Received: 23 July 2021 | Accepted: 19 August 2021 | Published online: 16 February 2022

DOI: 10.1002/plr2.20185

Journal of Plant Registrations

REGISTRATION

Cultivar

Registration of 'L 12-201' sugarcane

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Assigned to Associate Editor Marvellous Zhou.

Registration by CSSA.

Abstract

'L 12-201' (Reg. no. CV-206, PI 699125) sugarcane (an interspecific hybrid of *Saccharum* spp.) was released on 10 Apr. 2019 for commercial production in the Louisiana sugar industry. L 12-201 was derived from a cross between the female parent 'L 97-128' and the male parent 'HoCP 96-540'. Early-stage selection through the seedling and two unreplicated clonal stages by researchers at the Louisiana State University Agricultural Center culminated in the assignment of a permanent varietal designation in 2012. Thereafter, the experimental variety was further evaluated cooperatively with personnel from the USDA-ARS at Houma and the American Sugar Cane League, Inc., at Thibodaux, LA, through several stages at multiple locations. In the final testing stage, data were collected from 60 replicated, combine-harvested trials at 12 representative light- and heavy-textured soil locations. Averaged across the plant-cane crop, the sucrose content, cane yield, and sugar yield were significantly ($P < .05$) higher in L 12-201 than in 'L 01-299', the most widely grown cultivar in the Louisiana sugar industry. In the first- and second-ratoon crops, L 12-201 had significantly ($P < .05$) less cane yield and sugar yield than L 01-299, but sucrose content was not significantly different between L 12-201 and L 01-299. When averaged across the light-textured versus heavy-textured soil locations, no significant differences in performance were found for L 12-201 in any of the traits measured. The new cultivar had a lower stalk population and greater stalk weight compared with L 01-299, especially in the ratoon crops. L 12-201 is a mid-maturing cultivar. Whenever possible, L 12-201 should be harvested before the arrival of subfreezing temperatures because it is among the least cold tolerant cultivars in the industry. L 12-201 is resistant to sorghum mosaic, smut, leaf scald, and ratoon stunt; moderately resistant to brown rust; and susceptible to yellow leaf and the sugarcane borer.

Abbreviations: LSU AgCenter, Louisiana State University Agricultural Center; SSR, simple sequence repeat.

1 | INTRODUCTION

Sugarcane (*Saccharum* spp. hybrids) is not a major crop in the United States, but it remains a crop of great economic importance in many regions of the world, including countries in Latin America, the Caribbean, southern Africa, Asia, and the Pacific. Sugarcane accounted for about 86% of the world's sugar in 2017 (OECD-FAO, 2018). In the mainland United States, sugarcane is produced in Louisiana, Florida, and Texas. In 2019, over 12 million tonnes of cane were produced in Louisiana on 195,103 ha of land in 24 of 64 Louisiana parishes (counties) (ASCL, 2019). Sugarcane is the third leading agricultural commodity in Louisiana behind poultry and forestry, with respect to economic returns to the state's economy. It is the first among row crop commodities, with an annual economic impact of US$1 billion to cane growers and raw sugar factories, and generates an overall economic value of $3 billion (LSU AgCenter, 2018).

The availability of new, genetically superior cultivars of sugarcane is foremost for sustaining the productivity of the Louisiana sugar industry (ASCL, 2019). The first sugarcane varieties grown in Louisiana were not developed here but rather imported from other sugar industries. Louisiana is the most northern latitude (between 29˚38′ N and 31˚17′ N) where sugarcane is grown, which presents challenges not faced by most sugarcane industries in tropical areas. As such, although responsible for sustaining the Louisiana sugar industry through its inception, these imported varieties did not perform at their optimum potential under Louisiana conditions. Local breeding efforts that focused on early (sucrose) maturity, cold tolerance, and ratooning ability ushered in varieties in the Louisiana sugar industry, whose productivity approached levels achieved in some tropical environments (Breaux, 1984; Dunkelman & Breaux, 1972). This improved yields and decreased the level of risk that can be expected from growing a tropical crop in a temperate environment where a plant-killing freeze and dormancy period can be expected to occur every year and where the plant must survive the winter, re-establish in the spring, and produce a profitable crop within 7–9 months.

The development and release of ‘L 12-201’ (Reg. no. CV-206, PI 699125) represent the culmination of yet another effort toward the development of sugarcane cultivars adapted to Louisiana's temperate environment. L 12-201 was officially released to the Louisiana sugar industry on 10 Apr. 2019.

2 | METHODS

2.1 | Crossing and early-stage selection

Activities specific to the development of L 12-201 are summarized in Table 1. Crossing and early-stage selection through

Core Ideas

- L 12-201 sugarcane was released for cultivation in the Louisiana sugar industry.
- L 12-201 was released because of its high yield potential compared with other cultivars.
- L 12-201 is a mid-maturing cultivar.
- Whenever possible, L 12-201 should be harvested before the arrival of subfreezing temperatures.

