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Determining Optimal Levels of Pruning in *Hylocereus undatus* [(Haw.) Britton and Rose] in Trellis Systems

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Abstract: The main objective of this work was to determine the optimum level of pruning in pitaya. In addition, we want to establish the relationship between pruning levels and the intensity of flowering, and between flowering levels and heavy flower bud drop that affects this species. With these aims, two experiments were performed on *Hylocereus undatus* [(Haw.) Britton and Rose] cultivated in greenhouses and trained in a trellis system. Our results conclude that cane pruning leaving 15 cladodes per meter in a trellis system is the most productive, as it yielded more fruit of similar weight. Positive relationships between flowering and setting, regardless of pruning levels, justify less severe pruning. Fruit set and size did not depend on pruning levels, although we found a fruit weight reduction when a single cladode developed more than one fruit. Flower buds drop was proportionally higher in cladodes forming more flowers, suggesting that bud competition plays a role in their drop. However, flower bud thinning seems unnecessary, although if a flower is to be chosen, it is better to select those formed at the apex of the cladode since they produce larger fruits.

Keywords: dragon fruit; pitaya; flowering; fruit size; flower buds drop

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Citation: Chiamolera, F.M.; Parra, L.; Sánchez, E.; Casas, M.; Hueso, J.J.; Cuevas, J. Determining Optimal Levels of Pruning in *Hylocereus undatus* [(Haw.) Britton and Rose] in Trellis Systems. *Agronomy* **2023**, *13*, 238. https://doi.org/10.3390/agronomy13010238

Academic Editors: Theodore Radovich, Michael Kantar and Robert E Paull

Received: 26 December 2022
Revised: 9 January 2023
Accepted: 10 January 2023
Published: 13 January 2023

1. Introduction

Pitaya (*Hylocereus* spp.; Family Cactaceae), also known as pitahaya or dragon fruit, is a climbing cactus which exotic fruit has gained increasing interest due to its beauty, nutritional value and abundance of bioactive compounds [1–3]. Native from Mesoamerica rainforests, most species of this genus of cacti have long triangular succulent cladodes (stems) that are the photosynthetic organs but also the fruitful shoots since the flowers arise from compound buds formed on the edges of 1-year-old cladodes [4]. These flowers are very large (>20 cm) and open at night, being pollinated by hawk moths and bats [5,6]. They are ephemeral, lasting only one night. Thus, in cultivation, efficient and rapid pollination, often achieved by hand, is required [7].

The flowering season in *Hylocereus undatus* [(Haw.) Britton and Rose], the most studied species, occur in waves (between three and six, depending on the genotype, season and environment). Factors affecting flowering include cladode age and vigor [8], but also the temperature and light, including here intensity and photoperiod [9,10]. In this regard, pitaya is a long-day plant, and its floral induction is strongly conditioned by the photoperiod, with critical values around 12 h day length [9]. Perhaps because of its abundant flowering, most pitayas present heavy flower buds drop before anthesis. This drop is often explained by resource competition between developing flowers but is also referred to as caused by abiotic stresses [7,10–12], although, the ultimate reasons behind this phenomenon are actually unknown.

The main producing countries of pitaya are those of its native region and those from South-East Asia (especially Vietnam, China and Indonesia) [13], but pitaya is also increasingly planted in the Mediterranean area (Spain, Israel, Italy and Turkey) under protected cultivation [11]. Unfortunately, pitaya management is not yet well-established in many aspects, including pruning. In this regard, most authors just recommend sanitary pruning and removing only broken cladodes and those affected by pests and diseases [14–16]. On this last point, Hieu et al. [17] probed that intense pruning reduced canker disease incidence and severity. Nonetheless, very little is known about the intensity of annual pruning for achieving optimal yield and, at the same time, promoting enough shoot renewal. On this matter, only one manuscript could be found in the literature comparing pruning levels. In it, Alam et al. [18] recommend leaving 50 cladodes per pole in central leader-trained pitayas ("mop top trees") as the most productive level of pruning.

We recently established that cane pruning, just tipping the long cladodes, is the best procedure for obtaining the highest flowering and yield in white-fleshed pitaya, allowing too good shoot renewal [19]. Once the best technique has been established, we aim now to determine the optimal level of pruning, that is, the best number of fruitful shoots per plant or unit area left after pruning in pitayas trained in a trellis system. Secondly, we want to find out the relationships between pruning levels and the intensity of flowering, and then of the flowering level with the heavy flower buds drop affecting this species. Finally, we aim to determine the relationships between fruit load and quality at harvest.

