horticultura brasileira

Scientific Communication

OLIVEIRA, GJA; ZEIST, AR; TOROCO, BR; GARCIA NETO, J; LEAL, MHS; SILVA JUNIOR, AD; OLIVEIRA, JNM; LEAL, JLP. 2022. Agronomic performance of experimental white-fleshed sweet potato genotypes in commercial fields. *Horticultura Brasileira* 40: 342-347. DOI: http://dx.doi.org/10.1590/s0102-0536-20220314

Agronomic performance of experimental white-fleshed sweet potato genotypes in commercial fields

Guilherme José A Oliveira [1]; André Ricardo Zeist [2]; Bruno R Toroco [1]; Jair Garcia Neto [1]; Murilo Henrique S Leal [1]; André D Silva Junior [3]; Joana NM de Oliveira [1]; João Lucas P Leal [1]

[1]Universidade do Oeste Paulista (Unoeste), Presidente Prudente-SP, Brasil; guilhermejaost@hotmail.com; bruno-taroco@hotmail.com; jairgarcianeto@gmail.com; muriloleal8@gmail.com; ojoana140@gmail.com; joaolucasliresleal@gmail.com; [2]Universidade Federal de Santa Catarina (UFSC), Florianópolis-SC, Brasil; andre.zeist@ufsc.br; [3]Univerisdade Federal de Viçosa (UFV), Viçosa-MG, Brasil, andrejunior018@gmail.com

ABSTRACT

Selecting new sweet potato genotypes that are adapted to the soil, climate, and cultivation conditions of the producing regions is necessary. Thus, the objective of this work was to evaluate the agronomic performance of experimental genotypes of white-fleshed sweet potato in commercial fields, seeking to evaluate their potential as commercial cultivars. The experiments were carried out in the municipalities of Presidente Prudente, Emilianópolis, Tarabai, and Álvares Machado in São Paulo state. The randomized complete block design with five repetitions was used in the experiments, where the genotypes UZBD-L1-04 and UZBD-L5-29 were evaluated along with the controls Ligeirinha Paulista, Canadense, and INIA Arapey. The assessed traits were tuberous root total yield, number of commercial tuberous roots, commercial tuberous root yield, average mass of commercial tuberous roots, percentage of commercial tuberous root dry mass, soluble solids, resistance to pest-caused damage, root length, diameter, and appearance. UZBD-L1-04 performed better than the other genotypes (the average of environments for tuberous root total yield was 31.76 t/ha), showing great potential as a commercial cultivar for the studied region.

Keywords: *Ipomoea batatas*, agronomic traits, experimental clones, superior genotypes.

RESUMO

Desempenho agronômico de genótipos experimentais de batata-doce de polpa branca em lavouras comerciais

Selecionar novos genótipos de batata-doce, que sejam adaptados às condições edafoclimáticas e de cultivo das regiões produtoras, se faz necessário. Assim, objetivou-se avaliar o desempenho agronômico de genótipos experimentais de batata-doce de polpa branca em lavouras comerciais, buscando obter indicação do seu mérito como cultivares comerciais. Os experimentos foram conduzidos nos munícipios de Presidente Prudente-SP, Emilianópolis-SP, Tarabai-SP e Álvares Machado-SP. Foi adotado o delineamento experimental de blocos ao acaso, com cinco repetições, avaliando-se os genótipos UZBD-L1-04 e UZBD-L5-29, e utilizando as testemunhas Ligeirinha Paulista, Canadense e INIA Arapey. Foram avaliados a produtividade total de raízes tuberosas, número de raízes tuberosas comerciais, produção de raízes tuberosas comerciais, massa média de raízes tuberosas comerciais, porcentagem de massa seca de raízes tuberosas comerciais, sólidos solúveis, resistência a danos causados por pragas, comprimento, diâmetro e aparência das raízes. Concluiu-se que o genótipo UZBD-L1-04 obteve desempenho superior aos demais (média dos ambientes para produtividade total de raízes tuberosas de 31,76 t/ha), e possuindo potencial como cultivar para a região.