TABLE 1 Summary of breeding and selection activities leading to the release of L 12-201

Year	Stage	Number of entries
2005	Cross made at the Sugar Research Station, St. Gabriel, LA, and stored at –12 ˚C.	
2008	True seed germinated and seedlings transplanted into the field	81,474
2009	Selection in first-ratoon seedling crop (advanced to first-line trial)	1,836
2010	Selection in plant-cane first-line trial (advanced to second line trial)	388
2011	Selection in plant-cane second-line trial (advanced to increase plots)	150
2012	Assignment in first-ratoon second-line trial; on-station nursery trials planted	40
2013	Plant-cane on-station nursery trials harvested; off-station nursery trials planted	11
2014	First-ratoon on-station nursery trials harvested; plant-cane off-station nursery and infield trials harvested	3
2015	Second-ratoon on-station nursery trials harvested; first-ratoon off-station nursery and infield trials harvested; outfield trials planted	2
2016	Second-ratoon off-station nursery and infield trials harvested; plant-cane outfield trials harvested	1
2017	Third-ratoon off-station nursery and infield trials harvested; first-ratoon outfield trials harvested	1
2018	Second-ratoon outfield trials harvested	1
2019	Cultivar released on 10 Apr. 2019	1

the second clonal line trial stage were conducted at the Sugar Research Station in St. Gabriel, LA (30°15′13″ N, 91°06′05″ W). L 12-201 was derived from a cross, 'XL 05-115', made during the 2005 crossing campaign, and the seed was stored at –12 °C until it was germinated and planted in 2008. The female parent 'L 97-128' (Gravois et al., 2008) was released to the Louisiana sugar industry in 2004 but is no longer recommended for production. The male parent 'HoCP 96-540' (Tew et al., 2005) was released to the Louisiana sugar industry in 2003. Once the leading cultivar in the state, its acreage peaked at 50% in 2009, after which it began to decline, and by 2019 it was grown on 15% of the industry acreage. HoCP 96-540 has slowly been superseded by another cultivar, 'L 01-299' (Gravois, et al., 2011) because (a) HoCP 96-540 succumbed to brown rust (caused by *Puccinia melanocephala* Syd. & P. Syd.) infection and (b) L 01-299, which is resistant to brown rust, has a longer and more productive ratoon crop cycle.

Seed from the L 12-201 cross, along with seed from other crosses, was germinated in the greenhouse in January 2008 and transplanted to the field in April 2008. The seedlings from the same cross were planted on two adjacent rows at 0.40 m between seedlings and 1.8 m between rows with a 1.2-m alleyway separating each cross. Check cultivars were raised in the greenhouse from single-node cuttings in trays and transplanted in several locations in the field along with the seedlings. The seedlings were harvested in December 2008 and allowed to overwinter, but no data were collected. A total of 70,878 out of 81,474 seedlings survived the winter.

Individual seedling selection occurred among the overwintered seedlings in September 2009. Selection involved visually appraising individual seedling stools for yield component traits, such as plant height, stalk number, stalk diameter, and freedom from diseases and/or insect damage. About two stalks from desirable stools were cut and checked for the presence or absence of pith or tube (hollow stalk). Two stalks were cut from desirable seedlings (no pith), topped at the growing point, tied together, and carried out of the field. The stalks were punched at the mid-point height, the juice was extracted with a hand-held punch, and Brix ($g^{-100\ g}$ of solution) was estimated as an indirect measure of sucrose content using a hand-held refractometer. Seedlings with Brix values below a certain threshold (usually the average Brix value of commercial checks in the test) were discarded. The same two stalks were used to establish the first-line trial stage. Among the 1,836 seedlings selected and planted into the first-line trial in 2009, 60 were from the L 97-128 × HoCP 96-540 cross. The first-line trial stage was planted to nonreplicated, single-row plots measuring 1.8 m in length with 1.2-m alleyways between plots. Multiple single-row plots of check cultivars were also planted in the trial. First-line trials were conducted in 2010 and 2011 in the plant-cane and first-ratoon cane crops. In 2010, the first-line trial was selected in the plant-cane crop as described above for cane yield components. Clones that were not discarded were tested for Brix by punching three random stalks in a plot at the mid-point height, and the juice was used to measure Brix. These values were compared with those of check cultivars in the trial. Six stalks were cut from the desirable clones and used to establish the second-line trial stage. Among the 388 clones advanced to the second-line trial stage, 17 were from the L 97-128 × HoCP 96-540 cross. The second-line trial plots consisted of single rows measuring 4.9 m long with 1.2-m alleyways between plots. Multiple single-row plots of check cultivars were interspersed in the trial. Second-line trials were conducted from 2011 through 2013 in the plant-cane, first-ratoon, and second-ratoon crops. In 2011, 150 clones, eight of which were from the L 97-128 × HoCP 96-540 cross, were selected from the plant-cane crop of the second-line trial and used to establish two increase plots, one on heavy-textured soil and the other on light-textured soil. The selection started with first visually appraising the clones for vigor by judging for the following traits: lodging, stalk number based on counts (and extrapolated to per hectare), stalk diameter, stalk height, and disease and insect resistance. Clones judged to be adequate for these characteristics when compared with check cultivars were then evaluated for pith and/or tube. A random 10-stalk sample was hand-cut from plots of clones that were deemed acceptable, stripped of leaves, and taken to the Sugar Research Station sucrose laboratory for processing. The samples were weighed to estimate stalk weight (kg). The samples were then shredded with a Dedini laboratory disintegrator (Dedini S/A Indústrias de Base) and analyzed for fiber content (%), juice Brix, and optical rotation (Z°) via near-infrared spectroscopy using SpectraCane 400 integrated with a Bruker Matrix-F Fourier transform near-infrared spectrometer (Bruker Optics Inc.). These parameters were used to estimate sucrose content (Gravois & Milligan, 1992; Legendre, 1992).

