

OBTAINING TWO *Ficus carica* L. HARVESTS PER VEGETATIVE CYCLE IN THE STATE OF RIO GRANDE DO SUL

OBTENÇÃO DE DUAS SAFRAS POR CICLO VEGETATIVO EM *Ficus carica* L. NO ESTADO DO RIO GRANDE DO SUL

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Abstract: Pruning management allows changing the fig tree phenology, modifying the harvest periods, including the potential to obtain more than one harvests per vegetative cycle. The aim of this study was to evaluate the productive behavior of 'Pingo de Mel' fig cultivar submitted to dry pruning in the winter and different green pruning times in the summer in order to obtain two fig harvests per plant vegetative cycle. Treatments consisted of: i) control, with only winter pruning on 08/13/2013; ii) winter pruning on 08/13/2013 + green pruning on 11/12/2013; and iii) winter pruning on 08/13/2013 + green pruning on 12/10/2013. The experiment was carried out in the 2013/2014 harvest in fig trees cultivated in Veranópolis - RS. The experimental design was randomized blocks, with four replicates and two plants per plot, per treatment. Variables associated with phenology, production per plant, average fruit mass, soluble solids (SS) and total titratable acidity (TTA) were analyzed. The phenological cycle of plants pruned in the winter provided harvest in January. In turn, plants submitted to green pruning on 11/12/2013 and 12/10/2013 promoted harvests in March and April, respectively. Green pruning performed in November allowed for higher production per plant and higher fruit quality compared to that performed in December. With the practice of green pruning, higher total annual fig production and higher availability of fruits to consumers are obtained.

Keywords: Pruning management, Production season, Fig.

Resumo: O manejo da poda permite alterar a fenologia da cultura do figo, modificando os períodos de colheita, inclusive com potencial de obtenção de mais de uma safra por ciclo vegetativo. Objetivou-se avaliar o comportamento produtivo da cultivar Pingo de Mel submetida à poda seca no inverno e diferentes épocas de poda verde no verão, para obtenção de duas safras de figo por ciclo vegetativo da planta. Os tratamentos consistiram em: i) testemunha, com apenas poda de inverno em 13/08/2013; ii) poda de inverno em 13/08/2013 + poda verde em 12/11/2013; e iii) poda de inverno em 13/08/2013 + poda verde em 10/12/2013. O experimento foi realizado na safra 2013/2014 em figueiras cultivadas em Veranópolis - RS. O delineamento experimental foi o de blocos

casualizados, com quatro repetições e duas plantas por parcela, por tratamento. Variáveis associadas à fenologia, produção por planta, massa média de fruto, sólidos solúveis (SS) e acidez total titulável (ATT) foram analisadas. O ciclo fenológico das plantas podadas no inverno proporcionou a colheita em janeiro. Por sua vez, as plantas submetidas a poda verde em 12/11/2013 e 10/12/2013 promoveram colheitas em março e abril, respectivamente. A época de poda verde realizada em novembro permitiu maior produção por planta e maior qualidade de fruto comparativamente a dezembro. Com a produção oriunda da prática da poda verde, um incremento na produção total anual de figo é obtido pelo produtor e de disponibilidade da fruta para o consumidor.

Palavras-chave: Manejo da poda, Época de produção, Figo.

INTRODUCTION

In Brazil, fig cultivation (*Ficus carica* L.) occurs mainly in the Southern and Southeastern regions, and the states of Rio Grande do Sul (RS) (49.5%), São Paulo (37.6%), Minas Gerais (7.1%) and Paraná (4.4%) are the largest producers (IBGE, 2018). Most of RS production is obtained by family farming, mainly concentrated in the municipalities of Feliz, Gramado, Planalto and Piratini, totaling 11,741 tons in an area of 1,566 ha, with productivity of 7.5 tons. ha⁻¹ (IBGE, 2018).

In RS, the climate and the management adopted provide a single harvest per year, concentrated in January and February (Medeiros, 2002). During this period, there is reduction in the fruit price due to the higher offer in the market. Although the state of RS is the largest national fig producer, the production chain is practically devoid of research, and studies are needed to improve crop's management and production system.