2. Materials and Methods

2.1. Experimental Sites and Crop Management

The first experiment was performed in a pitaya (*H. undatus*) orchard located at the UAL-Anecoop Foundation in Almería (SE Spain) (longitude 2°17′02″ W, latitude 36°51′54″ N). The altitude is 95 m above sea level, and the orchard is 5 km from the Mediterranean Sea. The second experiment was carried out in a small plantation located at the Cajamar Experimental Station, in El Ejido (Almería) (longitude 2°43′10″ W, latitude 36°47′40″ N) 40 km away from the first. The altitude of the Station is 151 m above sea level, and the plantation is 11 km from the Mediterranean Sea. Both experimental orchards are in an area that has a semi-arid subtropical Mediterranean climate, according to the classification of Papadakis [20], with a mean annual temperature of 18.5 °C, with December and January as the coldest months, while August is the warmest one. The average accumulated rainfall in the area does not exceed 250 mm per year (January to December), while the average annual relative humidity ranges between 67% and 73% depending on the year. Bright, sunny days are very common, and sunlight hours reach an average value of 3273 h per year. Day length, determining floral induction in this species, ranges at our experimental sites between 14 h and 10 h (day/night) in summer and 10 h and 14 h in winter. Since a critical photoperiod of 12 h has been established for pitaya [9], the inductive day length in our latitudes might start in mid-March and end in mid-October.

The soil in the UAL-Anecoop Foundation experimental plot is a sandy-clay loam with 46.4% sand, 20.6% silt and 33.0% clay, while the soil at the Cajamar Experimental Station plot is also a sandy-clay loam, but with 59.8% sand, 14.6% silt and 25.6% clay. At both sites, the soil was sampled between 20 and 30 cm depth, since most of the roots of pitaya are in the first 40 cm [21].

The pitayas used in the experiments were *H. undatus* cuttings (rootstock was not used). This experimental plant material came years ago to peninsular Spain from the Canary Islands, and it was the previous result of a prospection made by Dr. V. Galán on Reunion Island. For this, the clone used is known as Clone A from Reunion Island, described in Le Bellec and Judith [22].

In the first experiment, the cuttings were planted in 2017 and were in full production. These experimental plants were grown under a typical Almería flat-roofed structure ("Parral" type) greenhouse 4.5 m high. The greenhouse was covered with 0.2 mm polyethylene plastic film placed 2.7 m above the top of the experimental plants' canopy and only had natural lateral ventilation. Whitewashing the greenhouse plastic cover in spring and the plastic cover itself aim to reduce solar radiation between 30 and 40%. Sunlight reduction is important for the growth and fruiting of this crop, with effects depending on the species [23,24]. The pitayas were planted at a distance of 1.0 m between plants and 5.0 m between rows, and trained in a two-dimensional trellis system (a hedgerow similar to a double "Geneva" curtain) 1.8 m in height (Figure 1a). From this height, the cladodes hung, forming a production wall. These pitayas were drip irrigated and fertigated annually with 146 units of fertilizers (UF) of N, 50 UF of P_2O_5 and 235 UF of K_2O applied proportionally to the volume of irrigation water (around 1100 m^3 ha^{-1}). Hand cross-pollination was performed at anthesis early in the morning (from 5:30 to 7:00 a.m.) by first collecting fresh pollen from open flowers of nearby plants of different genotypes and applying it using a fine brush on the stigma of each open flower. Pest and disease control was carried out following IPM guidelines. All cultural practices, except pruning, were carried out in the same way in these experimental plants.

(**a**) (**b**)

Figure 1. Details of the productive wall after pruning and partial view of the trellis system and the greenhouse of the first experiment (**a**). Flowering plants and partial view of the plants in bloom on a T-shaped structure under the greenhouse of the second experiment (**b**).