Cane yield (Mg ha^{-1}) was estimated by dividing the product of stalk weight (kg $stalk^{-1}$) and stalk number (stalks ha^{-1}) by 1,000. Sugar yield (Mg ha^{-1}) was then estimated as the product of cane yield (Mg ha^{-1}) and sucrose content (g kg^{-1}) divided by 1,000. Two six-stalk bundles from clones, judged to be acceptable for the above traits when compared with the checks, were cut and used to plant the two increase plots. Increase plots consisted of single rows measuring 4.9 m long. Also, in 2011, six stalks from 150 clones corresponding to clones in the increase plots were sampled from the first-line trial (first-ratoon cane crop) plots and evaluated at the Sugar Research Station sucrose laboratory as described above.

In 2012, clones in the increase plots (plant-cane crop) and the corresponding clones in the second-line trial plots (first-ratoon cane crop) were evaluated. These data, together with data from the first-line trial, were used to advance clones to the on-station nursery trial stage. It is also at this point that experimental varieties were assigned a permanent name designation. L 12-201, for example, denotes that the cultivar was bred and selected by the Louisiana State University Agricultural Center (LSU AgCenter) sugarcane cultivar development program (L) and was assigned the variety number 201 in 2012 (12). The numbers 1–499 have historically been reserved for clones selected by the LSU AgCenter program. Of 40 cultivars assigned in 2012, five were from the L 97-128 × HoCP 96-540 cross. The male parent, HoCP 96-540, was involved in the parentage of seven other cultivars that were assigned in 2012.

2.2 | Replicated yield trials

Six stalks taken from the increase plots were used to plant single-row, on-station nursery trials. This was the first stage to be planted out of the Sugar Research Station. Plot size was as in the second-line trial except that each experimental variety was replicated twice and planted at three locations. The locations were the Sugar Research Station in St. Gabriel, LA; the USDA-ARS Ardoyne Farm in Shriver, LA (29˚44′42″ N, 90˚49′04″ W); and the Iberia Research Station in Jeanerette, LA (29˚54′59″ N, 91˚40′21″ W).

On-station nursery trials were conducted from 2013 to 2015 in the plant-cane through to the second-ratoon cane crop. Millable stalk counts of entire plots were made in early August, and stalk number was estimated for each clone by extrapolating to per hectare. During this process, lodging, stalk height, and insect and disease resistance were recorded. At harvest, a random 10-stalk sample was hand-cut from each plot; stripped of the leaves; and used to estimate stalk weight, fiber, and sucrose content as earlier described. Cane yield was estimated as the product of stalk number and stalk weight. Sugar yield was estimated as the product of cane yield and sucrose content. However, in 2013, only data from millable stalk counts and notes from visual assessments of on-station nursery plots together with data accumulated from the corresponding clones in the previous stages were considered in deciding which varieties to advance to two concurrent (off-station nursery and infield) stages in 2013. This included extra data points from the second-line trial (second-ratoon cane crop) and increase (first-ratoon cane crop) plots. Of 10 experimental varieties advanced to the off-station nursery and infield stages, L 12-201 was the only one from the L 97-128 × HoCP 96-540 cross. Off-station and infield trials were conducted from 2014 (plant cane) through 2017 (third-ratoon cane crop). Off-station nursery and infield trials were conducted in collaboration with the USDA-ARS.

Off-station nursery trials were conducted at three locations: Newton Cane, Inc., in Bunkie, LA (30˚95′32′′ N, 92˚18′26′′ W); Michael Melancon Farm in Cecilia, LA (30˚20′11″ N, 91˚50′52″ W); and Joel Landry Farm in Paincourtville, LA (29˚59′28″ N, 91˚03′35″ W). Off-station nursery trials consisted of single-row plots measuring 6.1 m long each planted using eight stalks. The experimental design for each trial was a randomized complete block design with two replications. Stalk number, stalk weight, cane yield, sucrose and fiber contents, and sugar yield were estimated as described for the on-station nursery.

Infield trials were planted at two locations: Blackberry farms in Vacherie, LA (30˚00′40″ N, 90˚43′10″ W), and Donny Vallot farms in Erath, LA (29˚95′83′′ N, 92˚03′60′′ W). Two-row plots, each measuring 7.6 m long, were planted using a total of 20 stalks. The experimental design was a randomized complete block design with two replications. Cane yield in the infield trial stage was measured using a combine harvester and a high-dump weigh wagon equipped with load cells to record cane weight (Johnson & Richard, 2005). Both rows were harvested and weighed, and the plot weights were used to compute cane yield. Prior to harvest, a 10-stalk sample was hand-cut and processed at the USDA-ARS laboratory facility using core laboratory methods (Gravois & Milligan, 1992; Legendre, 1992).

The final testing stage (the outfield stage) was planted in 2015 and tested through 2018 (second-ratoon cane crop) across 12 south Louisiana locations. Six of these locations were considered “light-textured” soil type, and the other six were considered “heavy-textured.” Outfield trials consisted of two-row plots measuring 15.2 m long with two replications. Stalks were planted at a rate of two stalks placed side by side with an overlap at the end of the two stalks. The distance between plots within a row (alleyway) was 1.5 m and between rows was as described previously. Outfield trials were conducted in collaboration with the USDA-ARS and the American Sugar Cane League of the U.S.A. Inc.

