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Postharvest pruning as a strategy to decrease shoot vigor and drying in a high-density pecan orchard

Poda pós-colheita como estratégia de redução de vigor e secamento de brotações em pomar de alta densidade de nogueira-pecã

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High-density pecan orchards may improve production and mitigate shading issues with the use of pruning. The period in which it is carried out may influence shoot vigor, branch drying, fructification and fruit quality. This study aimed at evaluating vegetative growth, production and fruit quality by conducting hedge and central pruning in a high-density pecan orchard for two cycles. The cultivar Pitol 1 was subject to the following treatments, which were evaluated in two cycles: no pruning, postharvest hedge pruning, dry hedge pruning, postharvest central pruning and dry central pruning. Variables under analysis were shoot growth, dry branches, production efficiency and fruit quality. Postharvest pruning decreased vigor and, consequently, shoot growth. The number of dry branches decreased after central pruning in both pruning periods whereas hedge pruning did not mitigate the problem. Production and production efficiency just increased after pruning in the second cycle. Fruit borne by trees that were subject to postharvest pruning got heavier but only the ones borne by trees subject to central pruning got larger. Central pruning resulted in lighter and yellowish kernels. Postharvest pruning is an alternative solution to get less vigorous shoot in high-density pecan orchards and its response is similar to the one of the winter pruning regarding reduction in dry branches. Postharvest central pruning is the treatment that increases fruit quality more than the others, in terms of size and weight.
Key words: *Carya illinoinensis*, luminous intensity, shading.

Pomares de nogueira-pecã conduzidos em alta densidade, por meio da poda, podem melhorar a produção e reduzir problemas de sombreamento. A época de realizar a poda pode influenciar no vigor da brotação, secamento de ramos, na frutificação e na qualidade de frutos. Objetivou-se com este estudo avaliar o crescimento vegetativo, produção e qualidade de frutos com a realização das podas hedge e central em duas épocas em pomar de nogueira-pecã de alta densidade. Os tratamentos avaliados em duas safras com a cultivar Pitol 1 foram: sem poda, poda hedge pós-colheita, poda hedge seca, poda central pós-colheita e poda central seca. As variáveis analisadas foram crescimento de brotações, presença de ramos secos, eficiência produtiva e qualidade dos frutos. A poda pós-colheita reduziu o vigor e consequentemente o crescimento das brotações. A presença de ramos secos foi reduzida com a poda central em ambas as épocas de execução, enquanto a poda hedge não reduziu esse problema. A produção e eficiência produtiva foram aumentadas pelas podas somente na segunda safra após a realização. Os frutos de plantas submetidos as podas pós-colheita obtiveram maior peso, porém somente as com poda central obtiveram maior tamanho. A poda central resultou em amêndoas mais claras e amareladas. A poda pós-colheita é uma alternativa para obter brotações menos vigorosas em pomares de nogueira-pecã em alta densidade e apresenta resposta semelhante na redução de ramos secos da poda executada durante o inverno. A poda central pós-colheita que mais aumenta a qualidade de frutos, com incremento de tamanho e peso.
Palavras-chave: *Carya illinoinensis*, intensidade luminosa, sombreamento.

1. INTRODUCTION

Pecan is an arboreal fruit plant which may grow to 40 m in height and 20 m in canopy diameter [1]. Regarding its characteristics, it grows slowly and bears fruit after the 6th year, even though consistent commercial production may only be expected after the 10th year. The culture has experienced growth in Brazil and the country ranks fourth in pecan production nowadays [2]. Average yield of Brazilian orchards, which ranges between 600 and 1000 $kg.ha^{-1}$ [3], has been considered unsatisfactory in the light of its feasibility. Certain factors, such as new unproductive or low-yield orchards and, mainly, poor management practices in old orchards, may lead to low yield [3].

High-density in fruit orchards, such as pecan ones, aims at reaching high yield in early years and, consequently, high financial gains per hectare [4-6]. As a result, many farmers have implanted high-density orchards with more than 100 trees per hectare.

However, when orchards reach the production phase, they have problems due to excess shading caused by branch overlapping [1, 7]. Shading is a critical factor insofar as the most harmed branches are the ones found in the basal part of trees, the ones which, in ideal conditions, bear more nuts [8]. In other fruit cultures, feasibility of high-density goes together with certain techniques, such as the use of dwarf rootstocks or cultivars, vigor control with frequent pruning and the use of plant regulators [9-11]. A limiting factor in pecan production is the fact that dwarf pecan rootstocks and cultivars are not available yet [12].

