penergetic p

penergetic
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Anwendungsbericht/User Application Report

Produkt/Product:
penergetic b
art.nr. 3000
penergetic p
art. nr. 4000

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Effects of applying penergetic plant products on productivity and quality of a Hayward kiwi orchard.

This trial was conducted in a Hayward kiwi-producing orchard, located in the municipality of Molina. The orchard is managed to produce fruits for export.

Specific purposes

- To assess the effects of treatments on vegetative growth of kiwi trees.
- To assess the effects of treatments on productivity of kiwi trees.
- To assess the effects of treatments on quality of harvested fruit.

Planting year	Planting spacing	Lot area (ha)	Production per hectare (kg/ha)		
			2019 - 2020	2020 - 2021	2021 - 2022
2012	3*4	6.2	36,098	43,554	35,740

Table 1: Production per hectare 2019-2022

Methodology

Experimental design and treatments

A fully randomized experimental design was established, with 2 treatments and 4 repetitions. Every experimental unit consisted of 30 trees in 3 adjacent rows.

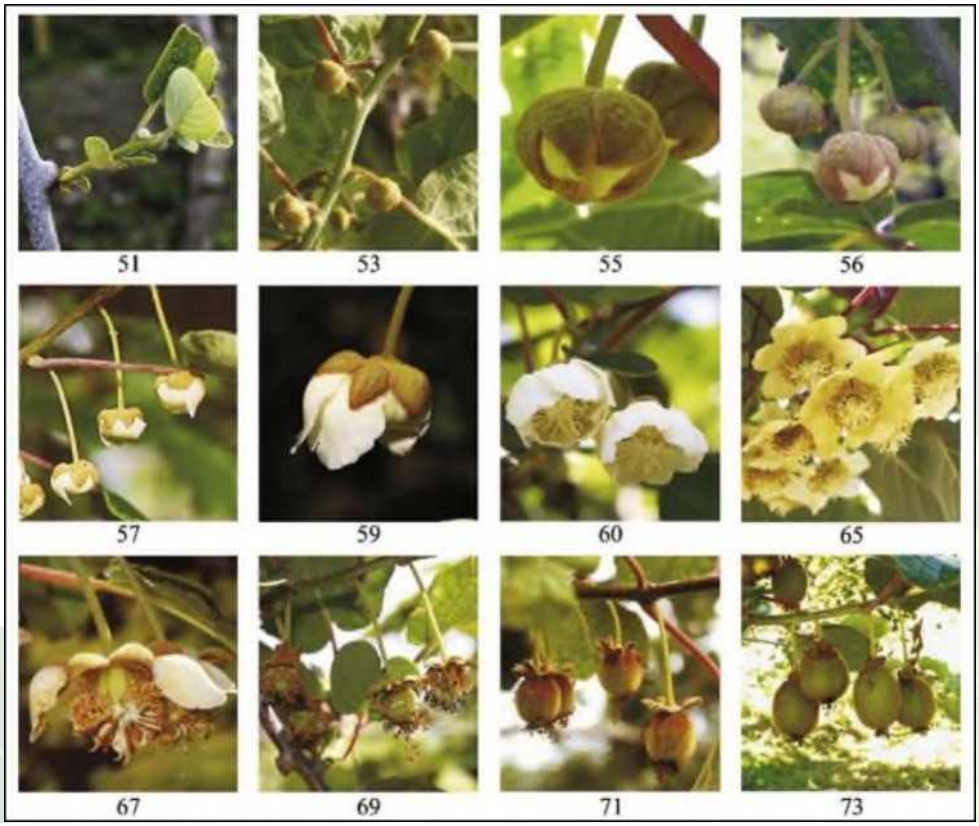
Treatment	Products	Dose (g/ha.)	Season of application	Date of application
T0	Orchard program (No soil activators)			
T1	*penergetic b art. nr. 3000*	1,000	Post-harvest	05.06.2021
		1,000	Late winter (30 days prior to applying penergetic p.)	13.08.2021
	penergetic p art. nr. 4000	300	Sprouting (35* BBCH)	30.09.2021
		300	Flowering (53-61 BBCH)	10.11.2021
		300	Fruit growth (69-71 BBCH)	09.12.2021

Table 2: Description of treatments

Treatment T0 was orchard's traditional management, with no soil activators applied.