The second experiment was carried out also with *H. undatus* adult plants of the same genotype (clone A from Reunion Island) planted in this case in September 2016 under an asymmetrical plastic greenhouse in which blanching at spring was also performed (reducing sun radiation similarly to the experiment above mentioned). The greenhouse was 4.0 m high at the ridge and 2.5 m at the band and, in this case, was provided with zenithal and lateral ventilation. Experimental plants were supported by a structure T-shaped just 1.5 m high and 0.25 m wide (Figure 1b). These plants were trained as a single guyot, a system often used in grapevine and characterized by having only one main branch growing from the trunk. From this single branch, a number of productive cladodes hung for flowering and fruiting. The plants were closely spaced 0.5 m apart in the row and 2.0 m between rows, resulting in a density of about 10,000 plants per hectare. Fertigation was performed as above by drip irrigation, with an annual amount of irrigation water of around 1500 m^3 ha^{-1} and fertilizers doses of 150 UF of N, 35 UF of P_2O_5 and 280 UF of K_2O. Plant protection was also carried out following IPM guidelines, with aphids on flowers being the only remarkable pest in this orchard. Hand cross-pollination was performed as above at 7:00 a.m. with flowers still fully receptive.

2.2. Treatments, Experimental Designs and Measured Parameters

The first study compared *H. undatus* response to four pruning levels, namely, leaving after pruning only 6, 9, 12 or 15 1-year-old cladodes per linear meter of the productive wall (Figure 1a). Cane pruning, tipping only the last apical buds of the cladode [18], was carried out on 4 March 2022. The experimental design was completely randomized, with four replicates per treatment. In order to randomize the replicates, the 50 m long double "Geneva" curtain (25 m on the north side and 25 m on the south side) was divided into sixteen 2.0 m long segments, leaving 4.5 m at both ends of the curtain to avoid edge effects. The sixteen segments of the double curtain were randomly assigned, four for each treatment, acting as replicates.

On these experimental plants, we evaluated their reproductive performance, comparing among treatments the number of reproductive buds, open flowers, and fruits and their size (weight, equatorial diameter, length) and sweetness (total soluble solids (TSS) content). Flowering intensity, as the number of open flowers per cladode, was determined on 6 June and 20 August, corresponding to the first two waves of flowering of the experimental plants. Fruit set and size, after hand cross-pollination, and TSS content were determined in the third more abundant flowering wave (early September). Given the non-climacteric nature of pitaya, the harvest of these fruits was performed at ripening on three different dates of the same week (3, 7 and 10 October), when the fruit fully developed a magenta color on the skin. Fruit size and TSS content were measured on random samples of 10 ripened fruits of each replicate. The size of each fruit was estimated at harvest by its weight, length and equatorial diameter. The weight of each fruit was measured using a digital scale (A&D Model EK1200i, Seoul, Korea). Their diameter and length were recorded at the equatorial zone of each fruit using a digital vernier (Powerfix Profi, OWIN GmbH & Co. KG, Neckarsulm, Germany). TSS content was measured using a digital refractometer (model PAL-1, Atago Co., Tokyo, Japan) from the juice of the central part of each fruit; data were expressed in °Brix.

These parameters were compared by analysis of variance (ANOVA). When necessary, means were separated by Tukey's test at 5% ($p < 0.05$). The yield per cladode was estimated for each pruning treatment taking into account the number and average fruit weight. Correlation and regression analyses were performed to determine the relationships between the number of cladodes left after pruning with flowering, fruit setting and yield. Correlation analyses of the different parameters estimating fruit size parameters were also performed.

With the aim to know better how the level of flowering of single cladodes affects flower bud drop and fruit set and quality, we simultaneously performed a second experiment at the Cajamar Experimental Station orchard with the same plant material. In this experiment, we tagged 120 1-year-old mature cladodes distributed in six plant rows (20 cladodes per row) (Figure 1b). On those tagged cladodes, we individually determined the number of flower buds produced, the position in which the buds appeared (basal, middle or apical), the number of open flowers, the percentage of buds evolving to open flowers (and, then, the contrary, i.e., the percentage of aborting buds) and the number of fruits setting and reaching harvest. Fruit yield and quality in each individual cladode were estimated by their average weight and TSS content, as explained above.

In order to explore the existence of fruit set constraints in *H. undatus* when flowering is high, correlation and regression analyses were performed between the number of flower buds produced per cladode, the proportion of them reaching anthesis (that is, not aborting) and the percentage of flowers setting fruit. Fruit weight relations with fruit number were also explored.

3. Results and Discussion

Pruning treatments had a significant effect on the number of flower buds and open flowers in the first flowering wave, with more reproductive buds and flowers for T_9 and T_{12} treatments (Table 1), while pruning treatments with a lower and higher number of cladodes produced fewer flowers. The regression analyses between flowering and pruning levels showed the best fitting for a quadratic equation ($R^2 = 0.98$; $p = 0.2691$), with the maximum value in plants left after pruning with 12 cladodes per lineal meter.