Pruning, which is an alternative technique to improve production and decrease shading issues, has been widely used in fruticulture. Its physiological principles are plant vigor control, high production of quality fruit, regulation of fruitful and vegetative branches, tree conduction systems, removal of poorly-positioned, sick and dead branches and regulation of production alternation [13, 14].

In adult high-density orchards, pruning aims at enabling sunlight penetration among branches since only branches that have photosynthetic activity are able to bear fruit. In orchards with shading problems, hedge pruning and central pruning have been investigated [8]. The former is usually mechanized and consists of lateral tip pruning, which originates a fruit wall, while the latter consists in removing strategic branches from the inside of canopies [15-18].

Pruning is usually carried out in winter, in the dormancy period. However, the period may influence pecan shoot vigor, branch drying and fructification. A problem that has been observed when pruning is carried out during dormancy is vigorous shoot growth [19]; in the case of opening pruning, shading in the orchard may become a problem again. The study of alternative periods in the search for low shoot growth is needed to observe responses. Pecan harvest takes place in fall even though its dates may vary among cultivars. Postharvest pruning may be an alternative since it is carried out when trees still have leaves, but fruit harvest is not affected.

Therefore, this study aimed at evaluating vegetative growth, production and fruit quality by conducting hedge and central pruning in a high-density pecan orchard for two cycles.

2. MATERIAL AND METHODS

The experiment was carried out in a commercial pecan orchard in Santa Rosa, Rio Grande do Sul (RS) state, Brazil (27°55’15” S; 54°32’37” W; altitude 330 m). In the Köppen-Geiger classification, the climate in the area is Cfa [20]. Data on monthly maximum and minimum temperatures and on rainfall in the period were provided by the Sistema de Monitoramento Agrometeorológico da Agritempo (Figure 1). The soil is typic dystropherric red latosol [21]. The orchard was implanted in 2008, spacing was 7 m x 7 m and density was 204 trees per hectare. No annual pruning management had been carried out after pruning conducted in the fifth year. The orchard does not have any irrigation system. The orchard was subject to 5-6 fungicide applications per cycle but neither herbicide application nor field mowing was carried out because there is sheep and crop integration in the area. Fertilization, which was based on soil and leaf analyses, consisted of organic compost, triple superphosphate and chlorinated urea.

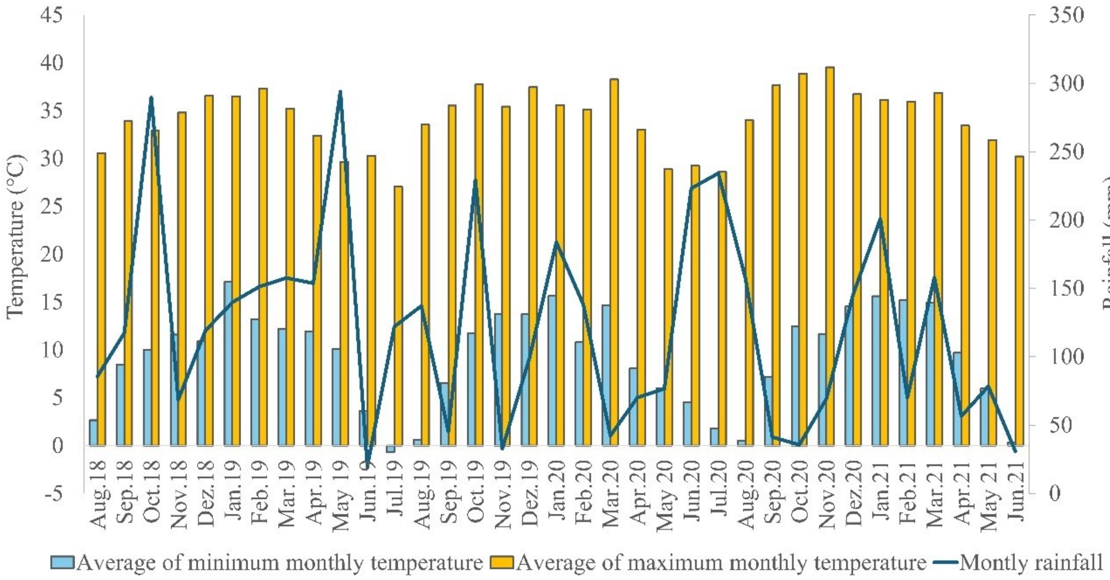

Figure 1. Averages of monthly minimum and maximum temperatures and rainfall in Santa Rosa, RS, Brazil, between August 2018 and June 2021. Source: data issued by the Agritempo - Sistema de Monitoramento Agrometeorológico.