L 12-201 was one of two experimental varieties entered by the LSU AgCenter sugarcane cultivar development program into the outfield test. Outfield trials were harvested in a manner like the infield trials. No burning was done to remove leaves before harvest. Laboratory analysis for quality characteristics was performed at the USDA-ARS laboratory facility using core laboratory methods (Gravois & Milligan, 1992; Legendre, 1992). Experimental varieties that make it into the outfield trial stage are considered active; as such, data are collected on them from previous trial stages. Outfield trial data were reviewed every year along with data from previous trial stages, and clones that continued to perform well were replanted into the outfield trial stage. Thus, 3 yr of plant-cane, 2 yr of first-ratoon, and 1 yr of second-ratoon crop data are available on L 12-201.

2.3 | Maturity, ripener, and freeze tolerance trials

A clone’s maturity profile can be important in determining harvest schedule. The maturity tests were conducted by researchers at the USDA-ARS. Plots were two rows, 10 m long, and replicated four times. A 10-stalk sample (five from each row) was taken monthly from the plant-cane crop and biweekly from the first-ratoon crop to monitor for sucrose accumulation.

The use of plant growth regulators ("ripeners") has been adopted in Louisiana to enhance sucrose content in early-season harvested sugarcane. A ripener test was conducted at the Sugar Research Station in St. Gabriel, LA, to assess the response of L 12-201 to ripener application. The trial was planted as single-row, 10-m-long plots, each replicated four times. The ripener, glyphosate (PowerMax II) at 0.2 kg acid equivalence ha^{-1}, was applied in the plant cane crop on 12 Sept. 2017 and sampled for laboratory analysis after 32 d. A 10-stalk sample was cut from each plot and processed at the Sugar Research Station sucrose laboratory.

In Louisiana sugarcane is grown under subtropical conditions, and subfreezing temperatures can occur before the crop is harvested. Subfreezing temperatures, especially when followed by warm weather, can damage cane and lead to sucrose deterioration. On 12 Nov. 2019, subfreezing temperatures lasting 13.5 h were recorded in south Louisiana parishes. This presented an opportunity to study freeze tolerance characteristics among experimental varieties, including L 12-201. An outfield trial in Cheneyville (31˚0′48″ N, 92˚17′22″ W) in northern Louisiana was used in this study. Eight stalks were sampled from each plot weekly beginning from 14 Nov. to 16 Dec. 2019. Stalks were taken to the Sugar Research Station sucrose laboratory for analysis. The stalks were not stripped of leaves and were topped at the whorl instead of the top visible dewlap, as is customary. After shredding the stalks, the shredded tissue was pressed for 2 min using a mechanical press (Hiniron Manufacturing) to extract the juice. The juice was used to measure sucrose content (g kg^{-1}), purity (the ratio of sucrose to total soluble solids, %), pH, titratable acidity (g L^{-1}), and polysaccharides (ppm/Brix) based on methods described by Legendre et al. (2002) and Clarke et al. (1986). Each entry was assigned a cold tolerance rating as an indication of juice deterioration characteristics based on these traits.

2.4 | Disease and insect reactions

The reaction of L 12-201 to pests and diseases of economic importance to sugarcane in Louisiana was determined using a combination of disease observations in performance trials, propagation, and distribution plots and from controlled tests in inoculated greenhouse and field trials. Disease response data were generally converted to resistance ratings on a 1–9 scale (1 = highly resistant; 9 = highly susceptible). Reaction of L 12-201 to smut [caused by *Sporisorium scitamineum* (Syd.) M. Piepenbr., M. Stoll & Oberw.] and leaf scald [caused by *Xanthomonas albilineans* (Ashby) Dowson] was obtained using inoculated field trials at the USDA Research Farm in Schriever and the LSU AgCenter's Sugar Research Station in St. Gabriel, LA as described in Pontif et al. (2021).

Several years of performance trials were evaluated for the severity of symptoms resulting from natural infection by *Puccinia melanocephala* Syd. & P. Syd., the causal agent of brown rust, during the spring and summer months when the conditions were favorable for disease development. Brown rust has occurred more frequently since 2000 (Hoy & Hollier, 2009), leading to severe disease outbreaks in some years. Resistance ratings were assigned based on symptom severity on young leaves.

Reaction of L 12-201 to ratoon stunting was assessed by researchers at the USDA-ARS. Seed cane of experimental varieties were cut using a cane knife dipped in a suspension of *Leifsonia xyli* subsp. *xyli* cells and then planted in field trials. Susceptibility was based on the percentage of vascular bundles in stalks colonized by the bacterium. Colonization levels were determined using tissue-blot immunoassay (Grisham & Hoy, 2017). Yield loss trials planted using infected versus noninfected (hot water treated) seed cane were also used to assess susceptibility as described by Grisham et al. (2009).

Mosaic, a historically important disease of sugarcane in Louisiana, can be caused by two viruses, *Sugarcane mosaic virus* or *Sorghum mosaic virus*, of which the latter is the prevalent strain currently found. Several evaluation trials were monitored for the development of symptoms of mosaic from natural spread of virus inoculum until the cultivar was released in 2018. The smut and leaf scald trial described above was also used to screen for natural spread of mosaic by aphid (*Melanaphis sacchari* Zehntner) vectors of the virus. In the trial, mosaic-infected clones were interspersed (one row per two rows of experimental varieties) to act as a close source of inoculum for spread by migrating aphids. An artificial inoculation test was also conducted jointly by researchers from the LSU AgCenter and the USDA-ARS. Inoculum consisted of virus-infected symptomatic leaves macerated in a 1:10 w/v of 0.01 M potassium buffer (pH 7.5) with the homogenate filtered through cheesecloth. Carborundum was dusted onto leaves prior to inoculation. Thirty-day-old plants raised in Styrofoam flats in the greenhouse were inoculated by rubbing the leaves with a scouring pad dipped in the inoculum. Each clone was represented by six plants. Plants were observed for mosaic symptoms after 5–6 wk. Presence of the virus that causes mosaic symptoms was confirmed in symptomatic plants by researchers at the USDA-ARS using reverse transcription–polymerase chain reaction analysis.

