Agronomic performance of Arabica coffee cultivars in the subtropical humid environment of Vale do Ribeira Paulista, Brazil[1]

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ABSTRACT

This research is related to the evaluation of vegetative growth parameters, initial yield and incidence of pests and diseases of twelve Arabica coffee cultivars submitted to the subtropical humidity environment of Vale do Ribeira Paulista, Brazil. The experiment was performed in the Experimental Campus of the UNESP in Registro, in a randomized block design, with three replications. Stem diameter, number of plagiotropic branches, plant height, number of internodes of plagiotropic branches, length of the first plagiotropic branch, incidence of brown eye spot and phoma leaf spot on coffee leaves, infestation by leaf miner and the yield of cultivars were evaluated. The results obtained allowed to conclude that: i) cultivars Catuaí Amarelo IAC 62, Catuaí Vermelho IAC 99 and Mundo Novo IAC 379-1 were higher than the others, with yield above the national average in 2020 and percentage of flat beans below 10%; ii) all cultivars evaluated showed a similar level of increment of variables that indicate plant growth and reproductive development; iii) the cultivation environment is favorable to infestation by the leaf miner and unfavorable to the incidence of leaf rust; iv) The prevailing climatic conditions in the Vale do Ribeira Paulista is suitable for the production of Arabica coffee.

Keywords: *Coffea arabica*; plant growth; yield; *Leucoptera coffeella*.

INTRODUCTION

Coffee is the second most traded commodity in the world after oil, being cultivated in more than 52 countries (ICO, 2020). Currently, Brazil is considered the largest producer and exporter of fresh coffee in the world and coffee is one of its vital productive activities from a social and economic point of view, due to the number of jobs created and the significant contribution to the formation of its foreign exchange income. The 1st survey of the Brazilian coffee harvest in 2022 is 55.74 million bags of 60 kg, which is influenced by a positive biannuity and will be 16.8% higher compared to the 2021 crop (CONAB, 2022). The brazilian harvest of coffee in 2021 was 47.72 63.08 million 60-kg bags and, from this total, 80.52% were exported (CONAB, 2022). Although Conillon (*Coffea canephora* Pierre ex Froehner) is more productive and resistant to the incidence of pests and diseases, the preference for the cultivation of Arabica coffee is due to the fact that the fruits of the species allow the production of beverages with superior quality, with a higher market value (Lemos *et al.*, 2020).

In addition to genetic and edaphic factors, plant growth, flowering, fruit development, incidence of pests and diseases, Arabica coffee yield, and even beverage quality, are determined by environmental factors such as water availability in the soil, air temperature and solar radiation incidence levels (Pereira *et al.*, 2007; Bote & Vos, 2017; Rolim *et al.*, 2020). Climate can influence the genetic expression of the plant and, in some cases, production

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viability depends on the selection of cultivars more adapted to the place of interest or on the adoption of specific cultivation methods (Barbosa *et al.*, 2019; Cheng *et al.*, 2016). In general, the cultivation of Arabica coffee is limited to intertropical zones, which have air temperatures ranging between 19 and 22 °C and differentiation between winter and summer in terms of rainfall (Ramalho *et al.*, 2014). Above-ideal temperatures throughout the year and water scarcity have negative effects on coffee growth and production which, in the face of global climate changes, have been frequent climatic adversities, affecting traditionally coffee-producing regions (Craparo *et al.*, 2015; Ovalle-Rivera *et al.*, 2015; Sarmiento-Solera *et al.*, 2019). In the specific case of coffee quality, high temperatures accelerate fruit maturation, reducing the accumulation of sugars and aromatic compounds throughout the development of the beans, which reduces beverage quality (Rolim *et al.*, 2020).

Therefore, information about the performance or physiological responses of Arabica coffee under different climatic conditions are considered important for different studies and applied areas. Not only do they allow the selection of areas for production, but also the selection of more adapted cultivars and the development of technologies and methodologies for production in view of climate change, besides the need to reduce production losses under unfavorable growth conditions (Craparo *et al.*, 2015; Silva *et al.*, 2018).