The experiment had a completely randomized block design with three replicates and five trees per reproduction. Treatments consisted in combining two pruning methods and two periods: 1) no pruning (Figure 2a); 2) postharvest hedge pruning (fall) (Figure 2b); 3) dry hedge pruning (winter) (Figure 2c); 4) postharvest central pruning (fall) (Figure 2d); and 5) dry central pruning (winter) (Figure 2e). Postharvest pruning was carried out in fall while dry pruning was conducted in winter. Treatments were applied to grafted trees of the cultivar Pitol 1, which is also known as 'Melhorada'. This cultivar has been registered in Brazil and exhibits vigorous growth and compact leaflets.

Hedge pruning, i. e., lateral tip pruning of branches, was carried out by a motor pruner and a pruner with an extension pole in two steps: one side in the first year and the other side, in the following year (among rows, east-west sun path). Branches were pruned 2.5m from the trunk. Dry hedge pruning was carried out on August 8th, 2018 and on August 13th, 2019. Postharvest hedge pruning took place on June 1st, 2019 and on June 8th, 2020. Central pruning, which meant removing from one to three branches from the inner crown by a motor pruner, was conducted in a single step: winter central pruning took place on August 8th, 2018 while the postharvest one was carried out on June 2nd, 2019. After pruning, branches were cut and weighed on a mechanical scale and the pruning mass of every treatment was determined.

The number of dry branches was evaluated throughout the vegetative period of trees in 2020 and 2021; branches that had no leaves and the ones that had dry leaves were counted. Growth of shoots that emerged on spots where branches were cut was evaluated. Length of four shoots per tree was measured by a measuring tape one year after pruning. Annual branch growth was evaluated in unpruned trees.

Pruning mass was evaluated by weighing pruned branches on a scale. To evaluate hedge pruning, the sum of pruning masses of both sides pruned annually was used while the evaluation of central pruning required the weight of branches pruned in the middle of canopies.

Pecans were harvested between June 2nd and 4th, 2020 and between June 15th and 16th, 2021 by a shaker mounted on a tractor. They were manually picked up from the ground. Production was evaluated by weighing pecans of every tree on a digital scale. Yield, production efficiency in relation to the canopy volume (PECV) and production efficiency in relation to the trunk cross-sectional area (PETCSA) were estimated by the following equations: yield based on production per tree and tree density; PECV = production (kg)/canopy volume (m^3); PETCSA = production (kg)/trunk cross-sectional area (cm^2).

