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EVALUATION OF DIFFERENT ROOTSTOCKS AND CULTIVARS ON PRUNING WEIGHT IN YOUNG PEAR TREES

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Abstract: This study was carried out to evaluation of the effects on pruning weight (kg plant^{-1}), cumulative pruning weight per plant (kg plant^{-1}), and cumulative pruning weight per hectare (kg ha^{-1}) of 3 quince rootstocks [Quince BA29 (BA29), Quince A (QA), Quince C (MC)] and 3 pear clonal rootstocks (Fox11, OHxF333, Farold 40) and pear seedling rootstocks grafted with 4 standard pear cultivars ('Abate Fetel', 'Deveci', 'Santa Maria', 'Williams') between 2019-2021 years. Rootstocks, cultivars, research years and their interactions significantly affected all examined parameters in the study, except for the interaction of year x rootstock x cultivar. Regarding rootstock averages, the highest pruning weight (kg plant^{-1}) was observed from Fox 11, the lowest was in the BA29, QA, and MC quince rootstocks. Regardless of the cultivar averages, the highest pruning weight was in the 'Deveci', the lowest was in the 'Santa Maria' pear cultivar. The highest pruning weight (kg plant^{-1}) was observed from 'Deveci'/Fox11, and the lowest was in the 'Williams'/QA, 'Williams'/BA29, 'Abate Fetel'/MC, and 'Santa Maria'/MC combinations in terms of rootstock x cultivar interaction. The highest cumulative pruning weight per plant (kg) was determined in the 'Deveci'/Fox11, the lowest was in the 'Williams'/QA combination in terms of rootstock x cultivar interaction. Furthermore, the highest cumulative pruning weight per hectare (kg) was determined in the 'Deveci'/Fox11, the lowest was in the 'Williams'/QA, 'Williams'/BA29, 'Abate Fetel'/MC, 'Santa Maria'/MC, and 'Santa Maria'/Seedling combination in terms of rootstock x cultivar interaction. Except for the pear seedling rootstock, quince clone rootstocks generally had lower all pruning weight traits than pear clone rootstocks in the study. It can be said that the weaker development of quince rootstocks compared to pear rootstocks causes this situation. According to the results of this study carried out on young pear trees, it can be said that quince rootstocks are somewhat advantageous due to less pruning labor and cost.

Keywords: Pear, Rootstock, Cultivar, Cumulative pruning weight, Pruning weight

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1. Introduction

Pear fruit belongs to the *Pyrus* genus of the pome fruit group, related to the *Pomoideae* subfamily and *Rosaceae* family of the Rosales order, which is a crucial fruit species after apple is grown in the temperate climatic regions of the world. Most of the cultivated pear cultivars originate from *Pyrus communis* and *Pyrus serotina*. Türkiye is one of the *Pyrus communis* homeland (Özbek, 1978). World pear production reported 23109219 tons, and Türkiye's pear production ranked fifth in the world with 545.569 tons. China took place in the first position with 16 million tons, Italy in the second with 619470 tons, America in the third with 609628 tons, and Argentina in the fourth position with 600000 tons (FAOSTAT, 2022). In pear orchards, 100 tons of pruning debris are obtained annually. In 2016, 128 thousand tons of pruning residue were obtained from 16000 hectares of pear and apple orchards in Belgium. Pruning residues are now often burned on garden sides, which this incineration process increases the carbon pollution or remains near the orchards that can be the second home of pests and diseases (Boeykens et al., 2018). In order to obtain regular yield and fruit of the high quality from pear trees, pruning is essential and should be done correctly (Larsen and Fritts, 1984; Rom and Carlson, 1987; Jackson, 2003). The pear tree shows specific fruit structures due to the location of the buds on the branches. These buds evaluate in different ways according to their environmental conditions and their importance. Due to the variations in the environmental necessities of cultivars, pear trees require specific pruning methods for high yield and ideal quality fruit production (Jackson, 2003). Pruning varies according to different cultivars and rootstocks' responses and growing strength. Pear cultivars with less vegetative growth, such as 'Hardy', 'Flemish Beauty', 'Anjou', and 'Comice' produce high yield, and 15-20 years old trees form tiny branches that give less fruit. Therefore, regular and conscious pruning is essential for high yield and acceptable fruit quality. However, in the pear orchards without pruning, trees develop severely zigzag, show excessive fruit load, but produce small and poor quality fruit (Gurpinder et al., 2018). In low-yielding pear orchards, vigorous rootstocks and cultivars are the main factors limiting pear production (Maas, 2008; Hawerroth and Petri, 2011; Rufato et al., 2012; Pasa et al., 2016,