Palavras-chave: *Ipomoea batatas*, características agronômicas, clones experimentais, genótipos superiores.

Received on January 21, 2022; accepted on June 30, 2022

Sweet potato (*Ipomoea batatas*) is an oleraceae native to the Americas (Carmona *et al.*, 2015) and belongs to the *Convolvulaceae* family, genus *Ipomoea*. Among the 1000 species of this genus, *I. batatas* is the only one with commercial value (Moulin *et al.*, 2014). It exhibits a diversity of forms regarding roots, leaves, and branches due to its high phenotypic variation (Oliveira *et al.*, 2021). In addition, this species is self-incompatible and hexaploid (2n = 6x = 90), with a high degree of heterozygosity. These factors make it easier to cross and to obtain new genotypes (Leal *et al.*, 2021). These factors make the crossing and obtaining of new genotypes easier.

Sweet potato has great social and economic appeal, rusticity, and a high capacity to produce energy in short periods (Amaro *et al.*, 2019). It is cultivated in 115 countries; Asia is responsible for 66% of the world's production, Africa for 28.3%, the Americas for 4.6%, Oceania for 1%, and Europe for 0.1% (FAO, 2018). Brazil, where production reached 741,203 t in 2018, is the 16th largest world producer, with an average of 14.0 t ha^{-1} produced in 52 thousand hectares (FAO, 2018; IBGE, 2018). Due to its excellent nutritional value, sweet potato is a vegetable of great importance for human consumption (Oliveira *et al.*, 2015). This tuberous root has high levels of balanced nutrients and functional compounds, such as carotenoids, anthocyanins, and phenolic compounds, which make it a health-promoting food (Katayama *et al.*, 2017). Since it has the potential to combat malnutrition, research on sweet potatoes has been intensified in the quest to improve yield and processing (Nascimento *et al.*, 2015).

The western region of São Paulo state is one of Brazil's main sweet potato producers and is a national reference in production and export. In this region, where intermediate to high levels of technology are used, the average yield is 15.0 t/ha (IBGE, 2018; Leal *et al.*, 2021). In turn, sweet potato has the potential to easily reach yields of 25 to 30 t/ha in 4-5 months of cultivation and, in some situations, even above 40 t/ha (Andrade Júnior *et al.*, 2009, 2012). Therefore, to achieve such productivity, in addition to good management and cultural practices, the use of more productive genotypes is essential (Silva *et al.*, 2015).

The low technological level used in this crop is the main responsible for the low yields obtained, especially the use of obsolete genotypes, which are susceptible to pests and diseases and bear unwanted traits, and a lack of technical recommendations for each region (Andrade Júnior *et al.*, 2012; Amaro *et al.*, 2019; Leal *et al.*, 2021). For instance, in the western region of São Paulo, the most commonly used genotypes are Canadian, INIA Arapey, and Ligeirinha, which have been maintained by producers and cultivated for over a decade (Montes, 2013). Thus, there is a need to use new genotypes that are more productive, adapted to regional soil and climate conditions, and responsive to technological advances.

The main product of economic interest is the tuberous roots. Thus, it is vital that genotypes meet the needs of producers and the requirements of consumers (Leal *et al.*, 2021). Genotypes with high production and a commercially acceptable root format that favor harvesting and transport and resist the main pests and diseases are desirable (Massaroto *et al.*, 2014). On the South American continent, pulp roots with white or cream color are the most demanded. Furthermore, in Brazil, they are the most commercialized and, consequently, the most consumed (Leal *et al.*, 2021).

In the search for new superior genotypes, genetic diversity must be explored by crossing individuals adapted to local conditions with superior genotypes from other regions (Leal *et al.*, 2021). To strengthen the cultivation of sweet potatoes in the western region of São Paulo, the Center for Studies in Olericulture and Fruticulture of Western São Paulo (CEOFOP) from the University of Western São Paulo has been conducting a sweet potato genetic improvement program aiming at developing and selecting new superior cultivars for the region. Since 2019, this breeding program has tested 1500 experimental genotypes obtained through polycrosses between local accessions and commercial cultivars introduced from other regions (Leal *et al.*, 2021).