In this context, this study is related to the analysis of the initial plant growth, the first fruit production and the incidence of pests and diseases of twelve Arabica coffee cultivars submitted to the subtropical cloudy and humid environment of the Vale do Ribeira Paulista, whose climate is characterized by high cloudiness, relative air humidity and frequency of rainfall, with air temperature ranging between 18 and 26 °C and low incidence of solar radiation.

MATERIAL AND METHODS

Location

This study was conducted at the Experimental Campus of the São Paulo State University “Júlio de Mesquita Filho” – UNESP, in Registro (24º29’S; 47º50’W; 25 m a.n.m.). The municipality of Registro is located in the center of Vale do Ribeira Paulista (Figure 1) and has social, economic and climatic characteristics that are representative of the region. Its area is 72.24 thousand hec-tares, with a population of 56.32 thousand inhabitants; the climate is classified as humid subtropical (Cfa according to the Köppen classification criteria) (IBGE, 2016).

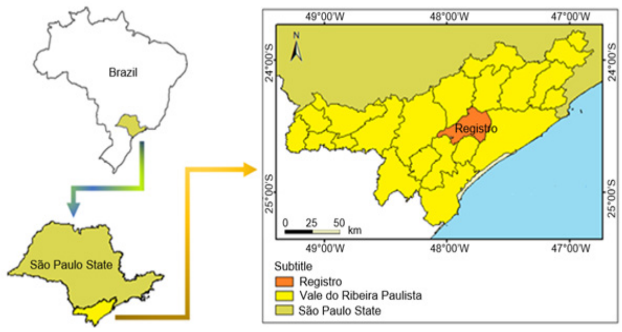

Figure 1: Location of Registro, SP, Brazil, one of the 22 municipalities that make up the Vale do Ribeira Paulista.

The region is considered important from an environmental point of view, due to the rich biodiversity present in aquatic and terrestrial ecosystems. The economy of Vale do Ribeira Paulista is based on services, agriculture, aquaculture and fishing (IBGE, 2016).

The climate in Registro is characterized by high cloudiness, relative humidity and frequency of rainfall, with temperatures during the austral summer above the recommended limit for the cultivation of Arabica coffee. Due to the high cloudiness, where less than 45 days of the year have clear sky conditions, there is a low incidence of solar radiation compared to other traditionally Arabica coffee producing regions (Escobedo *et al.*, 2009; Sarmiento-Solera *et al.*, 2019; Teramoto *et al.*, 2019). Clouds can reduce the incidence of photosynthetically active radiation (PAR) by up to 60% on the Earth surface (Escobedo *et al.*, 2009). Other differences in terms of climate, present in the Vale do Ribeira Paulista region, are the relative humidity of the air above 82% and the absence of a dry period throughout the year (Teramoto *et al.*, 2019). In all months of the year, the monthly rainfall volume is greater than 85 mm and the frequency of rainfall greater than 5 days, with the annual accumulated close to 190.0 mm. This climatic characteristic is similar to what happens in Arabica coffee producing countries, such as Colombia, with its coffee regions located close to the Equatorial belt (López-Fisco *et al.*, 2008), but at much higher altitudes, making the temperature mild.

Experimental design

The experiment was set in early February 2018 and twelve *C. arabica* cultivars were evaluated (Table 1): one was cultivar Siriema VC 4, resistant to the leaf miner, *Leucoptera coffeella*, Guérin-Méneville and leaf rust, *Hemileia vastatrix*, Berkeley & Broome; seven, cultivars Obatã IAC 1669-20, Obatã IAC 4739, IAC 125 RN, Paraíso MG H 419-1, Catucaí Amarelo 2SL, Catucaí Amarelo 24/137 and Arara, resistant to leaf rust, *Hemileia vastatrix* and four, cultivars Catuaí Vermelho IAC 99, Catuaí Amarelo IAC 62, Mundo Novo IAC 379-19 and Acaiá IAC 374-19, susceptible to both pathogens, repeated in treatments with and without chemical control to the respective biotic agents.