2017). *Pyrus* and *Cydonia* species are used as rootstock for pear production (Iglesias and Asin, 2011; North et al., 2015). However, *Pyrus* species as rootstocks have some problems, such as strong growth, heterogeneity, and slow production (Maas, 2008; Massai et al., 2008). Rootstock selection is vital for determining the vegetative development of trees, plant production, garden management, and planting densities (Webster, 2002). Extremely vigorous rootstocks provide excessive vegetative development, reducing the use of light by fruits (Jackson, 2003; Sharma et al., 2009; Clingeleffer et al., 2019). Therefore, pruning of intertwined branches, diseased branches, and dry branches is necessary for benefiting from light and regular fruit formation, and pruning increases the number of high-quality fruits (Sharma et al., 2009). Branch drying, fungal diseases, and other pathogens are minimized when appropriate pruning techniques are used in the orchards (Badrulhisham and Othman, 2017). However, since pruning is costly, rootstocks and cultivars with low vegetative growth are always desired features in pear cultivation. Pruning was reported to be responsible for more than 20% of variable costs in apple 'Gala' orchards in Washington (Gallardo et al., 2009). In addition, pruning is cumbersome and can result in worker falls, cuts, and dangerous injuries (Fathallah, 2010). However, pear cultivars grafted on quince rootstocks show earliness and uniformity of production (North et al., 2015). At the same time, dwarf rootstocks allow good orchard management, high-density planting, and require less pruning (Maas, 2008). In Europe QA, QC, EMH, BA29, Adams 332, and Sydo rootstocks are used (Jackson, 2003). These rootstocks are 40-50% dwarfed, provide early maturation and high yield, and at the same time, they require less pruning (Lombard and Westwood, 1987). The aim of this study was to investigate the effects of BA29, QA, MC, FOX11, FAROLD40, OHF333, and seedling rootstocks on the pruning weights of 'Abate Fetel', 'Deveci', 'Williams' and 'Santa Maria' cultivars.

2. Materials and Methods

This study was carried out in the pear orchard established with 1-year-old saplings in Ondokuz Mayis University Bafra Agricultural Research Center (41°33'50'' N, 35°52'23'' E, and 20 m altitude) in 2018. In the study, dwarf rootstocks (quince) were planted at 1.5x3.5 m (1905 plant ha^{-1}), semi-dwarf and seedling rootstocks were planted at 3.0x3.5 m distances (953 plant ha^{-1}). In the study, 'Deveci', 'Williams', 'Santa Maria', and 'Abate Fettel' pear cultivars grafted on BA29, Quince A, and Quince MC clone rootstock and OHxF333, Fox11, Farold40 pear clone, and seedling rootstocks were used. In the research, the plants were supported by wires on the horizontal arms of 50 cm length, passed from a height of about 50 cm from the ground, and 3.5 m high metal poles with 4 rows of galvanized wire at 80 cm intervals on the main stem. The plants were pruned regularly every year according to the modified leader system. The plants were irrigated with drip irrigation between 15 May and 15 September. Fertilization was done with 15-30-15+ME fertilizer at the beginning of summer and 20-20-20 NPK-containing fertilizer in autumn with drip irrigation. Winter fertilization was done by giving it to the crown projection of the plants with NPK fertilizer containing 15-15-15+Zn in winter. The rows were covered with black ground mulch for weed control, and the rows were regularly processed with a rotovator. The trial area has a soil depth of more than 1 meter and the soil has 2.73-10% clay (low), 13.21-20% silt (medium), 6.5-20% sand (medium), pH 7.5 (slightly alkaline), 0.2-0.3 dS/ m salt (no salt), 0.3-0.5 organic matter (low), 3-6% lime ($CaCO_3$) (low), 0.03-0.06% N (less) and 5-10 ppm P (medium) content. In the district of Bafra, where the research was conducted, the typical Black Sea climate is seen, with cool summers, warm and rainy winters (about 750 - 1000 mm per year). Hot and dry wind blowing from the district's south and southwest directions reduces the humidity. The relative humidity average of Bafra is 73%. Especially in April and May, humidity averages 77 - 79%. Since absolute humidity is directly proportional to temperature, it reaches the highest value of 28% in summer. The highest precipitation in the district is in November, and the least precipitation is observed in May. The average annual precipitation is around 700 mm. The average number of rainy days per year is 100 days (TSMS, 2022).

The research was established in a Randomized Blocks Design with 3 replications and 10 plants per replication in dwarf rootstocks and 5 plants in semi-dwarf and seedling rootstocks. The data obtained were analyzed in the IBM SPSS 21.0 statistical package program, and the differences between the averages were determined at the $P<0.05$ level with the 'Duncan Multiple Range Test (Genç and Soysal, 2018).' the results were presented in Tables and Figures.

