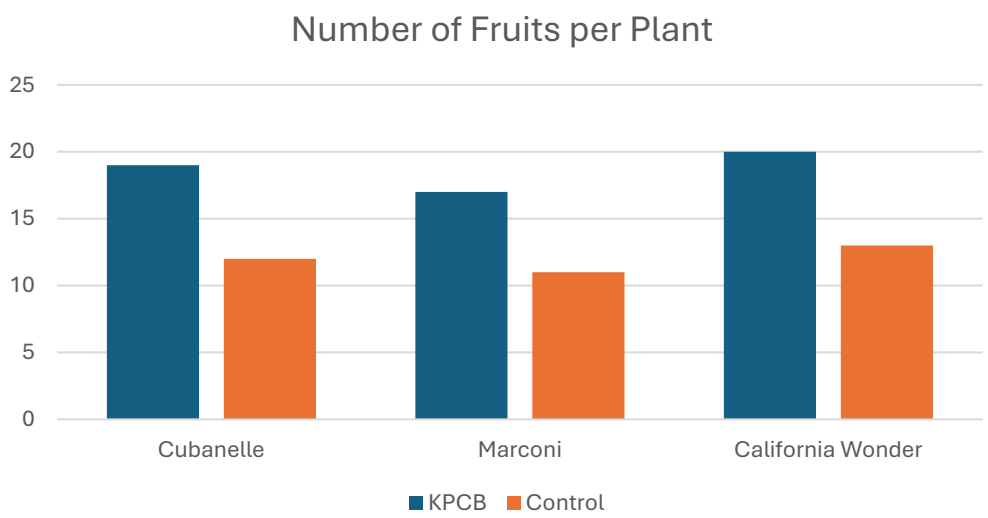
Variety	Treatment		Gain
	KPCB	Control	
Cubanelle (g)	43.32	34.46	**26% heavier**
Marconi (g)	50.90	38.45	**32% heavier**
California Wonder (g)	73.22	54.00	**36% heavier**



Number of Fruits per Plant

The number of fruits per plant is one of the major statistics that relate to sustainability due to reductions in land use, water use, labor, harvest time and other sustainability factors. Hence the importance of this thesis showing a significant fruit per plant increase between 54% and 58% in KPCB treated peppers.

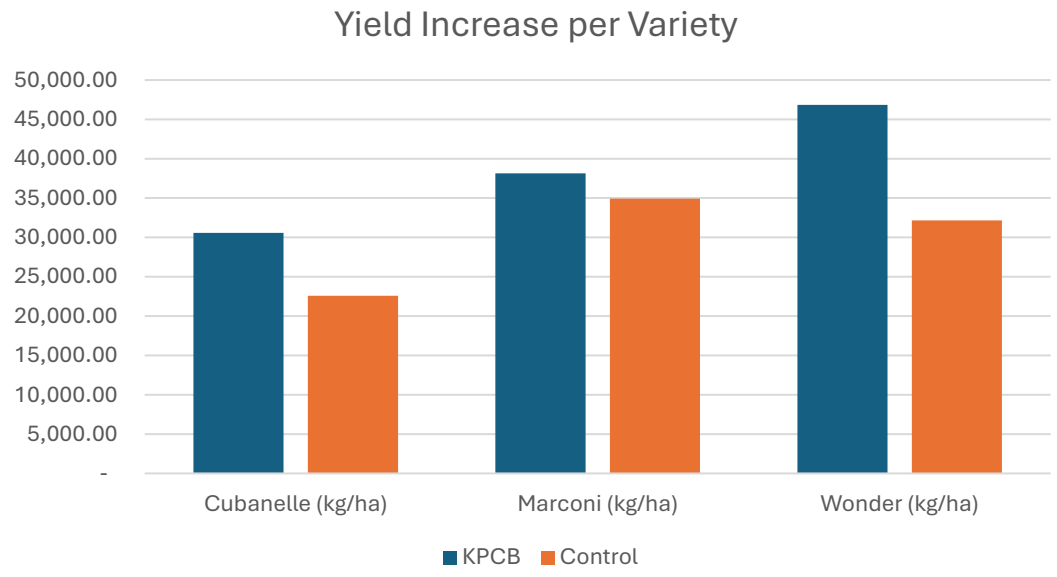
Variety	Treatment		Gain
	KPCB	Control	
Cubanelle (avg.)	19	12	**58% more fruits**
Marconi (avg.)	17	11	**55% more fruits**
California Wonder (avg.)	20	13	**54% more fruits**