Treatment T1 consisted in applying penergetic b for soil and penergetic p for plants as a supplement to the orchard's program.

BBCH scale: *35 BBCH consider sprouting, with 5-cm shoots and no flowers.



Assessments

Base count

To eliminate factors outside the trial, every experimental unit was characterized based on their productive potential. To this end, the following assessments were conducted in the central tree of the experimental unit;

- No. of spurs
- total No. of buds
- No. of vegetative shoots
- No. of fruit shoots.

This information was also used to determine sprouting percentage.

Vegetative growth

During the season, vegetative growth was assessed through fractional cover (FC). This measurement was performed on the central tree of every experimental unit on four occasions throughout the season (November, December, January and February).

Plant productivity

At harvest, plant yield (kg/pl) was measured, which involved fully harvesting the central plant of every repetition and recording their yield independently. In addition, crop load of plants was obtained based on the average weight of 40 representative fruits for every plant, which value was used for estimating number of fruits per plant. Finally, plant productivity was assessed by relating yield to number of shoots or plant spurs.

Quality of harvested fruit

A sample of 40 fruits was obtained from harvested fruit, which were quality-assessed based on the following parameters;

- Fruit weight (g)
- Dry matter (%)
- Soluble solids (%)
- firmness (lb),
- Shape and Category

In addition, a size curve was constructed.

Statistical analysis

Prior to statistical analysis, results expressed as a percentage (%) were transformed into arcsine. Then, all results were to fulfill variance normality and homoscedasticity assumptions. However, when the analyzed data did not fulfill these assumptions, then Kruskal Wallis non-parametric analysis was performed.

When assumptions were fulfilled, then a variance analysis was performed (ANOVA). When ANOVA showed there were significant differences, then an LSD multiple comparison test was performed with 95% significance. All analyses were conducted with InfoStat statistical software (Di Rienzo J.A., Casanoves F., Balzarini M.G., González L., Tablada M., Robledo C.W. InfoStat 2015 release).

Weather conditions

Climate conditions for 2021-22 season were normal for the study area, with winter rainfall and maximum temperatures in summer months (December, January and February).