3. Results and Discussion

The rootstocks, cultivars, research year, year x rootstock, year x cultivar, and rootstock x cultivar interactions had a significant effect on pear and quince clone rootstocks and pear seedling rootstocks grafted with the 'Deveci', 'Williams', 'Santa Maria' and 'Abate Fetel' pear cultivars on the pruning weight per plant. However, the effect of year × rootstock × cultivars interaction was not statistically significant. In terms of year's average, pruning weight per plant varied between 0.10-0.90 kg $plant^{-1}$. The pruning weight per plant in 2021 (0.90 kg $plant^{-1}$) was higher than in other years. Regarding rootstock average, pruning weight per plant varied between 0.16 kg – 1.07 kg $plant^{-1}$. Fox11 pear rootstock (1.07 kg $plant^{-1}$) had the highest pruning weight per plant among the examined rootstocks, and the lowest was MC, QA, and BA29 quince clone rootstocks (0.16, 0.22, and 0.23 kg $plant^{-1}$). In terms of cultivar averages, pruning weight per plant varied between 0.30-0.68 kg $plant^{-1}$. The highest pruning weight per plant was observed in the

'Deveci' cultivar (0.68 kg plant^{-1}) and the lowest was in the 'Santa Maria' cultivar (0.30 kg plant^{-1}) (Table 1; Figure 1).

The pruning weight per plant varied between 0.07-2.03 kg plant^{-1} in terms of year x rootstock interaction. The highest pruning weight per plant was found in Fox11 rootstock in 2021. In terms of year x cultivar interaction, the pruning weight per plant varied between 0.08-1.26 kg plant^{-1}. The highest pruning weight per plant was determined in the 'Deveci' cultivar in 2021. The pruning weight per plant ranged from 0.07 to 1.59 kg plant^{-1} in terms of rootstock x cultivar interaction.

Table 1. The effects of rootstocks and pear cultivars on the pruning weight (kg plant^{-1}) in pear

Rootstocks	Cultivars	Years			Mean
		2019	2020	2021	
BA29	Abate Fetel	0.06 a	0.22 a	0.42 a	0.23 ef*
	Deveci	0.13 a	0.30 a	0.46 a	0.29 def
	Santa Maria	0.14 a	0.27 a	0.40 a	0.27 def
	Williams	0.10 a	0.11 a	0.12 a	0.11 f
QA	Abate Fetel	0.12 a	0.25 a	0.42 a	0.26 def
	Deveci	0.10 a	0.26 a	0.42 a	0.26 def
	Santa Maria	0.09 a	0.30 a	0.51 a	0.30 def
	Williams	0.04 a	0.06 a	0.10 a	0.07 f
MC	Abate Fetel	0.05 a	0.13 a	0.23 a	0.13 f
	Deveci	0.09 a	0.21 a	0.34 a	0.21 ef
	Santa Maria	0.14 a	0.12 a	0.14 a	0.13 f
	Williams	0.07 a	0.20 a	0.28 a	0.18 ef
Fox11	Abate Fetel	0.09 a	1.29 a	2.56 a	1.31 ab
	Deveci	0.08 a	1.64 a	3.06 a	1.59 a
	Santa Maria	0.11 a	0.36 a	0.57 a	0.35 def
	Williams	0.11 a	1.06 a	1.95 a	1.04 bc
OHxF333	Abate Fetel	0.11 a	0.91 a	1.59 a	0.87 bcd
	Deveci	0.13 a	1.00 a	1.89 a	1.01 bc
	Santa Maria	0.12 a	0.42 a	0.70 a	0.41 def
	Williams	0.15 a	0.81 a	1.41 a	0.79 bcde
Farold 40	Abate Fetel	0.07 a	0.58 a	1.02 a	0.56 cdef
	Deveci	0.08 a	0.89 a	1.57 a	0.85 bcd
	Santa Maria	0.14 a	0.42 a	0.67 a	0.41 def
	Williams	0.18 a	0.84 a	1.54 a	0.85 bcd
Seedling	Abate Fetel	0.09 a	0.51 a	0.93 a	0.51cdef
	Deveci	0.07 a	0.59 a	1.07 a	0.58 cdef
	Santa Maria	0.08 a	0.21 a	0.37 a	0.22 ef
	Williams	0.05 a	0.33 a	0.56 a	0.31 def
Main Effects					
Rootstocks	BA29	0.11 f	0.22 f	0.35 f	0.23 d
	QA	0.09 f	0.22 f	0.36 f	0.22 d
	MC	0.08 f	0.16 f	0.25 f	0.16 d
	Fox11	0.10 f	1.09 bc	2.03 a	1.07 a
	OHxF333	0.13 f	0.78 cd	1.40 b	0.77 ab
	Farold 40	0.12 f	0.68 de	1.20 b	0.67 ab
	Seedling	0.07 f	0.41 ef	0.73 de	0.41 c
Cultivars	Abate Fetel	0.08 f	0.55 cde	1.02 ab	0.55 ab
	Deveci	0.10 f	0.70 bcd	1.26 a	0.68 a
	Santa Maria	0.12 f	0.30 ef	0.48 de	0.30 c
	Williams	0.10 f	0.49 de	0.85 bc	0.48 ab
Years		0.10 c**	0.51 b	0.90 a	
Year		0.001	Year x Cultivar		0.001
Rootstock		0.001	Rootstock x Cultivar		0.001
Cultivar		0.001	Year x Rootstock x Cultivar		0.087
Year x Rootstock		0.001			