Seeking greater competitiveness, the new genotypes must undergo rigorous selection stages to evaluate the agronomic and physico-chemical characteristics of the tuberous roots to meet the demands of farmers and consumers (Leal *et al.*, 2021). An important aspect is that these genotypes are also tested in commercial fields in the final trials to obtain greater reliability of their real potential. Currently, CEOFOP has white-fleshed sweet potato genotypes that, over five selection cycles, were pre-selected for agronomic, physicochemical, and pest resistance traits. Finally, it is necessary to evaluate this performance in commercial fields under levels of technological management commonly adopted by producers to confirm their potential as commercial sweet potato cultivars. Therefore, the objective of this work was to evaluate the agronomic performance of experimental genotypes of white-fleshed sweet potato in commercial fields, thus seeking to evaluate their potential as commercial cultivars.

MATERIAL AND METHODS

Experimental sites

The experiments were carried out in the municipalities of Presidente Prudente (site 1), Emilianópolis (site 2), Tarabai (site 3), and Álvares Machado (site 4) in São Paulo state. The areas used were commercial fields of rural producers who have been cultivating sweet potato for at least 15 years and who are partners in research activities of CEOFOP. According to the Köppen classification, the climate of these regions is Aw, with an average annual temperature of 25°C and precipitation from 1,400 to 1,500 mm. These regions present a rainy period from October to March and another period with low rainfall from April to September. The soil of the sites is classified as medium-textured dystrophic Red Argisol (EMBRAPA, 2018), with smooth wavy relief and good drainage.

Genotypes and experimental design

The treatments were arranged in a factorial scheme (4x5), with four sites and five genotypes. The experiments at sites 1 and 2 were set in January 2021 (summer-autumn cycle) and at sites 3 and 4 in March 2021 (autumn-winter cycle). The experiments were carried out in a randomized complete block design, with five repetitions. The experimental genotypes UZBD-L1-04 and UZBD-L5-29 from CEOFOP have white pulp roots and purplish red and white bark, respectively. Three white-fleshed controls were also used, namely, Ligeirinha Paulista, Canadian, and INIA Arapey, which are the most cultivated in western São Paulo.

Experiment setup and conduction

A spacing of 0.33 m between plants within each row and 1.00 m between rows was used, and the six central plants were evaluated. The experimental plots consisted of two 3-m long rows spaced 1.00 m apart, with a total area of 6.0 m^2 and a useful area of 2.0 m^2.

Selected and standardized vines (approximately 0.30 m long) from plants kept in a maintenance nursery, free from pathogens and arthropod pests, were used for planting. For soil preparation, two heavy plowing and three light harrowing treatments were carried out. The rows were 0.4- to 0.5-m high. Crop treatments and base and top dressing were carried out as recommended for the crop, according to the soil chemical analysis (Echer *et al.*, 2015). During both cycles, irrigation was performed according to the crop water requirements, except for site 4. During the experimental periods, daily data of the minimum and maximum air temperatures were collected using maximum and minimum thermometers, and rainfall data were obtained from rain gauges installed no more than 500 m from the experimental units. Weed was controlled manually.

