AGRONOMIC CHARACTERIZATION AND GENETIC PARAMETER ESTIMATION IN YELLOW PASSION FRUIT

CARACTERIZAÇÃO AGRONÔMICA E ESTIMATIVA DE PARÂMETROS GENÉTICOS EM MARACUJAZEIRO AZEDO

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ABSTRACT: The selection of yellow passion fruit (*Passiflora edulis* Sims) genotypes with high yield and fruit quality is essential for the development of passion fruit crop in the country. Therefore, the objective of this study was to evaluate the agronomic performance and estimate the genetic parameters of 32 yellow passion fruit genotypes cultivated in the Federal District, Brazil. The experiment consisted of randomized block design with 32 treatments, eight plants per plot, and four replications. Fruits were classified based on their equatorial diameter. Yield, number of fruits per hectare, and fruit weight were evaluated. Genotypes MAR20#23 and UnB-P7 presented the highest total yield, and MAR20#23 also showed the greatest total number of fruits per hectare. BRS GA1 and MAR20#23 had the best performance for industrial purposes dues to the fruits of smaller diameter classes. UnB-P7, AR-01, and MSC were more indicated for *in natura* consumption owing to the fruits of greater diameter classes. The high magnitude estimates for heritability and genetic variation coefficients indicate the possibility of greater genetic gains with direct selection for yield and number of fruits of 1C diameter class. Significant phenotypic correlations were observed, indicating the possibility of indirect selection for number of fruits, fruit weight, and yield.

KEYWORDS: Agronomic performance. Plant breeding. Passion fruit cultivation.

INTRODUCTION

Brazil stands out as the world's largest producer and consumer of passion fruit. In 2016, fruit production reached 703,489 tons in an area of 49,889 hectares (IBGE, 2016). Yellow passion fruit (*Passiflora edulis* Sims), also known as sour passion fruit, represents approximately 95% of the national production (COSTA et al., 2008). The Brazilian passion fruit mean yield (14.10 t ha^{-1}) (IBGE, 2016) is considered as low when compared with the productive potential of the species, which can reach more than 40 t ha^{-1} (FREITAS et al., 2011; NEVES et al., 2013). The cultivation of inadequate varieties (JUNQUEIRA et al., 1999), the low production technology usage (MELO et al., 2001), and the lack of homogeneous and productive materials (MELETTI et al., 2000) are limiting factors to the increase of fruit quality and orchards yield.

The development of genotypes with high yield, uniformity, and fruit quality is important for breeding programs (FALEIRO et al., 2006) since they increase the species production potential (NEVES et al., 2013). In addition, these materials may increase the producers' income and simplify some stages of the productive process, such as post-harvest fruit classification (MELETTI et al., 2000).

Fruit quality is measured both by its internal and external characteristics. The former is related to flavor (acidity and sugars content) and juice content (yield). The latter is associated with appearance and fruit standardization parameters, which influence the consumer's choice. Fruits with better external appearance are usually intended for the fresh fruit market, while the others are destined for the industry (BALBINO, 2005). Therefore, the objective of this study was to evaluate the agronomic performance of 32 yellow passion fruit genotypes cultivated in the Federal District, Brazil, and to estimate some essential genetic parameters for the definition of breeding strategies.

MATERIAL AND METHODS

The experiment was conducted at Água Limpa Farm, belonging to University of Brasilia (UnB) (16°S and 48°W, 1,100 m asl), located in Brasilia, DF, Brazil. It consisted of a randomized

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block design, with 32 treatments, eight plants per plot, and four replications. The genotypes evaluated in this study were obtained from Embrapa and UnB and were selected based on yield, fruit quality, and resistance to diseases. The plants were arranged in the field, spaced 2.75 m between rows, and 3 m between plants, totaling 1,024 useful plants, with external border. The experiment was carried out in Clayey Red-Yellow Latosol; soils were deep, well drained, and low fertile. Soil analysis presented the following results: Al (0.05 meq); Ca+Mg (1.9 meq); P (4.5 ppm); K (46 ppm); pH 5.4; and 4% Al saturation. Liming was applied, and 1 kg of simple superphosphate per pit was incorporated at the pre-planting stage. Monthly topdressings were performed in a circle, at a distance of 40 to 50 cm from the stem, while simple superphosphate was incorporated into the soil. The crop was managed using a trellis fence system comprised of 6 m-distant wooden stakes and two pieces of smooth wire, at 1.60 and 2.20 m from the ground. Formation pruning was performed. The crop was daily watered by a drip irrigation system, with the application of approximately 5 L m^{-2} of water. Drippers were spaced at 30 cm apart. Weeds were controlled by periodic hoeing between rows and post-emergent herbicides in the rows. No chemical control of diseases or artificial pollination was performed to increase fruiting during the experiment evaluation period.

