VOL IV

Estudos em Ciências Agrárias e Ambientais

Eduardo Spers
(Organizador)

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APRESENTAÇÃO

É com grande satisfação que apresentamos o volume IV da coletânea **Estudos em Ciências Agrárias e Ambientais**, resultado do esforço colaborativo de pesquisadores de diferentes regiões e instituições, que compartilham aqui reflexões, dados e contribuições relevantes para o avanço do conhecimento técnico-científico em suas áreas de atuação.

Este volume reúne 13 trabalhos organizados em cinco eixos temáticos que refletem a diversidade e complexidade do campo agrário e ambiental contemporâneo: Sistemas de Produção Aquático e Animal; Sustentabilidade Ambiental e Conservação de Recursos Naturais; Sistemas de Produção Vegetal e Agricultura de Precisão e Educação e Inovação no Meio Agrário.

Os temas abordados vão desde o manejo sustentável de recursos naturais, passando por inovações tecnológicas na agricultura e aquicultura, até discussões sobre formação profissional e segurança sanitária nas cadeias produtivas. Essa pluralidade é o reflexo da crescente interdisciplinaridade que caracteriza os estudos agrários e ambientais hoje – exigindo diálogos entre a ciência, a tecnologia, a educação, a economia e a sociedade.

Além da qualidade dos estudos apresentados, destacamos o compromisso dos autores com a pesquisa aplicada, a sustentabilidade e a busca por soluções adaptadas às realidades locais, muitas vezes desafiadoras. A presença de autores da América Latina e Europa também fortalece o caráter internacional da obra, fomentando o intercâmbio de experiências e metodologias.

Agradecemos a todos os autores pela confiança em compartilhar seus trabalhos conosco. Que esta publicação possa inspirar novas pesquisas, colaborações e, acima de tudo, práticas que contribuam com a construção de sistemas agrários e ambientais mais resilientes, justos e inovadores.

Desejamos a todos uma excelente leitura!

Eduardo Eugênio Spers

SUMÁRIO

CAPÍTULO 10

CALCIUM CARBONATE APPLIED TO THE SUBSTRATE AND FOLIAR SPRAY IN TOMATO AND BELL PEPPER[1]

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ABSTRACT: The objective was to determine if the applications of calcium carbonate to the substrate and foliar spray influence the color and the quality of the tomato and bell pepper grown under greenhouse. The work was carried out in a 300 m^2 greenhouse, 'Closter' tomato and 'Canon' bell pepper plants were used, in both species a factorial experiment 5^2 bounded to 13 treatments to evaluate linear, quadratic response surface and factor interaction. In both crops, the application concentrations of calcium carbonate to the substrate ranged from 0 to 12800 kg ha^{-1}, while foliar spray ranged from 0 to 15.36 kg ha^{-1}, the variables evaluated were color L* a* b*, polar diameter and equatorial diameter. In tomato

[1] Project: Development of an Agricultural Calcium Amendment Based on a Byproduct Generated by the Cement Industry CONACYT-PROINNOVA, Cements of Chihuahua Group, Autonomous University of Chihuahua.

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fruit affected more red they were treated with 6269.7 kg ha^{-1} $CaCO_3$ to the substrate without foliar spray, to have more elongated fruits and wider is necessary to increase the amount of calcium carbonate in foliar sprays; in bell pepper, the most polar diameter was obtained 10,635.0 kilograms per hectare with foliar spray of 1.9 kilograms per hectare, the brightest fruits were achieved with an application of calcium carbonate to the substrate of 226.5 kilograms per hectare and foliar spray 14.3 kilograms per hectare.
KEYWORDS: 'Closter' tomato; 'Canon' bell pepper; color L*a*b*; fruit size; response Surface.

1. INTRODUCCTION

Calcium is an important nutrient to increase the quality and yield in fruit and vegetable crops. The symptoms of the lack of calcium in the fruits of tomato and bell pepper are the apical rot, burns in the new growths and death in the points of growth so much in the roots as in the shoots. During the ripening of the fruits of the tomato and sweet pepper the quality properties are affected such as firmness, diameter of the fruit, color and the shelf life is reduced, but with the applications of calcium carbonate to the soil and foliar before the pinch of the fruits you can improve these quality parameters.

Open field crops with acid soils and high salt content, calcium deficiency in fruits is more common. Cultures in calcareous soils (high in $CaCO_3$) require calcium intake, because this element is not necessarily available to plants as it has low solubility.