The experimental design used was in randomized blocks, with three replications and plots of eight plants; the six central plants were considered useful. The sixteen treatments were planted in a spacing of 3.0 m between rows x 0.60 m between plants. Leaf rust control in experimental plots of cultivars susceptible to the pathogen was carried out through three applications, in October 2019, February 2020 and July 2020; the fungicide Cyproconazole was used as an active ingredient (80 g/L), at a dose of 750 mL of commercial product per hectare, considering a flow of 400 liters of syrup per hectare. The leaf miner was controlled with insecticide applications with the active ingredient Chlorantraniliprole (350 g kg^{-1}), at a dose of 90 grams of commercial product per hectare, considering a flow rate of 400 liters of syrup per hectare.

Evaluation of vegetative growth

The variables plant height (PH), stem diameter (SD), number of plagiotropic branches (NPB), number of internodes in the plagiotropic branches (NIPB) and length of the first plagiotropic branch (LFPB) were measured in the 5th month after planting in the field (July 2018) and the 18th month of cultivation (April 2019). The values related to the increment of each variable, calculated by the difference between the values measured in April 2019 and July 2018.

Evaluation of productivity

The average yield, expressed in bags ha^{-1}, was obtained by converting coffee harvested on the farm, between May and July 2020, into processed coffee; the conversion factor was obtained through the actual yield of each cultivar, that is, the volume of harvested coffee necessary for the production of a 60 kg bag of processed coffee (L bag^{-1}). For the calculation, samples of three liters of coffee were separated from each experimental plot which, after drying, reached 11% moisture (b.u.), and were then processed. The percentages of fruits ripe (parchment), green, raisin and dry were calculated by sampling 500 mL of fruits from the six central plants of each plot, collected from plagiotropic branches located in the four quadrants; harvest was carried out when most of the fruits of the plot were ripe. The percentage of fruits devoid of endosperm, called flat or floaters, was calculated in samples of 100 parchment fruits, by counting the number of fruits that floated, due to lower density, in a container with water.

Table 1: Twelve *C. arabica* cultivars evaluated and their RNC number (National Register of Cultivars according to the MAPA) and characteristics.

Cultivars	RNC number	Characteristics
Mundo Novo IAC 379-19	02909	Susceptible to both pathogens.
Acaiá IAC 474-19	02925	
Catuaí Vermelho IAC 99	02933	
Catuaí Amarelo IAC 62	02939	
Obatã IAC 1669-20	02956	Resistant to leaf rust, *Hemileia vastatrix.*
Obatã IAC 4739	30009	
IAC 125 RN	28587	
Catucaí Amarelo 2SL	04915	
Catucaí Amarelo 24/137	04911	
Paraíso MG H419-1	15981	
Arara	28884	
Siriema VC 4	34014	Resistant to the leaf miner, *Leucoptera coffeella*, Guérin-Méneville and leaf rust, *Hemileia vastatrix.*

Verification of the incidence of pests and diseases

The incidence of brown eye spot, *Cercospora coffeicola* Berk. & Cooke, in leaves was evaluated monthly between January and July 2020, according to the method proposed by Moraes (1998). The incidence of phoma leaf spot was evaluated monthly between August 2019 and July 2020, through the percentage of leaves with symptoms in non-destructive samples of one hundred leaves per plant. The population fluctuation of the leaf miner was evaluated between August 2019 and July 2020, using the method proposed by Moraes (1998).

The percentages of disease incidence were transformed into the area below the incidence progress curve of the leaf miner (AACPIBM), incidence of phoma (AACPIPH) and incidence of brown eye spot (AACPIC), according to criteria established by Campbell & Madden (1990).

Statistical analysis

Sixteen treatments with three replications were considered. Statistical analyzes of the parameters of vegetative grouth, yeld and incidence of pragues and deseases were performed using the the R software (R Development Core Team 2010). The significance was verified, at 5% of probability, by the F test. From the detection of significant differences between treatments and their interactions, the splits were made and the means grouped by the Scott Knott test.

RESULTS

Table 2 shows the mean increments of the studied vegetative variables, from July and November 2018 to February and April 2019, for the 16 treatments.