The agronomic performance was evaluated at one year after planting, from November 2009 to April 2010, totaling 20 harvests. Fruits were weekly harvested from the ground, weighed, and classified according to their equatorial diameter (D), as follows: 1C ($D \leq 55$ mm); 1B ($55 < D \leq 65$ mm); 1A ($65 < D \leq 75$ mm); 2A ($75 < D \leq 90$ mm); 3A ($D > 90$ mm) (ABREU et al., 2009). Estimated yield (kg ha^{-1}) and number of fruits per hectare (considering 9,697 plants per hectare), and fruit weight (g) were evaluated for all diameter classes together (total), as well as for each diameter class.

Data were subject to analysis of variance, and means were compared by the Tukey's test, at 5% probability. Mean genotypic (σ^2_g), phenotypic (σ^2_p), and environmental (σ^2_e) estimates; mean broad sense heritability (h^2); and coefficients of experimental (CV_e) and genetic (CV_g) variation were obtained for each of the variables analyzed. A phenotypic correlation was calculated between the variables, using the following expression:

$$r_f = \frac{\hat{Cov}_f(X,Y)}{\sqrt{\sigma_f^2(X).\sigma_f^2(Y)}}$$

, where $\hat{Cov}_f(X,Y)$ is the estimator of phenotypic covariance between two traits X and Y; $\sigma_f^2(X)$ is the estimator of the phenotypic variance of trait X; and $\sigma_f^2(Y)$ is the estimator of the phenotypic variance of trait Y.

The intensity of the correlation was classified based on the magnitude of the values, as suggested by Carvalho et al. (2004): r = 0 (null); $0 < |r| \leq 0.30$ (weak); $0.30 < |r| \leq 0.60$ (intermediate); $0.60 < |r| \leq 0.90$ (strong); $0.90 < |r| \leq 1$ (very strong); and $|r|= 1$ (perfect). All statistical analyses were performed using the Genes software (CRUZ, 2013).

RESULTS AND DISCUSSION

Significant differences were observed between genotypes for all traits, except for fruit weight of diameter classes 2A and 3A. Studies carried out with yellow passion fruit progenies have demonstrated high genetic variability for some traits, such as number of fruits per plant, and fruit weight and length (FREITAS et al., 2012; KRAUSE et al., 2012). This variability evidences the breeding potential of genotypes selection (OLIVEIRA et al., 2008).

The total yield varied from 4,055.19 (EC-3-0) to 15,474.39 kg ha^{-1} (MAR20#23), with a mean of 9,543.88 kg ha^{-1} for all genotypes (Table 1). For some of the genotypes studied, the total yield was higher than the national mean (IBGE, 2015). Studies on the agronomic traits of different yellow passion fruit genotypes cultivated in the Federal District have demonstrated distinct behavior for EC-3-0. According to these data, genotype EC-3-0 presented superior performance, with a total yield of 15,460 (ABREU et al., 2009) and 26,480 kg ha^{-1} (JUNQUEIRA et al., 2003). Coimbra et al. (2012), Maia et al. (2009), and Junqueira et al. (2003) observed a superior performance for EC-RAM in relation to the other genotypes, with an estimated total yield of 43,287; 13,968; and 32,880 kg ha^{-1}, respectively. However, in the present study, EC-RAM exhibited a total yield of only 6,350.40 kg ha^{-1}.

The total number of fruits per hectare ranged from 31,063 (UnB-P5) to 119,715 (MAR20#23). In general, the most productive genotypes also presented the greatest number of fruits. Although they did not significantly differ, a considerable numerical variation of 52,000 fruits between AR-01 and EC-RAM was recorded. These fruits, in practical terms, could be commercialized (Table 1). MAR20#23 can produce 342,847 fruits per hectare in the edaphoclimatic conditions of the Federal District (COIMBRA et al., 2012), confirming the superior performance of the genotype in this region.

Table 1. Total yield (TY; Kg ha^{-1}), number of fruits per hectare (TNF), and fruit weight (TFW; g) in 32 yellow passion fruit (*Passiflora edulis* Sims) genotypes cultivated in Brasilia, DF, Brazil.