Reverse transcription–polymerase chain reaction analysis (Grisham et al., 2010) was also used to monitor for the presence or absence of *Sugarcane yellow leaf virus*, in a natural-spread field experiment. Researchers at the USDA-ARS Sugarcane Research Unit monitored trials that included rows of experimental varieties interspersed among rows of virus-infected susceptible cultivars (3:1 ratio).

The resistance/susceptibility rating of L 12-201 to sugarcane borer [*Diatraea saccharalis* (F.) (Lepidoptera: Crambidae] was assessed in plant-cane crops at the Sugarcane Research Station. The rating was established by comparing borer infestation on L 12-201 relative to those of sugarcane cultivars with known levels of susceptibility/resistance according to Wilson et al. (2020). Trials were conducted under enhanced pest pressure, and bored internode data collection followed the methods of White et al. (2008) and Wilson et al. (2020).

2.5 | Botanical and molecular characterization

The botanical descriptions for L 12-201 were recorded using the plant-cane crop in late August 2019 at approximately 170–180 d after spring emergence. The descriptions were based on 10 stalks taken from the middle row of a three-row plot that was 7.3 m long. The stalks were taken from the middle row to minimize the effect of environmental factors, such as direct sunlight on stalk color. Quantitative measurements were based on an average of 10 stalks, morphological characteristics were according to Artschwager and Brandes (1958), and color was described based on the Munsell color chart for plant tissues (Munsell Color, 1977).

Twelve simple sequence repeat (SSR) markers, which generated maximum polymorphisms among Louisiana clones (Parco et al., 2011), were used to confirm the parentage of L 12-201 and to distinguish it from other commercial sugarcane cultivars of Louisiana. Polymerase chain reaction was performed with 50 ng genomic DNA of L 12-201, its parents (L 97-128 and HoCP 96-540), and eight current Louisiana commercial sugarcane cultivars following the protocol and thermal profile as detailed earlier (Khan et al., 2013). Polymerase chain reaction products were resolved in a 13% polyacrylamide gel, stained using ethidium bromide, and visualized and captured in a Kodak Gel Logic200 gel documentation system (Carestream). The alleles were scored as 1 for presence and 0 for absence in a marker-genotype binary matrix. L 12-201 was also screened for the presence of *Bru*1, the major brown rust resistance gene, as described by Parco et al. (2014).

2.6 | Statistical analyses

Data were analyzed using the PROC MIXED procedure in SAS version 9.4 (SAS Institute, 2018). Multilocation trials were analyzed by year (crop-year) with cultivars considered as fixed effects and location and replication considered random effects in the model. The maturity and cold tolerance data were also analyzed using the PROC MIXED procedure. Least squares means were generated for each cultivar, and pairwise differences between means were separated using the PDIFF option ($P < .05$). The data were also analyzed to determine the effect of soil type on cultivar performance, with cultivars and soil types considered as fixed effects and locations (nested within soil types) considered as random effects in the model. The slice option was used to partition cultivar effects from the cultivar × soil type interaction term, which provided a significance test ($P < .05$) of cultivar performance between soil types.

The sugarcane borer data (percentage bored internodes) were analyzed using the Proc GLIMMIX procedure in SAS version 9.4. Varieties were considered as fixed effect and replications as random effect in the model. Mean separation among varieties was accomplished using Tukey's honestly significant difference at $\alpha = .05$. This was instructive in ranking variety performance relative to the susceptible and resistant checks in the trial.

Genetic (dis)similarity among the sugarcane clones including L 12-201 was computed from the fingerprint-generated genotype-marker binary matrix, and similarity index-based clustering was performed using Ward's method in DARwin version 6 (Perrier & Jacquemoud-Collet, 2006).

3 | CHARACTERISTICS

3.1 | Replicated yield trials

The on-station nursery trial stage is the first stage where experimental clones and commercial cultivars that served as checks cultivars are tested in two additional locations outside of the Sugar Research Station (Table 2). In general, few check cultivars performed significantly better than L 12-201, and these were only for a few traits. In the plant-cane crop, 'L 03-371' (Gravois et al., 2012) was the only check cultivar to significantly outperform L 12-201 for sugar yield, cane yield, and stalk number. Significantly more stalks were produced by L 03-371 and L 01-299 in the first- and second-ratoon cane crops and by 'L 99-226' (Bischoff et al., 2009) in the second-ratoon cane crop. Among the check cultivars that performed significantly better than L 12-201 in the on-station nursery stage, only L 01-299 is still recommended for cultivation in Louisiana. The results were generally similar in the off-station nursery and infield stages, which led to L 12-201 being advanced to the final testing stage of the program.