Yield Increase per Variety

The data in the table below was taken from the economic analysis.

Variety	Treatment		Gain
	KPCB	Control	
Cubanelle (kg/ha)	30,571.67	22,575.00	**35% higher yield**
Marconi (kg/ha)	38,131.67	34,930.00	**9% higher yield**
California Wonder (kg/ha)	46,838.33	32,171.67	**46% higher yield**
Average:	30,571.67	22,575.00	**30% higher yield**



Cost/Benefit Analysis

The researchers performed an economic analysis of the performance achieved for each treated variety based on its monetary income value and its own production costs.

Treatment	Yield (kg/ha), Raw	Yield (kg/ha), Adjusted**	Gross Income	Cost of treatment	Cost, variable	Cost, total	Benefit, Net	Benefit/ /Cost Ratio	Cost Effective--ness (%)
T1 (Wonder +KPCB)	46838.33	42154.50	14754.07	375.00	5011.99	6211.99	8542.08	2.38	137.51%
T2 (Marconi +KPCB)	38131.67	34318.50	12011.48	375.00	4150.04	5350.04	6661.44	2.25	124.51%
T3 (Cubanelle +KPCB)	30571.67	27514.50	9630.08	375.00	3401.60	4601.60	5028.48	2.09	109.28%
T4 (Wonder, Control)	32171.67	28954.50	10134.08	125.00	3310.00	4510.00	5624.08	2.25	124.70%
T5 (Marconi, Control)	34930.00	31437.00	11002.95	125.00	3583.07	4783.07	6219.88	2.30	130.04%
T6 (Cubanelle, Control)	22575.00	20317.50	7111.13	125.00	2359.93	3559.93	3551.20	2.00	99.75%

System cost (useful life 2 years)	1000.00*	Resale price	0.35	/kg
Irrigation system installation	500.00	Harvest + trans	0.1	/kg
		Fixed cost	1200.00	/ha

* NOTE: the costs of system purchase and installation may be lower for farmers in Ecuador today.