Genotype	TY	TNF	TFW
UnB-P6	12,213.28 abc	86,729.25 abcd	137.06 a
MAR20#40	9,742.20 abc	86,582.06 abcd	114.56 ab
UnB-P1	8,353.54 abc	68,512.06 abcd	125.56 ab
MAR20#29	4,219.94 bc	35,720.00 cd	120.00 ab
MAR22#2005	9,886.31 abc	79,100.56 abcd	125.56 ab
Roxo Australiano	5,369.65 abc	62,874.56 abcd	84.56 b
MAR20#15	12,659.36 abc	97,187.06 abcd	131.25 ab
MSC	5,149.49 abc	33,123.00 cd	155.25 a
RC-3	5,129.09 abc	39,899.06 bcd	125.56 ab
Rubi Gigante	10,499.22 abc	85,994.56 abcd	120.00 ab
AR-01	13,996.95 abc	102,879.56 abcd	137.06 a
AR-02	8,791.22 abc	69,827.06 abcd	125.56 ab
MAR20#49	8,258.44 abc	68,250.56 abcd	120.00 ab
BRS Sol Cerrado	7,663.21 abc	61,627.06 abcd	125.56 ab
MAR20#6	13,010.45 abc	104,005.25 abc	120.00 ab
UnB-P5	4,601.02 abc	31,063.06 d	137.06 a
MAR20#23	15,474.39 a	119,715.00 a	125.56 ab
UnB-P4	10,916.42 abc	83,087.06 abcd	125.56 ab
UnB-P2	12,164.40 abc	106,601.25 abc	109.25 ab
UnB-P7	14,663.15 ab	102,879.56 abcd	149.06 a
MAR20#03	13,149.69 abc	101,123.00 abcd	125.56 ab
EC-3-0	4,055.19 c	37,055.25 cd	109.25 ab
MAR20#10	9,282.68 abc	90,299.25 abcd	104.06 ab
MAR20#34	11,085.57 abc	99,855.00 abcd	109.25 ab
MAR20#21	13,647.48 abc	118,507.06 ab	109.25 ab
FB200	10,578.75 abc	81,509.25 abcd	131.25 ab
FP-01	8,529.32 abc	72,494.56 abcd	114.56 ab
BRS GA1	11,035.68 abc	105,949.25 abc	104.06 ab
EC-RAM	6,350.40 abc	50,962.06 abcd	125.56 ab
GA2	10,873.51 abc	92,415.00 abcd	120.00 ab
Redondão	8,278.57 abc	70,356.56 abcd	114.56 ab
MAR20#39	5,775.61 abc	49,616.56 abcd	109.25 ab

Different lowercase letters in the columns indicate significant differences (Tukey's test, $P \leq 0.05$).

Fruits of diameter classes 1C and 1B are of great interest to the industry for being small and usually rejected by the fresh fruit market. Fruits of greater diameter classes (1A, 2A, and 3A) are intended for the *in natura* market (COIMBRA et al., 2012). The highest yield and the greatest number of fruits of 1C diameter class were observed in BRS GA1, with 3,343.41 kg ha^{-1} and 53,939 fruits, respectively. MSC presented the lowest yield and number of fruits of 1C diameter class, with 238.14 kg ha^{-1} and 4,455 fruits. For 1B diameter class, MAR20#23 presented the highest yield (9,019.51 kg ha^{-1}) and the greatest number of fruits (62,875). MSC showed the lowest yield (2,295.98 kg ha^{-1}) and UnB-P5 showed the lowest number of fruits (16,192). For fruits classified as 1A, UnB-P7 presented the highest yield (4.156.60 kg ha^{-1}) and number of fruits (19,251). In contrast, EC-3-0 showed the lowest yield (643,60 kg ha^{-1}), and MAR20#29 exhibited the lowest number of fruits (3,480) (Table 2).

Low yields were observed for larger fruits (2A and 3A) when compared with the other diameter classes. For 2A diameter class, AR-01 presented the greatest fruit yield (639.99 kg ha^{-1}) and the greatest number of fruits (2449), differing only from genotype MAR20#29, which registered 2.86 kg ha^{-1} and 13 fruits (Table 2). This result corroborates other studies that reported the superior performance of AR-01 in relation to fruit yield and number of fruits in the diameter classes 1A and 2A (ABREU et al., 2009; MAIA et al., 2009; COIMBRA et al., 2012). For the fruits of 3A diameter class, MSC presented the best performance, with 115.94 kg ha^{-1} and 409 fruits (Table 2).

Greater fruit weight is fundamental to the fresh fruit market. Larger fruits have better commercial classification and, consequently, better prices. Neves et al. (2013) stated that fruits with fruit weight greater than 180 g present good commercial value for the fresh fruit market. The total weight per fruit ranged between 84.56 g (Roxo Australiano) and 155.25 g (MSC), with a mean weight of 121.58 g for all genotypes evaluated (Table 1). Coimbra et al. (2012) reported similar results for genotypes AR-01, AR-02, MAR20#03, FP-01, RC-3, and EC-RAM, and did not detect differences between genotypes. However, the fruit weight range obtained in this study, as well as that reported by Coimbra et al. (2012), was lower than the variations recorded by Campos et al. (2007) (191 and 228 g $fruit^{-1}$) and by Vale et al. (2013) (207 and 286 g $fruit^{-1}$). Considering the diameter classes 1C and 1B, genotypes UnB-P7 (71.25 g) and MAR20#15 (155.25 g) presented the highest fruit weight, respectively, while genotypes EC-RAM (38.06 g) and Roxo Australiano (99.00 g) showed the lowest values, respectively. UnB-P5 obtained the greatest fruit weight in the 1A diameter class (231.56 g), differing only from EC-3-0 (174.56 g). No significant differences were recorded between fruit weight in the diameter classes 2A and 3A for the different genotypes (Table 2).