The quality of the fruits of the bell pepper and fresh tomato is evaluated using the intensity of the red color as a basic criterion. This determination was made using a Minolta L*, a* and b* reflection colorimeter, which is based on the use of trigonometric functions. In the CIE-L*a*b* color measurement system, the L* coordinate measures darkness to light, a* represents red if it is positive and green if it is negative, b* corresponds to yellow if it is positive and blue if it is negative.

The CIE-L* a* b* color space describes all the colors that the human eye can perceive from its three coordinates: L* a* b* and is accepted internationally to evaluate the color in food and other products industrialized (León *et al.*, 2006; Pérez *et al.*, 2009; Jha *et al.*, 2010; Pathare *et al.*, 2013). Another of the systems used to transmit color values is the CIE space L* C* h*, which is a polar representation of the CIE system L* a* b*, with cylindrical coordinates (L* C* h*) instead of rectangular coordinates (McGuirre, 1992; Carvajal *et al.*, 2011; Pathare *et al.*, 2013).

Although calcium is classified as a secondary nutrient, it is involved in numerous biochemical and morphological processes of plants and has been implicated in many physiopathies of considerable economic importance for the post-harvest production and quality of fruits and vegetables.

The color of the fruit is an external characteristic and a method to determine the degree of ripening of fruits and vegetables, the objective of this study was to determine if applications of calcium carbonate to the soil and foliar during pre and post harvest influence the color of the epicarp and the quality of the fruit of tomato and bell pepper grown under greenhouse.

2. MATERIALS AND METHODS

The work was carried out in a 300 m^2 greenhouse, equipped with extractors, wood-based central heating, drip irrigation system, moderately automated. 'Closter' tomato and 'Canon' bell pepper plants were used, both planted in pen-type substrate bags with 3 plants for each bag 100 cm long X 15 cm high X 20 cm wide, with an approximate weight of 3 kg capacity. In both species a factorial experiment 5^2 bounded to 13 treatments was used, each treatment consisted of 5 repetitions and in turn each repetition of two bags (pens) with three plants each (Table 1). The application levels for each type (substrate and foliar) were divided into four separate applications spaced 7 days, the variables evaluated were color L* a* b*, polar diameter and equatorial diameter.

Table 1. Factors and levels for foliar and substrate applications in tomato and bell pepper.

Factors	levels				
	1	2	3	4	5
Tomato					
Calcium Carbonate kg (CaO) ha^{-1} (Substrate)	0.0	1600	3200	6400	12800
Calcium Carbonate (Ca) kg ha^{-1} (Foliar)	0.0	1.92	3.84	7.68	15.36
Bell pepper					
Calcium Carbonate kg (CaO) ha^{-1} (Substrate)	0.0	1600	3200	6400	12800
Calcium Carbonate (Ca) kg ha^{-1} (Foliar)	0.0	1.92	3.84	7.68	15.36

3. RESULTS AND DISCUSSION

Color changes in ripe fruits take place as a result of the degradation of chlorophyll and an increase in carotene content. The tomato fruits that presented a greener color (a* = -4.0) were with a dose of calcium carbonate of 6,400.0 kg ha^{-1} to the substrate and 7.7 kg ha^{-1} foliar, progressively increasing the red color to the coordinate a* of 2.0 with calcium carbonate to the soil 6,269.7 kg ha^{-1} while the leaf decreased to 0.0 kg ha^{-1} (Table 2). The a* color in red pepper decreased from 22.7 to 22.5 in red, which implied a decrease in calcium carbonate applied to the substrate to 1,842.9 kg ha^{-1} and an increase in foliar applications to 13.0 kg ha^{-1}.

Table 2. Maximum[X] response surface for color a* in tomato and bell pepper.

