Phenology and production of blackberry trees in the southern Minas Gerais

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Abstract

The objective of this study was to evaluate the phenology, yield and productivity of "Brazos" and "Tupy" blackberry cultivars in the first production cycle in southern Minas Gerais. The experiment was carried out in a property in the municipality of Serrania – Minas Gerais (MG), with a randomized block design, two cultivars ("Brazos" and "Tupy"), 10 blocks and two useful plants per experimental unit. In the harvest of the 2022/23 production cycle, the beginning, end and duration of flowering were recorded, as well as the beginning, end and duration of the harvest. The following productive parameters were evaluated: number of fruits per plant, fresh fruit mass (g), yield (g plant^{-1}) and estimated productivity (kg ha^{-1}). In mid-November, six fruits per plot were randomly selected to obtain physical fruit parameters (mean lengths and diameters). The data was submitted to analyses of variance and the means were compared using the Tukey test, at 5 % probability. The "Brazos" cultivar had longer flowering and harvest duration. "Tupy" overtook "Brazos" in number of fruits per plant, yield and estimated productivity ($p<0.05$). "Brazos" produced heavier fruits with a larger diameter ($p<0.05$). It was concluded that the flowering and harvest duration of the "Brazos" and "Tupy" blackberry cultivars are similar in the first production cycle. During the first production cycle, the "Tupy" cultivar achieved higher production and higher estimated productivity, and the "Brazos" cultivar produced heavier fruits with a larger diameter.

Keywords: Productivity. Red fruits. Small fruits.

Introduction

Blackberry (*Rubus* spp.) is an expanding crop in Brazil, however, there is little updated information regarding its production and planted area (ANTUNES et al., 2014). Worldwide, the area cultivated with blackberries is estimated to be around 30 thousand hectares (ANTUNES et al., 2022). When considering the Brazilian production of red fruits, it is believed that it occupies an area of 4,200 hectares, of which strawberries (*Fragaria x ananassa*) occupy most of the area (83 %), followed by blackberries (RANGEL JÚNIOR et al., 2019).

According to Antunes et al. (2022), although no official Brazilian data on blackberry production exists, it is estimated that, together with blueberries, it occupies around 2,000 hectares in area. Among the leading states in blackberry production are: Rio Grande do Sul, Minas Gerais, Paraná and São Paulo—with more than 92 % of the national production (HORTIFRUTI BRASIL, 2020).

According to Antunes et al. (2006), blackberry production in Brazil occurs between October and February, meaning that outside this interval no domestic supply of the product is available. Thus, Antunes et al. (2014) make it clear that off-season production can be economically advantageous, since prices can be up to 700 % higher than in the normal harvest period.

Blackberry belongs to the group of plants of the *Rubus* genus; whose fruits are used to make jellies, sweets, ice creams and pulps (ANTUNES, 2002). The average price paid to the producer is variable, depends on the production season and

form of commercialization, which can be fresh or processed. The commercialization of fresh fruit is uncommon and generally done in street markets, whereas processing it is more common (ANTUNES et al., 2014).

Areas cultivated with this crop are advancing to the Brazilian southeast, and in this sense, Curi et al. (2015) consider that the evaluation of blackberry cultivars in these regions is paramount, since they are adapted to temperate climates (RANGEL JÚNIOR et al., 2019). In addition, blackberry cultivation is considered an appropriate option for the diversification of family farming due to its low cost of implementation, low orchard maintenance, and reduced need for pesticides, which makes it a viable option for the agroecological system (ANTUNES et al., 2010).

Blackberry enables the production of a variety of products and is considered a quick return crop, since in the second year of cultivation it already goes into production (ANTUNES et al., 2014). Despite being a rustic fruit tree with low cost of implementation and conduction, there is scarce information on implementation and production costs of the crop in southern Minas Gerais.

Blackberry cultivars have phenological differences and, consequently, require different management (ANTUNES et al., 2014). Therefore, the objective of this study was to evaluate the phenology, yield and productivity of the "Brazos" and "Tupy" blackberry cultivars in the first production cycle in southern Minas Gerais.

Material and methods

The experiment was carried out on a property located in the municipality of Serrania – Minas Gerais (MG), located at 21°3'22" South and 46°05'26" West, at an average altitude of 800 meters, in November 2023. According to the Köppen classification, the region has a Cwb climate, that is, a mesothermal or tropical high-altitude climate with a dry winter and a rainy summer.