The contrasts observed among the different studies may be due to the genetic nature of the analyzed materials since they are originated from open pollination. Additionally, different water and nutritional management, distinct harvest times, different substrates and packages used for seedling formation, plant physiological conditions, and environmental factors favorable to the occurrence of phytopathogens may have contributed to these variations. The pollination type should also be considered since it influences fruiting. Artificial pollination, which was not performed in the present study, would have substantially increased yield, fruit weight, fruit diameter and length, and percentage of pulp; and reduced peel thickness (KRAUSE et al., 2012). Such traits would favor both the fresh fruit market and the industry. Fruits with greater pulp weight and size are preferred by the *in natura* market. Conversely, high pulp yield and reduced peel thickness are desirable traits for industrial purposes (FERREIRA et al., 2010).

The three variables evaluated presented heritability estimates of high magnitude (Table 3). The CV_g for the variables total yield (14.70), total number of fruits (15.06), and total fruit weight (4.09) were low when compared with the results obtained by Freitas et al. (2011) (Table 3). These low values may indicate the existence of low genetic variability among the evaluated genotypes.

Heritability values ranged from 8.17 (fruit weight of 2A diameter class) to 81.70% (number of fruits of 1C diameter class) (Table 4). Considering the magnitudes of heritability estimates and the CV_g, higher gains with direct selection are expected for yield and number of fruits of 1C diameter class since the environment has little influence on the expression of these traits. Oliveira et al. (2008) reported the highest estimates of coefficients of heritability (greater than 50%) for fruit length, number of fruits per plant, and fruit weight. Similarly, Freitas et al. (2011) reported high heritability values for the number of fruits per plot (98.02%) and fruit length (82.69%).

Despite the low CV_g observed for the different diameter classes, the CV_g/CV_e ratio was greater than 1 for number of fruits of 1C diameter class (1.06) and total fruit yield for the same diameter class (1.02) (Table 4). These values indicate a favorable selection condition since the genetic variance surpasses the environmental variance. These variables also presented the highest heritability estimates, contributing to the values of CV_g/CV_e ratio. For the other variables, CV_g/CV_e ratio was lower than 1, indicating that the use of simple breeding methods, such as mass selection, will not provide significant gains during the selection process. Breeding methods based on family performance are more appropriate than those based on individual performance (FREITAS et al., 2015).

Seventy significant phenotypic correlations were observed, with valuesvarying between 0.34 and 0.99. In 60% of the significant correlations, estimates values were equal to or greater than 0.6, indicating a strong correlation and the possibility of indirect selection for these traits. The presence of significance for low correlation values has been detected by other authors (VASCONCELOS et al., 1998; KUREK et al., 2002), and may be associated with the high degrees of freedom included in the t-test (VASCONCELOS et al., 1998) (Table 5). In this study, the increase in the total number of fruits increased the total yield (r_f = 0.96), as also reported in other studies (OLIVEIRA et al., 2011; NEVES et al., 2013). Similarly, Pimentel et al. (2008) recorded a strong phenotypic correlation between number of fruits and yield per plant. Strong phenotypic correlations were observed between number of fruits and fruit yield for each diameter class: 1C (r_f = 0.98), 1B (r_f = 0.97), 1A (r_f = 0.99), 2A (r_f = 0.99), 3A (r_f = 0.98). For fruits of 3A diameter class, a strong correlation was reported between number of fruits and fruit weight (r_f = 0.92), and between fruit yield and fruit weight (r_f = 0.94) (Table 5).

Table 2. Yield (Y; Kg ha^{-1}), number of fruits per hectare (NF), and fruit weight (FW; g) of diameter classes 1C, 1B, 1A, 2A, and 3A in 32 yellow passion fruit (*Passiflora edulis* Sims) genotypes cultivated in Brasilia, DF, Brazil.