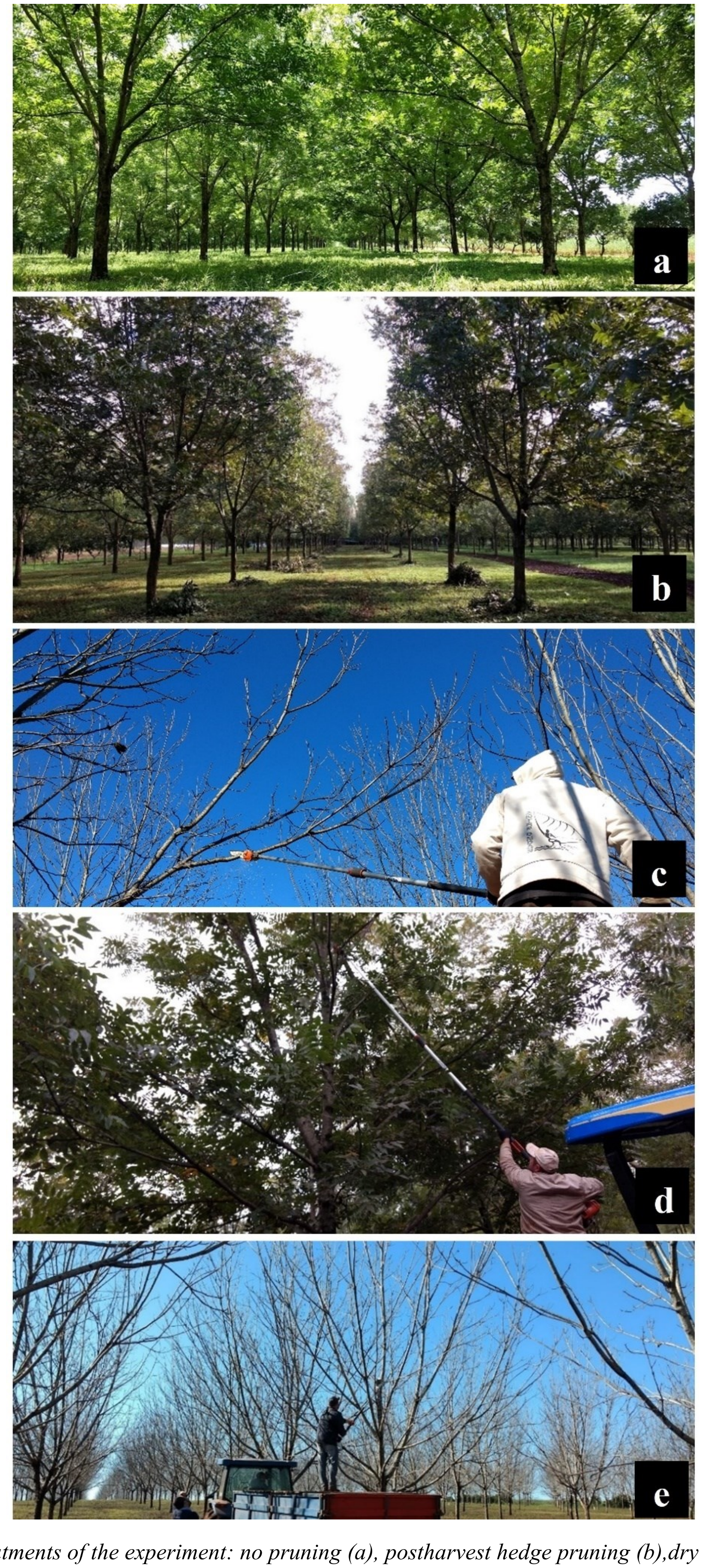

Figure 2. Treatments of the experiment: no pruning (a), postharvest hedge pruning (b),dry hedge pruning (c), postharvest central pruning (d) and dry central pruning (e).

Canopy volume and trunk cross-sectional area were found by the following equations:

$$CV = \frac{1}{3} \cdot \pi \cdot r^2 \cdot h$$

CV = canopy volume π = 3,1416 r = canopy radius h = canopy height

$$TCSA = \pi . r^2$$

TCSA = trunk cross-sectional area π = 3,1416 r = trunk radius

Samples (1.4 kg) of every tree were collected, subject to a drying process in a forced air oven and evaluated to determine the number of fruit per kg. Afterwards, 25 fruit per sample were randomly selected (nine samples per treatment, totaling 225 fruit) to evaluate fruit mass, kernel mass, shell mass (g), fruit length, fruit diameter, kernel length and kernel diameter (mm). Kernel yield was calculated by the following equation: kernel yield (%) = (kernel mass (g)/fruit mass (g)) x 100. Kernels also had their luminosity and color evaluated by a Konica Minolta 410. Besides, the percentage of commercial kernels was also calculated after excluding all kernels with defects caused by oxidation, stained by insects, attacked by diseases and shriveled ones.

Results were subject to the analysis of variance and averages were compared by the Tukey's test at 5% error probability by the Sisvar 5.6 program [22].

3. RESULTS AND DISCUSSION

Postharvest pruning, which was carried out in fall, resulted in lower shoot growth than the one that resulted from the same pruning method conducted in winter (dry pruning) (Figure 3). Hedge pruning led to 7.58% decrease in shoot growth while central pruning led to 30.05% decrease, by comparison with the same pruning method conducted in winter. Therefore, both pruning methods led to lower growth when they were carried out right after harvest, which is an interesting fact regarding maintenance of sunlight inside and among trees.

Winter corresponds to vegetative dormancy, when important metabolic processes, such as translocation of bud water and carbohydrate mobilization to adjacent tissues – branches, trunk and, mainly, roots –, take place in plants [23]. According to Faust (1989) [19], pruning in dormancy is invigorating while, in the vegetative period, it decreases growth, a fact that was observed by this study. Wells (2024) [24] compared shoot growth of trees that were subject to hedge pruning in winter and summer and observed that, when pruning was carried out in the vegetative period, growth decreased 76%, i. e., it showed a very satisfactory result.