Evaluated traits

Plants were harvested approximately 120-140 days after planting the branches. The evaluated traits were tuberous root total yield (RTY, in t/ha), number of commercial tuberous roots (NCR, in 1000/ha), commercial tuberous root yield (CRY, in t/ha), average mass of commercial tuberous roots (AMCR, in g), and percentage of commercial tuberous root dry mass (CRDM). Tuberous roots weighing more than 80 g and with a regular or slightly non-uniform shape and without damage by pests, diseases, and cracks that hampers marketability were considered commercial roots (Perrud *et al.*, 2021). A sample of five commercial roots was analyzed for root length (LENG, in cm) and root diameter (DIAM, in cm); soluble solids (SS, in °Brix) were also assessed using homogenized and filtered pulp in a portable digital refractometer (Instrutherm/Mod. RTD-95). In addition, five roots (from the total production) per plot were evaluated for appearance (RA) using a scale of notes (Andrade Júnior *et al.*, 2012): 1= non-standard, with a very irregular shape, presence of large veins and deep cracks, 2= very uneven, with large veins and cracks, 3= non-uniform, with large veins and cracks, 4= slightly uneven with veins, and 5= regular fusiform shape, without veins or cracks. Resistance to damage caused by insect pests (RI) was determined using a rating scale: 5= roots free from damage, 4= roots with rare damage, 3= few commercial roots damaged, 2= majority of commercial roots damaged, and 1= commercial roots unacceptable for human and animal consumption (Massaroto *et al.*, 2014).

Data analysis

Data from the quantitative evaluated traits were tested for normality of errors and homogeneity of residual variances by Lilliefors and Bartlett's tests, respectively, and subsequently subjected to individual and joint analysis of variance. Means were compared by Tukey's test at 5% probability. These analyses were performed using the statistical program Genes (Cruz *et al.*, 2006).

RESULTS AND DISCUSSION

In the sweet potato fields conducted in the summer-autumn (Presidente Prudente and Emilianópolis), the monthly rainfall varied from 319 mm (January) to 10.4 mm (April). In the autumn-winter fields (Tarabai and Álvares Machado), it ranged from 202 mm (March) to 6.2 mm (April). For air temperatures, in the summer-autumn crops, the lowest minimum was 18.5°C (April), and the highest maximum was 31.7°C (March), with average temperatures ranging between 25.8°C (March) and 24°C (April). In the autumn-winter crops, the lowest minimum was 14.9°C (June), the highest maximum was 31.7°C (March), and the average temperatures ranged between 25.8°C (March) and 19.7°C (June) (Table 1).

Through joint analysis of variance, an interaction between genotype and environment was observed for the parameters RTY, NCR, CRY, RI, and SS. For % AMCR, DIAM, and CRDM, in which no interaction was detected; there was a significant influence of genotypes and environments by themselves. For AR, only genotype influenced the

Table 1. Data on rainfall, average temperature (Tmed), and maximum (Tmax) and minimum (Tmin) air temperature during the sweet potato growing months in the municipalities of Presidente Prudente, Emilianópolis, Tarabai, and Álvares Machado, in São Paulo state. Presidente Prudente, Unoeste, 2021.

Months	Rainfall (mm)	Tmed (°C)	Tmax (°C)	Tmin (°C)
	Presidente Prudente-SP			
January	318.9	25.4	30.9	22.2
February	69.8	25.6	31.5	20.7
March	203.8	25.8	31.7	21.2
April	10.4	24.0	30.6	18.5
	Emilianópolis-SP			
March	319.0	25.3	30.5	22.1
April	69.5	25.2	31.0	20.6
May	201.0	25.5	31.5	21.3
June	11.1	24.3	30.3	19.0
	Tarabai-SP			
March	143.8	25.3	32.0	20.4
April	6.2	23.1	30.4	17.1
May	29.6	21.3	28.8	14.9
June	84.6	18.7	25.1	13.7
	Álvares Machado-SP			
March	202	25.2	31.5	2.01
April	10.4	23.5	31.0	18.7
May	24.6	22.0	29.0	16.0
June	102.6	19.7	25.4	14.9

trait significantly. None of the factors explored was significant for LENG.

The experimental genotype UZBD-L1-04 obtained superior results for all evaluated parameters, except for % CRDM. However, in Álvares Machado, the production differences were smaller (Table 2). In this environment, no irrigation was performed, and cultivation was carried out in a period with irregular rainfall distribution; so, the presumably most promising genotypes did not express their full productive potential (Tables 1, 2, and 3). According to Montes (2013), the sweet potato crop has considerable production in environments with annual rainfall between 750 and 1000 mm or with 500 to 600 mm of rainfall in the crop cycle. During the autumn-winter cropping cycle, rainfall accumulation was 157.9 mm (Table 1), which resulted in lower yield performance of the genotypes in Álvares Machado, where irrigation was not used, as previously mentioned (Table 2).