Genotype	Y1C	NF1C	FW1C	Y1B	NF1B	FW1B
UnB-P6	1,621.8 abcde	25,200.56 abcdef	67.06 ab	7,082.25 ab	45,795.00 ab	149.06 ab
MAR20#40	2,555.2 abc	39,401.25 abcd	63.00 ab	5,683.45 abc	39,999.00 ab	143.00 ab
UnB-P1	857.94 cde	16,575.56 cdef	51.56 ab	5,161.98 abc	41,208.00 ab	125.56 ab
MAR20#29	616.22 cde	11,341.25 cdef	51.56 ab	2,843.44 abc	20,519.56 ab	131.25 ab
MAR22#2005	1,769.56 abcd	28,644.56 abcde	63.00 ab	5,770.8 abc	39,600.00 ab	143.00 ab
Roxo Australiano	771.32 cde	16,769.25 bcdef	44.56 ab	3,378.24 abc	37,732.06 ab	99.00 b
MAR20#15	2,000.81 abcd	31,772.06 abcde	63.00 ab	7,823.21 abc	51,983.00 ab	155.25 a
MSC	238.14 e	4,454.56 f	51.56 ab	2,295.98 c	16,383.00 b	143.00 ab
RC-3	503.04 de	9,949.06 ef	44.56 ab	2,960.11 abc	21,903.00 ab	125.56 ab
Rubi Gigante	1,745.04 abcd	29,583.00 abcde	55.25 ab	6,326.48 abc	45,368.00 ab	143.00 ab
AR-01	1,661.52 abcde	27,059.25 abcde	63.00 ab	7,886.28 abc	55,813.06 ab	137.06 ab
AR-02	839.06 cde	14,640.00 cdef	55.25 ab	5,164.26 abc	40,601.25 ab	120.00 ab
MAR20#49	939.45 cde	20,519.56 abcdef	48.00 ab	4,204.55 abc	33,214.06 ab	125.56 ab
BRS Sol Cerrado	802.37 cde	14,160.00 cdef	55.25 ab	4,229.19 abc	34,595.00 ab	120.00 ab
MAR20#6	1,950.21 abcd	31,328.00 abcde	63.00 ab	8,305.92 abc	59,657.06 a	137.06 ab
UnB-P5	549.08 de	8,234.56 ef	63.00 ab	2,540.04 bc	16,191.56 b	149.06 ab
MAR20#23	2,581.64 abc	38,024.00 abcd	67.06 ab	9,019.51 a	62,874.56 a	143.00 ab
UnB-P4	877.5 cde	15,251.25 cdef	55.25 ab	6,484.66 abc	49,394.06 ab	131.25 ab
UnB-P2	2,559.20 abc	39,302.06 abcd	67.06 ab	6,524.19 abc	52,325.56 ab	120.00 ab
UnB-P7	2,019.95 abcd	28,644.56 abcde	71.25 a	7,752.05 abc	51,983.00 ab	149.06 ab
MAR20#03	1,737.78 abcd	30,536.56 abcde	55.25 ab	7,914.37 abc	54,989.25 ab	149.06 ab
EC-3-0	651.25 cde	11,288.06 def	55.25 ab	2,621.97 abc	20,735.00 ab	120.00 ab
MAR20#10	2,057.79 abcd	38,906.56 abcd	55.25 ab	5,296.9 abc	41,411.25 ab	131.25 ab
MAR20#34	2,240.26 abcd	39,899.06 abc	55.25 ab	6,498.67 abc	48,619.25 ab	131.25 ab
MAR20#21	3,259.83 ab	49,394.06 ab	63.00 ab	8,792.71 ab	61,131.56 a	137.06 ab
FB200	1,977.54 abcd	28,055.25 abcde	67.06 ab	6,959.04 abc	46,009.25 ab	143.00 ab
FP-01	1,190.28 abcde	21,903.00 abcdef	55.25 ab	5,542.49 abc	41,513.06 ab	131.25 ab
BRS GA1	3,343.41 a	53,939.06 a	63.00 ab	5,881.84 abc	42,641.25 ab	137.06 ab
EC-RAM	680.21 cde	15,624.00 cdef	38.06 b	3,621.41 abc	26,081.25 ab	137.06 ab
GA2	1,460.47 abcde	26,731.25 abcde	55.25 ab	7,014.55 abc	53,475.56 ab	131.25 ab
Redondão	1,377.10 abcde	24,179.25 abcdef	59.06 ab	5,196.12 abc	38,219.25 ab	137.06 ab
MAR20#39	973.18 bcde	16,834.06 bcdef	55.25 ab	3,452.16 abc	25,599.00 ab	131.25 ab

Different lowercase letters in the columns indicate significant differences (Tukey's test, $P \leq 0.05$).

Table 2. Continuation.