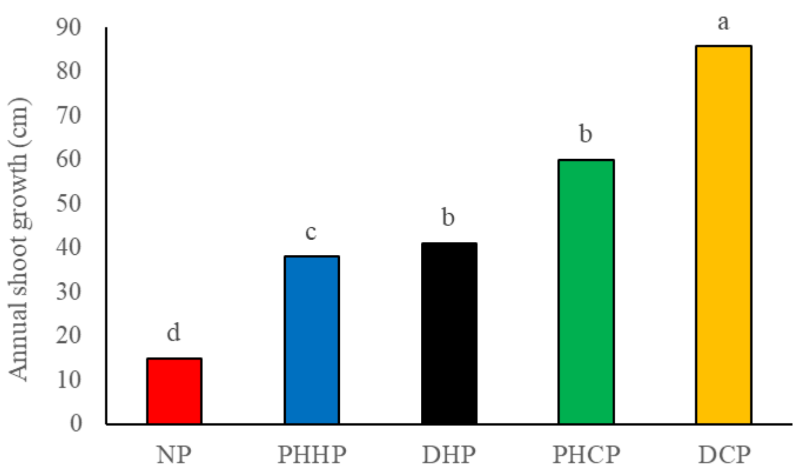

Figure 3. Annual shoot growth of high-density pecan trees subject to the following treatments: no pruning (NP); postharvest hedge pruning (PHHP), dry hedge pruning (DHP), postharvest central pruning (PHCP) and dry central pruning (DCP).

Pruning mass of postharvest and dry central pruning was higher than the one of hedge pruning carried out in both periods (Figure 4). The difference results from the pruning method, since hedge pruning meant only tip pruning of branches while central pruning meant the removal of whole branches, a fact that increased pruning mass removed from trees.

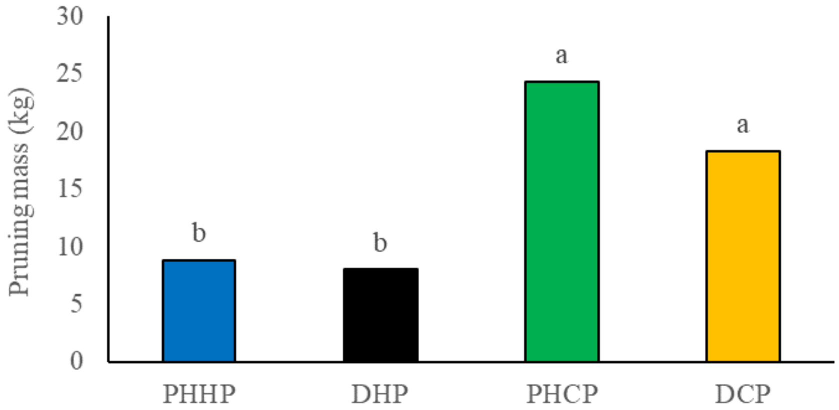

Figure 4. Pruning mass of high-density pecan trees subject to the following treatments: postharvest hedge pruning (PHHP), dry hedge pruning (DHP), postharvest central pruning (PHCP) and dry central pruning (DCP)

Dry central pruning decreased the number of dry branches in both cycles while postharvest central pruning decreased it in the second cycle (Figure 5). The average of cycles showed that both central pruning methods resulted in fewer dry branches. Decrease in the number of dry branches after central pruning was mainly due to more sunlight penetration in the canopy. Sunlight is a crucial factor to keep leaves of basal branches and the inner canopy photosynthetically active. On the other hand, in shading conditions, leaves end up losing this capacity and drying. As opposed to central pruning, hedge pruning did not decrease branch drying. It may have happened because the former ends up increasing the number of branches on tree laterals and there is more sunlight in these places, even though the inner canopy is shaded. Another factor is that many branches subject to tip pruning do not sprout anymore. Branch drying is a huge problem in pecan trees because the most harmed branches, the basal ones, are the ones that exhibit the highest potential of production [8].