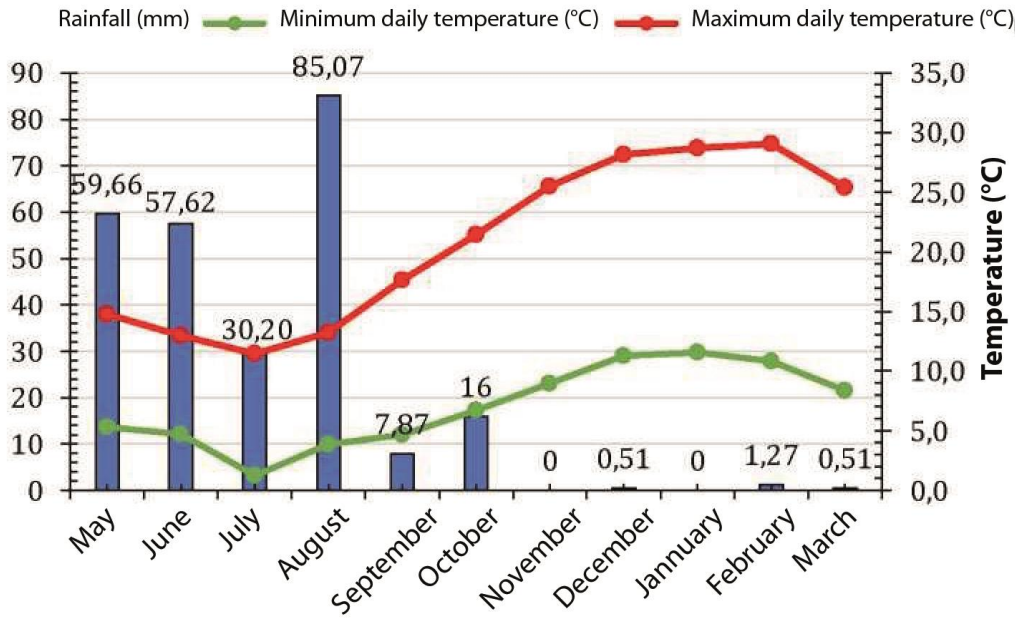


Figure 1: Orchard's weather conditions during the season

Base count

Results suggest there were statistically significant differences in number of spurs per plant between treatments, mainly in T1, with around 22 spurs/pl. In addition, treatments have no significant effect on total number of shoots or sprouting percentage, with around 58% in both treatments. Also, there are no significant differences in number of fruit shoots. However, significant differences can be seen in number of vegetative shoots per plant, mainly in T0.

Treatment	Total No. of spurs	No. of buds/plant	Sprouting %	Fruit shoots/plant	Vegetative shoots/plant
T0	19.3 b	397 a	59.7 a	201.8 a	61 a
T1	22.0 a	511 a	55.0 a	285.6 a	18 b
Sig. (p value)	0.0089	0.1430	0.427	0.124	0.0003

Table 3: Base count of selected trees in each treatment.

Plant productivity

Productivity results show that plant yield is affected by treatments, reaching a statistically higher yield in T1. Concerning productivity parameters, significant differences are noted in fruit grams per spur, mainly in T1, with a clear trend towards increased number of fruits in T1.

Treatment	Productivity				
	kg/pl	kg/ha	No. of fruits/pl	Fruit grams/buds	Fruit grams/flower bud
T0	*51.7* b	36,188b	*449* a	120.6 b	241.2 a
T1	72.3 a	50,600 a	588 a	182.3 a	294.6 a
Sig. (p-value)	*0.0445*	*0.0445*	*0.0981*	*0.0038*	*0.002*

Table 4: Productivity of trees for each treatment.

Quality of harvested fruit

Fruit weight shows statistically significant differences between treatments, with T1 reaching a statistically higher weight than T0. Dry matter, soluble solids and firmness parameters show no statistically significant differences between treatments. No significant differences in shape can be seen, but a slight better shape in T1 is noted.

Treatment	Weight (gr)	Dry matter (%)	Soluble solids (°Brix)	Pressure (lb) -	Shape	
					Ema/P	Eme/Ema
T0	96.0 b	15.0 a	8.8 a	11.6 a	0.93 a	0.89 a
T1	102.6 a	15.5 a	8.6 a	11.3 a	0.89 a	0.91 a
Sig (p value)	*0.0247*	*0.287*	*0.5255*	*0.5513*	*0.1979*	*0.581*

