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Effects of Different Pruning Systems on Fruit Quality and Yield in California Wonder Peppers (*Capsicum annuum* L.) Grown in Soilless Culture

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ABSTRACT

This study was conducted to determine the effects of four pruning methods (Non-pruned, two, three and four stem pruning) on some growth parameters, yield and fruit quality in California Wonder Pepper (*Capsicum annuum* L.). The experiment was carried out between April and September 2020 in a climate controlled venlo type glass research greenhouse with automation system. In this study, two commercial pepper Rapido and Roxy California Wonder type (Rapido: red color Roxy: yellow color) varieties were used. Seedlings transplanted in cocopeat slabs were grown in soilless culture. The experiment was designed according to randomized plots with three replicates each including eight plants. Pruning applications-leaving two, three and four branches in pepper varieties significantly increased plant height, plant fresh weight and stem diameter as compared to the non-pruned plants. Pruning methods significantly increased fruit weight, fruit length and fruit diameter. Leaf chlorophyll index (SPAD), fruit flesh thickness, fruit firmness, fruit Brix and fruit EC values were positively affected by pruning methods. However, there was no significant differences observed regarding pruning methods on fruit color and pH. Total yield per plant was reduced as compared to non-pruned plants, except for four branch pruning. However, the reduction in the number of branches left with pruning significantly increased the rate of marketable fruit. To conclude, it was determined that the decrease in the number of branches left in California Wonder pepper varieties significantly decreased the number of non-marketable fruits, especially three and four branch pruning increased fruit quality as well as marketable yield.

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INTRODUCTION

The peppers cultivated today are in the genus *Capsicum*, which is one of the 98 genera of the *Solanacaea* family (Eshbaugh 2012). There are 43 species in the genus *Capsicum*. The most important 5 species of *Capsicum* grown in the world are *C. annuum* L., *C. frutescens* L., *C. baccatum* L., *C. chinense* Jacq. and *C. pubescens* Ruiz & Pav (Carrizo Garcia et al. 2016; Barboza et al. 2019; Mavi 2020). California Wonder which is one of the oldest varieties of bell pepper and it is known that a Californian breeder made selection and developed it in 1928 (Votava and Bosland 2002). Pepper fruits have important nutritional value and phytochemical source necessary for human dietsuch ascarbohydrates, proteins and fats (Taheri-Garavand et al. 2011),

Plant density and pruning applications play an important role in the effective use of greenhouses. Plant density and pruning applications play an important role in the effective use of greenhouses. Plant density and plant arrangement influenced plant development, plant dry weight, stem diameter, plant width, growth and marketable yield of chili

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pepper. Planting density, which can be maintained by adjusting row spacing and plant spacing, is a strong determinant of yield in various crops, including pepper (Setiawati et al. 2022).

Yield of sweet pepper was depended on the number of plants accommodated per unit area of land (Maboko and Plooy 2008; El Naim and Jabereldar 2010; Islam et al. 2011). Shoot pruning in pepper is a method used by farmers and researchers to control disease and pest, facilitate the aeration of plants, increase the use of light and increase marketable fruit yield (Maffei et al. 2016). The aim of pruning is to maximize marketable fruit yield by controlled pruning of inefficient flower shoots and intertwined branches. As a result of controlled shoot pruning, the plant's use of water and nutrients can be effectively adjusted (Das et al. 2016). Fruits obtained from plants with excessive vegetative growth will be small if pruning is not applied (Orsini et al. 2016). While optımum fruit yield is obtained at ideal plant density, higher quality but lower yield is obtained at low plant density (Akintoye et al. 2009). Pruning to two or three stems was reported to be effective in increasing yield and reducing fruit size of cherry tomatoes to a more acceptable marketable size (Maboko and Plooy 2008).

This study was conducted to determine the effects of different pruning methods on some growth parameters, yield and fruit quality in California Wonder Pepper.

MATERIALS AND METHOD

Plant Material, Treatments and Experimental Design.