The greatest increments in SD growth occurred in cultivars Mundo Novo IAC 379-19 and Catucaí Amarelo 24/137, while the smallest evolutions occurred in cultivars Siriema, Acaiá IAC 474-19 and Obatã IAC 1669-20. In the variable plant height increase, relatively high values are observed, ranging from 27.87 cm to 77.60 cm. It must be considered that they are values related to the increase in height when the plants reached 13 months of age, that is, values considered satisfactory for plant growth in that evaluation period. Cultivars Catuaí Vermelho IAC 99 and Mundo Novo IAC 379-19, with chemical control, and Catucaí Amarelo 24/137 presented the highest values for plant height evolution during the evaluation period, and the lowest heights were observed in cultivars Siriema, Acaiá IAC 474-19 and Obatã IAC 4739.

The largest increments in relation to NPB were observed in cultivars Catuaí Amarelo IAC 62, Mundo Novo IAC 379 and Catucaí Amarelo 24/137, while cultivars Acaiá IAC 474-19, Obatã IAC 4739 and Siriema presented the lowest values. The highest incremental values of LFPB occurred in cultivars Mundo Novo IAC 379-19, Acaiá IAC 474-19 and Arara. In Table 3, it can be observed that cultivars IAC 125 RN, Catucaí Amarelo 24/137 and Catuaí Amarelo IAC 62 were the ones with the highest amount of internodes in the plagiotropic branches, while cultivars Acaiá IAC 474-19 and Siriema had the lowest values.

Table 3 shows the estimated initial yield values in 60 kg ha^{-1} bags, from the production of fruits harvested in the experimental plots, the average percentage of fruits at stages parchment, green, raisin and dry and the percentage of flat fruits of arabica coffee cultivars evaluated in Registro, SP.

Under experimental conditions, cultivars Catuaí Vermelho IAC 99 and Mundo Novo IAC 379-19, Obatã IAC 1669-20, IAC 125 RN, Acaiá IAC 474-19, Paraíso H 419-1, Catucaí Amarelo 2SL and Siriema, presented low yield. On the other hand, cultivars Catuaí Amarelo IAC 62, Catucaí Amarelo 24/137 and Arara, with initial yield of 43.4, 54.5 and 54.5 bags of 60 kg ha^{-1}, respectively, presented yield higher than the Brazilian average in 2020.

The percentages of green fruits observed ranged between 27.0 and 79.0%, and cultivars Obatã IAC 4739, IAC 125 RN, Paraíso H 419-1 and Arara presented the highest percentages of green fruits compared to the other ripening stages, indicating a later cycle of fruit development, at this early stage of the reproductive plant development. The percentage of fruits without endosperm varied between 3.33 and 25%.

Table 4 shows the values of Area Below the Incidence Progress Curve of the leaf miner (AACPIBM), phoma (AACPPH) and brown eye spot (AACPCER), for the Arabica coffee cultivars evaluated in Vale do Ribeira Paulista.

The cultivars with the highest levels of infestation by the leaf miner were Catuaí Vermelho IAC 99 and Mundo Novo IAC 379-19. The occurrence of phoma started to be evaluated only from January 2020, and the disease had a higher incidence between March and May that year. The joint analysis of data, carried out from AACPPH, revealed the existence of two distinct groups, with mean values very close to each other. The same happened in relation to the occurrence of brown eye spot, whose incidence was even lower, under the experimental conditions. There was no leaf rust incidence during the experimental period.

Table 2: Mean increment values for the variables stem diameter (SD), plant height (PH), length of the first plagiotropic branch (LFPB) and number of internodes of plagiotropic branches (NIPB) of Arabica coffee cultivars, in Registro, SP.