Table 1. Flower buds and open flowers number, and flower buds abortion in response to pruning treatments in the first (June) and second (August) flowering waves.

Pruning Treatments	First Flowering			Second Flowering		
	Flower Buds Number	Open Flower Number	Flower Buds Abortion (%)	Flower Buds Number	Open Flower Number	Flower Buds Abortion (%)
T_6	1.25 b	1.00 b	20.0 a	9.50 a	8.75 a	7.9 a
T_9	6.25 ab	6.00 ab	4.0 a	9.25 a	8.25 a	10.8 a
T_{12}	9.75 a	7.75 a	20.5 a	12.00 a	11.50 a	4.2 a
T_{15}	3.75 ab	3.00 ab	20.0 a	14.75 a	12.00 a	18.6 a
p	0.0208	0.0416	0.8864	0.5679	0.6802	0.8406

Mean comparison in columns by Tukey's test at $p < 0.05$. For each column, different letters indicate a statistical significance.

Similar response, although with a more intense flowering, was observed in the second flowering wave (August). On these dates, the highest number of flower buds, and open flowers one week later, was counted in T_{15} plants, closely followed by T_{12} (Table 1). Although, in August, flowering response to pruning was linear (R^2 = 0.78; p = 0.2617). The same trend was observed for the number of reproductive buds initiated in this second wave (Table 1). Finally, the last flowering in early September again showed a better quadratic adjustment (R^2 = 0.98; p = 0.0130) (Figure 2), although the linear response gave very similar values for the coefficient of determination. Flower buds were not counted in this last flowering.

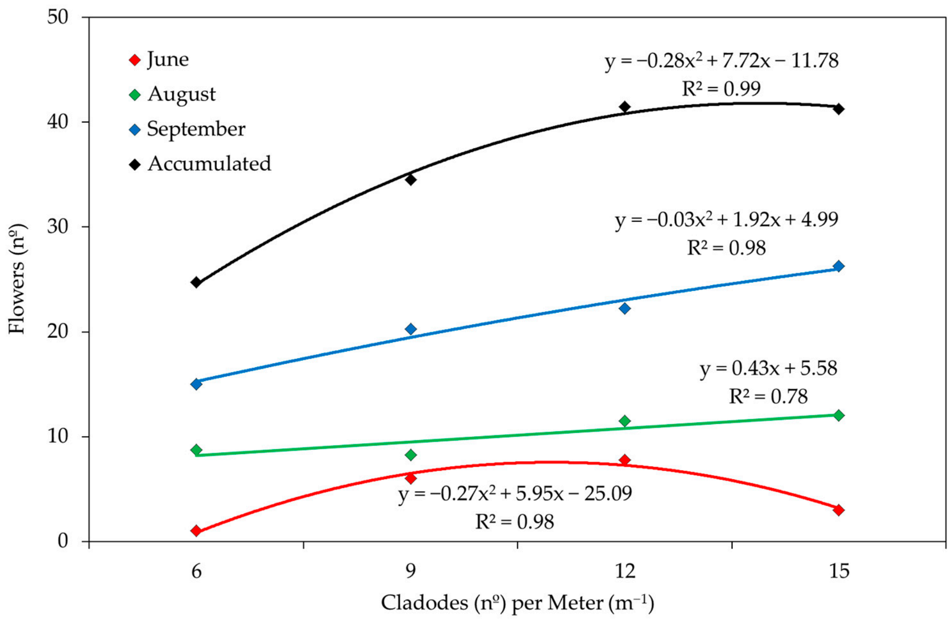

Figure 2. Flowering levels in response to pruning intensity. In red, the first wave; in green and blue, the second and third waves. In black, the total accumulated level of flowering.

As a result of the summation of all three flowering waves, significant differences were found among treatments in the total number of flowers produced, with T_{12} and T_{15} having significantly more flowers (64% more) than the plants of treatment T_6. T_9 had intermediate values, which made the regression analyses show again better fitting for a quadratic equation (R^2 = 0.99; p = 0.0048) (Figure 2).

The conclusion derived from these results is that, to some extent, the higher the number of cladodes left after pruning, the higher the total number of reproductive buds and flowers produced during the season (Figure 2). However, the accumulated flowering obtained in response to pruning was not linear, and the best fitting was obtained for a quadratic equation that gives maximum flowering levels for about 14 cladodes per lineal meter when resolving the equation shown in Figure 2.