The experiment was conducted during the period of April and September 2020 in a fully automation system and climate controlled venlo type glass greenhouse of Kırşehir Ahi Evran University (38°08′02″N, 34°07′08″E). In this study, two commercial Rapido and Roxy California Wonder type (Rapido: red color Roxy: yellow color) varieties were used. Seedlings were obtained from Antalya Fide I.C. Seedlings were transplanted into the cocopeat slabs and grown in soilless culture. During the study, the pepper plants were irrigated with the pH and EC controlled automation system by changing their nutrient content according to the growth of the plant. Irrigation was set by the use of a timing irrigation controller and kept to a per day volume that would give a 20% (v/v) of solution drainage from the slabs. The daytime temperature inside the greenhouse was set at 24°C, the night temperature was set not to drop below 16°C and humidity inside the greenhouse is set to 60%.

The experiment was designed with 3 replications and each plot consisted of 8 plants. Two plants were planted on each one meter long cocopeat slabs. Pruning applications were made 15 days after transplanting the seedling. Plants were pruned to two, three and four stem. Pruning was not applied to the control plants. During pruning, the inward facing shoot were removed and followed every week.

At the end of the experiment, plant height from cocopeat level to growth tip (cm), plant stem and leaf fresh weights (g) and plant stem diameter 4 cm above ground level (mm) were determined (Ulas et al. 2021; Oral, 2019). All harvests made during the experiment were weighed and recorded separately for each plant as yield per plant, marketable yield per plant, unmarketable yield per plant (g plant^{-1}) . To determine their average fruit weight, fruit length, fruit diameter and fruit pericarp thickness, 20 fruits were selected randomly for each pruning application group at harvest (Oral 2019).

Fruit firmness (force required to penetrate the tissue in kg) was measured by using an Effegi penetrometer fitted with a 11.1 mm diameter probe at the locular space and carpel wall of the whole fruit at the equatorial region (Showalter 1973). To measured total soluble solids (TSS), whole fruit pericarp was squeezed with a blender and filtered on the filter paper to read as percent (%) using digital refractometer (Hanna HI 96801) (Karaca et al. 2012). Also, pH and EC (dS m^{-1}) values of fruit juices were measured by using table type pH meter (HI5221-02 Hanna) and EC meter (Mettler Toledo MC-126), respectively (Navarro et al. 2002). The SPAD values of the leaves were measured using a SPAD-502 meter (Konica-Minolta, Japan) for each application (Ulaş et al. 2019). Fruit colors (L*, a*, b* values) were measured at three positions on the fruit surface, on the shoulder, at the equator and at the base by using a Minolta Chromameter (Model CR-100 Minolta Camera, Osaka, Japan) with LCH model calibrated with standard white plate (CY=87.5, x=0.308, y=0.315)) (Karaca et al. 2012).

Experimental data were analysed by using GLM procedure of the SPSS software (Windows version of SPSS, release 16.00). The significance of the differences between the means was determined using Duncan Multiple Range Test within the same software. In addition, Pearson Correlation Test was applied to determine the relationships between all the data obtained at the end of the experiment.

RESULTS AND DISCUSSION

It was determined that pruning applications by leaving two, three and four branches in California Wonder type pepper varieties significantly increased plant height, plant fresh weight and stem diameter compared to the non-pruned plants

(Table 1). Among the applications, the highest plant height was determined in pruning by leaving two branches in both varieties, while the highest plant fresh weights were determined in pruning application by leaving four branches. The stem diameter was determined as the highest in the pruning system made by leaving two branches in the Roxy variety and leaving three branches in the Rapido variety. It was reported that this increase in morphological parameters examined with the effect of pruning is caused by the flow of nutrients to the axillary branches that can be directed to the apical tissues that cause the elongation of the shoots (Singh and Kaur 2018).

Table 1. *Effects of different pruning systems on Plant height (cm), Plant fresh weight (g) and Plant stem diameter (mm) of different California Wonder type varieties grown under greenhouse conditions.*

	Plant height (cm)		Plant fresh weight (g)		Plant stem diameter (mm)	
Varieties / Pruning	Rapido	Roxy	Rapido	Roxy	Rapido	Roxy
Non-pruned	146.3c	152.5c	1513.8abc	1391.3c	21.9d	24.6bc
2 Stem	183.8ab	189.2a	1591.3ab	1516.2abc	26.3ab	27.0a
3 Stem	182.2ab	171.3b	1555.0abc	1475.0bc	27.0a	26.4ab
4 Stem	181.3ab	182.5ab	1615.0ab	1688.8a	23.8cd	26.5ab
	Varieties:***		Varieties:***		Varieties:***	
	Pruning: ***		Pruning:***		Pruning:***	
	Varieties x Pruning: NS		Varieties x Pruning: NS		Varieties x Pruning: NS	

Values denoted by different letters are significantly different between pruning combinations within columns at $p<0.05$. Significance of main and interaction effects F values: $p < 0.05$ (*), $p < 0.01$ (**), and $p < 0.001$ (***),with N.S. meaning not significant.