Genotype	Y1A	NF1A	FW1A	Y2A	NF2A	FW2A	Y3A	NF3A	FW3A
UnB-P6	3,076.52 ab	13,629.56 ab	224.00 ab	316.69 ab	1,313.06 ab	231.56 a	9.31 b	41.25 b	67.06 a
MAR20#40	1,364.22 ab	6,723.00 ab	195.00 ab	7.40 ab	41.25 ab	55.25 a	0.00 b	0.00 b	0.00 a
UnB-P1	1,778.89 ab	8,601.56 ab	202.06 ab	449.57 ab	1.405.25 ab	323.00 a	0.00 b	0.00 b	0.00 a
MAR20#29	713.6 b	3,480.00 b	188.06 ab	2.86 b	13.06 b	24.00 a	0.00 b	0.00 b	0.00 a
MAR22#2005	2,067.84 ab	9,554.06 ab	209.25 ab	233.05 ab	929.25 ab	239.25 a	0.00 b	0.00 b	0.00 a
Roxo Australiano	1,119.36 ab	5,928.00 ab	174.56 ab	34.5 ab	161.56 ab	120.00 a	5.22 b	35.00 b	17.06 a
MAR20#15	2,502.72 ab	11,555.25 ab	216.56 ab	154.84 ab	575.00 ab	143.00 a	0.00 b	0.00 b	0.00 a
MSC	1,772.89 ab	9,024.00 ab	202.06 ab	608.40 ab	2.375.56 ab	255.00 a	115.94 a	409.06 a	168.00 a
RC-3	1,467.73 ab	7,097.06 ab	209.25 ab	162.61 ab	769.06 ab	209.25 a	0.00 b	0.00 b	0.00 a
Rubi Gigante	2,183.74 ab	9,899.25 ab	216.56 ab	174.72 ab	675.00 ab	149.06 a	0.00 b	0.00 b	0.00 a
AR-01	3,706.59 a	17,094.56 a	209.25 ab	639.99 a	2,449.25 a	263.06 a	13.05 ab	41.25 b	94.06 a
AR-02	2,383.16 ab	12,044.06 ab	195.00 ab	276.41 ab	1,104.56 ab	255.00 a	0.00 b	0.00 b	0.00 a
MAR20#49	2,374.68 ab	11,235.00 ab	216.56 ab	567.38 ab	2,184.56 ab	155.25 a	0.00 b	0.00 b	0.00 a
BRS Sol Cerrado	2,256.75 ab	11,129.25 ab	202.06 ab	212.06 ab	840.00 ab	239.25 a	6.16 b	24.00 b	26.56 a
MAR20#6	2,560.80 ab	12,154.06 ab	209.25 ab	158.20 ab	599.25 ab	255.00 a	0.00 b	0.00 b	0.00 a
UnB-P5	1,296.18 ab	5,661.56 ab	231.56 a	145.16 ab	599.25 ab	137.06 a	0.00 b	0.00 b	0.00 a
MAR20#23	3,634.74 a	17,555.25 a	209.25 ab	161.40 ab	741.56 ab	202.06 a	0.00 b	0.00 b	0.00 a
UnB-P4	2,840.07 ab	15,128.00 ab	181.25 ab	506.59 ab	2,208.00 ab	224.00 a	0.00 b	0.00 b	0.00 a
UnB-P2	2,510.64 ab	12,768.00 ab	188.06 ab	390.62 ab	1,443.00 ab	255.00 a	10.40 b	35.00 b	29.25 a
UnB-P7	4,156.50 a	19,250.56 a	216.56 ab	510.15 ab	2,001.56 ab	149.06 a	0.00 b	0.00 b	0.00 a
MAR20#03	2,899.36 ab	13,224.00 ab	224.00 ab	408.96 ab	1.599.00 ab	255.00 a	16.64 ab	59.06 ab	89.25 a
EC-3-0	643.6 b	3,874.06 b	174.56 b	24.88 ab	104.06 ab	67.06 a	0.00 b	0.00 b	0.00 a
MAR20#10	1,781.56 ab	8,835.00 ab	195.00 ab	60.02 ab	296.57 ab	114.56 a	0.00 b	0.00 b	0.00 a
MAR20#34	2,077.20 ab	10,049.06 ab	202.06 ab	142.51 ab	587.06 ab	137.06 a	0.00 b	0.00 b	0.00 a
MAR20#21	1,459.26 ab	7,097.06 ab	202.06 ab	54.17 ab	224.00 ab	143.00 a	0.00 b	0.00 b	0.00 a
FB200	1,462.28 ab	6,682.06 ab	216.56 ab	59.90 ab	296.56 ab	120.00 a	5.70 b	24.00 b	24.00 a
FP-01	1,737.78 ab	8,788.06 ab	195.00 ab	28.31 ab	109.25 ab	155.25 a	0.00 b	0.00 b	0.00 a
BRS GA1	1,639.04 ab	8,099.00 ab	202.06 ab	67.08 ab	399.00 ab	120.00 a	0.00 b	0.00 b	0.00 a
EC-RAM	1,698.46 ab	7,831.25 ab	216.56 ab	82.51 ab	350.56 ab	131.25 a	0.00 b	0.00 b	0.00 a
GA2	2,174.15 ab	10,815.00 ab	195.00 ab	121.63 ab	624.00 ab	195.00 a	0.00 b	0.00 b	0.00 a
Redondão	1,598.33 ab	7,568.00 ab	202.06 ab	57.6 ab	224.00 ab	155.25 a	0.00 b	0.00 b	0.00 a
MAR20#39	1,169.64 ab	6,083.00 ab	202.06 ab	81.22 ab	389.06 ab	120.00 a	0.00 b	0.00 b	0.00 a

Different lowercase letters in the columns indicate significant differences (Tukey's test, $P \leq 0.05$).