As it is quite obvious, removing too many fruitful shoots by pruning eliminates potential flower buds and hence decreases the number of flowers formed. However, leaving a too high number of shoots after pruning does not increase the level of flowering much, as can be seen in Figure 2. This is because pitaya flower development is strongly dependent on solar radiation, so when a too-high number of cladodes are left after pruning, we cannot always select well-illuminated cladodes. This is the reason why the percentage of cladodes forming flowers significantly (p = 0.0026) descended gradually and linearly from 95.0% of them in T_6 to 69.7% in T_{15} (86.7% in T_9 and 84.9% in T_{12}) and the number of flowers per cladode from 2.1 in T_6 to 1.4 in T_{15} (1.9 and 1.7 flower/cladode in T_9 and T_{12}, respectively), confirming the idea that heavy pruning allowed better cladode selection but remove flowers in excess. On the contrary, no pruning or too slight pruning leads to self-shading and then to poor flowering in pitaya [18], as is well-known in many fruit crops [25–29]. In this regard, pitaya-protected cultivation supposes an additional challenge because solar radiation is partly blocked, especially if the covering plastic is not clean enough.

On the other hand, our results show that pruning and flowering levels did not significantly modify buds' abortion (Table 1). Although T_{12} and T_{15} occasionally presented higher rates of flower buds abortion (Table 1), this was the result of some replicates of these treatments with a higher rate of bud drop. The variability in bud drop percentage was, nonetheless, extreme in all treatments and flowering waves, and no coherent trend with pruning treatments could be detected. That is the reason why we decided to take a closer look at bud drop and determine bud abortion in every single cladode in response to their flowering intensity (see second experiment below).

On the other hand, the fruit set was not influenced either by the level of pruning, with more than 80% of the flowers setting fruit after hand cross-pollination (results not shown). In other words, no detrimental effects were noted for a higher flowering favored by lighter pruning on the fruit set, with the latter being a process high in *H. undatus*, as far as pollination is efficiently achieved. Then, if no negative effects were noted due to higher flowering, the number of fruit reaching ripening was, therefore, largely determined by the number of open flowers. As a result of the lack of correspondence between pruning level and flower buds abortion and fruit set, the percentage of buds ending as mature fruit was not significantly related to pruning treatments (p = 0.6955) and was between 77.0 and 84.4% of the flower buds initiated, depending on the pruning level (results not shown).

Fruit size did not depend either on the level of pruning since no significant differences or descending trends were observed among treatments (Table 2). Significant effects on fruit sweetness were not noted either, with the only exception of the values measured in T_{12} that were higher than those obtained in the fruit of T_{15} plants. The trend, however, was not clear since T_6 and T_9 reached intermediate values of T_{12} and T_{15} (Table 2). Therefore, heavier pruning (T_6) did not favor better fruit quality.

Table 2. Fruit size and soluble solid content in response to pruning treatments.

Pruning Treatments	Weight (g)	Diameter (mm)	Length (mm)	TSS (°Brix)
T_6	331.9 a	70.2 a	107.5 a	9.5 ab
T_9	344.6 a	73.2 a	111.7 a	9.3 ab
T_{12}	262.4 a	66.9 a	98.0 a	10.5 a
T_{15}	300.1 a	68.5 a	109.1 a	9.2 b
p	0.4088	0.2740	0.3469	0.0293

Mean comparison in columns by Tukey's test at $p < 0.05$. For each column, different letters indicate a statistical significance.

In addition to the lack of effect of pruning levels on fruit size, the results show that all fruit size parameters were, as expected, closely related ($p < 0.0001$). Correlation analyses showed that fruit weight, diameter and length were all linearly related in this genotype (R = 0.96 and 0.95 for the correlation between fruit weight and diameter and length, respectively, and 0.91 between diameter and length; $p < 0.0001$). This also means that no significant alterations were found in the shape of the fruit depending on its size. At the same time, these close relationships allow for closely estimating fruit diameter and length at harvest by the weight of the fruit and vice-versa. On the contrary, a negative effect of fruit size on TSS content was found (R = −0.66 for the correlation between weight and °Brix; $p = 0.0055$), so heavier fruit were less sweet; the contrary was observed in the T_{12} treatment (Table 2).