Fruit weight, fruit length and fruit diameter of Rapido and Roxy pepper varieties grown in greenhouse conditions were significantly affected by pruning systems. Among the two varieties, the highest average fruit weight was measured in Rapido variety in all pruning systems. The higher fruit weights in Rapido and Roxy pepper varieties were measured in two stem, three stem and four stem pruning systems. With the effect of pruning systems, an increase in fruit size and fruit diameter was determined. The highest fruit length was obtained by three stem pruning system in Rapido (90.38 mm) and Roxy (80.46 mm) varieties. The highest fruit diameter was obtained in four stem pruning systems in both varieties (Table 2). The purpose of pruning is to provide an appropriate balance between fruit number and fruit size by leaving an appropriate number of branches on the plant. It is known that the decrease in the number of shoots improves the fruit quality (Cebula 1995). Similar to our results, they reported that red bell pepper varieties had a higher average fruit weight than yellow pepper varieties (Alsadon et al. 2013). In two, three or four branch pruned plants, as the amount of pruning increased, fruit size, fruit diameter and average fruit weight increased. This is because the leaf/fruit ratio is higher than the less pruned plants (Zende 2008).

Table 2. *Effects of different pruning systems on average Fruit weight (g), Fruit length (mm) and Fruit diameter (mm) of different California Wonder type varieties grown under greenhouse conditions.*

	Average fruit weight (g)		Fruit length (mm)		Fruit diameter (mm)	
Varieties / Pruning	Rapido	Roxy	Rapido	Roxy	Rapido	Roxy
Non-pruned	205.7b	180.0c	82.0b	70.2d	35.2ab	23.1d
Two Stem	236.6a	198.0b	88.1a	75.3c	35.7ab	28.1c
Three Stem	237.6a	197.6b	90.4a	80.5bc	34.3ab	32.1b
Four Stem	232.7a	198.7b	89.2a	78.4bc	36.3a	34.8ab
	Varieties:***		Varieties:***		Varieties:**	
	Pruning:***		Pruning:***		Pruning:***	

Varieties x Pruning: NS	Varieties x Pruning: NS	Varieties x Pruning: NS

Values denoted by different letters are significantly different between pruning combinations within columns at $p<0.05$. Significance of main and interaction effects F values: $p < 0.05$ (*), $p < 0.01$ (**), and $p < 0.001$ (***),with N.S. meaning not significant.

The higher fruit yields in Rapido and Roxy varieties were measured in four stem and non-pruned plants, while the lowest fruit yield per plant was measured in two stem pruning systems. The highest marketable yield per plant for two pepper varieties were measured in four stem pruning systems. Although the yield per plant in both varieties was measured to high in non-pruned plants, it was determined that the marketable yield per plant decreased at the highest in non-pruned plants. The reason of this is the weight of the discarded fruit is quite high (Table 3).

Unmarketable yield per plant was significantly affected by the variety and pruning systems, the amount of unmarketable yield in Rapido variety was determined considerably higher than Roxy variety. While the non-marketable yield of non-pruned plants in Rapido variety was 22.61%; it was stated 7.27%, 12.56 and 18.18% for two, three and four stem pruning, respectively. Likewise, while the non-marketable yield of non-pruned plants in Roxy variety was 12.13%; it was determined 3.15%, 3.48 and 5.09% for two, three and four stem pruning, respectively (Table 3). There is a disadvantage for the farmers that there is no commercial counterpart and the production cost of the unmarketable yield due to the excess amount of aborted fruit in pepper cultivation without pruning. Similar finding was observed by Sing and Kaur (2018) in greenhouse bell pepper (*Capsicum annuum* L. *grossum* cv. Indra, Bachata and Inspiration). Aktaş et al. (2009) recommended a pruning system with at least four shoots per plant for high yield in the summer months when the temperature is high and less humidity conditions. Adjusting plant density by pruning has a significant effect on marketable yield in many vegetable species (Stoffella and Bryan 1998). In our findings, it is noteworthy that Rapido variety, whose fruits are larger than those of Roxy variety, has a higher rate of non-marketable fruit. This finding was found to be important in terms of showing that leaving less number of branches in coarse fruit varieties is more effective in reducing non-marketable yield. Fruit weight and color tone are an important factor in consumer preferences in California Wonder bell peppers. High quality fruits, which are considered as class A, weight of 150-200 g and have 4 lobes (Zende 2008). For this reason, large and brightly colored fruits also have higher economic returns in Rapido and Roxy varieties used in the study. Similar to our findings, it was reported that there is an increase in the fruit yield of pepper with an increase in the number of shoots in pepper cultivation in soilless culture (Jovicich et al. 2004; Maboko et al. 2010). It was reported by other researchers that there was a positive relationship between the number of branches and yield determined in our findings (Bahadırlı 2002; Cebula et al. 1998).