*Differences between means with different letters in the same column are significant, **Differences between means with different letters in the same line are significant.

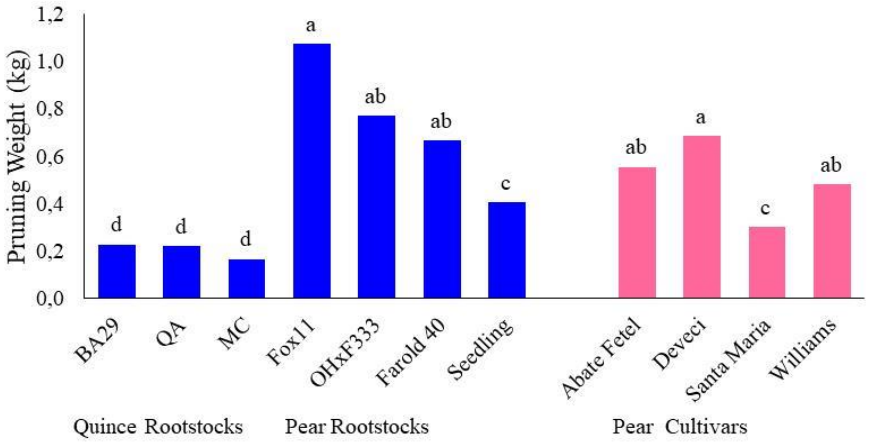

Figure 1. Effects of different rootstock and cultivars on pruning weight per plant (kg) in pear.

In terms of rootstock x cultivar interaction, the highest pruning weight per plant was in the 'Deveci'/Fox11 combination (1.59 kg plant^{-1}), and the lowest was in the 'Williams'/QA, 'Williams'/BA29, 'Abate Fetel'/MC and 'Santa Maria'/MC combinations (0.07, 0.11, 0.13 and 0.13 kg plant^{-1}, respectively). In terms of year x rootstock x cultivar interaction, pruning weight per plant varied between 0.04-3.06 kg plant^{-1} (Table 1). In the study, the pruning weight per plant increased as the years progressed, and it was generally higher in pear rootstocks than in quince clonal rootstocks (Figure 1).