The property is part of the Fruiting Incentive Project in the municipality of Serrania – MG. In this project, each producer (property) received 2,400 blackberry seedlings of the thorny "Brazos" and "Tupy" cultivars, 1,200 of which were seedlings of each cultivar, coming from Frutiplan, a company accredited by the Brazilian Agricultural Research Corporation (EMBRAPA), located in Pelotas – Rio Grande do Sul (RS). Cultivation began on November 30, 2022, with a total of 2,400 blackberry plants propagated by seedlings, cultivated with a spacing of 3.0 × 0.5 m, separated by a 5 m corridor and conducted on 0.5 m tall espaliers, and a planting density of 6,667 plants ha^{-1}. The first harvest started in October 2023 and continued until the first half of December 2023. Chemical management was carried out to break dormancy using a growth regulator (Cyanamide), since the climatic conditions of the region did not allow the plant to reach the necessary number of chill hours.

The experiment was conducted in randomized blocks, with two cultivars: "Brazos" and "Tupy" in 10 blocks with two useful plants per experimental unit. In the harvest of the 2022/23 production cycle, according to the stages of bud development, the phenological stages were marked (ANTUNES et al., 2000): beginning (more than 5 % of flowers open), end (90 % of flowers open) and duration of flowering; beginning and end of the harvest. During the 30 days of harvests in November 2023, the following productive parameters were evaluated: number of fruits per plant, fresh fruit mass (g), yield (g $plant^{-1}$) and estimated productivity (kg ha^{-1}).

The fruits were harvested by experimental unit every two days when they were in the stage of complete maturation, with a black coloration, in plastic harvesting baskets sized 40 × 25 × 10 cm, then counted and weighed. To determine the yield per plant and estimated productivity, all fruits and their respective masses were accounted for at the end of the production cycle. The estimate of mean yield per plant (g $plant^{-1}$) was obtained

by the fresh matter mass of each fruit multiplied by the number of fruits per plant. Productivity (kg ha^{-1}) was based on 6,667 plants ha^{-1} density (with spacing of 3 m between rows and 0.5 m between plants), obtained by multiplying the mean weight per plant by density (plants per ha). In mid-November, six fruits per plot were randomly selected to obtain physical fruit parameters (mean lengths and diameters).

According to data collected by the National Institute of Meteorology – INMET (2024), the mean maximum and minimum temperatures and accumulated precipitation for November 2023 were 24.6°C, 23.1°C and 95.8 mm, respectively. Data were submitted to analyses of variance and means were compared using the Tukey test, at 5 % probability.

Results and discussion

Antunes et al. (2010) explain that the variation that occurs in the phenological pattern of the cultivars is the result of genetic characteristics of each of them associated with climatic phenomena, such as temperature and photoperiod, which interfere with flowering and sprouting. In this study, it was possible to observe that the "Brazos" cultivar started flowering five days before the "Tupy" cultivar, achieving a longer flowering duration (Table 1).

Curi et al. (2015), when evaluating blackberry production in Lavras – MG, observed that, during the first production cycle (2010/2011), the sprouting of different blackberry cultivars occurred at the end of the first half of July, with flowering beginning in August. The flowering period of the "Tupy" cultivar in Rio Grande do Sul occurs between the end of August and the 20th of September, with the harvest happening from November 30th to December 20th (ANTUNES, 2002).

Evaluating the agroecological cultivation of five blackberry cultivars in Pelotas – RS, Antunes et al. (2010) found that, on average, comparing the three evaluated years (cycles 2003/2004, 2004/2005 and 2005/2006), the harvest period lasted 57 days between November and January. However, in the first cycle (2003-2004), the "Tupy" cultivar had the shortest harvest period (30 days). In the first production cycle (2003/2004), the flowering of the "Brazos" cultivar started on 09/10 and lasted until 11/01; the "Tupy" cultivar started flowering a little later, on 09/20, lasting until 11/01.

Production can be anticipated or delayed based on the modification of environmental factors and/or crop management techniques, considering that to sprout the cultivar requires reduced chilling and heat requirements, in addition to a short flower and fruit formation period (ANTUNES et al., 2014).

In Pelotas – RS, the harvest of the "Brazos" cultivar began in mid-November and ended in mid-January, i.e., 60 days duration for the first production cycle on average (ANTUNES et al., 2010). In Lavras, the harvest duration (for the first production cycle) of the same cultivar was 122 days, from 10/01/2010 to 01/31/2011 (CURI et al., 2015). And in Serrania – MG, the mean harvest duration was 50 and 48 days for "Brazos" and "Tupy", respectively (Table 1).

Table 1. Phenological description of the 2022/23 production cycle—start, end and duration of flowering (SF, EF and DF) and harvest (SH, EH and DH) of two blackberry cultivars grown in Serrania – MG.

Cultivar	SF	EF	DF (days)	SH	EH	DH (days)
Brazos	09/20/2023	10/19/2023	30	10/22/2023	12/10/2023	50
Tupy	09/25/2023	10/20/2023	26	10/29/2023	12/15/2023	48

Source: authors (2024)

As highlighted by Curi et al. (2015), a longer harvest period is important, since hot summers and/or excessive rainfall can damage fruits and affect harvests. In southern Minas Gerais, the blackberry harvest period conventionally occurs from the end of October to February, and the "Brazos" cultivar is more productive (5.3 kg per plant) than the "Tupy" cultivar (3.6 kg per plant) (ANTUNES et al., 2000).