In RS, fig plants vegetate during spring and summer and goes into dormancy in autumn and winter. Alternatives aimed at changing crop management and in the fruit offer period can bring economic advantages to producers and expand the availability of fruits to the consumer market (Nienow et al., 2006). Changes in the production structure through early and/or late harvests and pruning management would configure a distinct market scenario compared to that currently presented in RS (Medeiros, 2002).

The performance of winter pruning followed by green pruning in the summer would bring the possibility of obtaining two fig harvests per year in the state, with harvests in more favorable market times. This proposal is the result of the adaptation of the management proposed for vines in RS by Souza and Fochesato (2007) and Anzanello et al. (2010), who obtained two grape harvests per vegetative cycle in the 'Depressão Central' region of Rio Grande do Sul. The productive success of the second harvest is linked to the combination of specific seasons of winter pruning and green pruning (Fochesato et al., 2007). If green pruning is performed early, it leads to small production due to insufficient bud differentiation, and if performed late, it may not reach the ideal maturation point for occurring in the autumn, a time of low temperatures and insolation (Souza and Fochesato, 2007).

Therefore, this work aimed to evaluate the productive behavior of 'Pingo de Mel' fig cultivar submitted to dry pruning in the winter and different green pruning times in the summer, aiming to produce two fig harvests at different times of the year in the same plant vegetative cycle.

MATERIAL AND METHODS

The experiment was carried out at the Department of Agricultural Diagnostics and Research, Department of Agriculture, Livestock and Rural Development, located in the municipality of Veranópolis – RS (latitude 28°56'14" S, longitude 51°31'11" W and altitude of 705 m a.s.l.). The average annual temperature is 17.5°C and the average rainfall is 1,639 mm (Simonetto and Grellmann, 2003). According to the Köppen classification, the climate of the region is temperate (Cfb1), (Moreno, 1961), and the soil is a typical Dystrophic Red Latosol (LVdf1) (Streck et al., 2002).

For the experiment, 'Pingo de Mel' fig tree cultivar was used in vegetatively propagated plants (clones), with 20 years of age, spaced 2.5 m between plants and 3.00 m between rows. The experimental design used was randomized blocks (RBD), with four replicates and two plants per plot, per treatment. One dry pruning season in the winter (08/13/2013) and two green pruning seasons in the summer (11/12/2013, 12/10/2013) were tested. Treatments consisted of: i) control, with only winter pruning; ii) winter pruning + green pruning on 11/12/2013; and iii) winter pruning + green pruning on 12/10/2013.

Winter pruning consisted of performing a drastic pruning of branches emitted in the previous cycle, with 5 to 10 cm in length (2 to 3 buds), keeping approximately 24 branches per plant. All plants were submitted to dormancy breaking by applying 1% hydrogenated cyanamide after winter pruning. Green pruning, on the other hand, was performed by pruning shoots from 60 cm in height, forcing a new sprouting of fruit buds, close to the axils of leaves, at the end of branches. Control plants were not submitted to pruning.

The variables analyzed were: harvest season, production per plant (kg), average fruit mass (g), soluble solids (SS) and total titratable acidity (TTA). Production per plant was obtained by weighing collected fruits in electronic scale. Average fruit mass was obtained by dividing production per plant by the number of fruits per plant. SS content was determined in refractometer, in °Brix, and total titratable acidity, in cmol L⁻¹, from titration with 0.1N NaOH. For SS and TTA determination, 15 figs per experimental unit were used.

Quantitative production and qualitative production variables were submitted to analysis of variance. Results with significant differences, by the "F" test, had their means submitted to the Tukey test, at 5% significance level.