Table 3. Estimates of mean phenotypic (V_p), genotypic (V_g), and environmental variances (V_e), mean broad sense heritability (h^2), coefficient of genetic variation (CV_g), and coefficient of relative variance (CV_g/CV_e) for total yield (TY; Kg ha^{-1}), total number of fruits per hectare (TNF), and total fruit weight (TFW; g) in 32 yellow passion fruit (*Passiflora edulis* Sims) genotypes cultivated in Brasilia, DF, Brazil.

Genetic parameters	TY	TNF	TFW
σ^2_p	305,608.45	2,406.28	0.39
σ^2_e	105,835.73	689.31	0.19
σ^2_g	199,772.71	1,716.97	0.20
h^2%	65.37	71.35	52.38
CV_g	14.70	15.06	4.09
CV_g/CV_e	0.69	0.79	0.52

Table 4. Estimates of mean phenotypic (V_p), genotypic (V_g), and environmental variances (V_e), mean broad sense heritability (h^2), coefficient of genetic variation (CV_g), and coefficient of relative variance (CV_g/CV_e) for yield (Y; Kg ha^{-1}), number of fruits per hectare (NF), and fruit weight (FW; g) of diameter classes 1C, 1B, 1A, 2A, and 3A in 32 yellow passion fruit (*Passiflora edulis* Sims) genotypes cultivated in Brasilia, DF, Brazil.

Genetic parameters	Y 1C	NF 1C	FW 1C	Y 1B	NF 1B	FW 1B	Y 1A	NF 1A	FW 1A	Y 2A	NF 2A	FW 2A	Y 3A	NF 3A	FW 3A
σ^2_p	115,268.71	1,556.88	0.25	188,934.94	1,206.35	0.26	83,431.72	366. 37	0.22	44,511.70	161.92	8.19	4,811.06	14.97	10.46
σ^2_e	22,249.63	285.44	0.14	64,613.05	399.23	0.17	35,332.58	150.42	0.11	17,727.21	67.55	7.52	1,768.98	5.41	4.77
σ^2_g	93,019.08	1,271.44	0.11	124,321.89	807.11	0.09	48,099.14	215.95	0.11	26,784.50	94.37	0.67	3,042.08	9.57	5.69
h^2%	80.7	81.7	43.86	65.8	66.91	35.1	57.65	58.94	50.85	60.17	58.28	8.17	63.23	63.9	54.41
CV_g	25.77	23.14	4.37	15.11	14.2	2.59	15.57	15	2.33	39.4	36.52	6.31	170.94	113.8	90.32
CV_g/CV_e	1.02	1.06	0.44	0.69	0.71	0.37	0.58	0.6	0.51	0.62	0.59	0.15	0.66	0.67	0.55

Table 5. Estimates of phenotypic correlation (r_p) among total number of fruits per hectare (TNF), total yield (TY; Kg ha^{-1}), total fruit weight (TFW; g), and yield (Y; Kg ha^{-1}), number of fruits per hectare (NF), and fruit weight (FW; g) of diameter classes 1C, 1B, 1A, 2A, and 3A, in 32 yellow passion fruit (*Passiflora edulis* Sims) genotypes cultivated in Brasilia, DF, Brazil.