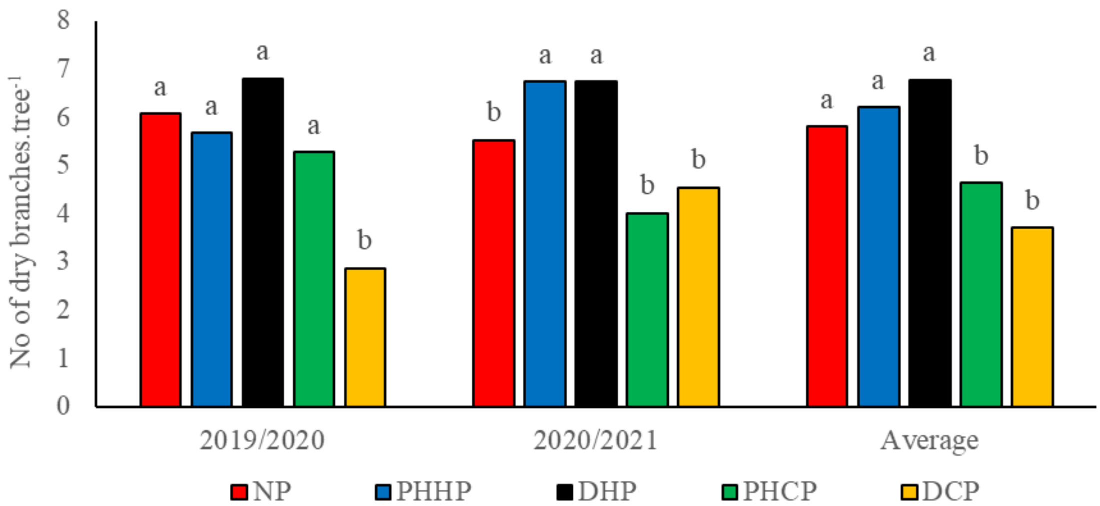

Figure 5. Number of dry branches per pecan tree subject to the following treatments: no pruning (NP); postharvest hedge pruning (PHHP), dry hedge pruning (DHP), postharvest central pruning (PHCP) and dry central pruning (DCP)

As expected, in the first year, production was lower in trees that were subject to pruning methods, regardless of the period in which they were conducted. However, in the second year, production was higher in pruned trees (Table 1). Pruning increased the number of twigs, i. e., the productive branches of pecan trees, which were from 5 to 40 cm in length [25].

There was production alternation in both cycles under evaluation. There was low production in 2019/2020 while there was higher production in 2020/2021. Production alternance results mainly from two reasons: fruit ripening at the end of the cycle, near leaf senescence, a fact that decreases time to accumulate carbohydrates to the next cycle; and fruit composition, i. e., 70% of lipids wears trees out in years in which there is high production [23, 26].

Table 1. Production per tree, yield, production efficiency in relation to the canopy volume (PECV) and production efficiency in relation to the trunk cross-sectional area (PETCSA) of pecan trees subject to the following treatments: no pruning; postharvest hedge pruning, winter hedge pruning, postharvest central pruning and winter central pruning in both cycles 2019/2020 and 2020/2021 and their average

Treatments	Production per tree (kg)	Yield (kg ha^{-1})	PECV (kg m^3)	PETCSA (kg cm^2)
	2019/2020			
No pruning	3.84 a	784.18 a	0.029 a	0.012 a
Postharvest hedge pruning	2.50 b	509.32 b	0.021 a	0.007 b
Dry hedge pruning	1.52 c	310.35 c	0.011 b	0.004 bc
Postharvest central pruning	1.42 c	289.27 c	0.009 b	0.003 c
Dry central pruning	2.05 bc	418.18 bc	0,012 b	0.005 bc
p value	0.0001	0.0001	0.0001	0.0001
	2020/2021			
No pruning	6.22 b	1269.83 b	0.048 b	0.020 ns
Postharvest hedge pruning	7.60 ab	1549.58 ab	0.066 a	0.021
Dry hedge pruning	9.49 a	1936.37 a	0.066 a	0.021
Postharvest central pruning	9.43 a	1923.72 a	0.061 ab	0.022
Dry central pruning	9.32 a	1901.14 a	0.056 ab	0.023
p value	0.0001	0.0001	0.0015	0.7214

*Averages followed by different letters on a column differ by the Tukey's test at 5% probability; ns= non-significant.

Production efficiency in relation to the canopy volume (PECV) in the 2019/2020 cycle was higher when there was no pruning and when postharvest hedge pruning was conducted. In the 2020/2021 cycle, hedge pruning stood out in both periods (Table 1). The second cycle shows that tip pruning carried out throughout hedge pruning not only increased production but also decreased canopy volume, thus, moving production closer to tree axes and making them more efficient in producing fruit. Production efficiency in relation to the trunk cross-sectional area was higher when trees were not pruned in the 2019/2020 cycle, a fact that is closely related to low production after the other treatments were conducted. In the following cycle, there was no significant difference.

Fruit mass showed differences in the second cycle and in the average of cycles. Hedge and central pruning conducted in winter and hedge pruning conducted in fall led to higher fruit mass than the one of unpruned trees (Table 2). Kernel mass did not show any difference in both cycles under evaluation. Shell mass only showed differences in the 2020/2021 cycle and in the average of both cycles under evaluation. In the 2020/2021 cycle, the four pruning treatments resulted in high masses. The average of both cycles showed that postharvest hedge pruning and both central pruning methods led to higher shell masses.