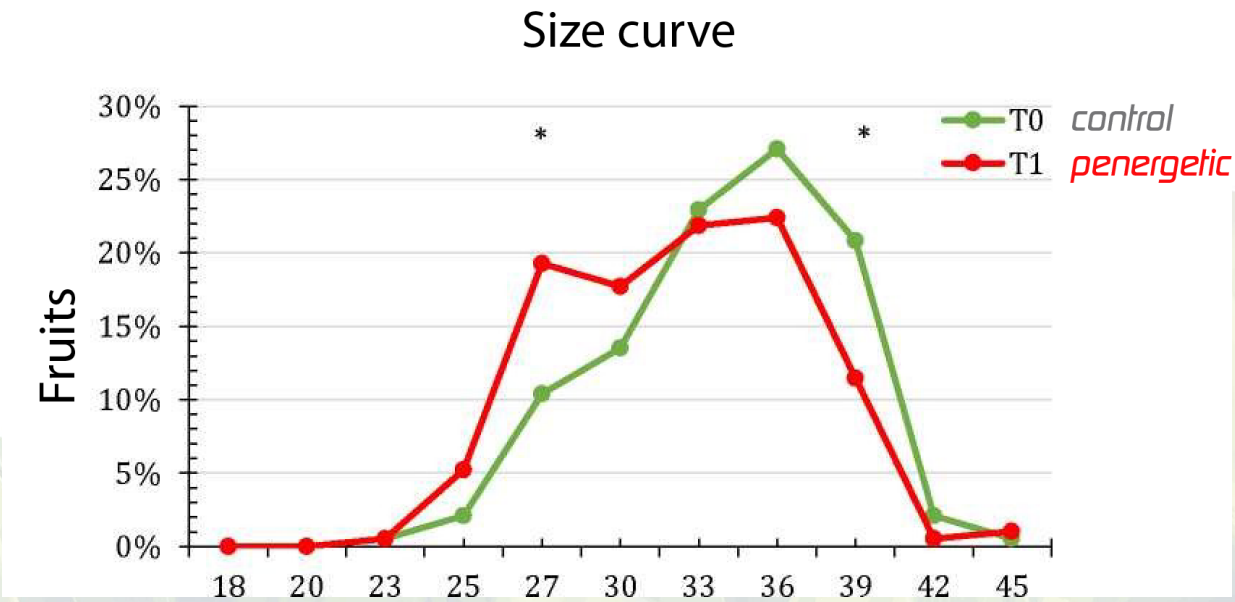
Table 5: Quality parameters for harvested fruit in trees for each treatment.

Concerning fruit category, no statistical difference can be seen between treatments either. However, a high percentage of fruit in CAT 1 is achieved in both treatments.

Treatment	CAT 1	CAT 2	COMMERCIAL
T0	83.5 a	14.5 a	2.0 a
T1	86.3 a	11.3 a	3.0 a
Sig (p-value)	0.633	0.5573	0.721

Table 6: Fruit classification based on export criteria for each treatment.

Concerning size curve, it can be seen that the T1 curve shifts to larger sizes, which shift is statistically significant. The size is to be understood as “number of fruits per box”. Therefore, the smaller the number, the bigger the fruits.



Statistical differences can be seen in sizes 27 and 39, reflecting that T1 fruit is larger in size than T0 fruit.

Table 7. Fruit distribution (%) by size in both treatments.

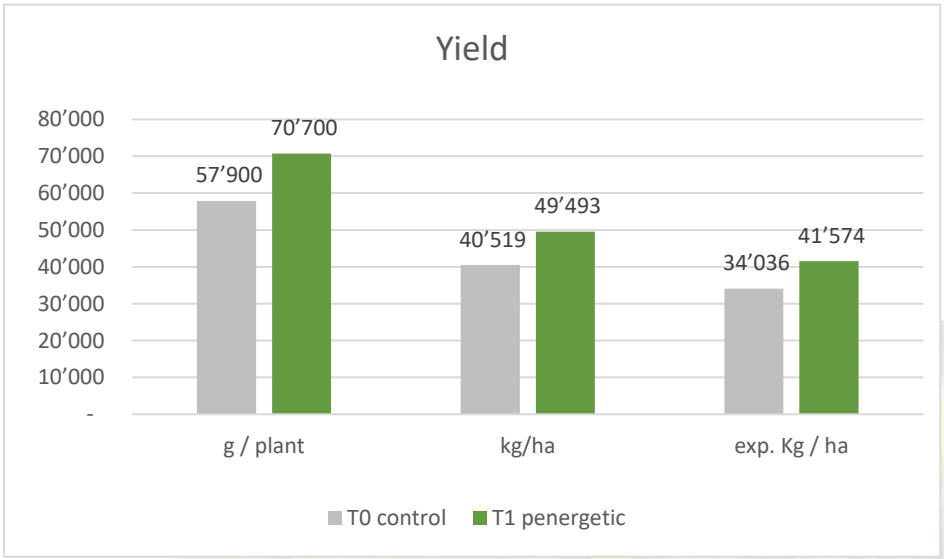
Treatment	23	25	27	30	33	36	39	42	45
T0	0.6 a	2.0 a	10.4 b	13.8 a	23.0 a	27.2 a	21.0 a	2.0 a	0.6 a
T1	0.6 a	5.0 a	19.4 a	17.8 a	22.0 a	22.4 a	11.2 a	0.3 a	0.8 a
Sig (p-value)	0.815	0.115	0.023	0.0635	0.3746	0.6355	0.0117	0.0524	0.815

Economic analysis (yield and size)

For the economic analysis, yield adjustments were made.