	TNF	TY	TFW	NF1C	Y1C	FW 1C	NF1B	Y1B	FW1B	NF1A	Y1A	FW1A	NF2A	Y2A	FW2A	NF3A	Y3A	FW3A
TNF	1	0.96*	-0.13	0.90*	0.89*	0.57*	0.97*	0.95*	0.25	0.65*	0.65*	0.13	0.18	0.17	0.27	-0.18	-0.16	-0.03
TY	-	1	0.15	0.78*	0.81*	0.65*	0.94*	0.98*	0.43	0.78*	0.79*	0.3	0.35*	0.34	0.39	-0.09	-0.06	0.08
TFW	-	-	1	-0.34	-0.24	0.25	-0.10	0.08	0.64*	0.43*	0.48*	0.57*	0.60*	0.60*	0.39*	0.37*	0.39*	0.39
NF1C	-	-	-	1	0.98*	0.54*	0.78*	0.79*	0.26	0.32	0.33	0.10	-0.14	-0.15	-0.05	-0.31	-0.29	-0.18
Y1C	-	-	-	-	1	0.67*	0.79*	0.81*	0.34	0.34	0.36*	0.13	-0.12	-0.13	-0.04	-0.27	-0.25	-0.15
FW1C	-	-	-	-	-	1	0.52*	0.63*	0.52*	0.40*	0.42*	0.22	0.11	0.11	0.09	-0.04	-0.01	0.07
NF1B	-	-	-	-	-	-	1	0.97*	0.19	0.67*	0.67*	0.09	0.20	0.20	0.35*	-0.18	-0.16	-0.01
Y1B	-	-	-	-	-	-	-	1	0.41*	0.69*	0.70*	0.25	0.21	0.21	0.33	-0.18	-0.15	0.004
FW1B	-	-	-	-	-	-	-	-	1	0.29	0.36*	0.70*	0.16	0.15	0.02	0.05	0.07	0.11
NF1A	-	-	-	-	-	-	-	-	-	1	0.99*	0.30	0.74*	0.73*	0.65*	0.12	0.15	0.26
Y1A	-	-	-	-	-	-	-	-	-	-	1	0.41*	0.73*	0.72*	0.64*	0.11	0.14	0.27
FW1A	-	-	-	-	-	-	-	-	-	-	-	1	0.32	0.32	0.26	0.05	0.07	0.17
NF2A	-	-	-	-	-	-	-	-	-	-	-	-	1	0.99*	0.75*	0.43*	0.45*	0.49*
Y2A	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.76*	0.43*	0.45*	0.49*
FW2A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.34*	0.36*	0.41*
NF3A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.98*	0.92*
Y3A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.94*
FW3A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1

*Correlation is significant at 0.05 level.

The total number of fruits was negatively correlated with the fruit weight (r_f = -0.13), as also observed by Pimentel et al. (2008) and Neves et al. (2013) for genetic correlations in parents and hybrids of yellow passion fruit. Therefore, an increase in the number of fruits reduced fruits size, which is undesirable for the fresh fruit market. The total number of fruits negatively correlated with the number of fruits of 1C (r_f = -0.34) and 1B (r_f = -0.10) diameter classes, as well as with the yield of fruits of 1C diameter class (r_f = -0.24). A negative correlation was also reported between the variables of fruits of smaller diameter class (1C and 1B) and the variables of fruits of greater diameter class (2A and 3A) (Table 5).

CONCLUSIONS

Genotypes MAR20#23 and UnB-P7 presented the highest total yield, with values higher than the national mean. MAR20#23 also showed the greatest total number of fruits per hectare, standing out from the other genotypes.

The highest yield and the greatest number of fruits suitable for industrial purposes (diameter classes 1C and 1B) were identified in genotypes BRS GA1 and MAR20#23.

For the *in natura* consumption, the best performance was verified in UnB-P7, AR-01, and MSC (diameter classes 1A, 2A, and 3A, respectively).

High heritability values and CV_g/CV_e ratio greater than 1 for yield and number of fruits of 1C diameter class indicate a favorable selection condition.

The differences in yield and fruit quality recorded for the genotypes of this study confirm the potential for selection and future crosses that aim at increasing these traits.

RESUMO: A seleção de genótipos de maracujazeiro azedo (*Passiflora edulis* Sims) que apresentem alta produtividade e qualidade de frutos é essencial para o desenvolvimento da cultura do maracujá no país. Portanto, este trabalho teve como objetivo avaliar o desempenho agronômico e de estimar parâmetros genéticos de 32 genótipos de maracujazeiro azedo cultivados no Distrito Federal, Brasil. O experimento consistiu de um delineamento em blocos casualizados com 32 tratamentos, oito plantas por parcela, e quatro repetições. Os frutos foram classificados de acordo com o seu diâmetro equatorial. Produtividade, número de frutos por hectare e peso de frutos foram avaliados. Os genótipos MAR20#23 e UNB-P7 apresentaram as maiores produtividades totais, com valores superiores à média nacional. MAR20#23 também mostrou o maior número total de frutos por hectare. BRA GA1 e MAR20#23 exibiram a melhor performance para frutos de menores classes de diâmetro, que são destinados a fins industriais. Para o consumo *in natura* (frutos de maiores classes de diâmetro), UnB-P7, AR-01 e MSC apresentaram o melhor desempenho. As altas magnitudes das estimativas de herdabilidade e dos coeficientes de variação genéticos indicam a possibilidade de maiores ganhos por seleção direta para produtividade e número de frutos classe 1C. Correlações fenotípicas significativas foram observadas, indicando a possibilidade de seleção indireta para número de frutos, peso de frutos e produtividade.

PALAVRAS-CHAVE: Desempenho agronômico; Melhoramento vegetal; Passicultura.

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