The fact that UZBD-L1-04 has a higher yield performance than the commercial controls most cultivated in western São Paulo demonstrates its potential to be cultivated in this region since, the more adapted a genotype is to the growing conditions, the greater

Table 2. Traits with a significant genotype x environment interaction: total yield of tuberous root (RTY), total number of commercial tuberous roots (NCR), commercial tuberous root yield (CRY), resistance to damage caused by insect pests (RI), and soluble solids (SS) of sweet potato. Presidente Prudente, Unoeste, 2021.

Genotype	Presidente Prudente-SP	Emilianópolis-SP	Tarabai-SP	Álvares Machado-SP+
		RTY (t/ha)		
UZBD-L1-04	42.03 Ba[x]	74.60 Aa	52.53 Ba	20.50 Ca
UZBD-L5-29	10.98 Bd	24.33 Ab	13.36 ABb	17.82 Aba
Canadense	26.18 Abc	28.65 Ab	22.98 Ab	9.12 Ba
INIA Arapey	35.21 Aab	33.82 Ab	21.26 Bb	14.88 Ba
Ligeirinha	17.65 Acd	29.13 Ab	20.02 Ab	18.85 Aa
		NCR (1000/ha) **		
UZBD-L1-04	89.66 Aa	105.25 Aa	96.66 Aa	26.66 Bb
UZBD-L5-29	48.33 Ab	67.50 Ab	53.33 Ab	52.66 Aa
Canadense	54.33 Ab	60.00 Ab	60.00 Ab	33.33 Bab
INIA Arapey	65.00 Aab	55.00 ABb	63.33 Ab	33.33 Bab
Ligeirinha	67.33 Aab	76.66 Ab	66.66 Ab	56.66 Aa
		CRY (t/ha) **		
UZBD-L1-04	35.32 Ba	40.98 ABa	42.940. Aa	7.80 Ca
UZBD-L5-29	9.24 Bc	19.58 Ab	10.44 Bc	8.69 Ba
Canadense	18.70 Ab	19.15 Ab	20.13 Ab	5.49 Ba
INIA Arapey	30.71Aa	22.25 Bb	21.26 Bb	9.78 Ca
Ligeirinha	15.01 ABbc	21.240 Ab	16.15 ABbc	11.66 Ba
		RI*		
UZBD-L1-04	4.33 Aa	4.00 ABa	3.66 ABa	3.00 Ba
UZBD-L5-29	3.33 Aab	3.00 Aab	2.33 Aa	2.66 Aa
Canadense	3.00 Aab	3.00 Aab	3.00 Aa	3.00 Aa
INIA Arapey	2.33 Bb	4.33 Aa	2.66 Ba	3.00 Ba
Ligeirinha	3.33 Aab	2.33 Ab	2.66 Aa	3.00 Aa
		SS (Brix)		
UZBD-L1-04	10.86 Aa	9.93 Babc	12.46 Aa	10.80 Aa
UZBD-L5-29	9.93Aa	8.80 Abc	9.63 Ab	9.86 Aa
Canadense	8.53 Aa	8.73 Ac	9.53 Ab	9.33 Aa
INIA Arapey	8.70 Ba	11.93 Aa	9.46 ABb	9.38 Ba
Ligeirinha	9.03 Aa	11.40 Aab	1.63 Aab	10.46 Aa

[x]Means followed by same capital letters in the rows and equal lowercase letters in the columns do not differ from each other by Tukey's test at 5% probability. +Sites where irrigation was not used. *RI, where 5= roots free from damage, 4= roots with rare damage, 3= few commercial roots damaged, 2= majority of commercial roots damaged, and 1= commercial roots unacceptable for human and animal consumption; **Tuberous roots with at least 80 g, regular shape, and without damage were considered commercial.