RESULTS AND DISCUSSION

For plants submitted to double pruning management, first-harvest fruits, resulting from winter pruning performed on 08/13/2013, were harvested between 01/20/2014 and 01/30/2014 (Table 1), demonstrating that the 'Pingo de Mel' cultivar may show early harvest when pruning is performed earlier. 'Pingo de Mel' fig cultivar harvest occurs in the state of RS from January 15 to February 25, variable with the winter pruning time, traditionally carried out between the end of August and beginning of September (Medeiros, 2002). Second-harvest fruits, resulting from green pruning, were harvested between 03/11/2014 and 03/19/2014 for plants pruned in November and between 04/05/2014 and 04/18/2014 for those pruned in December (Table 1). Green pruning allowed obtaining late fruits with greater market appreciation, in the off-season period. Fruits harvested in January are sold at R\$ 4,50 per kilo, while those harvested in March and April are sold at R\$ 6,00 to R\$ 6,50 per kilo (Ceasa/RS, 2020). Harvests between March and April with the performance of green pruning, in a similar management adopted in 'Niágara Branca', 'Niágara Rosada' and 'Concord' grape cultivars were also obtained by Souza and Fochesato (2007), extending the period of fruit supply in the market.

TABLE 1.
Harvesting periods of 'Pingo de Mel' fig cultivar submitted to conventional management and to double pruning management, in Veranópolis – RS.

Management	Winter pruning	Green pruning	Harvest times	
			1st harvest	2nd harvest
Conventional	08/13/2013	---	01/10/14 to 01/20/14	---
Double pruning	08/13/2013	11/12/2013	01/20/14 to 01/30/14	03/11/14 to 03/19/14
Double pruning	08/13/2013	10/12/2013	01/20/14 to 01/30/14	04/05/14 to 04/18/14

In plants submitted to conventional management, with only winter pruning (control plants), harvest was carried out from January 10 to 20, 2014 (Table 1), a little before the harvest of the first-harvest plants submitted to double pruning. This is justified by the fact that the control plants direct photoassimilates predominantly to the ripening of fruits, while in plants submitted to double pruning, reserves have been split, with a portion destined to the ripening of first-harvest fruits and another destined to the emission and development of new second-harvest sprouts (Anzanello et al., 2010). Possibly, this was the reason for the delay in the harvesting of first-harvest plants submitted to green pruning compared to control plants.

The phenological cycle of the first harvest lasted approximately 150 days and the second about 120 days. The reduction in the phenological cycle of the second harvest in relation to the first is a consequence of higher temperatures that occurred during the development of plants submitted to green pruning. As fig trees are conditioned by thermal availability to complete their cycle (Souza et al., 2009), higher average temperature in the months preceding the second harvest was the main factor responsible for the shortening of their production cycle.

The yield of plants submitted to conventional management was 15 kg plant⁻¹ (Table 2). The yields of plants submitted to double pruning management were 13.2 to 13.8 kg plant⁻¹ in the first harvest, and 5.5 kg plant⁻¹ in the second harvest for plants pruned on 11/12/2013 and 3.5 kg plant⁻¹ for those pruned on 12/10/2013 (Table 2). Yield is equivalent to 19.9 tons. ha⁻¹ in the conventional system and 25.7 tons. ha⁻¹ in the double pruning system, for those submitted to green pruning in November, adding almost 30% in production. With the practice of green pruning, higher total annual fig production and higher fruit availability to consumers are obtained. The lower production in the first harvest of plants submitted to green pruning compared to those unpruned (conventional management) is due to the elimination of the productive area of pruned branches above 60 cm, when green pruning is performed to stimulate new sprouts responsible for the second harvest.

TABLE 2.
Production per plant, in kg, and fruit mass, in g, of 'Pingo de Mel' cultivar submitted to conventional management and to double pruning management, in Veranópolis – RS.

Management	Winter pruning date	Green pruning date	Production per plant (kg)		Fruit mass (g)	
			1st harvest	2nd harvest	1st harvest	2nd harvest
Conventional	08/13/2013	---	15.0 a	---	60 a	---
Double pruning	08/13/2013	11/12/2013	13.8 bA	5.5 aB	55 aA	35 aB
Double pruning	08/13/2013	12/10/2013	13.2 bA	3.5 bB	56 aA	32 aB

Means followed by the same letter, lowercase in the column and uppercase in the row, do not differ significantly by the Tukey's test at 5% probability.