L 12-201 was evaluated in the final testing stage (outfield) in plant cane (2016) through the second ratoon (2018) (Table 3). In addition, L 12-201 was replanted into the outfield trial every year it remained active as an experimental variety producing 3 yr of plant-cane (2016–2018), 2 yr of first-ratoon (2017–2018), and 1 yr of second-ratoon

TABLE 2 Summary of on-station nursery trials conducted at three southern Louisiana locations from 2013 to 2015

Cultivar	Sugar yield	Cane yield	Sucrose content	Stalk weight	Stalk no.
	Mg ha^{-1}		g kg^{-1}	kg	stalks ha^{-1}
	Plant-cane means, 2013				
L 12-201	14.96	118.8	126.0	1.41	85,026
HoCP 96-540	12.52	105.8	118.5–	1.28	83,158
L 99-226	15.74	126.0	125.0	1.48	85,399
L 01-299	14.08	125.1	112.5–	1.27	97,362
L 03-371	17.56+	138.8+	126.0	1.29	107,451+
	First-ratoon means, 2014				
L 12-201	16.91	141.2	120.0	1.35	104,837
HoCP 96-540	12.46	107.2	117.0	1.10	96,801
L 99-226	15.68	128.0	123.5	1.30	98,296
L 01-299	14.72	127.3	116.0	0.98	129,691+
L 03-371	14.29	119.3	120.0	0.91	131,932+
	Second-ratoon means, 2015				
L 12-201	13.61	101.3	134.5	1.02	99,603
HoCP 96-540	9.73–	77.3–	125.0	0.80–	97,174
L 99-226	15.72+	116.3	134.5	0.98	119,226+
L 01-299	14.10	111.6	127.0	0.79–	142,585+
L 03-371	13.41	103.6	130.0	0.83–	123,896+

Note. Values within a column that are significantly (P = .05) higher or lower than that for L 12-201 are denoted by a plus (+) or minus (−), respectively.

crop data. L 12-201 produced significantly more sugar yield than 'L 01-283' (Gravois et al., 2010) and L 01-299 in the plant-cane crop and more than HoCP 96-540 in the plant and the first- and second-ratoon crops. The new cultivar produced significantly more cane yield than HoCP 96-540, L 01-283, L 01-299, and 'HoCP 09-804' (Todd et al., 2018) and accumulated more sucrose than HoCP 96-540 and L 01-299 in plant cane. L 01-299 was the only check cultivar that produced significantly more cane yield than L 12-201 in the first- and second-ratoon crops, and this probably accounted for the higher sugar yield values for L 01-299 relative to L 12-201. Three check cultivars, L 01-283, 'Ho 07-613', and HoCP 09-804, consistently accumulated more sucrose than L 12-201 in the first- and second-ratoon crops. L 12-201 tended to produce significantly heavier stalks than all the cultivars in the trial. Conversely, L 12-201 produced significantly fewer stalks than most cultivars in the trial, and this was consistent across crops. Stalk weight and stalk number both influence cane yield; however, stalk number is considered a very important trait in sugarcane in Louisiana because it is an indicator of ratooning ability. In an experiment to study traits influencing ratooning ability in Louisiana, Milligan et al. (1996) reported that stalk number in the younger crop was the only trait significantly correlated to ratoon crop cane yield, suggesting that selection for stalk number in the younger crops would enhance older crop yields. Moreover, stalk number is relatively easy to visualize and is easier to measure than stalk weight, especially in the early stages of selection. Stalk weight is associated with more rapid decline in yields in older crops, which is why Louisiana sugarcane breeders strive to select cultivars with high stalk number to negate the adverse effect of this decline in cane yield. As expected, stalk weight decreased in the older crops in L 12-201, as with the other cultivars in the trial. However, compared with other cultivars, only L 01-299 produced significantly more cane yield than L 12-201 in the older ratoon crops, suggesting that L 12-201 is as productive in the older ratoon crops as the other cultivars despite its relatively low stalk number.

Outfield tests are planted on six light-textured and six heavy-textured soil locations in Louisiana (Table 4). Louisiana sugarcane breeders use these two broad categories as a simple means to classify sample locations as generally representative of the spectrum of soil types found in the industry. Louisiana sugarcane growers contend that sugarcane production is more profitable in light-textured compared with heavy-textured soils. Heavy-textured soils are generally considered less favorable for sugarcane cultivation especially under conditions of environmental stress, such as drought or flooding. Heavy-textured soils are estimated to occupy about 30–35% of the industry (Herman Waguespack, personal communication, 2019), but no deliberate attempt has been made to breed and select sugarcane cultivars specifically adapted to

TABLE 3 Summary of outfield trials conducted at 12 southern Louisiana locations from 2016 to 2018

Cultivar	Sugar yield	Cane yield	Sucrose content	Stalk weight	Stalk no.
	Mg ha^{-1}		g kg^{-1}	kg	stalks ha^{-1}
	Combined plant-cane means, 2016–2018 (32)[a]				
L 12-201	11.08	77.6	143.0	1.39	56,950
HoCP 96-540	9.88–	73.3–	134.0–	1.27–	59,140
L 01-283	10.45–	72.2–	145.5	0.96–	75,701+
L 01-299	10.32–	74.0–	139.5–	1.06–	71,146+
HoCP 04-838	10.87	76.4	142.5	1.04–	73,968+
H0 07-613	10.52	80.5	145.5	1.14–	71,455+
HoCP 09-804	10.79	74.2–	145.0	0.89–	85,073+
L 11-183	11.02	78.2	141.0	1.13–	70,123+
	Combined first-ratoon cane means, 2017–2018 (20)				
L 12-201	10.80	77.3	140.5	1.31	60,029
HoCP 96-540	9.76–	73.1	134.0–	1.15–	63,995
L 01-283	10.96	75.5	146.0+	0.93–	82,867+
L 01-299	11.72+	83.2+	141.5	0.98–	86,161+
HoCP 04-838	10.58	75.8	140.5	1.02–	75,893+
H0 07-613	11.23	77.1	146.0+	1.15–	66,773
HoCP 09-804	11.38	78.2	146.5+	0.83–	95,311+
L 11-183	10.74	78.0	138.5	1.05–	75,725+
	Combined second-ratoon cane means, 2018 (8)				
L 12-201	10.18	81.8	124.0	1.14	72,894
HoCP 96-540	7.18–	63.7–	112.0–	1.04–	61,900
L 01-283	10.44	79.6	131.0+	0.88–	91,090+
L 01-299	11.39+	94.4+	120.5	0.89–	107,520+
HoCP 04-838	10.15	79.8	128.0	0.97–	84,611+
H0 07-613	9.11	69.3–	131.5+	1.04–	67,855
HoCP 09-804	11.37	84.3	135.5+	0.78–	109,495+
L 11-183	9.16	75.5	120.5	0.99–	77,887

