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CROP PRODUCTION AND MANAGEMENT - Note

Early performance of ‘Kampai’ and ‘Rubimel’ peach on 3 training systems

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ABSTRACT: The aim of this study was to examine the early performance of ‘Kampai’ and ‘Rubimel’ peach on 3 training systems. The study was conducted between 2010 and 2013. Treatments were the training systems ‘Ypsilon’, Central Leader, and Open Center, arranged in a randomized complete block design. Assessed parameters were production per tree, fruit weight, yield, fruit firmness, and soluble solids. The early yield and economic return are greater in Central Leader training system for both cultivars. Besides, training system does not influence fruit quality attributes.

Key words: *Prunus persica*, yield, precocity, planting density.

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Peach production in Brazil is concentrated in the state of Rio Grande do Sul (65%) (Fachinello et al. 2011), where the orchards are characterized by low early yield (Robinson et al. 2006). One of the reasons that lead to these problems is the adoption of the open center training system at low planting densities. Besides, production is based on industry cultivars, which are poorly paid by the industries. However, the interest in fresh market cultivars has been increasing recently (Raseira et al. 2010). So, the study of the strategies to increase yield of fresh market cultivars is of paramount importance to overcome the aforementioned problems.

The traditional open center training system at densities of 300 – 500 trees·ha^{-1} results in poor yield during the early years of the orchard (Robinson et al. 2006), whereas the use of higher planting densities and different tree shapes has led to substantial yield increases in the early life of peach orchards (Layne et al. 2002). Even though some peach cultivars respond similarly to tree training, according to Lauri and Corelli Grappadelli (2014), the reaction of trees to training is cultivar-specific. Thus, it is important to investigate which training system is more suitable for a given peach cultivar.

The main goal of grower is the rapid return of investment and high yields saving (Maas 2008), which could be achieved by increasing planting density with modern training systems. However, traditional peach training systems such as open center — currently used by a large portion of peach growers in Brazil — induce late bearing (4th to 5th year), leading to a long payback time. The aim of this research was, therefore, to examine the early performance of 'Kampai' and 'Rubimel' peach on three training systems.

The study was conducted in the municipality of Capão do Leão (RS), Brazil (lat 31°52′00″S; long 52°21′24″W; alt: 48 m) in 2012 and 2013. The soil of the experimental area is an Argissolo Amarelo distrófico (Ultisol), according to the Brazilian Soil Classification system (Santos et al. 2013). Climatic conditions during the experimental period of the trial were previously described by Pasa et al. (2015).

Plant material consisted of 'Kampai' and 'Rubimel' cultivars, described by Raseira et al. (2014), grafted on peach rootstock 'Capdeboscq'. These varieties have shown to be promising cultivars for peach production in Pelotas (RS) (Gonçalves et al. 2014) and Botucatu (SP) (Ferraz et al. 2015). Treatments consisted on 3 training systems: 'Ypsilon' (Y) — 2 opposite scaffolds; Central Leader (CL) — a single vertical axis; and Open Center (OC) — 4 scaffolds even distributed (to further description of these training systems, see Raseira et al. 2014). Trees were spaced 5 × 2 m (1,000 trees·ha^{-1}) on Y and CL, and 5 × 4 m on OC training system (500 trees·ha^{-1}). Planting occurred in August 2010 in an area previous fertilized according to soil analysis. At the planting, trees were cut back to 50 cm from the ground to promote lateral branching necessary to tree training. All fruits of the first crop (2011) were removed from the trees to allow the development of tree framework. Cultural practices for all treatments were performed according the rules of Integrated Peach Production (Fachinello et al. 2014). In the summer, trees were irrigated by drip irrigation.

Trees were arranged in a randomized complete block design with 4 replicates of 5 trees per cultivar-training system combination. The 3 central trees of each plot were harvested at commercial maturity in 11/19/2012 and 11/09/2013 ('Kampai'); 11/26/2012 and 11/22/2013 ('Rubimel'), leaving 1 tree at each end as border. The total number of fruit per tree was counted and weighed (kg). From these data, the production per tree (kg), fruit weight (g), and yield (Mg·ha^{-1}) were obtained.

At harvest, samples of 20 fruits per replicate were randomly selected to fruit firmness and soluble solids measurements. Fruit firmness was measured with a penetrometer TR Di Turoni 53205 using an 8-mm diameter probe. Sections of skin, ~ 2 cm in diameter, were removed at the widest point of the fruit on opposite sides prior to determination of fruit firmness (FF), expressed in Newton (N). After that, samples were juiced and pipetted onto a digital refractometer (Atago PR32) to determine soluble solids, expressed as °Brix.

Statistical analyses were performed using the R software (R Core Team 2014). Data were analyzed for statistical significance by means of F-test. Duncan's test was performed to compare treatments when analysis of variance showed significant differences among means.