Since T1 shows a higher number of fruit shoots/pl, which may have influenced yields obtained, yields were reconstructed by using a fixed number of fruit shoots/pl in both treatments (240), to then multiply these by fruit grams per fruit shoot for each treatment, resulting in the following yields to be used in the statistical analysis.

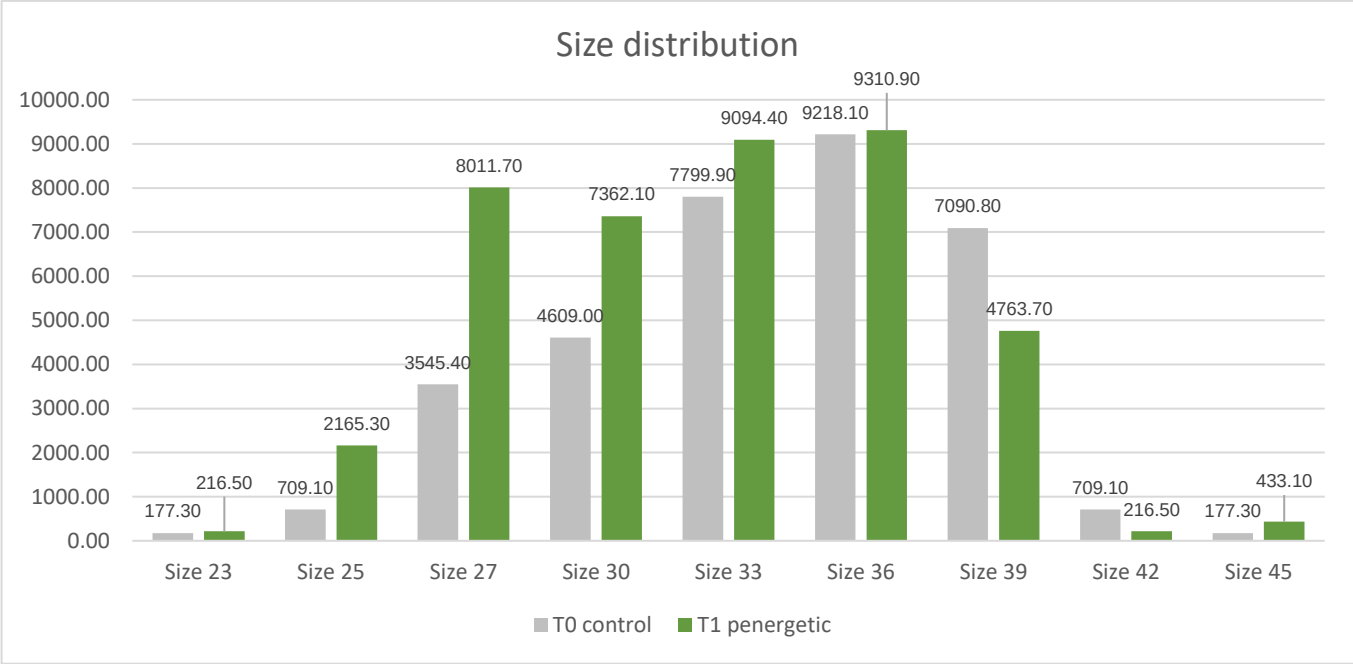
Treatment	Fruit shoots/pl	Fruit grams/ fruit shoot	Yield kg/pl	Yield kg/ha	Yield exp. kg/ha
T0	240	241.2	57.9	40,519	34,036
T1	240	294.6	70.7	49,493	41,574



Subsequently, using the specific size curve for each treatment, fruit kilograms per size were determined in both treatments (Table 8).

Table 8. Fruit yield (kg) per size for each treatment.