Similar results were obtained by Anzanello et al. (2010), who used winter pruning in August and green pruning in November and reached yield of 1.26 kg. plant⁻¹ for 'Niágara Branca' and 0.84 kg. plant⁻¹ for 'Concord' grapes in the second harvest. Fochesato et al. (2007) also achieved, at the same pruning seasons, 3.64 kg. plant⁻¹ for 'Niágara Branca' and 1.37 kg. plant⁻¹ for 'Niágara Rosada' grapes in the second harvest in the 'Depressão Central' region of RS. Yield differences between fruit crops show that the fig tree is more responsive to the double pruning management than vine aiming a second production, being an attractive and profitable alternative for fig producers.

The higher production in the second harvest for plants pruned in November is directly related to the higher number of sprouts emerging from branches submitted to green pruning in this treatment. The greater number of sprouts is probably linked to greater plant metabolic activity, when green pruning is carried out in November. Green pruning performed at this time, with the specific combination of dry pruning and green pruning spaced by 3 months, favored bud sprouting. In treatment with green pruning performed in December, with interval of four months, branches were lignified, with buds probably already at the pre-dormancy state, hindering or preventing their sprouting. With the double pruning management in vines, Anzanello et al. (2010) also found this possibility to justify the difference in production between treatments with different green pruning periods.

The low yield of plants submitted to green pruning may be linked to the period of water deficit that occurred in the summer, which affected, in addition to emission, the development of sprouts responsible for the second harvest. The fig crop has high water demand due to the large leaf area, and periods of water deficit can affect the vegetative and productive crop development, making irrigation necessary (Leonel, 2008; Caetano et al., 2012).

In terms of average fruit mass, figs obtained in the second harvest were smaller when compared to those of traditional harvest (Table 2). Fruits harvested in the second harvest can be sold as ripe figs or unripe figs for the production of jam, given their smaller size, being an additional selling alternative for producers. Unripe figs should be harvested when the fruit ostiole presents pink to reddish color (Pereira, 1981). There were no differences in fruit mass between treatments for each harvest (Table 2).

The double pruning management in vines in the state of RS is potentially feasible in mesoclimates, where the climate is milder in the winter, with no occurrence of late or early frosts (Fochesato et al., 2007; Anzanello et al., 2010). Therefore, the same can be applied for the fig crop, being a recommended cultural practice for specific microclimates not prone to the occurrence of frosts.

Regarding qualitative analysis, fruits submitted to green pruning on 11/12/2013 did not show significant differences in the soluble solids content and total titratable acidity when compared to fruits from dry pruning (Table 3). This behavior can be explained by the good insolation that occurred during the maturation of both harvests. For fruits harvested in April from green pruning on 12/10/2013, there was reduction in SS content and increase in TTA of fruits compared to those harvested in January (first harvest) and March (second harvest, from green pruning on 11/12/2013). This is due to the greater drop in temperature at night and the lower luminosity, together with the ripening of fruits in the second production occurred in April, impairing the degradation of acids and accumulation of sugars in fruits, as physiologically described by Pommer et al. (2003).

TABLE 3.

Soluble solids (SS), in °Brix, and total titratable acidity (TTA), in cmol L⁻¹ of 'Pingo de Mel' cultivar submitted to conventional management and to double pruning management, in Veranópolis – RS.

Management	Winter pruning date	Green pruning date	SS (°Brix)		TTA (cmol L ⁻¹)	
			1st harvest	2nd harvest	1st harvest	2nd harvest
Conventional	08/13/2013	---	23 a	---	5.6 a	---
Double pruning	08/13/2013	11/12/2013	22 aA	20 aA	5.8 aA	6.0 aA
Double pruning	08/13/2013	12/10/2013	22 aA	15 bB	5.7 aA	7.3 bB

Means followed by the same letter, lowercase in the column and uppercase in the row, do not differ significantly by the Tukey's test at 5% probability.

The performance of winter pruning associated with green pruning in the summer allows obtaining two fig harvests per vegetative cycle at different times of the year. The productive and qualitative potential of the second harvest with green pruning is greater when it is carried out in November.

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