Cultivar[1]	**SD**	**PH**	**LFPB**	**NPB**	**NIPB**
	cm	cm	cm	No	No
Tall, susceptible to leaf rust and leaf miner					
Mundo Novo IAC 379-19**	21.40 a	77.60 a	36.81 b	24.80 a	466.93 c
Mundo Novo IAC 379-19***	18.13 b	63.46 b	30.29 c	20.00 b	291.13 d
Acaiá IAC 474-19**	14.53 c	40.92 d	25.92 d	16.53 c	188.67 e
Acaiá IAC 474-19****	15.96 c	57.23 c	37.69 b	20.53 b	388.20 c
Small, susceptible to leaf rust and leaf miner					
Catuaí Vermelho IAC 99*	15.36 c	67.06 b	29.67 c	21.07 b	443.60 c
Catuaí Vermelho IAC 99***	15.77 c	52.56 c	27.01 c	21.47 b	433.73 c
Catuaí Amarelo IAC 62**	18.05 b	54.35 c	28.11 c	22.13 b	344.93 d
Catuaí Amarelo IAC 62***	15.56 c	57.69 c	28.81 c	25.33 a	489.87 c
Small, leaf rust resistant					
Obatã IAC 1669-20*	15.02 c	48.99 d	31.51 c	20.40 b	298.80 d
Obatã IAC 4739*	16.71 c	44.83 d	26.79 c	19.47 b	316.93 d
IAC 125 RN*	18.47 b	47.24 d	24.07 d	21.20 b	609.53 a
Catucaí Amarelo 2SL*	15.59 c	57.86 c	32.55 b	20.80 b	408.80 c
Catucaí Amarelo 24/137*	18.67 b	66.32 b	35.77 b	22.93 a	523.87 b
Paraíso MG H419-1*	15.47 c	45.61 d	33.75 b	20.53 b	429.33 c
Arara*	17.44 b	55.19 c	43.57 a	21.33 b	364.47 d
Small, resistant to leaf rust and leaf miner					
Siriema***	8.46 d	27.87 e	21.30 d	12.00 d	212.20 e
CV (%)	9.20	11.36	10.17	9.94	10.64

[1]Means of cultivars followed by the same letter do not differ by the Scott-Knott test, at 5% probability. *with leaf miner control; **with leaf rust and leaf miner control; ***without chemical control.

DISCUSSION

Plant growth in Arabica coffee is highly dependent on climatic conditions, particularly due to factors associated with air temperature and availability of water and solar radiation (Silva *et al.*, 2018). The Brazilian harvest of Arabica coffee in 2020, under the influence of positive bienniality and favorable climatic conditions, without the negative effect of droughts and frosts, had an average yield of 32.7 bags of 60 kg ha^{-1} (CONAB, 2020). In this study, in most of the cultivars evaluated, there was a high plant growth associated with an initial yield similar to that of other traditional Arabica coffee producing regions in Brazil.

Regarding plant growth, the plants showed a high plant growth rate, with emphasis on PH, NPB and LFPB. This result may be related to the lower availability of solar radiation for plants due to the high cloudiness in the region, leading to greater plant growth and, consequently, plants tend to have high yields due to their high degree of leafiness caused by the vast growth in height and number of plagiotropic branches. Furthermore, the absence of water stress may have contributed to these results. Similar results were observed by Perdoná & Soratto (2015), in irrigated Arabica coffee intercropped with macadamia nuts (*Macadamia integrifolia*), where there was greater plant growth under lower availability of PAR and absence of water stress. According to Ovalle-Riviera *et al.* (2015), stem elongation and increase in leaf area are considered to be plant responses to cultivation in environments with low light.

The absence of water stress during the period of induction and maturation of flower buds generates uneven flowering, with a greater number of flowerings, and a consequent increase in the percentage of green beans at harvest (López-Fisco *et al.*, 2008). Temperatures above ideal for the plant and water deficit accelerate fruit maturation, conditions that negatively influence beverage quality (Rolim *et al.*, 2020). Reductions in the incidence of solar radiation can also increase fruit maturation time, positively interfering with beverage quality (Rolim *et al.*, 2020). The estimated initial yield of the evaluated cultivars corroborates the results obtained by the cited authors, being associated with the absence of a dry period during flowering and high temperatures during the austral summer, when the fruits are in development. Most of the cultivars showed a high fruit production, uneven in relation to maturation stage and with relatively high percentage of flat beans. Commercial cultivars have, on average, less than 5% flat fruits. The values observed in a significant part of the evaluated selections were much higher and the causes of this occurrence, certainly of an environmental nature, need to be very well evaluated in the next harvest periods.