its productive potential (Mantovani *et al.*, 2013). Although the Canadian and INIA Arapey controls do not have commercial registration in the Ministry of Agriculture, Livestock, and Supply, they have been the most explored genotypes in Brazilian territory for decades; however, these genotypes were not developed and selected in the edaphoclimatic conditions of western São Paulo. INIA Arapey was developed in 1998 by the National Institute of Agricultural Research of Uruguay, while the origins of the Canadian and Ligeirinha genotypes are still unknown. Low yields, mainly due to the unavailability of upgraded cultivars (Ngailo *et al.*, 2019), result in the use of greater amounts of inputs for acceptable productivity, which can reduce the viability and environmental sustainability of the culture (Silva *et al.*, 2016).

For the recommendation of a cultivar, factors such as location, planting time, fertilization, and production purpose are interconnected (Oliveira *et al.*, 2015). Thus, the selection of superior genotypes within the local production conditions, together with the management employed by the producer, is an efficient way to identify a possible new cultivar. As superior highlights in relation to environments, UZBD-L1-04 obtained 75.41 for NCR in Emilianópolis, 91.36 and 37.28% more than the Canadian, INIA Arapey, and Ligeirinha controls, respectively. Additionally, it is worth mentioning that UZBD-L1-04 showed a CRY that was 113.28, 101.91, and 165.81% higher than those of the Canadian, INIA Arapey, and Ligeirinha controls, respectively, in Tarabai (Table 2).

In addition to yield-related characteristics, qualitative characteristics are important in identifying superior genotypes. A tuberous root with more attractive appearance influences the consumer's preference for the product (Silva *et al.*, 2014); thus, appearance is a relevant trait. UZBD-L1-04 was superior for RA, obtaining better evaluation (Table 3), meaning it is more attractive to the consumer. At the same time, UZBD-L1-04 was the genotype with the lowest incidence of damage by pests, contributing to a better appearance and demonstrating resistance to soil arthropod pests (Table 2). Regarding AMCR, values of 382.78 and 389.49 g were observed for UZBD-L1-04 and INIA Arapey, respectively (Table 3). Tuberous roots with an average mass between 300 and 450 g are the most valued and best paid by the market, considering that this standard meets higher levels of demand, such as the sweet potato export market (Perrud *et al.*, 2021).

Developing genotypes adapted to different climate conditions and crop management is the best route to increase productivity, positively impacting environmental and economic issues (Daronch *et al.*, 2019). Moreover, the low adoption of agricultural technologies in sweet potato cultivation by most producers is still common (Amaro *et al.*, 2017). The increase in yield and quality provided by a new genotype allows economic gains for producers without increasing production costs. Thus, UZBD-L1-04 is a promising genotype to meet the needs of Brazilian farmers, considering that, thus far, there are few genotypes with higher production, resistance to the main pests and diseases, and good physical attributes that are aligned with the requirements of national and international markets for sweet potato roots.

The experimental genotype UZBD-L5-29 was highlighted only for NCR and CRY in Álvares Machado (planted in March 2021), for RI in Tarabai and Álvares Machado (planted in March 2021), and SS in Presidente Prudente and Álvares Machado (planted in January and March 2021, respectively) (Tables 2 and 3). This genotype had lower results than the controls INIA Arapey for AMCR and DIAM and Ligeirinha for % CRDM, demonstrating that not every genotype developed and selected within the genetic improvement program confirms the potential to be cultivated in commercial fields under the farmers' management conditions. INIA Arapey performed well concerning RI, AMCR, and DIAM (Tables 2 and 3), whereas Ligeirinha only had good values for % CRDM (Table 3). Regarding the experimental sites, the control genotype Ligeirinha suffered little influence from the environment for all the evaluated characteristics (Table 2).

Finally, UZBD-L1-04 may be indicated as a new sweet potato cultivar for the western São Paulo region since promising results were observed for this genotype, such as a higher yield of tuberous roots and superior qualitative traits, thus having the potential to contribute to the development and strengthening of the crop in the studied region.