Table 3. *Effects of different pruning systems on Fruit yield per plant (kg), Marketable yield per plant (kg) and Unmarketable yield per plant (%) of different California Wonder type varieties grown under greenhouse conditions.*

	Fruit yield per plant (kg)		Marketable yield per plant (kg)		Unmarketable yield per plant (%)	
Varieties / Pruning	Rapido	Roxy	Rapido	Roxy	Rapido	Roxy
Non-pruned	4174.8a	3719.5b	3228.7bc	3268.7bc	22.61a	12.13c
Two Stem	3210.1c	2632.4c	2976.1c	2548.8d	7.27d	3.15e
Three Stem	3443.1bc	2609.4c	3009.8c	2515.7d	12.56c	3.48e
Four Stem	4441.4a	3714.5b	3633.7a	3526.5ab	18.18b	5.09de
	Varieties:***		Varieties:***		Varieties:***	
	Pruning:***		Pruning:***		Pruning:***	
	Varieties x Pruning: NS		Varieties x Pruning: NS		Varieties x Pruning: NS	

Values denoted by different letters are significantly different between pruning combinations within columns at $p<0.05$. Significance of main and interaction effects F values: $p < 0.05$ (*), $p < 0.01$ (**), and $p < 0.001$ (***),with N.S. meaning not significant.

There is no statistical difference between the varieties in terms of pericarp thickness. However, pruning systems applied in Rapido and Roxy pepper varieties increased pericarp thickness compared to non-pruned plants. The highest SPAD value was measured in Roxy plants with three stem pruning. The lowest SPAD value was measured in Roxy plants that were not pruned. In general, the amount of leaf chlopohyll index (SPAD) is high because the pruned plants receive sufficient light. Pruning treatment in both varieties increased the fruit firmness compared to the non-pruned plants. With the increase in the number of stem left in pruned plants, an increase in fruit firmness was determined. The highest fruit firmness was determined in the pruning system with four branches left in both varieties (Table 4). In greenhouse pepper cultivation, as the plant branch pruning and planting distance will affect the benefits of the fruits

and leaves from the sun, pericarp thickness, leaf SPAD value and fruit hardness will change accordingly. Similar to our results, they reported that single-branch pruning plants had higher in pericarp thickness than non-pruned plants (Singh and Kaur 2018). It was an expected result that California Wonder peppers with high pericarp thickness and fruit hardness have a long shelf life.

Table 4. *Effects of different pruning systems on Pericarp thickness (mm), SPAD and Fruit firmness (kg) of different California Wonder type varieties grown under greenhouse conditions.*

	Pericarp thickness (mm)		SPAD		Fruit firmness (kg)	
Varieties / Pruning	Rapido	Roxy	Rapido	Roxy	Rapido	Roxy
Non-pruned	5.82b	5.82b	69.12b	62.07d	3.52ab	2.31d
2 Stem	6.61ab	6.89a	69.22b	67.00cd	3.57ab	2.81c
3 Stem	6.85a	6.97a	76.34a	69.70bc	3.43ab	3.21b
4 Stem	6.88a	7.04a	70.02b	65.90bcd	3.63a	3.48ab
	Varieties: NS Pruning:*** Varieties x Pruning: NS		Varieties:*** Pruning:** Varieties x Pruning: NS		Varieties:*** Pruning:*** Varieties x Pruning: NS	

Values denoted by different letters are significantly different between pruning combinations within columns at $p<0.05$. Significance of main and interaction effects F values: $p < 0.05$ (*), $p < 0.01$ (**), and $p < 0.001$ (***),with N.S. meaning not significant.