Table 3: Initial yield, fractions in percentage of fruits at different ripening stages and percentage of flat fruits in Arabica coffee cultivars, evaluated in Registro, SP.

Cultivar[1]	Yield[2]	Fruit ripening stage				Flat fruits
		Parchment	Green	Raisin	Dry	
	60-kg ha^{-1} bags	%	%	%	%	%
Tall, susceptible to leaf rust and leaf miner						
Mundo Novo IAC 379-19**	18.24 c	27.38 a	26.97 d	16.38 a	29.27 a	6.00 b
Mundo Novo IAC 379-19***	33.6 b	27.77 a	33.49 d	15.01 a	23.72 a	6.00 b
Acaiá IAC 474-19**	7.8 c	35.74 a	24.83 d	15.19 a	24.24 a	10.67 b
Acaiá IAC 474-19****	15.0 c	25.19 a	41.13 c	11.81 a	21.87 a	9.33 b
Small, susceptible to leaf rust and leaf miner						
Catuaí Vermelho IAC 99*	28.6 b	18.66 b	32.21 d	23.56 a	25.57 a	13.33 a
Catuaí Vermelho IAC 99***	36.2 b	15.92 b	33.68 d	18.47 a	31.93 a	5.00 b
Catuaí Amarelo IAC 62**	32.7 b	5.79 b	31.72 d	27.59 a	24.89 a	4.00 b
Catuaí Amarelo IAC 62***	43.4 a	23.98 a	30.16 d	25.83 a	18.70 b	10.00 b
Small, leaf rust resistant						
Obatã IAC 1669-20*	24.9 c	21.49 a	46.65 c	15.35 a	16.52 b	6.67 b
Obatã IAC 4739*	35.7 b	13.01 b	76.96 a	6.45 a	3.57 b	20.00 a
IAC 125 RN*	32.3 b	7.66 b	79.05 a	3.64 a	9.64 b	3.33 b
Catucaí Amarelo 2SL*	13.10 c	14.30 b	53.09 b	16.22 a	16.38 b	25.00 a
Catucaí Amarelo 24/137*	29.3 b	14.79 b	47.99 c	20.23 a	16.99 b	16.67 a
Paraíso MG H419-1*	54.5 a	10.62 b	33.64 d	16.71 a	39.02 a	15.00 a
Arara*	54.5 a	22.82 a	58.96 b	6.30 a	11.92 b	19.00 a
Small, resistant to leaf rust and leaf miner						
Siriema***	14.4 c	26.29 a	45.02 c	14.16 a	14.53 b	4.00 b
Mean	29.6	20.09	43.47	15.81	20.55	10.87
CV (%)	28.3	31.45	20.70	42.67	41.82	42.13

[1]Means of cultivars followed by the same letter do not differ by the Scott-Knott test, at 5% probability.
[2]Values estimated from fruit production in 2020. *with leaf miner control; **with leaf rust and leaf miner control; ***without chemical control.

The ideal for a cultivar is to present 5% green fruits and a higher percentage of production corresponding to parchment fruits at the end of the ripening period (Ronchi *et al.*, 2015). The percentage of unripe fruits at harvest observed in this study were well above this limit. In the case of cultivars Obatã IAC 4739, IAC 125 RN, Paraíso H 419-1 and Arara, the percentage of green fruits was much higher when compared to the other maturation stages. For the other cultivars, the differences between the percentages of fruits in the four stages were low. In relation to the percentage of parchment, it was higher in cultivars Acaiá IAC 374-19 and Mundo Novo IAC 379-19, a condition that evidences the occurrence of early fruit ripening. This result is similar to that observed for cultivar Mundo Novo in hot climate producing regions (Bardin-Camparotto *et al.*, 2012). Cultivars IAC 125 RN, Catuaí Amarelo IAC 62, Catuaí Vermelho IAC 99, Obatã IAC 1669-20, Siriema, Mundo Novo IAC 379-19 and Acaiá IAC 474-19 stood out positively. The year 2020 was atypical in terms of rainfall in Vale do Ribeira Paulista, specifically in the months preceding harvest, with rainfall volumes below normal.