Pruning is necessary to maintain a balanced growth and development in fruit trees. The severity of pruning is essential in keeping vegetative and generative development in balance in fruit trees. In young fruit trees that have not started fruiting, severe pruning usually delays the onset of yield by increasing vegetative development. Pruning is done on trees in physiological balance makes in a way that keeps yield and development in balance (Sansavini and Musacchi, 1994; Jackson, 2003). The study showed significant differences between years in terms of pruning weights per plant. It can be said that this difference is due to the increase in the growth and development of plants from year to year, and the growth vigor of rootstocks and cultivars. The difference in growth in fruit trees is due to the age of the trees and the increase in growth and development (Gercekcioglu et al., 2014). In a study conducted in the field where the study was conducted, pear rootstocks had higher plant growth and development than quince rootstocks (Kurt et al., 2022). It can be said that the difference in the growing strength of the rootstocks also appeared in the pruning weight. The pruning weights of the vigorous growing rootstocks were also high. In modern pear growing, quince clone rootstocks are used for dense planting due to their dwarfing characteristics. Since their growth and development strength are weaker than pear rootstocks, they also need less pruning. Low-density planting in orchards was established with vigorous rootstocks planting fewer saplings per decare than in high-density planting, prolonged pruning time, and increased labor costs (Rom and Carlson, 1987). It was stated that rootstocks with strong growth have higher pruning weights per plant and may need intensive pruning (Jackson, 2003; Giocobbo et al., 2008). Urbina et al. (2003) reported that the effect of years of research on the average pruning weight of 'Williams' pear grafted on different rootstocks was not significant, and they reported that there were significant differences between rootstocks in terms of pruning weight in some research years. Researchers emphasized that the 5-year average pruning weight was 1.7-2.4 kg tree^{-1}. Musacchi et al. (2005) reported that the effects of rootstock and cultivars on pruning weight per plant of 7-year-old 'Abate Fetel', 'Conference' and 'Comice' pear cultivars grafted on MC and Sydo quince clone rootstocks using different pruning systems were significant. They stated that pruning weight per plant was lower in MC than in Sydo. It was emphasized that the pruning weight of 'Abate Fetel' cultivar was the highest, while the 'Conference' cultivar had the lowest. Giacobbo et al. (2008) reported that the pruning weight of the 'Packham's Triumph' pear cultivar grafted on quince and pear rootstocks was higher on strong rootstocks than on weak rootstocks, and they emphasized that the highest pruning weight was in Smyrna and Alongado rootstocks and the lowest in Portugal rootstock. Giacobbo et al. (2010) reported that the effect of rootstocks on the pruning weight of 'Carrick' pear cultivar, which they grafted on 13 different quinces and one pear rootstock, was significant. Clingeleffer et al. (2019) reported that the rootstock x cultivar interaction significantly affected pruning weight. Almeida et al. (2020) cited the effect of important quince rootstocks on the pruning weight of 'Abate Fetel' and 'Rocha' pear cultivars grafted on BA29, EMC, and Adams quince clone rootstocks, and they stated that the pruning weight was higher 'Rocha' pear cultivar. These researchers reported that the pruning costs of poorly growing rootstocks and cultivars and their pruning weights were also low. In the high-density planted orchard, pruning time is prolonged, but the amount and duration of pruning weight per unit tree were less (Rom and Carlson, 1987). McClymont et al. (2021) reported that the pruning weight varied between

2.06-3.23 kg, and also they reported a significant difference between rootstocks in terms of pruning weight. It can be said that the results obtained from the research are compatible with previous studies.

In the study, the cumulative pruning weight per plant varied between 0.49-3.22 kg plant^{-1} regarding rootstock averages and between 0.90-2.05 kg plant^{-1} in cultivar averages. Regarding rootstock averages, the highest cumulative pruning weight per plant was in Fox11 pear clone rootstock (3.22 kg plant^{-1}) and the lowest 0.49 kg plant^{-1} in QA quince clone rootstock. In terms of cultivar averages, the highest cumulative pruning weight per plant was found in 'Deveci' (2.05 kg plant^{-1}) and the lowest in 'Santa Maria' (0.90 kg plant^{-1}) pear cultivars (Figure 2). The highest cumulative pruning weight per plant for rootstock x cultivar interaction ranged between 0.21-4.77 kg plant^{-1}. The highest cumulative pruning weight per plant was determined in 'Deveci'/Fox11 (4.77 kg plant^{-1}), and the lowest was in the 'Williams'/QA (0.21 kg plant^{-1}) (Figure 3).

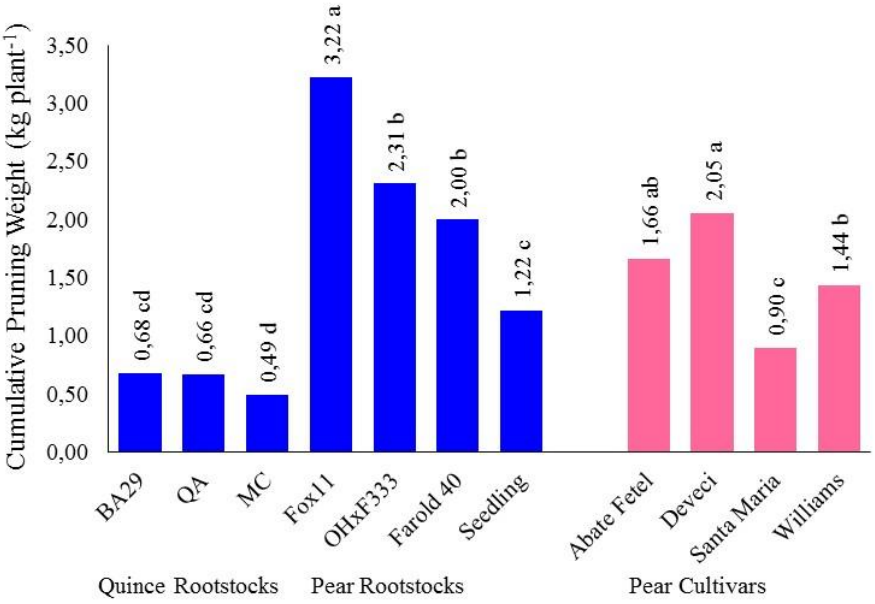

Figure 2. Effects of different rootstock and cultivars on cumulative pruning weight per plant (kg plant^{-1}) in pear.