Treatment	23	25	27	30	33	36	39	42	45
T0	177.3	709.1	3,545.4	4,609.0	7,799.9	9,218.1	7,090.8	709.1	177.3
T1	216.5	2,165.3	8,011.7	7,362.1	9,094.4	9,310.9	4,763.7	216.5	433.1



Upon obtaining fruit kilograms per size, income per size was estimated based on average number of fruits sold per size for season 2021-22.

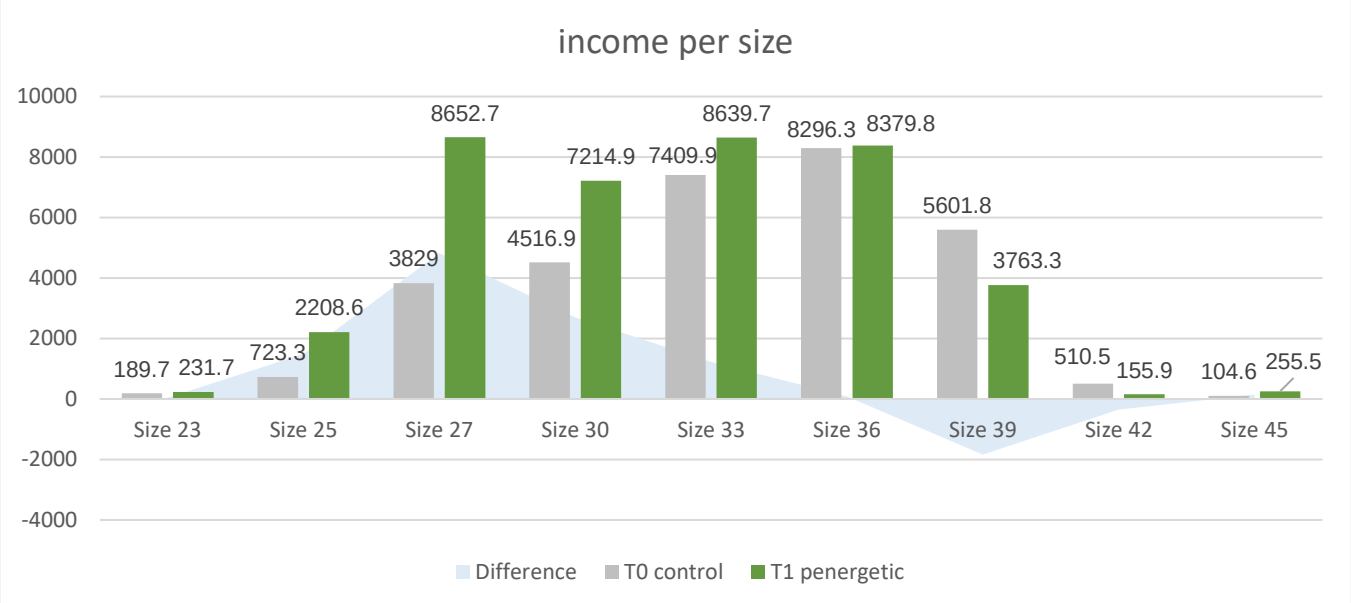
Table 9. Grower's average seasonal return per size.

Season	Sizes									
	20	23	25	27	30	33	36	39	42	45
2021-22	1.08	1.07	1.02	1.08	0.98	0.95	0.90	0.79	0.72	0.59

This analysis shows that grower's income in T0 was US$31,182. However, income amounted to US$39,502 with the application of treatment T1.

Table 10. Grower's income per size of harvested fruit in each treatment.

Treatment	US$ per size									
	23	25	27	30	33	36	39	42	45	Total US$
T0	189.7	723.3	3,829.0	4,516.9	7,409.9	8,296.3	5,601.8	510.5	104.6	31,181.9
T1	231.7	2,208.6	8,652.7	7,214.9	8,639.7	8,379.8	3,763.3	155.9	255.5	39,502.1



Income difference is US$8,320, which is achieved with an extra cost of US$200 due to the application of penergetic b and penergetic p product. In addition, if we relate income to kilograms produced, US$0,92/kg is achieved in T0 and US$0,95/kg in T1, which results from improved size.