Table 3. Traits with significance for genotype: average mass of commercial tuberous roots (AMCR), diameter of roots (DIAM), root appearance (RA), and percentage of commercial tuberous root dry mass (CRDM) of sweet potato. Presidente Prudente, Unoeste, 2021.

Genotype	AMCR (g)	DIAM (cm)	RA	CRDM (%)
UZBD-L1-04	382.78 a[x]	7.31 a	4.83 a	28.39 b
UZBD-L5-29	214.21 c	6.73 ab	3.91 b	28.84 b
Canadense	293.48 b	5.99 b	4.00 b	29.08 b
INIA Arapey	389.49 a	7.47 a	3.33 b	28.90 b
Ligeirinha	239.15 bc	6.65 ab	3.58 b	35.14 a

[x]Means followed by same lowercase letters in the column do not differ from each other by Tukey's test at 5% probability.

ACKNOWLEDGEMENTS

The authors thank the Foundation for Research Support of the State of São Paulo (FAPESP) for their support through a scholarship granted to the first author (Process 2020/15974-4).

REFERENCES

AMARO, GB; FERNANDES, FR; SILVA, GO; MELLO, AF; CASTRO, LA. 2017. Desempenho de cultivares de batata doce na região do Alto Paranaíba-MG. *Horticultura*

Brasileira 35: 286-291.

AMARO, GB; TALAMINI, V; FERNANDES, FR; SILVA, GO; MADEIRA, NR. 2019. Desempenho de cultivares de batata-doce para rendimento e qualidade de raízes em Sergipe. *Revista Brasileira de Ciências Agrárias* 14: e5628.

ANDRADE JÚNIOR, VC; VIANA, DJS; FERNANDES, JSC; FIGUEIREDO, JA; NUNES, UR; NEIVA, IP. 2009. Selection of sweet potato clones for the region Alto Vale do Jequitinhonha. *Horticultura Brasileira* 27: 389-393.

ANDRADE JÚNIOR, VC; VIANA, DJS; PINTO, NAVD; RIBEIRO, KG; PEREIRA, RC; NEIVA, IP; AZEVEDO, AM; ANDRADE, PCR. 2012. Características produtivas e qualitativas de ramas e raízes de batata-doce. *Horticultura Brasileira* 30: 584-589.

CARMONA, PAO; PEIXOTO, JR.; AMARO, GB.; MEDONÇA, MA. 2015. Divergência genética entre acessos de batata-doce utilizando descritores morfoagronômicos das raízes. *Horticultura Brasileira* 33: 241-250.

CRUZ, CD; REGAZZI, AJ; CARNEIRO, PCS. 2006. Modelos biométricos aplicados ao melhoramento genético. Viçosa, BR: UFV. 390 p.

DARONCH, DJ; PELUZIO, JM; AFFERRI, FS; TAVARES, AT; SOUZA, CM. 2019. Eficiência ambiental e divergência genética de genótipos de soja na região central de Tocantins. *Revista Cultura Agronômica* 28: 01-18.

ECHER, FR.; CRESTE, JE.; TORRE, EJR. 2015. Nutrição e adubação da batata-doce. Presidente Prudente, BR: UNOESTE. 94p.

EMBRAPA. Empresa Brasileira de Pesquisa Agropecuária. 2018. SANTOS, GH; JACOMINE, PKT; ANJOS, LHC; OLIVEIRA, VA; LUMBRERAS, JF; COELHO, MR; ALMEIDA, JA; ARAÚJO FILHO, JC; OLIVEIRA, JB; CUNHA, TJF (eds). Sistema Brasileiro de Classificação de Solos, 5. ed.– Brasília, DF. 356p.

FAO. Food and Agriculture Organization of the United Nations. 2018. Available at <http://www.fao.org/faostat/en/#data/QC> Accessed August 5, 2021.

IBGE (Instituto Brasileiro de Geografia e Estatística). Levantamento sistemático da produção agrícola. Rio de Janeiro, 2018. Available at <www.ibge.gov.br> Accessed August 21, 2021.