		Tomato				Bell pepper	
		factors				factors	
Regression		$CaCO_3$ Substrate	$CaCO_3$ Foliar	Regression		$CaCO_3$ Substrate	$CaCO_3$ Foliar
		0.5645[W]	0.1183			0.5828	0.1173
Lineal (L)	0.1574[W]			Lineal (L)	0.1450		
Cuad. (C)	0.1810			Cuad. (C)	0.1177		
Products	0.6470			products	0.5683		
Model	0.2124	R^2 0.5760 CV -112.86	μ -2.2	Model	0.1559	R^2 0.6198 CV 24.17	μ 17.1
Color	SE[Z]	Kg ha^{-1}	kg ha^{-1}	Color	SE	Kg ha^{-1}	kg ha^{-1}
-4.0	1.49	6400.0	7.7	22.7	2.49	6400.0	7.7
-3.7	1.45	6256.2	6.9	23.1	2.51	6187.7	8.4
-3.4	1.40	6198.1	6.2	23.3	2.51	5906.5	9.1
-3.0	1.35	6176.1	5.4	23.5	2.47	5555.3	9.7
-2.5	1.30	6172.0	4.6	23.6	2.42	5138.8	10.4
-1.9	1.24	6178.0	3.8	23.6	2.35	4666.8	10.9
-1.3	1.23	6190.2	3.1	23.5	2.27	4151.0	11.4
-0.6	1.26	6206.5	2.3	23.4	2.20	3602.6	11.9
0.2	1.36	6225.7	1.5	23.1	2.16	3030.7	12.3
1.0	1.53	6246.9	0.8	22.8	2.17	2442.5	12.7
2.0	1.77	6269.7	0.0	22.5	2.24	1842.9	13.0
Predicted fixed point		critical values decrypted		Predicted fixed point		critical values decrypted	
-4.20		4768.57	9.79	23.58		4907.26	10.64

[x]Ridge analysis; μ Overall mean, C.V. Coefficient of variation, R^2 Coefficient of determination. [W]probability of F: Pr ≥ 0.05 Not significant, Significant 0.05 ≤ Pr ≤ 0.01, highly significant Pr ≤ 0.01 Y Response (Pr> | t |) significant linear (L), quadratic (C), significant products of that nutrient with the rest; [Z]Standard error.

The color a* in bell pepper Table 2, indicates that to increase from a value of 22.7 to 23.6 4% increase, in the application of calcium carbonate to the substrate from 6400.0 to 4666.8 kg ha^{-1} it is necessary decrease 37%, and an increase in foliar from 7.7 to 10.9 L ha^{-1}. From a color a* of 23.6 there is a decrease of the red color to 22.5 with a decrease in the amount of calcium carbonate applied to the substrate 1842.9 kg ha^{-1} and an increase in foliar applications to 13.0 L ha^{-1}.

In Table 3, the response surface for color b in tomato and bell pepper yields the following values, the general average for color in tomato was 27.4 with a coefficient of determination R^2 0.5601 and a coefficient of variation of 3.14. The bell pepper presented a color average of 13.8 and a coefficient of determination R^2 0.5808 and a coefficient of variation of 7.24. The factors are applications of $CaCO_3$ to the soil and foliar, with different levels.

In tomato, the range in color b* fluctuated from 27.0 to 28.4 increase 5%, with an increase of calcium carbonate from 6400.0 to 7525.8 Kg ha^{-1} ibcrease to the substrate by 18% and a decrease of foliar $CaCO_3$ from 7.7 to 0.1 L ha^{-1}. This indicates that the fruit enters a ripening stage so that the yellow color increases as the tomato fruit matures.

Table 3. Maximum[X] response surface for color b* in tomato and bell pepper under greenhouse conditions, treated with calcium carbonate in substrate and leaf application

		Tomato				Bell pepper	
		factors				factors	
Regression		$CaCO_3$ Substrate	$CaCO_3$ Foliar	Regression		$CaCO_3$ Substrate	$CaCO_3$ Foliar
		0.9681[W]	0.9415			0.3622	0.2386
Lineal (L)	0.1004[W]			Lineal (L)	0.1106		
Cuad. (C)	0.8141			Cuad. (C)	0.2472		
products	0.2014			products	0.7268		
Model	0.2350	R^2 0.5601 CV 3.14	μ 4.27	Model	0.2057	R^2 0.5808 CV 7.24	μ 13.8
Color b	SE[z]	Kg ha^{-1}	kg ha^{-1}	Color b	SE	Kg ha^{-1}	kg ha^{-1}
27.0	0.52	6400.0	7.7	14.8	0.60	6400.0	7.7
27.1	0.51	6348.6	6.9	14.9	0.61	6011.0	8.3
27.2	0.49	6367.5	6.1	15.0	0.60	5612.1	8.9
27.4	0.47	6436.7	5.4	15.0	0.59	5204.4	9.5
27.5	0.45	6541.4	4.6	15.1	0.58	4788.6	10.1
27.6	0.44	6671.5	3.9	15.1	0.56	4365.5	10.6
27.8	0.44	6820.3	3.1	15.1	0.55	3935.8	11.2
27.9	0.45	6982.9	2.3	15.1	0.53	3499.9	11.8
28.1	0.48	7156.2	1.6	15.1	0.52	3058.6	12.3
28.3	0.53	7337.7	0.9	15.1	0.53	2612.2	12.9
28.4	0.61	7525.8	0.1	15.1	0.54	2161.2	13.4
Predicted fixed point		critical values decrypted		Predicted fixed point		critical values decrypted	
26.89		-2.54	11.23	15.13		3550.4	11.71