Regarding fruit pH, fruit EC and soluble solids content (SSC), there was a statistical difference between the varieties. The variation fruit pH, fruit EC and SSC in different cultivars might be due to the genetic variations or their ability for exploiting the environmental under greenhouse conditions. While the fruit pH was high in Roxy variety, the fruit EC value was high in Rapido variety. While no significant effect of pruning applications on fruit pH was determined in Roxy variety, there was a slight increase in pH value in Rapido variety compared to non-pruning plants. In Rapido and Roxy varieties, the fruit EC values of the pruned plants are higher than the non-pruned plants. Pruning practices significantly increased fruit SSC contents of Rapido variety compared to non-pruned plants. The SSC content of Roxy variety was slightly increased in plants with only three and four stem pruning (Table 5). Our findings show that pruning and reducing the number of stem in peppers has a positive effect on fruit quality. The reason might be higher assimilation supply was associated with better light conditions in plants that were pruned to fewer branches and this plants produce higher quality fruits due to higher assimilates (Ambroszczyk et al. 2007). Similar to our results, it was reported that the highest SSC values are in plants with one stem and then in plants with two stems (Singh and Kaur 2018).

Table 5. *Effects of different pruning systems on Fruit pH, Fruit Ec and Soluble solids content (Brix) of different California Wonder type varieties grown under greenhouse conditions.*

	Fruit pH		Fruit Ec		Soluble solids content (Brix)	
Varieties / Pruning	Rapido	Roxy	Rapido	Roxy	Rapido	Roxy
Non-pruned	5.25b	5.58a	4.76ab	3.62d	7.04b	6.28c
2 Stem	5.35ab	5.54a	5.06a	4.46bc	7.68a	6.40c
3 Stem	5.48ab	5.54a	5.06a	4.22c	7.78a	6.60bc
4 Stem	5.35ab	5.54a	5.00a	4.56bc	7.74a	6.44bc
	Varieties:*** Pruning: NS Varieties x Pruning: NS		Varieties:*** Pruning:*** Varieties x Pruning: NS		Varieties:** Pruning:** Varieties x Pruning: NS	

Values denoted by different letters are significantly different between pruning combinations within columns at $p<0.05$. Significance of main and interaction effects F values: $p < 0.05$ (*), $p < 0.01$ (**), and $p < 0.001$ (***),with N.S. meaning not significant.

While there was a difference in fruit L* value between varieties, pruning had no significant effect on the L * value (Table 6). The reason why Roxy variety is higher than the L* value of Rapido variety is that the genetic structure of the fruit of Roxy variety had been yellow bright colored, while the fruit of Rapido variety had been red coloured. The a*

value of Rapido variety is higher than that of Roxy variety. This is because the fruit of Rapido variety is genetically red in color. There was no effect of pruning on a* value in Rapido variety. In the Roxy variety, the highest a* value was measured in three stem pruning (10.53), four stem pruning (9.38) and two stem pruning (9.01) systems, while the lowest a* value was measured in non-pruning plants (6.51). Since it has yellow fruit genetically, the highest b* value was measured in the fruits of the Roxy variety. In addition, higher b* values were found in pruned plants compared to non-pruned plants. The effect of pruning on the b* value of Rapido variety fruits has not been determined to be significant. In Roxy variety, the highest b* value was measured in two stem pruning (37.75), four stem pruning (37.67) and three stem pruning (37.53) systems, while the least was measured in non-pruning (36.16) plants (Table 5). Pruning and planting distance are important parameters for the color distribution of the pepper plant. Proper lighting design for greenhouse pepper production and pruning to create to reduce shading also deserves further research. The exposure of pepper fruit to light, however, needs to be carefully controlled in order to reduce the risk of sunscald and other disorders such as blossom end rot. Therefore, in order to maximize the quality and market value of green, yellow and red bell peppers. It is iportant for developing peppers to be exposed to optimum light conditions (Bosland and Votava 2000; Cebula 1995; Hovi- Pekkanen et al. 2005).