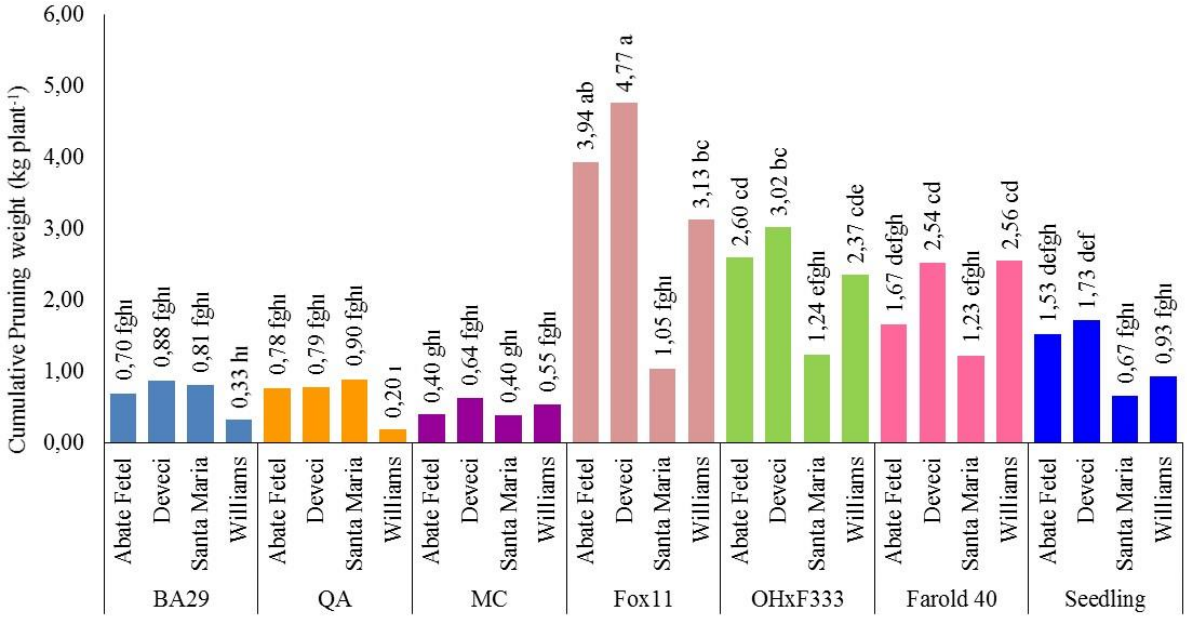

Figure 3. Effects of different rootstocks x cultivars interactions on cumulative pruning weight per plant (kg plant^{-1}) in pear.

The cumulative pruning weight per hectare varied between 942.8-3070.0 kg ha^{-1} in terms of rootstock averages and between 1143.4-2269.0 kg ha^{-1} in cultivar averages. Regarding rootstock averages, the highest cumulative pruning weight per hectare was detected in Fox11 pear clonal rootstock (3070.0 kg ha^{-1}) and the lowest in MC, QA, and BA29 quince clone rootstocks (942.8, 1265.9, and 1299.4 kg ha^{-1}, respectively). In terms

of cultivar averages, the highest cumulative pruning weight per hectare was found in 'Deveci' (2269.0 kg ha^{-1}) and the lowest in Santa Maria (1143.4 kg ha^{-1}) pear cultivars (Figure 4). Regarding rootstock x cultivar interaction, the cumulative pruning weight per hectare varied between 372.43-4544.49 kg ha^{-1}. The highest cumulative pruning weight per hectare was observed from 'Deveci'/Fox11 (4544.49 kg ha^{-1}) and the lowest was found in 'Williams'/QA, 'Santa Maria'/Seedling, 'Williams'/BA29, 'Santa Maria'/MC and 'Abate Fetel'/MC scion/rootstock combinations (372.43, 633.75, 634.50, 654.59 and 754.59 kg ha^{-1}, respectively) (Figure 5).