The estimated yield fitted a new quadratic equation ($R^2 = 0.83$; $p = 0.1346$), with the maximum yield (4.53 kg m^{-1}) obtained in T_{15} plants (Figure 3). T_6 produced the least, only 3.44 kg per lineal meter, meaning that severe pruning treatment caused losses higher than 1 kg m^{-1}. T_{12} produced as many fruits as T_{15} but of lesser weight (although a little bit sweeter). Therefore, leaving 15 cladodes per lineal meter gave the highest yield in this experiment.

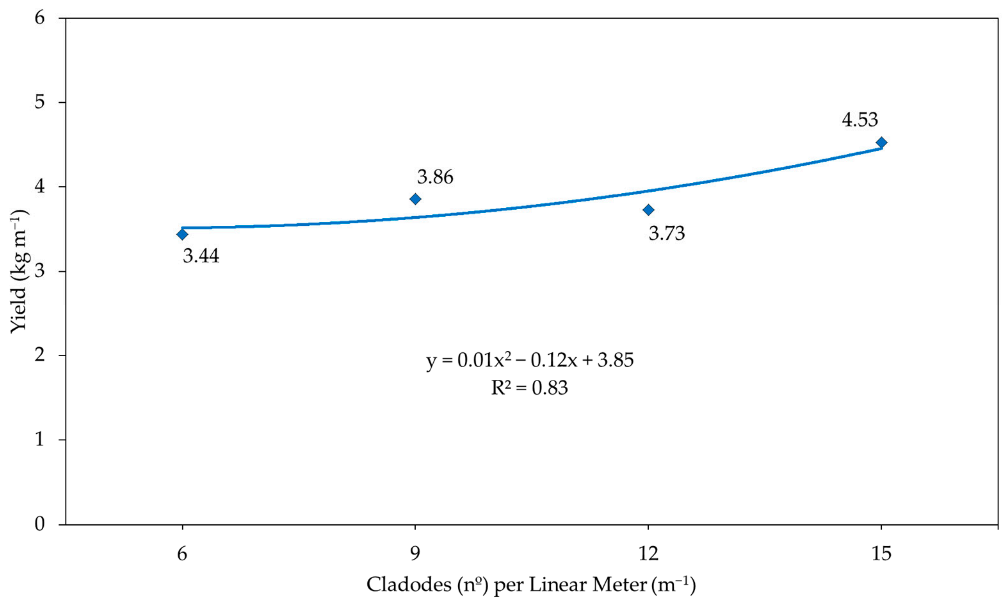

Figure 3. Yield (kg m^{-1}) in response to pruning treatments.

Not many references can be found in the literature about annual pruning in pitaya. Recently, Alam et al. [18] published a similar study but in *H. costaricensis* and trained as a central leader. These authors found a quadratic adjustment with more fruit but of smaller size when leaving the maximum number of cladodes (110 cladodes per pillar, with four plants per support pillar). As a consequence, the highest yield (10 kg per pillar) was obtained when pruning more heavily, leaving only 50 cladodes per pillar. Unfortunately, the dimensions of the pitayas were not given. Assuming a canopy diameter of 2 m, the levels of cladode pruning would be roughly between 5 and 18 cladodes per lineal meter of the perimeter of the canopy (between 4 and 14 cladodes per meter if the canopy diameter was 2.5 m). By making this approximate conversion, Alam et al.'s results suggested that farmers can obtain the best yield by leaving only eight cladodes per lineal meter of canopy. A higher number of cladodes per meter produced more fruit, but they were of lesser weight. Trellis systems, however, are more light captioning efficient since the self-shading of cladodes in the dome of the plants trained as central leader mop top trees is difficult to avoid [30]. In this regard, Truc et al. [30] noted that in mop top trees, only 20–30 outer cladodes produce fruit under this conventional system in Vietnam. Hieu et al. [17] also reported that more than 60% of the flowers are formed in the outer part of the canopy and no more than 5% in the deeper (third) layer of pitayas trained as mop top trees. For that reason, Le Bellec et al. [14] recommend removing by pruning all entangled cladodes. In our trellis system, the maximum number of flowers and fruit were obtained, leaving between 12 and 15 cladodes per meter (Figure 2), while the highest yield was produced, leaving after annual pruning 15 cladodes per meter. Similarly, Truc et al. [30] recommend pruning up to 12 cladodes per plant in a T-Bar trellis, leaving them 10 cm apart, which would represent 10 cladodes per lineal meter. The authors emphasize the importance of sunlight exposure to maintain fertile cladodes. As a whole, the results suggest that optimal yield in pitaya is obtained when selecting by pruning enough well-illuminated cladodes but avoiding overlapping.