[x]Ridge analysis; μ Overall mean, C.V. Coefficient of variation, R^2 Coefficient of determination. [W]probability of F: Pr ≥ 0.05 Not significant, Significant 0.05 ≤ Pr ≤ 0.01, highly significant Pr ≤ 0.01 Y Response (Pr> | t |) significant linear (L), quadratic (C), significant products of that nutrient with the rest; [Z]Standard error.

The color b* in bell pepper Table 3, indicates that to increase from 14.8 to 15.1 by 2% it is necessary to reduce calcium carbonate from 6400.0 to 2161.2 kg ha^{-1} by 66%, increasing foliar carbonate from 7.7 to 13.4 L ha^{-1} in 74%. In the red pepper, the increase in yellow color is related to the decrease in calcium carbonate to the soil and an increase in foliar applications.

In Table 4, the response surface for color L* in bell pepper and tomato, gave as a response a general average of 54.0 in color L*, a coefficient of determination of R^2 0.4233 and a coefficient of variation of 7.92 in tomato. In bell pepper I present a general average of 34.7 in color L*, coefficient of determination R^2 0.5447 and coefficient of variation 2.12.

In the tomato crop, the following $CaCO_3$ factors were carried out on the substrate and foliar with different levels, resulting in the treatment of 6400.0 Kg ha^{-1} to the soil and 7.7 L ha^{-1} foliar of $CaCO_3$, which presented the fruits brighter, but by increasing the $CaCO_3$ to the ground to 12704.0 kg ha^{-1} and decreasing the $CaCO_3$ to a level of 6.4 L ha^{-1}, fruits with less bright were obtained. So, to obtain brighter fruits in tomato it is necessary to increase the $CaCO_3$ to the ground by 99%, and decrease the amount in foliar applications by up to 17%.

Table 4. Maximum[X] response surface for color L* in tomato and bell pepper under greenhouse conditions, treated with calcium carbonate in substrate and leaf application.

Tomato				Bell pepper			
		factors				factors	
Regression		$CaCO_3$ Substrate	$CaCO_3$ Foliar	Regression		$CaCO_3$ Substrate	$CaCO_3$ Foliar
		0.7343[W]	0.5336			0.4946	0.2200
Lineal (L)	0.9470[W]			Lineal (L)	0.0643		
Cuad. (C)	0.8637			Cuad. (C)	0.9833		
products	0.8960			Products	0.9453		
Model	0.9922	R^2 0.4233 CV 7.92	μ 54.0	Model	0.2580	R^2 0.5447 CV 2.12	μ 34.7
Color L*	SE[Z]	Kg ha^{-1}	kg ha^{-1}	Color L*	SE	Kg ha^{-1}	kg ha^{-1}
58.8	2.59	6400.0	7.7	34.7	0.44	6400.0	7.7
58.8	2.60	7009.0	7.4	34.8	0.45	6037.3	8.3
58.8	2.59	7633.6	7.3	34.9	0.44	5685.8	9.0
58.8	2.57	8263.6	7.1	35.0	0.44	5344.9	9.6
58.6	2.55	8896.1	7.0	35.0	0.43	5014.4	10.3
58.5	2.54	9529.7	6.9	35.1	0.42	4693.9	10.9
58.2	2.55	10164.0	6.8	35.2	0.41	4382.9	11.6
57.9	2.62	10799.0	6.7	35.3	0.40	4081.0	12.3

57.5	2.74	11433.0	6.6	35.4	0.40	3787.9	13.0
57.1	2.96	12068.0	6.4	35.5	0.41	3503.2	13.7
56.6	3.26	12704.0	6.4	35.6	0.44	3226.5	14.3
Predicted fixed point		critical values decrypted		Predicted fixed point		critical values decrypted	
58.85		7280.9	7.36	42.24		-288142	-60.88

[x]Ridge analysis; μ Overall mean, C.V. Coefficient of variation, R^2 Coefficient of determination. [W]probability of F: Pr ≥ 0.05 Not significant, Significant 0.05 ≤ Pr ≤ 0.01, highly significant Pr ≤ 0.01 Y Response (Pr> | t |) significant linear (L), quadratic (C), significant products of that nutrient with the rest; [Z]Standard error

In bell pepper, the brightness in the fruit increased from 34.7 to 35.6 the color L* in 3%, with the decrease in the dose of $CaCO_3$ from 6400 to 3226.5 Kg ha^{-1} in 50%, and increasing the leaf $CaCO_3$ from 7.7 up to 14.3 L ha^{-1} in 86%. This indicates that to increase the brilliance in the fruits it is necessary to decrease the $CaCO_3$ to the soil and increase it foliar.