Pruning practices caused a statistically insignificant increase in fruit a and b values in Rapido variety, while a significant increase in Roxy variety. It is thought that this increase in fruit a and b values may be caused by better light exposure of the fruit and leaves and the more efficient transfer of nutrients from leaf to fruit. In addition, it should not be forgotten that it can perform 20% of the total photosynthesis in its fruits (Powell et al. 2012).

Table 6. *Effects of different pruning systems on L*,a* and b* of different California Wonder type varieties grown under greenhouse conditions*

	L*		a*		b*	
Varieties / Pruning	Rapido	Roxy	Rapido	Roxy	Rapido	Roxy
Non-pruned	29.42b	63.66a	23.16a	6.51c	7.12c	36.16b
2 Stem	30.29b	64.16a	25.15a	9.01bc	7.25c	37.75a
3 Stem	29.37b	63.75a	25.55a	10.53b	7.50c	37.53a
4 Stem	30.39b	64.01a	25.78a	9.38bc	7.52c	37.67a
	Varieties:***		Varieties:***		Varieties:***	
	Pruning: NS		Pruning:**		Pruning:*	
	Varieties x Pruning: NS		Varieties x Pruning: NS		Varieties x Pruning: NS	

Values denoted by different letters are significantly different between pruning combinations within columns at $p<0.05$. Significance of main and interaction effects F values: $p < 0.05$ (*), $p < 0.01$ (**), and $p < 0.001$ (***), with N.S. meaning not significant.

The results of correlation revealed that plant height exhibited a positive significant correlation with plant stem diameter and pericarp thickness. Plant fresh weight exhibited positive significant correlation with fruit diameter and fruit firmness. Plant stem diameter exhibited positive significant correlation with pericarp thickness whereas negative and significant correlations were observed with fruit yield per plant and unmarketable yield per plant (%). Average fruit weight exhibited positive significant correlation with fruit length, fruit diameter, SPAD, fruit firmness, EC, soluble solids content and a* whereas negative and significant correlations were observed with L* and b*. Fruit length exhibited positive significant correlation with fruit diameter, SPAD, fruit firmness, EC, soluble solids content and a* whereas negative and significant correlations were observed with L* and b*. Fruit diameter exhibited a positive significant correlation with fruit firmness and a*. Fruit yield per plant exhibited a positive significant correlation with unmarketable yield per plant (%). Unmarketable yield per plant (%) exhibited a negative significant correlation with pH. SPAD exhibited a positive significant correlation with SSC, EC and a* whereas negative and significant correlations were observed with L* and b*. Fruit firmness exhibited a positive significant correlation with EC and a*. pH exhibited a positive significant correlation with L* and b* whereas negative and significant correlations were observed with a*. EC exhibited a positive significant correlation with soluble solids content and a* whereas negative and significant correlations were observed with L* and b*. Soluble solids content a positive significant correlation with a* whereas negative and significant correlations were observed with L* and b*. L* exhibited a positive significant correlation with b* whereas negative and significant correlations were observed with a*. a* exhibited negative significant correlations with b* (Table 7) .

In the findings, the negative correlation between morphological parameters and non-marketable yield draws attention. The increase in plant height, fresh weight and stem diameter determined in pepper plants by pruning caused a

significant decrease in non-marketable yield. The positive correlation between fruit weight and size and fruit flesh firmness, pericarp thickness, EC and SSC content was evaluated as an indicator of the positive effect of pruning practices on fruit quality. The positive correlation between leaf SPAD level and fruit weight, size, flesh firmness, EC and SSC contents were interpreted as increasing lighting with the effect of pruning promotes chlorophyll synthesis and consequently increases fruit quality.