In our second experiment, 50 cladodes developed 1 fruit, 27 formed 2 fruit and 6 were able to set and mature 3 fruit. Twenty-six cladodes did not form fruit, and eight cladodes were missing. Regardless of the number of fruit formed, most of them developed in the apical part of the cladodes (73 out of 94 fruit), while only 17 and 4 were formed in the middle and base of the cladodes. This is in agreement with the selection of cane pruning as the most productive procedure for pruning pitaya and the very bad results obtained when performing spur pruning [19]. This pattern of apical fruit set is the result of more flowers being formed at the apex of the cladode as may correspond to a climbing cactus, which must exhibit its large white nocturnal flowers to flying pollinating agents as bats and moths [5] that do not easily penetrate understory forests.

Not only were more fruit formed at the apex of the cladode, but they were also significantly heavier. Thus, the fruit formed at the apex averaged 215.1 ± 7.1 g, for 169.8 ± 14.1 g and 181.3 ± 21.2 g when setting in the middle part and in the base of the cladode, respectively. No significant differences were found, however, in TSS content depending on the section of the cladodes, although again, fruits formed at the apex were slightly sweeter (10.8 vs. 10.2 °Brix). A similar effect on fruit size and sweetness was observed depending on the number of fruit per cladode. Thus, a linear response was observed in both parameters with a similar slope and coefficient of determination (Figure 4). Given the recent domestication of pitaya, we were not able to find any literature regarding sink/source relationships in this species. However, fruit weight in different pitaya species strongly depends on the number of seeds [31–34] and hence on success in pollination (high in all pruning treatments here), as happens in many other berries. However, this does not imply a complete absence of fruit competition, as when more than one fruit per cladode developed, the size of the fruit was reduced (Figure 4). The equation indicates losses of around 30 g per fruit as their number per cladode increases gradually.

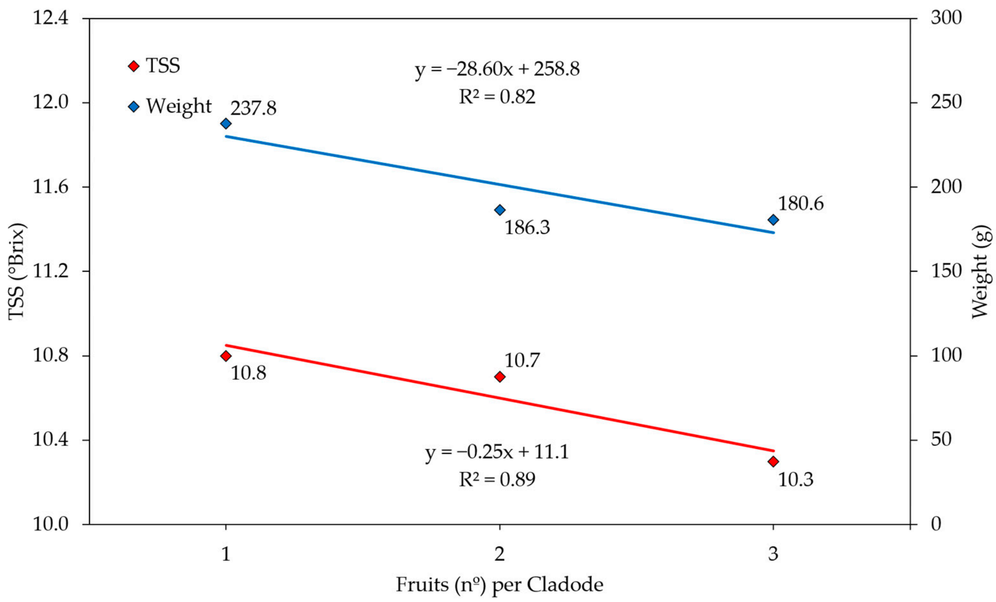

Figure 4. Fruit weight (g; in blue) and total soluble solid content (°Brix; in red) depending on the number of fruits per cladode.