The response surface for the polar diameter of tomato and bell pepper Table 5, with the $CaCO_3$ factors to the substrate and foliar, with different levels, presented a general average of 58.0 cm, coefficient of determination R^2 0.1460 and a coefficient of variation of 5.54 for tomato. The bell pepper, presented a general average of 82.5 cm, coefficient of determination R^2 0.4317 and coefficient of variation of 3.76.

The polar diameter in tomato increased from 58.0 to 60.2 cm by 4%, by decreasing the concentration of $CaCO_3$ to the soil from 6400.0 to 28.6 Kg ha^{-1} by 99.5%, and an increase in foliar $CaCO_3$ from 7.7 to 8.4 L ha^{-1} in 9% Table 2. For an increase in the polar diameter of the fruit it is necessary to decrease the CaCO3 to the soil and increase the dose via foliar.

The fruit of the bell pepper increased its polar diameter from 80.6 to 84.9 cm by 5%, with an increase in the dose of $CaCO_3$ to the soil from 6400.0 to 10635.0 kg ha^{-1} by 66%, while decreasing the foliar from 7.7 up to 1.9 L ha^{-1} in 75%. To achieve a greater polar size in the fruits it is necessary to increase the dose of $CaCO_3$ to the soil and decrease the concentrations to the foliage.

Table 5. Maximum[X] response surface for polar diameter in tomato and bell pepper under greenhouse conditions, treated with calcium carbonate in substrate and leaf application.

	Tomato			Bell pepper	
	factors			factors	
Regression	$CaCO_3$ Substrate	$CaCO_3$ Foliar	Regression	$CaCO_3$ Substrate	$CaCO_3$ Foliar

		0.8721W	0.8678			0.4609	0.5046
Linear (L)	0.8563W			Linear (L)	0.2348		
Cuad. (C)	0.6609			Cuad. (C)	0.5545		
products	0.9912			products	0.5276		
Model	0.9327	R^2 0.1460 CV 5.54	μ 58.0	Model	0.4530	R^2 0.4317 CV 3.76	μ 82.5
Polar diameter cm	SEZ	Kg ha^{-1}	kg ha^{-1}	Polar diameter cm	SE	Kg ha^{-1}	kg ha^{-1}
58.0	1.94	6400.0	7.7	80.6	1.88	6400.0	7.7
58.1	1.94	5923.8	8.2	80.9	1.86	6795.0	7.1
58.2	1.90	5235.3	8.3	81.1	1.82	7200.0	6.5
58.3	1.85	4564.9	8.4	81.5	1.77	7613.0	5.9
58.5	1.81	3906.7	8.4	81.8	1.71	8032.5	5.3
58.6	1.77	3254.8	8.4	82.2	1.65	8457.4	4.7
58.9	1.78	2606.5	8.4	82.7	1.59	8886.5	1.2
59.1	1.83	1960.3	8.4	83.2	1.54	9319.4	3.6
59.4	1.96	1315.5	8.4	83.7	1.52	9755.3	3.0
59.8	2.16	671.7	8.4	84.3	1.55	10194.0	2.5
60.2	2.44	28.6	8.4	84.9	1.63	10635.0	1.9
Predicted fixed point		critical values decrypted		Predicted fixed point		critical values decrypted	
58.09		6845.46	9.31	79.94		4256.9	11.59

xRidge analysis; μ Overall mean, C.V. Coefficient of variation, R^2 Coefficient of determination. Wprobability of F: Pr ≥ 0.05 Not significant, Significant 0.05 ≤ Pr ≤ 0.01, highly significant Pr ≤ 0.01 Y Response (Pr> | t |) significant linear (L), quadratic (C), significant products of that nutrient with the rest; ZStandard error

The response surface for equatorial diameter in tomato and bell pepper under greenhouse Table 6, indicates that the $CaCO_3$ factors to the substrate and foliar with the different levels, presented an average of 69.0 cm, coefficient of determination R^2 0.0635 and a coefficient of variation of 5.20 in the tomato. The bell pepper presented an average of 80.1 cm, coefficient of determination R_2 0.6795 and a coefficient of variation 2.15.