Regarding the variable fruit per kg, dry central pruning was more effective in the first cycle by comparison with treatments with no pruning and postharvest central pruning. In the 2020/2021 cycle and average of cycles, there was no significant difference among treatments. This variable is also important, mainly to classify nuts into sizes. Considering the average of cycles, fruit resulting from all treatments were classified into giant nuts, in agreement with the Mexican norm NMX-FF-084-SCFI-2009 [27].

Table 2. Fruit mass, kernel mass, shell mass and fruit per kg of 'Pitol 1' pecan trees subject to different pruning methods and periods in Santa Rosa, RS, Brazil, in both cycles 2019/2020 and 2020/2021 and their average.

Treatments	Fruit mass (g)	Kernel mass (g)	Shell mass (g)	Fruit.kg^{-1}
	2019/2020			
No pruning	8.42 ns	4.66 ns	3.75 ns	119.87 b
Postharvest hedge pruning	8.76	4.90	3.86	122.93 ab
Dry hedge pruning	8.77	4.94	3.83	125.87 ab
Postharvest central pruning	8.83	4.88	3.94	121.13 b
Dry central pruning	8.72	4.85	3.87	128.93 a
p value	0.4145	0.3424	0.4512	0.0080
	2020/2021			
No pruning	8.55 b	4.65 ns	3.91 b	118.60 ns
Postharvest hedge pruning	9.14 a	4.81	4.33 a	116.60
Dry hedge pruning	8.91 ab	4.72	4.19 a	119.33
Postharvest central pruning	9.34 a	4.91	4.43 a	115.20
Dry central pruning	9.29 a	4.90	4.38 a	116.47
p value	<0.0001	0.0650	<0.0001	0.0452
	Average			
No pruning	8.49 b	4.65 ns	3.83 b	118.16 ns
Postharvest hedge pruning	8.95 a	4.86	4.09 a	116.04
Dry hedge pruning	8.84 ab	4.83	4.01 ab	119.09
Postharvest central pruning	9.08 a	4.90	4.19 a	114.07
Dry central pruning	9.00 a	4.88	4.13 a	118.14
p value	0.0057	0.1068	0.0006	0.1100

*Averages followed by different letters on a column differ by the Tukey's test at 5% probability: ns= non-significant.

Concerning fruit length and fruit diameter, postharvest central pruning led to the highest averages (Table 3). Kernel length was high after all pruned treatments. However, kernel diameter was only high after both postharvest pruning processes, by comparison with unpruned trees. Even though there was variation between both cycles, postharvest central pruning was the treatment that increased fruit and kernel sizes the most, by comparison with the treatment with no pruning. Central pruning carried out after harvest has the advantage of immediate increase in sunlight when branches are removed. It enables to adjust the number of branches and to define which ones cause tree shading.

The variable kernel yield only showed any difference among treatments in the second cycle in which the treatment with no pruning led to higher kernel yield than postharvest hedge pruning (Table 4). The factor that determined low kernel yield after postharvest hedge pruning was the number of shriveled fruit: it was 2-fold higher than the one found when trees where not pruned. Kernel yield is one of the criteria used to evaluate and determine the price paid for nuts; the higher the kernel percentage, the higher the price paid to farmers. Pruning did not increase this variable in any year under evaluation. It should be highlighted that the orchard does not have any irrigation system. De Marco et al. (2021) [28] evaluated the effect of irrigation from January to May on the cultivar Success and found increase in kernel yield when 140 L tree^{-1} was applied every two days. Bilharva et al. (2018) [3] reported 55.24% kernel yield, which was reached in the first cycle under evaluation.

Table 3. Fruit length, fruit diameter, kernel length and kernel diameter of 'Pitol 1' pecan trees subject to different pruning methods and periods in Santa Rosa, RS, Brazil, in both cycles 2019/2020 and 2020/2021 and their average.