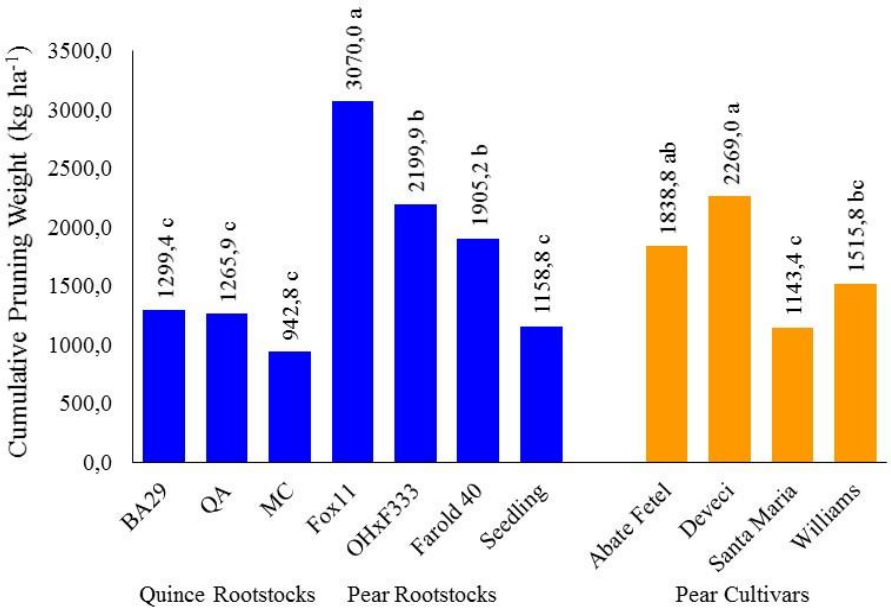

Figure 4. Effects of different rootstock and cultivars on cumulative pruning weight per hectare (kg ha^{-1}) in pear.

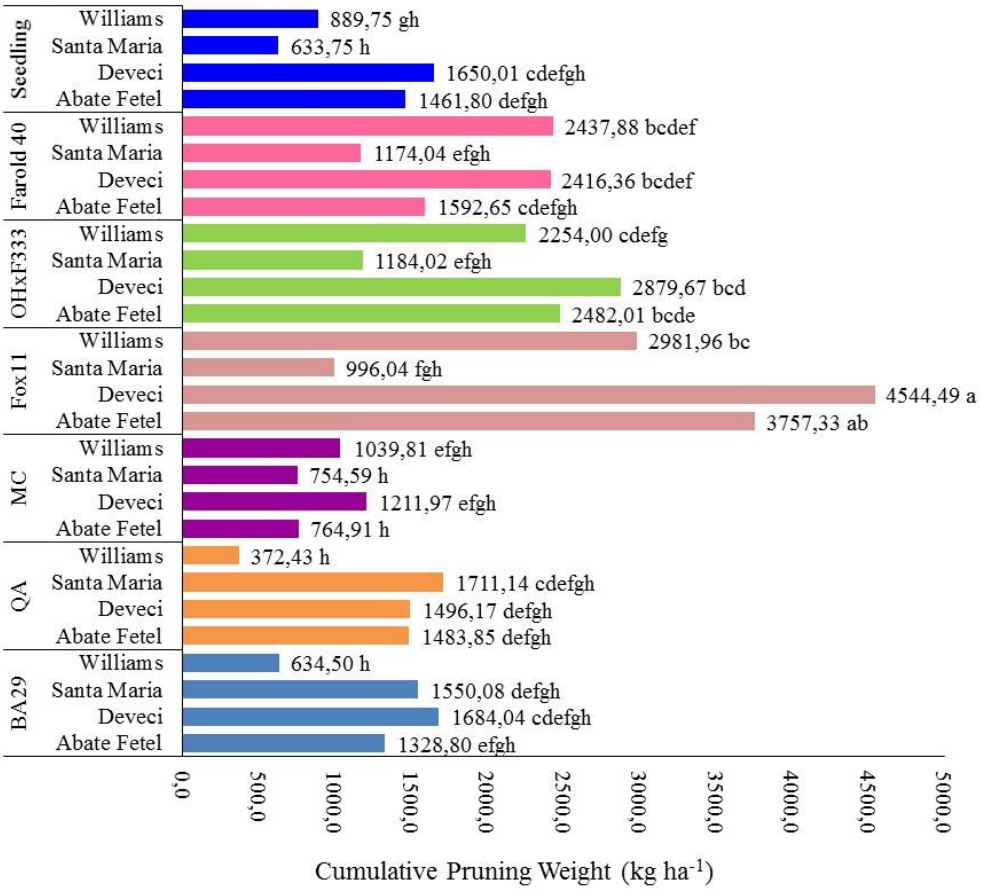

Figure 5. Effects of different rootstocks x cultivars interactions on cumulative pruning weight per hectare (kg ha^{-1}) in pear.