A different question is if flower buds compete among them and if, when we allow more flowers to develop in the same cladode, some of them might abort and drop. In fact, some pitaya farmers tend to remove what they think is an excessive number of flower buds in the edges of the cladodes, intentionally leaving one or two flowers per cladode. Indeed, our results show that, at the cladode level, a high number of flower buds causes a proportionally higher drop (Figure 5), suggesting competition between buds plays a significant role in their abortion. However, flower thinning by hand is not supported by our results since yield is higher when having more fruit per cladode, as can be deduced from Figure 4, and leaving nature to perform the job of thinning is cheaper. Actually, we occasionally found that some cladodes are able to develop until bloom a high number of buds and, more oddly, that some cladodes bearing only one bud lost it before anthesis due to its premature drop. In other words, intense flower initiation gives rise to a higher flower bud drop at the cladode level, but factors other than competition might also play a role in flower buds' abortion. Having said that, if farmers opt for performing this flower thinning, our results show that the fruits formed at the apex of the cladodes are significantly heavier.

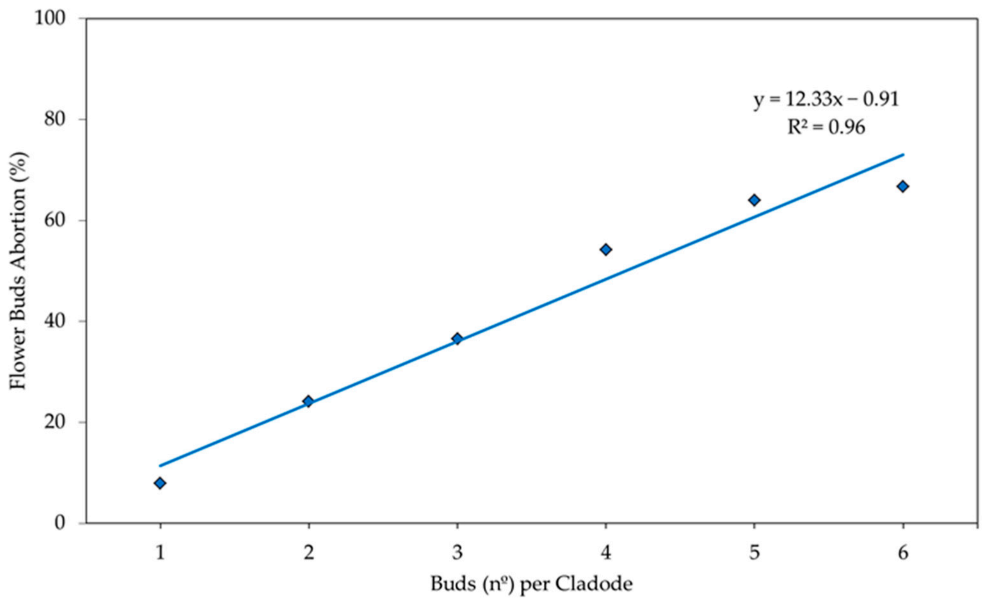

Figure 5. Flower buds abortion in relation to flowering intensity at cladode level.

4. Conclusions

Our results indicate that cane pruning leaving between 12 and 15 cladodes per meter in a trellis system is more productive than leaving only 6–9 cladodes per meter. A positive relationship between the number of flowers and fruit, regardless of pruning levels, justifies less severe pruning. Higher flowering in T_{12} and T_{15} did not provoke a higher rate of flower buds abortion suggesting flower bud thinning by hand is unnecessary. However, if a flower is to be chosen, better select those at the apex since they produce larger fruit. Fruit set and size (and TSS) did not depend on pruning levels either, although we found a reduction in fruit size when a cladode developed more than one fruit. Fruit size was more dependent on the number of fruit per cladode than on the number of cladodes left after pruning (at least in the levels here assessed), suggesting that, in pitaya, the fruitful shoots are, in a great extension, autonomous. Ongoing experiments explore the best dates for pruning, aiming to check if early pruning might allow blooming on the current year's shoots, therefore increasing flowering and yield.

Author Contributions: Conceptualization, J.C. and J.J.H.; methodology, J.C. and J.J.H.; validation, J.C. and J.J.H.; formal analysis, F.M.C. and J.C.; investigation, F.M.C., L.P., E.S., M.C., J.J.H. and J.C.; resources, J.C., M.C. and J.J.H.; data curation, F.M.C., J.C. and J.J.H.; writing—original draft preparation, F.M.C. and J.C.; writing—review and editing, F.M.C., L.P., J.J.H. and J.C.; supervision, J.C. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Data Availability Statement: All tables and figures are original. Not shown data can be given on request.

Acknowledgments: We would like to thank the Cajamar Experimental Station (El Ejido, Almeria, Spain) and Anecoop (Almeria, Spain), which kindly provided means and personnel.

Conflicts of Interest: The authors declare no conflict of interest.

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