Treatments	Fruit length (mm)	Fruit diameter (mm)	Kernel length (mm)	Kernel diameter (mm)
		2019/2020		
No pruning	43.48 b	23.25 ns	34.35 b	19.17 b
Postharvest hedge pruning	44.04 ab	23.40	35.01 ab	19.51 ab
Dry hedge pruning	43.87 ab	23.12	35.18 ab	19.54 ab
Postharvest central pruning	44.99 a	23.53	35.88 a	19.67 a
Dry central pruning	44.02 ab	23.16	35.28 ab	19.39 ab
p value	0.0456	0.0671	0.0611	0.0411
		2020/2021		
No pruning	43.88 c	24.02 c	34.46 c	20.71 ns
Postharvest hedge pruning	45.54 ab	24.51 b	35.85 ab	20.98
Dry hedge pruning	45.40 b	24.50 b	35.61 b	20.85
Postharvest central pruning	46.49 a	25.00 a	36.67 a	20.95
Dry central pruning	45.30 b	24.54 b	35.94 ab	20.88
p value	<0.0001	0.0001	0.0001	0.2028
		Average		
No pruning	43.68 c	23.63 c	34.41 b	19.94 b
Postharvest hedge pruning	44.79 ab	23.95 b	35.43 a	20.24 a
Dry hedge pruning	44.63 bc	23.81 bc	35.39 a	20.19 ab
Postharvest central pruning	45.74 a	24.24 a	36.27 a	20.31 a
Dry central pruning	44.66 abc	23.85 bc	35.61 a	20.13 ab
p value	<0.0001	<0.0001	<0.0001	0.0035

*Averages followed by different letters on a column differ by the Tukey's test at 5% probability; ns= non-significant.

Kernel luminosity was high in both treatments with central pruning in both cycles (2019/2020 and 2020/2021). The average of cycles showed that postharvest central pruning and winter central pruning led to higher values than the treatment with no pruning. Results enable to infer that central pruning results in clearer kernels, by comparison with hedge pruning. Some factors, such as high sunlight penetration and air circulation in the inner canopy, may be related to it. Hedge pruning decreased branch overlapping, mainly from neighboring trees, but increased plant mass close to tree axes.

Kernel color was better after winter central pruning in both cycles under evaluation: in the 2019/2020, by comparison with all other treatments; in the 2020/2021 cycle, by comparison with winter hedge pruning and postharvest central pruning. The average of cycles showed that winter central pruning led to better results than the other treatments, whose results were even worse than the one of the treatments with no pruning. Kernel color and kernel luminosity have been used as criteria of kernel freshness since dark and reddish kernels are related to rancidity while clear and yellowish ones are associated with new and quality products [8, 29]. The variable commercial kernels did not show any significant difference among treatments in the cycles under evaluation.

Table 4. Kernel yield, kernel luminosity, kernel color and commercial kernels of 'Pitol 1' pecan trees subject to different pruning methods and periods in Santa Rosa, RS, Brazil, in both cycles 2019/2020 and 2020/2021 and their average.

Treatments	Kernel yield (%)	Luminosity (L*)	Color (°Hue)	Commercial kernels (%)
		2019/2020		
No pruning	55.02 ns	46.31 b	71.59 b	92.00 ns
Postharvest hedge pruning	55.68	46.38 b	69.34 c	96.00
Dry hedge pruning	55.92	45.94 b	70.60 bc	91.55
Postharvest central pruning	55.15	48.34 a	69.94 c	94.67
Dry central pruning	55.34	48.65 a	73.17 a	94.22
p value	0.4136	<0.0001	<0.0001	0.1098
		2020/2021		
No pruning	53.97 a	40.07 ns	68.34 ab	88.00 ns
Postharvest hedge pruning	51.66 b	41.37	67.92 ab	90.22
Dry hedge pruning	52.28 ab	41.56	67.31 b	88.44
Postharvest central pruning	52.09 ab	41.07	67.34 b	86.67
Dry central pruning	52.21 ab	41.17	68.74 a	89.33
p value	0.0264	0.2460	0.0117	0.7804
		Average		
No pruning	54.49 ns	43.19 b	69.97 b	90.00 ns
Postharvest hedge pruning	53.67	43.88 ab	68.63 c	93.11
Dry hedge pruning	54.10	43.75 ab	68.96 c	90.00
Postharvest central pruning	53.62	44.71 a	68.64 c	90.67
Dry central pruning	53.77	44.91 a	70.96 a	91.78
p value	0.3099	0.0023	<0.0001	0.3745

*Averages followed by different letters on a column differ by the Tukey's test at 5% probability; ns= non-significant.

The authors believe that the evaluation of postharvest pruning carried out in different pecan cultivars is important since their responses may vary. The cultivar Pitol 1 exhibits late ripening; as a result, pruning is also late. Other cultivars whose harvest is precocious may favor precocious pruning which may exert effect on decrease in shoot growth.

4. CONCLUSION

- The pruning period interferes with annual pecan shoot growth and results in lower growth when pruning is carried out in the postharvest period.
- Central pruning conducted in fall and in winter decreases the number of dry branches in trees.
- Fruit production increases when dry hedge pruning, postharvest central pruning and dry central pruning are carried out in high-production years.
- Postharvest central pruning is the one that increases pecan quality the most, in terms of fruit size and mass.

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