Ozturk and Ozturk (2014), who reported a significant difference between rootstocks in terms of growth and development in the 'Deveci' pear cultivars grafted on different rootstocks, reported that the growing strength of the seedling rootstock was weaker than the other rootstocks. They have emphasized that this is due to the fact that quince rootstocks grow and develop faster than pear seedling rootstocks in the first years after planting. Our results are consistent with the results of the research. The growth characteristics of the cultivars used in the study also affected the pruning weight characteristics. Generally, the pruning weights of the vigorously growing cultivars were also higher. Especially 'Abate Fetel' cultivar, which bears fruit on spur branches, and the 'Deveci' cultivar, which developed strongly, needed more pruning and the pruning weights of these cultivars were higher than the other cultivars. Vigorous trees require more pruning time and labor and yield less fruit per unit of vegetative growth (Rom and Carlson, 1987). The study determined that the 'Santa Maria', which gave the highest yield, developed weaker and therefore had a lower pruning weight. Among the pear cultivars grafted on different rootstocks, it was stated that the cumulative pruning weight per hectare of the 'Abate Fetel', which was spur productive, was higher than the other cultivars (Musacchi et al. 2005). The cultivars that give more yield in fruit trees are weaker than those that give less yield. Since cultivars with high fruit yield spend the nutrients on growth and development, annual shoot growth and pruning weights are low (Rom and Carlson, 1987; Jackson, 2003). It can be said that the results about the pruning weight obtained from the research are compatible with the studies that partially included the rootstocks and cultivars used in this study.

There was a significant difference between rootstocks in terms of growth and development in the 'Deveci' pear grafted on different rootstocks. The growing strength of the seedling rootstock was weaker than the other rootstocks in the first years after planting (Ozturk and Ozturk, 2014). They have emphasized that this is due to the fact that quince rootstocks grow and develop faster than pear seedling rootstocks in the first years after planting due to their root structure. Our results are consistent with the results of the previous research. The growth characteristics of the cultivars used in the study also affected the pruning weight characteristics. Generally, the pruning weights of the vigorously growing cultivars were also higher. Especially 'Abate Fetel', which bears fruit on spur branches, and 'Deveci', which developed strongly, needed more pruning and the pruning weights of these cultivars were higher than other cultivars. Vigorous trees require longer pruning time and more labor and yield less fruit per unit of vegetative growth (Rom and Carlson, 1987). In the study, 'Santa Maria', which gave the highest yield, developed weaker and therefore had a lower pruning weight. Among the pear varieties grafted on different rootstocks, it was stated that the cumulative pruning weight per hectare of the 'Abate Fetel', which was spur productive, was higher than the other cultivars (Musacchi et al. 2005). The cultivars that give more yield in fruit trees are weaker than those that give less yield. Since cultivars with high yield spend the nutrients on fruit growth and development due to that the annual shoot growth and pruning weights are low (Rom and Carlson, 1987; Jackson, 2003). It can be said that the results of the pruning weight obtained from the research are compatible with the previous studies (Urbina et al., 2003; Musacchi et al., 2005; Giocabbo et al., 2008, 2010; Clingeleffer et al., 2019; Almeida et al., 2020).

4. Conclusion

In this study, the effects of some standard pear cultivars grafted on different quince and pear rootstocks on pruning weight, rootstock, cultivar, research years, and their interactions significantly affected the parameters examined. The highest pruning weight properties were determined in Fox11 in terms of the examined rootstocks, and in 'Deveci' in cultivars. The lowest examined pruning weight properties were observed in the MC rootstock in terms of rootstocks and 'Santa Maria' in cultivars. The highest values in terms of all pruning weight-related properties examined in the study were obtained from the 'Deveci'/Fox11 combination. Generally, the pruning weights of pear rootstocks were higher than the quince rootstocks. According to the data for the years 2019-2021, the lowest cumulative pruning weight per plant was determined in the 'Williams'/QA combination. The reason for this is the rootstocks' development vigor and the cultivars' growth characteristics. In addition, graft incompatibility between some quince rootstocks and pear cultivars/varieties can also cause this situation. As a result of this study carried out on young trees, quince rootstocks are recommended due to the low pruning cost and labor. In addition, it is necessary to continue the research for a long time and make detailed examinations to make a final decision about the most proper cultivar/rootstock combination.

Author Contributions

AÖ (45%), ZAF (35%), and YMK (20%) designed the study. AÖ (50%), ZAF (30%), and YMK (20%) data acquisition and analysis. AÖ (34%), ZAF (33%), and YMK (33%) writing up. AÖ (50%), ZAF (30%), and YMK (20%) submission and revision. All authors reviewed and approved the final version of the manuscript.

Conflict of Interest

The authors declared that there is no conflict of interest.

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