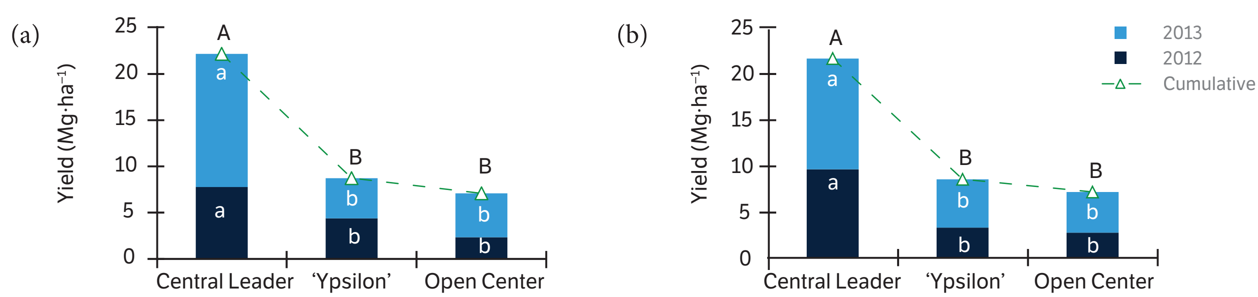
Production per tree in 2012 differed among training systems only for 'Rubimel', where trees on CL system showed the highest production (Table 1). In 2013, differences were significant for both cultivars, which behaved similarly, i.e. CL trained trees were more productive, followed by OC and Y (Table 1). The results found for 'Rubimel' in 2012 are similar to that found by Robinson et al. (2006), who observed more production per tree on CL (1,098 trees·ha^{-1}) than on OC (384 trees·ha^{-1}) training system in the 3rd year. However, in the same study, but in the 4th year, OC trees surpassed the production of CL, as opposed to what was observed in the present study for both cultivars in 2013. This different results →

are probably due the pruning management adopted by these authors, which headed back the CL trees to 1/3 every year, limiting the production area, whereas we have only headed CL trees to keep the leader shoot growing upwards.

Yield in 2012, 2013, and cumulative of both cultivars, was higher in the CL training system (Figure 1a,b). Similar results were found for 'Chimarrita' (Giacobbo et al. 2003), 'Loring' (Glenn et al. 2011), 'Allstar', 'Blushingstar', and 'Flavortop' peach (Robinson et al. 2006). Even though OC trees had greater production per tree than Y, its yield was similar because Y trees were at a closer spacing (i.e. in a higher planting density). It should be emphasized that, if a closer spacing for Y trained trees was used, like 1 m between trees, this training system would have obtained higher yield than OC trees. Trees trained in CL system showed outstanding early performance, with twice the yield than the other training systems in the 4th year. Considering planting and management costs were similar among training systems, CL would give a greater early economic return, similarly to Glenn et al. (2011). These results meet the main goals of growers, which are high yield and rapid return of the investment (Maas 2008).

Fruit weight, fruit firmness, and soluble solids did not differ among training systems, regardless of the cultivar (Table 1), similarly to 'Chimarrita' peach (Giacobbo et al. 2003). On the other hand, Robinson et al. (2006) found lower fruit weight in the CL and Y training system compared to OC. Interestingly, these authors reported a higher crop load on OC system. Therefore, considering that the trees in the present research also showed differences in crop load, but not in fruit size, the differences between studies are probably due to cultivar or site specificities.

Concluding, the central leader training system increases the early yield of 'Kampai' and 'Rubimel' peach. Besides, fruit size and quality are not affected by training system, regardless of the cultivar.



Means followed by different lowercase letters indicate significant differences of yield between training systems within year and uppercase letters between cumulative production, according to Duncan's test at $p < 0.05$.

Figure 1. Yield ($Mg \cdot ha^{-1}$) of 'Kampai' (a) and 'Rubimel' (b) peach on 3 training systems in 2012, 2013, and cumulative.

Table 1. Production per tree, fruit weight, fruit firmness, and soluble solids of 'Kampai' and 'Rubimel' peach on 3 training systems in 2012 and 2013.

Training system	Production per tree (kg)		Fruit weight (g)		Fruit firmness (N)		Soluble solids (°Brix)	
	2012	2013	2012	2013	2012	2013	2012	2013
				'Kampai'				
Central Leader	7.77	14.41 a	76.98	98.70	31.85	32.43	10.95	11.38
Open Center	4.68	9.50 b	72.29	95.31	29.15	29.90	11.95	11.90
'Ypsilon'	4.39	4.35 c	81.14	97.81	29.21	29.65	11.63	11.60
p	0.072	0.001	0.411	0.078	0.559	0.235	0.457	0.438
				'Rubimel'				
Central Leader	9.57 a	11.87 a	87.69	85.32	31.35	31.25	12.36	10.78
Open Center	5.47 b	8.79 b	87.90	91.46	31.32	32.33	12.48	11.45
'Ypsilon'	3.27 b	5.22 c	91.15	94.53	32.83	32.63	12.58	10.90
p	0.003	0.005	0.928	0.373	0.878	0.939	0.902	0.377

Means followed by different letters within columns are significantly different according to Duncan's test at $p < 0.05$.

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