KATAYAMA, K; KOBAYASHI, A; SAKAI, T; KURANOUCHI, T; KAI, Y. 2017. Recent progress in sweetpotato breeding and cultivars for diverse applications in Japan. *Breeding Science* 67: 3-14.

LEAL, MHS; ZEIST, AR; RODRIGUES JÚNIOR, N; SILVA JÚNIOR, AD; ARANTES, JHV; GARCIA NETO, J; PIERI, JRS, PERRUD, AC. 2021. Selection of new sweet potato genotypes based on production parameters, physical root characteristics and resistance to *Euscepes postfasciatus*. *Journal of Crop Science and Biotechnology* 24: 349-360.

MANTOVANI, EC; DELAZARI, FT; DIAS, LE; ASSIS, IR; VIEIRA, GH; LANDIM, FM. 2013. Eficiência no uso da água de duas cultivares de batata-doce em resposta a diferentes lâminas de irrigação. *Horticultura Brasileira* 31: 602-606.

MASSAROTO, JA; MALUF, WR; GOMES, LAA; FRANCO, HD; GASPARINO, CF. 2014. Behavior of roots of sweet potato clones. *Ambiência* 10: 73-81.

MONTES, SMNM. 2013. Cultura da batata-doce: do plantio à comercialização. São Paulo, BR: Agência Paulista de Tecnologia dos Agronegócios (APTA). 80p.

MOULIN, MM; BENTO, CS; SANTOS JUNIOR, AC; RODRIGUES, R. 2014. Caracterização de acessos de batata-doce baseado em características morfológicas. *Perspectivas Online: Biológicas & Saúde* 13: 23-36.

NASCIMENTO, KO; LOPES, DS; TAKEITI, CY; BARBOSA JUNIOR, JL; BARBOSA, MIMJ. 2015. Physicochemical characteristics of tubers from organic sweet potato roots. *Revista Caatinga* 28: 225-234.

NGAILO, S; SHIMELIS, H; SIBIYA, J; MTUNDA, K; MASHILO, J. 2019. Genotype-by-environment interaction of newly-developed sweet potato genotypes for storage root yield, yield-related traits and resistance to sweet potato virus disease. *Heliyon* 5: e01448.

OLIVEIRA, AM; BLANK, AF; ALVES, RP; PINTO, VS; ARRIGONI-BLANK, MF; MALUF, WR. 2015. Características produtivas de clones de batata-doce cultivados em três períodos de cultivo em São Cristóvão-SE. *Horticultura Brasileira* 33: 377-382.

OLIVEIRA, DJLSF; OTOBONI, MEF; PAVAN, BE; ANDRADE, MI; VARGAS, PF. 2021. Genetic divergence of sweet potato genotypes based on morphoagronomic traits. *Horticultura Brasileira* 39: 229-235. DOI: http://dx.doi.org/10.1590/S0102-0536-20210215

PERRUD, AC; BAVARESCO, LG; ZEIST, AR; LEAL, MHS; SILVA JÚNIOR, AD; RESENDE, JTV; SILVA, ML; TOROCO, BR. 2021. Relationship between bud number in seed branches and yield aspects of sweet potato. *Horticultura Brasileira* 39: 451-457. DOI: http://dx.doi.org/10.1590/s0102-0536-20210415

SILVA, GO; BORTOLETTO, AC; PONIJALEKI, R; MOGOR, AF; PEREIRA, AS. 2014. Desempenho de cultivares nacionais de batata para produtividade de tubérculos. *Revista Ceres* 61: 752-756.

SILVA, GO; CARVALHO, ADF; SOUZA, ZS; PONIJALEKI, RS; PEREIRA, AS. 2016. Desempenho genotípico de clones de batata via modelos mistos. *Agraria* 11: 259-266.

SILVA, GO; SUINAGA, FA; PONIJALEKI, R; AMARO, GB. 2015. Desempenho de cultivares de batata-doce para caracteres relacionados com o rendimento de raiz. *Revista Ceres* 62: 379-383.