In tomato, the equatorial diameter increased from 68.9 to 70.3 cm by 2%, decreasing the $CaCO_3$ to the soil from 6400.0 to 32.4 kg ha^{-1} by 99.5%, and increasing the dose of foliar $CaCO_3$ from 7.7 to 8.5 L ha^{-1} in 10%.

The fruit of the bell pepper increased its polar diameter from 80.6 to 84.9 cm with an increase in the dose of $CaCO_3$ to the soil from 6400.0 to 10635.0 kilograms per hectare with a foliar concentration of 1.9 kilograms per hectare.

In the bell pepper the equatorial diameter increased from 78.1 to 81.4 cm in 4%, with the increase of $CaCO_3$ to the ground from 6400.0 to 11690.0 kg ha^{-1} in 83%, with a decrease in the dose of foliar $CaCO_3$ from 7.7 to 3.4 L ha^{-1} in 56%.

Table 6. Maximum[X] response surface for equatorial diameter in tomato and bell pepper under greenhouse conditions, treated with calcium carbonate in substrate and leaf application.

Tomato				Bell pepper			
Regression		factors		Regression		factors	
		$CaCO_3$ Substrate	$CaCO_3$ Foliar			$CaCO_3$ Substrate	$CaCO_3$ Foliar
		0.9638[W]	0.9668			0.2147	0.1087
Lineal (L)	0.8764[W]			Lineal (L)	0.0485		
Cuad. (C)	0.9165			Cuad. (C)	0.1621		
products	0.8701			products	0.5242		
Model	0.9902	R^2 0.0635 CV 5.20	µ 69.0	Model	0.0942	R^2 0.6795 CV 2.15	µ 80.1
Equatorial diameter cm	SE[Z]	Kg ha^{-1}	kg ha^{-1}	Equatorial diameter cm	SE	Kg ha^{-1}	kg ha^{-1}
68.9	2.17	6400.0	7.7	78.1	1.04	6400.0	7.7
69.0	2.18	5968.9	8.2	78.3	1.03	6750.2	7.0
69.0	2.14	8339.2	8.5	78.5	1.01	7125.4	6.4
69.1	2.09	4655.5	8.6	78.8	0.98	7531.7	5.8
69.2	2.03	3975.8	8.7	79.1	0.95	7975.8	5.3
69.4	1.99	3305.5	8.7	79.4	0.91	8465.6	4.7
69.5	1.99	2642.6	8.6	79.7	0.88	9007.9	4.3
69.7	2.05	1985.2	8.6	80.1	0.86	9606.8	3.9
69.9	2.19	1331.6	8.6	80.5	0.86	10260.0	3.6
70.1	2.41	680.9	8.5	80.9	0.89	10959.0	3.5
70.3	2.73	32.4	8.5	81.4	0.97	11690.0	3.4
Predicted fixed point		critical values decrypted		Predicted fixed point		critical values decrypted	
69.04		7107.32	11.67	77.14		3804.4	13.98

[x]Ridge analysis; µ Overall mean, C.V. Coefficient of variation, R^2 Coefficient of determination. [W]probability of F: Pr ≥ 0.05 Not significant, Significant 0.05 ≤ Pr ≤ 0.01, highly significant Pr ≤ 0.01 Y Response (Pr> | t |) significant linear (L), quadratic (C), significant products of that nutrient with the rest; [Z]Standard error

4. CONCLUSIONS

In tomato fruit affected more red they were treated with 6269.7 kg ha^{-1} $CaCO_3$ to the substrate without foliar spray. Fruit affected higher brightness with 6400.0 kg were applied to the substrate and 7.7 kg per hectare in foliar spray. To have more elongated fruits and wider is necessary to increase the amount of calcium carbonate in foliar sprays.

In bell pepper, the brightest fruits were achieved with an application of calcium carbonate to the substrate of 226.5 kilograms per hectare and foliar spray 14.3 kilograms per hectare. The most polar diameter was obtained 10,635.0 kilograms per hectare with a concentration in foliar spray of 1.9 kilograms per hectare; The greater equatorial diameter was obtained application to the ground calcium carbonate of 11690.0 kg per hectare and foliar spray concentration of 3.4 kilograms per hectare.

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SOBRE O ORGANIZADOR

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