Note. Values within a column that are significantly ($P = .05$) higher or lower than that for L 12-201 are denoted by a plus (+) or minus (−), respectively.

[a] Numbers in parentheses represent the total number of trials in which L 11-183 was harvested. L11-183 was replanted into the outfield trial every year that it remained active as an experimental cultivar; hence the difference in number of trials within each crop. Also, due to unforeseen circumstances, not all 12 locations or crops within a location were harvested; hence the disparity with the expected number of locations or crops.

any soil type. This may explain why individual cultivar performance between the two soil types was not significant for most of the cultivars (Table 4). The few cultivars that performed differently under the two soil types included 'Ho 12-615', which produced significantly more cane yield, and L 01-299 and HoCP 09-804, which produced significantly more stalks in light-textured soils compared with heavy-textured soils. The new cultivar, L 12-201, did not perform significantly better for any trait in either of the two soil types. However, compared with the other cultivars, Ho 12-615 and HoCP 09-804 performed significantly better than L 12-201 for cane yield and sucrose content, respectively, in the light-textured soil locations, but these differences were not repeated in the heavy-textured soil locations. In the heavy-textured soil locations, Ho 12-615 and L 01-283 performed significantly better than L 12-201 for sugar yield and sucrose content, respectively. L 12-201 produced significantly fewer stalks that were significantly heavier compared with most of the check cultivars in the trial under both soil types. Therefore, relative to other cultivars in the industry, L 12-201 is suitable for cultivation on both soil types.

The fiber content of L 12-201, averaged across 14 observations, was 113 g kg^{-1}, which is lower than in L 01-299 (126 g kg^{-1}) but within the generally accepted range of 100–140 g kg^{-1}. Field observations indicate that L 12-201 is no more susceptible to herbicides commonly used to control weeds in sugarcane fields than other sugarcane cultivars currently in production.

TABLE 4 Summary of outfield trials conducted at six light-textured and six heavy-textured soil locations in the Louisiana sugar industry

Cultivar	Sugar yield	Cane yield	Sucrose content	Stalk weight	Stalk no.
	Mg ha^{-1}		g kg^{-1}	kg	stalks ha^{-1}
	Light-textured soil type				
L 12-201	9.58	34.7	276.17	2.94	24,019
HoCP 96-540	8.06–	31.0–	260.08–	2.62–	24,073
L 01-283	9.57	33.8	283.17	2.08–	33,076+
L 01-299	9.88	36.2	272.98	2.16–	34,571+
HoCP 04-838	9.73	34.9	278.87	2.26–	31,382+
HoCP 09-804	10.02	35.1	285.57+	1.84–	39,078+
L 11-183	9.31	34.6	269.36	2.36–	29,886+
Ho 12-615	10.67	39.7+	268.92	2.04–	39,599+
Ho 13-739	9.88	35.2	280.93	2.78–	25,206
Mean*	9.69	35.1	276.26*	2.53	28,680*
	Heavy-textured soil type				
L 12-201	9.40	32.7	287.65	2.86	23,412
HoCP 96-540	8.15–	30.4	268.37–	2.60–	23,674
L 01-283	9.00	30.2	298.21+	1.99–	30,702+
L 01-299	9.17	32.4	283.20	2.23–	29,963+
HoCP 04-838	8.62	30.4	283.76	2.15–	28,699+
HoCP 09-804	9.06	30.8	294.24	1.88–	32,906+
L 11-183	9.21	32.5	283.64	2.39–	27,623+
Ho 12-615	9.88+	34.8	283.83	1.91–	37,134+
Ho 13-739	9.35	31.6	295.93	2.77	23,204
Mean	8.95	31.9	280.76	2.49	26,449
	Test (Pr > *F*) of cultivar mean difference between light- and heavy-textured soil types*				
L 12-201	.87	.42	.39	.46	.74
HoCP 96-540	.83	.81	.53	.83	.82
L 01-283	.52	.13	.26	.37	.20
L 01-299	.35	.12	.44	.47	.01*
HoCP 04-838	.16	.07	.71	.25	.15
HoCP 09-804	.18	.08	.51	.69	.00*
L 11-183	.89	.38	.28	.79	.22
12-615	.30	.05*	.27	.22	.19
13-739	.50	.16	.29	.96	.27

Note. Soils in the Louisiana sugar industry are classified into two broad categories: light-textured and heavy-textured soil types. Six locations each are planted to represent the two soil types. Values within a column for that are significantly ($P = .05$) higher or lower than that for L 12-201 are denoted by a plus (+) or minus (–), respectively.
*Difference between means or cultivar performance between soil types was significant from 0 at $P = .05$.