Table 7. *Correlation coefficients among Plant height (H), Plant fresh weight (PW), Plant stem diameter (SD), Average fruit weight (FW), Fruit length (FL), Fruit diameter (FD), Fruit yield per plant (FY), Marketable yield per plant (MY), Unmarketable yield per plant (UY), Pericarp thickness (PT), SPAD, Fruit firmness (FF), Fruit pH, Fruit Ec, Soluble solids content (SSC) L*, a* and b* of two pepper varietys.*

	H	PW	SD	FW	FL	FD	FY	MY	UY	PT	SPAD	FF	pH	EC	SSC	L*	a*
PW	0.611																
SD	**0.763***	0.178															
FW	0.486	0.535	0.097														
FL	0.384	0.540	0.007	**0.965****													
FD	0.302	**0.776***	-0.125	**0.745***	**0.845****												
FY	-0.393	0.273	**-0.763***	0.213	0.251	0.327											
MY	0.088	0.277	0.087	0.068	-0.031	-0.045	0.317										
UY	-0.592	-0.065	**-0.878****	0.257	0.318	0.273	**0.849****	0.181									
PT	**0.892****	0.611	**0.714***	0.354	0.369	0.393	-0.402	-0.090	-0.606								
SPAD	0.244	0.374	0.045	**0.852****	**0.905****	0.700	0.215	0.218	0.367	0.261							
FF	0.302	**0.776***	-0.125	**0.745***	**0.845****	**0.980****	0.327	-0.045	0.273	0.393	0.700						
pH	0.239	-0.272	0.674	-0.563	-0.609	-0.677	-0.558	0.109	**-0.727***	0.310	-0.462	-0.677					
EC	0.477	0.707	0.011	**0.917****	**0.914****	**0.881****	0.243	0.159	0.273	0.384	**0.806***	**0.881****	-0.670				
SSC	0.276	0.397	-0.101	**0.970****	**0.955****	0.704	0.358	0.029	0.451	0.162	**0.861****	0.704	-0.655	**0.854****			
L*	0.030	-0.288	0.403	**-0.842****	**-0.844****	-0.675	-0.524	-0.109	-0.696	0.159	**-0.793***	-0.675	**0.850****	**-0.805***	**-0.924****		
a*	0.103	0.376	-0.302	**0.908****	**0.918****	**0.751***	0.455	0.049	0.604	0.000	**0.839****	**0.751***	**-0.820***	**0.870****	**0.963****	**-0.986****	
b*	0.040	-0.278	0.414	**-0.836****	**-0.834***	-0.661	-0.534	-0.104	-0.702	0.176	**-0.777***	-0.661	**0.852****	**-0.793***	**-0.921****	**0.999****	**-.983****

Correlation is significant at the 0.05 level(*), correlation is significant at the 0.01 level (**)

CONCLUSION

Fruit quality is as important as yield in crop production. In California Wonder pepper cultivation, the main goal of the producers is that the fruits are large and smooth shaped. In greenhouse pepper cultivation, the number of branches to be left in plants by pruning had a significant effect on fruit quality. When the findings obtained as a result of the study are evaluated in general, the reduction of the number of branches left in the plants by pruning in Rapido and Roxy pepper varieties significantly increased the plant height, fresh weight and stem diameter. It is thought that the positive effect of pruning applications on the examined morphological parameters is one of the main reasons for the increase in fruit quality.

The applied pruning methods increased the size and weight of pepper fruits as well as decreased the unmarketable yield. Therefore, pruning methods increased the rate of marketable quality fruit. Pericarp thickness and fruit firmness, which increased the shelf life of pepper fruits after harvest, increased especially in three and four branch pruning methods. It was determined that fruit pH, EC and SSC contents, which are effective on the taste and aroma of pepper fruits, are positively affected from pruning methods. As the density of branches decreased with pruning applications, the rate of exposure of plants to diseases and pests decreased, while the rate of seeing light of fruits increased. It is thought that pruning methods will have a positive effect in greenhouses with high humidity and low lighting in order to increase plant growth and fruit quality. Reducing the number of stem on the plant increased the economic value of the product as it increased fruit quality.

As a result, it was determined that pruning applications by leaving two, three and four branches on plants in California Wonder pepper varieties increased fruit quality and marketable yield, but the most positive effect among all parameters was leaving three and four branches in the pruning.

ETHICAL STATEMENT

During the writing process of the study titled " Effects of Different Pruning Systems on Fruit Quality and Yield in California Wonder Peppers (*Capsicum annuum* L.) Grown in Soilless Culture", scientific rules, ethical and citation rules were followed; No falsification has been made on the collected data and this study has not been sent to any other academic media for evaluation. Since this research is based on document analysis and descriptive analysis, there is no obligation for an ethics committee decision.

CONFLICT OF INTERESTS

The authors declared no conflict of interest.

AUTHORS CONTRIBUTION

All authors contributed equally.

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