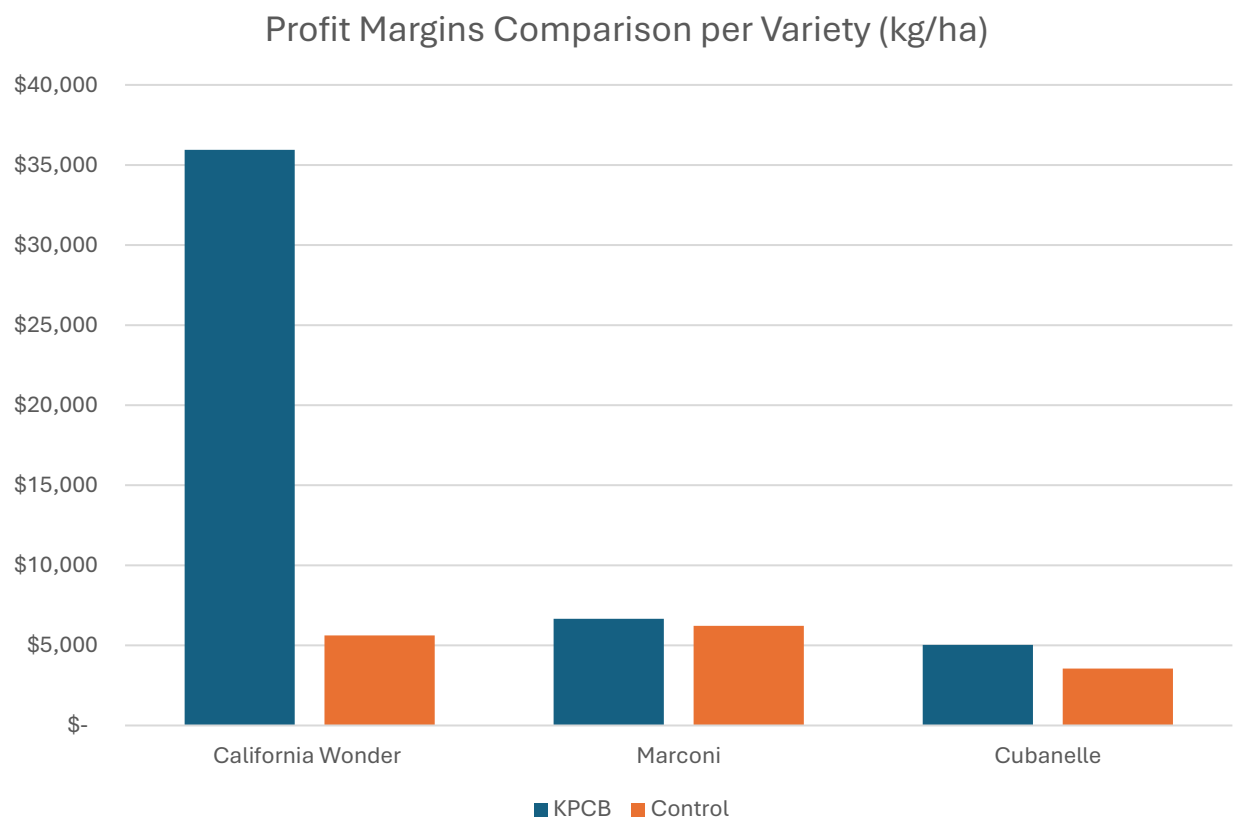
** Ten percent (10%) was deducted from raw yield to get saleable yield in kg/ha.

Based on the economic analysis performed by the researchers, on average the peppers treated with KPCB achieved an average net profit of 64%, in comparison to 54% average profit margin of Control peppers. The pepper varieties California Wonder, Marconi and Cubanelle treated with KPCB achieved 85%, 55%, and 52% Profit Margins, relatively, in comparison to 55%, 57%, and 50% in Control plots. This brought an extra 10% profit on average, or $32,237 in extra profit, per hectare.

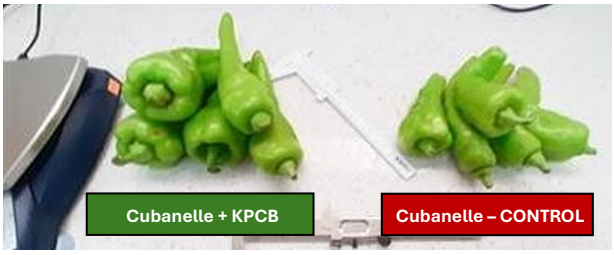
	KPCB				Control			
Variety	Gross Income /ha ($)	Total Costs /ha ($)	Net Profit /ha ($)	Net Profit (%)	Gross Income /ha ($)	Total Costs /ha ($)	Net Profit /ha ($)	Net Profit (%)
CA Wonder	$42,155	$6,212	$35,943	85%	$10,134	$4,510	$5,624	55%
Marconi	$12,011	$5,350	$6,661	55%	$11,003	$4,783	$6,220	57%
Cubanelle	$9,630	$4,602	$5,028	52%	$7,111	$3,560	$3,551	50%
			$47,632	**64%**	avg.		$15,395	54%

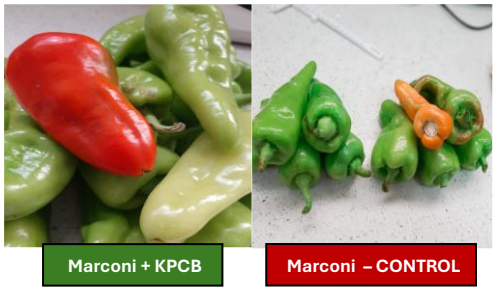
Therefore, the extra profit of KPCB after all expenses was $32,237 per hectare.