Considering the productive parameters evaluated during 30 days in the month of November in the first blackberry cultivars production cycle (2022/2023) in Serrania – MG, it was observed that the "Tupy" cultivar was superior to the "Brazos" cultivar in yield and productivity ($p<0.05$) (Table 2). Results that corroborate Antunes et al. (2010), which, using 3.5 m × 0.7 m spacing and with 4,081 plants ha^{-1} density, produced 1,150 g $plant^{-1}$ of the "Tupy" cultivar and 620 g $plant^{-1}$ of "Brazos".

This result differs from that reported by Antunes (2002), in which the "Brazos" cultivar achieved 5.3 kg of $plant^{-1}$ production, higher than the 3.6 kg $plant^{-1}$ of "Tupy" production, in Poços de Caldas – MG. Similarly, evaluating the extra-temporary production of blackberry varieties in the Poços de Caldas plateau, Minas Gerais, Antunes et al. (2006) reported an average production per plant of 2.93 kg for "Brazos" and 2.22 kg for "Tupy", during four production cycles (1997 to 2000).

Antunes et al. (2006) observed that, between the first blackberry harvest (1997–1998) and the second one (1998–1999), there was an upward trend in production, especially in "Brazos" and "Tupy", which obtained yields above 16 t ha^{-1}. In addition, in the second production cycle, "Brazos" produced 10.1 g fruits on average, producing 3 kg $plant^{-1}$, which resulted in an estimated 20 t ha^{-1} productivity.

Differently from what was found for the production of blackberries in November in Serrania – MG, whose estimated productivity of the "Tupy" cultivar (15.36 t ha^{-1}) was higher ($p<0.05$) than "Brazos" (11.11 t ha^{-1}), Curi et al. (2015) highlight that "Brazos" achieved an estimated productivity of 12.38 t ha^{-1}, the highest for Lavras – MG, in relation to "Tupy", whose productivity was 9.03 t ha^{-1}, during the first production cycle (2010/2011).

"Brazos" and "Tupy" produce large fruits, with over 6 g in mass (ANTUNES, 2002). In this study, the fruits of the "Brazos" cultivar were heavier and larger in diameter than those of the "Tupy" cultivar ($p<0.05$) (Table 2). However, these values differ from those reported by Antunes et al. (2006), whose average "Tupy" cultivar fruit weight (6.4 g) was higher than that of "Brazos" (5.21 g). Similarly, Curi et al. (2015) reported 8.2 g and 8.6 g mean fruit weight for "Brazos" and "Tupy" during the first production cycle, respectively.

Table 2. Productive variables of "Brazos" and "Tupy" blackberry cultivars during 30 days of harvest in November 2023 produced in the municipality of Serrania – MG.

Cultivar	Fruits/Plant	Production/ plant (g)	Fruits (g)	Estimated productivity (kg/ha)*	Height (m)	Diameter (mm)
Brazos	282.17 b	1,667.12 b	5.98 a	11,114.72 b	28.24	24.11 a
Tupy	413.52 a	2,304.27 a	5.57 b	15,362.60 a	28.33	22.11 b
P-value	<0.001	<0.001	<0.001	<0.001	0.87	<0.001
VC (%)	18.66	16.55	3.79	16.55	6.09	4.00

VC (%)–Variation coefficient. Means followed by different letters in the column differ from each other by the Tukey's test ($p<0.05$). *Considering 3.0 m × 0.5 m spacing with 6,667 plants per hectare density.

Source: authors (2024)

In the second production cycle, "Brazos" produced fruits with a larger diameter ($p<0,05$) than "Tupy", namely 27.2 mm and 22.4 mm, respectively, even though no statistical difference had been found between the cultivars in the first cycle, with "Brazos" (24 mm) and "Tupy" (24.1 mm) (CURI et al., 2015).

The "Brazos" cultivar has a longer duration in the harvest period of the first production cycle (ANTUNES et al., 2010; CURI et al., 2015) which influences the productive characteristics of the cultivar. It should be noted that the productive results obtained in this study refer to 30 days of harvest during the month of November of the first production cycle (2022/2023).

Conclusion

The flowering duration (30 and 26 days, respectively) and harvest (50 and 48 days, respectively) for the "Brazos" and "Tupy" blackberry cultivars was similar in the first production cycle. With a 30-day harvest during the month of November of the first production cycle (2022/2023), the "Tupy" cultivar achieved higher yield (number of fruits per plant and g plant^{-1}) and higher estimated productivity (kg ha^{-1}) than "Brazos".

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