CONCLUSION

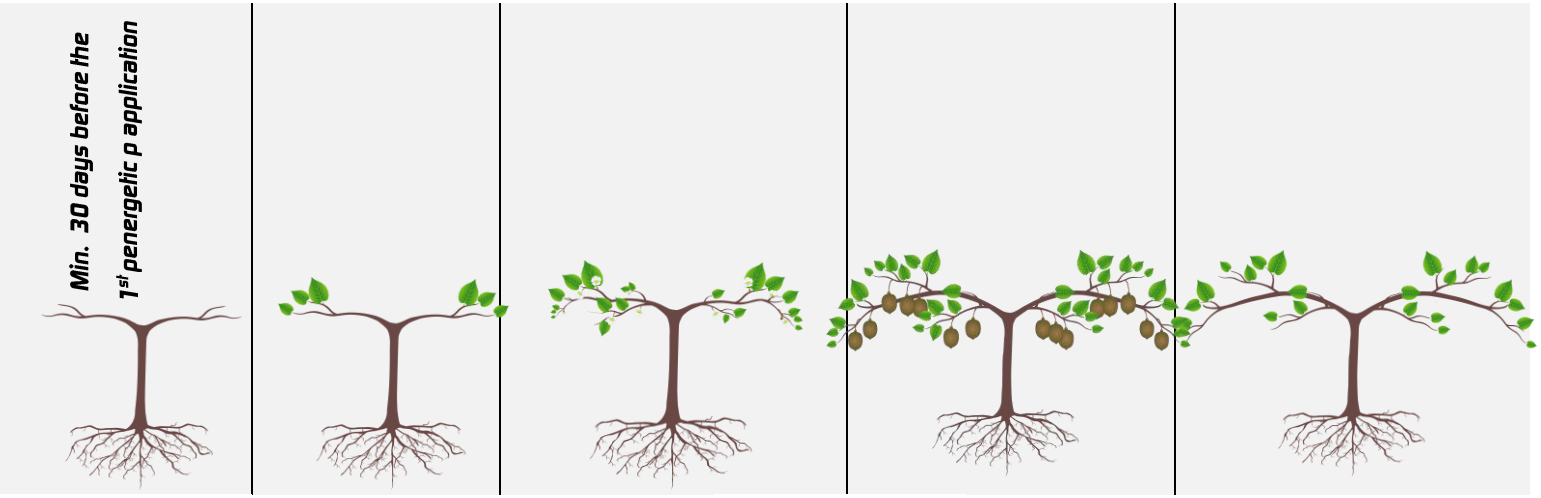
Study results show that applying penergetic (penergetic b and penergetic p) products had no statistically significant influence on vegetative growth of plants. However, optimal values of vegetative growth were achieved in both treatments.

Concerning the effects on tree productivity, results show that applying penergetic b and penergetic p did have a significant influence on tree yield and that in trees treated with penergetic, despite having a greater number of spurs, fruit grams per spur are still higher than T0 (control).

Concerning fruit quality, no significant effect can be seen on pressure, dry matter, soluble solids or shape. However, a statistically higher fruit weight is noted in trees treated with penergetic. This increased weight is also reflected in the size curve, with fruits of these trees being larger in size.

Lastly, we can conclude that applying penergetic b and penergetic p products during season 2021-22 had a significant influence on productivity of a Hayward kiwi orchard located in the municipality of Molina in Chile.

KIWI



Period / BBCH	before season	35	53 - 61	69 - 71	After harvest
	Late winter	Shoots, 35% of final varietal length	Opening of buds at the beginning of flowering; 10% of flowers opened	End of flowering/set, fruit diameter up to 10 mm; unset fruits fall off.	
Product					
penergetic b 3000 – Soil	500g – 3kg/ha				500g – 3kg/ha
penergetic p 4200 – Orchard		300g/ha	300g/ha	300g/ha	

Annex 1: Application & Dosage penergetic in Kiwis