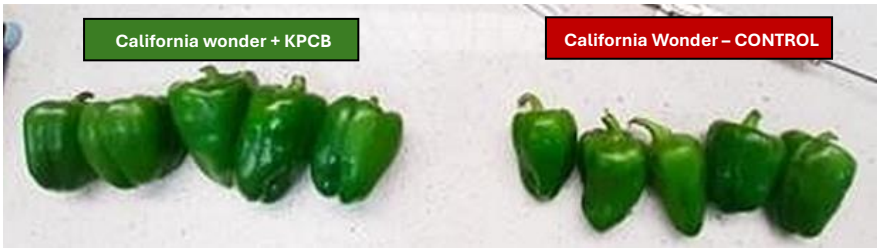
Since the extra 10% was gained after all expenses, a broad implementation of KPCB technology in Ecuador could potentially enrich the country's export of quality sweet peppers.



As can be seen in the harvest analysis photographs below, the peppers produced with KPCB were not only 23%-29% longer and 26%-36% heavier, but also more developed into appealing sweet pepper shapes with richer colors.







According to Robert Hadad, a Cornell University Vegetable Specialist, in a 2017 study he stated that "poor shape gives the appearance of poor quality" and counted color, size, texture, shape, and defects as the main factors determining appeal to buyers and market price.

References:

- Robert Hadad's study: https://rvpadmin.cce.cornell.edu/uploads/doc_645.pdf
- USDA: https://www.ams.usda.gov/grades-standards/vegetables
- Purdue Agriculture: https://ag.purdue.edu/hla/fruitveg/Pages/gradingguide.aspx

A survey of wholesale prices in USA and EU markets reveals same-day ranges of around 300% according to world's agricultural markets real-time data at www.selinawamucii.com/historical-prices/united-states-of-america/capsicum-bell-pepper/. Since the author of this thesis regarded a constant sale price, we further investigated the hypothesis that KPCB peppers might be sold at 10% higher price on average. As can be seen in the table below, such relatively small difference in sale price would bring an average profit of 68%, or $38,617 in extra profit over Control, per hectare.

	KPCB				Control			
Variety	Gross Income /ha ($)	Total Costs /ha ($)	Net Profit /ha ($)	Net Profit (%)	Gross Income /ha ($)	Total Costs /ha ($)	Net Profit /ha ($)	Net Profit (%)
CA Wonder	$46,370	$ 6,212	$40,158	87%	$10,134	$4,510	$5,624	55%
Marconi	$13,213	$ 5,350	$7,863	60%	$11,003	$4,783	$6,220	57%
Cubanelle	$10,593	$4,602	$5,991	57%	$7,111	$3,560	$3,551	50%
			$54,012	**68%**	avg.		$15,395	54%

CONCLUSIONS

In this highly detailed Quevedo University study, the researchers showed the KPCB technology's positive effects on all the development factors of sweet peppers, eventually bringing yields of Marconi, Cubanelle, and California Wonder varieties that were greater than their respective Control by 9%, 35%, and 46%, respectively.

We highly recommend that more trials be performed with these or similar pepper varieties, using our POPS (Profitability Optimization Protocol for Sustainability) program to finetune these results – to achieve the profitability optimum of each variety's own genetics – for the goal of boosting Ecuador's export of quality sweet peppers. Kyminasi Plants Crop Booster (KPCB) technology is recommended to any country interested in growing high quality nutritious food at lower costs.