Fruit ripening is of great importance in beverage quality; thus, it is interesting to know the percentages of fruits at each maturation stage. The fruits must be harvested at the optimal point of ripeness – parchment stage – since, when harvested green or drier, generate inferior quality beverages. The unevenness in fruit maturation observed in most of the evaluated cultivars occurs similarly in most of the Arabica coffee producing regions of Colombia and Central America, where rains are regularly distributed throughout the year, causing the plants to present diverse

Table 4: Area Below the Incidence Progress Curve of the leaf miner (AACPIBM), Phoma (AACPPH) and brown eye spot (AACPCER), in Arabica coffee cultivars, evaluated in Registro, SP.

Cultivar[1]	**AACPIBM**	**AACPPH**	**AACPCER**
Tall, susceptible to leaf rust and leaf miner			
Mundo Novo IAC 379-19**	245 f	1135 b	705 a
Mundo Novo IAC 379-19***	1275 b	1155 b	410 b
Acaiá IAC 474-19**	275 f	1055 b	550 a
Acaiá IAC 474-19****	905 c	1210 b	540 a
Small, susceptible to leaf rust and leaf miner			
Catuaí Vermelho IAC 99*	250 f	1275 b	820 a
Catuaí Vermelho IAC 99***	1795 a	1010 b	775 a
Catuaí Amarelo IAC 62**	210 f	1510 a	250 b
Catuaí Amarelo IAC 62***	710 d	1890 a	725 a
Small, leaf rust resistant			
Obatã IAC 1669-20*	330 f	990 b	615 a
Obatã IAC 4739*	440 e	1825 a	455 b
IAC 125 RN*	210 f	1355 b	415 b
Catucaí Amarelo 2SL*	475 e	1285 b	570 a
Catucaí Amarelo 24/137*	275 f	1615 a	580 a
Paraíso MG H419-1*	745 d	1175 b	500 b
Arara*	265 f	1745 a	645 a
Small, resistant to leaf rust and leaf miner			
Siriema***	155 f	790 b	360 b
CV (%)	20.97	18.02	24.56

[1]Means of cultivars followed by the same letter do not differ by the Scott-Knott test, at 5% probability. *with leaf miner control; **with leaf rust and leaf miner control; ***without chemical control.

blooms (López-Fisco *et al.*, 2008). Faced with this condition, in order to guarantee a better quality in coffee production, the coffee growers in these countries carry out fruits harvest selectively. Likewise, an alternative for coffee growing in humid subtropical environments is selective fruit harvesting once, in addition to ensuring higher quality coffee, it is suitable for small properties with family farming.

The leaf miner is one of the main pests of Brazilian coffee, with a greater occurrence in regions with hot climate and low air humidity and frequency of rainfall, causing losses ranging from 37% to 80% (Pereira *et al.*, 2007). The insect causes damage to plants by reducing their photosynthetic capacity, destroying the leaf blade and, mainly, by premature leaf fall.

The predominance of high relative humidity in Vale do Ribeira Paulista did not prevent the occurrence of infestation in coffee cultivars, with the occurrence of infestation by the leaf miner in the experimental plots (Table 4), observed especially in the last quarter of 2019 (data not shown), period that corresponds to a peak of infestation in other coffee regions of the country (Souza *et al.*, 1998). Thus, pest management under the climatic cultivation conditions in Vale do Ribeira Paulista requires special attention.

An important fact was the lack of leaf rust incidence, a result, albeit preliminary, indicating that the climatic characteristics of Vale do Ribeira Paulista, associated with the low altitude, seem to be unfavorable to the development of the disease, responsible for causing great economic damage in the main coffee regions of the country.

CONCLUSIONS

The initial yield above the national average in 2020 and the low incidence of fruits devoid of endosperm show that cultivars Catuaí Amarelo IAC 62, Catuaí Vermelho IAC 99 and Mundo Novo IAC 379-19 are promising for cultivation in a cloudy and humid environment.

The cultivation environment proved to be favorable to infestation by the leaf miner and unfavorable to the incidence of leaf rust.

The climate of the Vale do Ribeira region allows the production of Arabica coffee.

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