3.2 | Maturity, ripener, and freeze tolerance trials

Sugarcane is a tropical crop, and its cultivation in subtropical Louisiana is fraught with many challenges that affect its ability to grow and be processed into sugar. The Louisiana growing season is short (7–9 mo) compared with tropical environments and often includes extreme weather conditions, such as drought and hurricanes. The fear of a plant-killing freeze beginning from late November, which can result in the deterioration of sucrose quality, compels harvesting to commence early when the plant is not fully mature and to continue even under unfavorably wet conditions. Earlier starting dates for sugarcane harvesting are now more common in Louisiana. The application of plant growth regulators (ripeners) is used to enhance sucrose content levels in early-harvested cane. Results from the maturity trials to determine maturity profiles of cultivars are presented in Table 5. Table 6 compares the effect of ripener on L 12-201 relative to other Louisiana cultivars. Results from the maturity tests were consistent across crops and years; therefore, only the results averaged from the plant cane crops are presented. ‘HoCP 00-950’ is considered

TABLE 5 Maturity test (harvest dates) comparing sucrose content of L 12-201 with eight commercial sugarcane cultivars averaged across the plant cane crops during the 2017 and 2018 seasons

Cultivar	Harvest dates[a] Sept.	Oct.	Nov.	Increase[b]
	Mg ha^{-1}			%
L 12-201	103.0	127.5	144.5	39.9
HoCP 96-540	101.5	127.5	144.0	42.1
L 01-283	122.5+	137.5	148.5	21.3
L 01-299	96.0	115.0–	135.5–	38.4
HoCP 04-838	115.0	129.0	146.5	27.4
HoCP 09-804	123.0+	136.5	151.5	23.3
L 11-183	103.5	121.5	142.5	37.8
Ho 12-615	108.0	125.0	145.5	34.7
Ho 12-630	107.0	126.5	141.5	32.6
Average	109.0	127.5	144.5	33.0

Note. Cultivars with values that are significantly higher or lower ($p = .05$) than that for L 11-183 are denoted by a plus (+) or minus (–), respectively.

[a] Harvest dates were 26 Sept. 2017 and 25 Sept. 2018, 24 Oct. 2017 and 23 Oct. 2018, 21 Nov. 2017 and 20 Nov. 2018.

[b] Percentage increase in sucrose content between September and November.

TABLE 7 Relative ranking of L 12-201 and 12 other sugarcane cultivars in the Louisiana sugar industry for cold tolerance

Cultivar	Cold tolerance rating
HoCP 96-540	good
L 01-299	moderate
HoCP 04-838	good
HoCP 09-804	moderate
L 11-183	moderate
L 12-201	poor
Ho 12-615	poor
Ho 13-739	good
L 14-267	moderate
HoCP 14-885	moderate
L 15-306	moderate
HoL 15-508	moderate
Ho 15-971	moderate

Note. Ranking was based on deterioration characteristics of juice sampled from the plant cane crop on 14 Nov., 9 Dec., and 16 Dec. 2019 following subfreezing temperatures (−5.6 °C) that occurred on 13 Nov. 2019.

an early-maturing cultivar in Louisiana (Tew et al., 2009). At the earliest harvest dates in September, L 12-201 had accumulated sucrose content comparable to that of HoCP 00-950 but significantly less than that of L 01-283 and HoCP 09-804 (Table 5). By the last harvest date in November, L 12-201 had accumulated 39.9% more sucrose and had attained a sucrose level that was not significantly different from that of other cultivars in the industry. Based on its maturity profile, L 12-201 cannot be considered an early-maturing cultivar. At 35 d after application of ripener, L 12-201 that was treated accumulated 13.8% more sucrose than the nontreated check plots. The rate at which sucrose accumulated in L 12-201 did not continue to increase, as indicated by the 13.1% increase after 49 d. However, L 12-201 appears to respond favorably to ripener application compared with other cultivars in the industry. The results from the freeze tolerance test indicate that L 12-201 should be harvested early relative to other cultivars whenever possible because it was rated poor with respect to juice deterioration following a freeze (Table 7).

3.3 | Diseases and insect reactions

L 12-201 was resistant to mosaic, smut, leaf scald, and ratoon stunt; moderately resistant to brown rust; and susceptible to yellow leaf and the sugarcane borer (Table 8). Susceptibility of L 12-201 to the sugarcane borer suggests that the cultivar will require insecticidal protection and should not be planted in areas where aerial application is not possible.

3.4 | Agronomic, botanical, and molecular descriptors

Table 9 summarizes the botanical description of L 12-201 as per Artschwager and Brandes (1958). A key

TABLE 6 Effect of Roundup PowerMax II, applied at 0.2 kg acid eqivalent ha^{-1}, on enhancing sucrose content in L 12-201 and two commercial cultivars of sugarcane in Louisiana[a]

Cultivar	Sucrose content 35 DAA[b] Nontreated	Treated	Increase	Sucrose content 49 DAA Nontreated	Treated	Increase
	g kg^{-1}		%	g kg^{-1}		%
L 12-201	120.0	136.5	13.8	122.0	138.0	13.1
Ho 12-615	106.5	118.5	11.2	118.5	127.5	7.6
Ho 12-630	121.5	132.5	9.1	122.5	144.5	18.0

[a] Treatments applied 17 Sept. 2018 and hand harvested 22 Oct. 2018 and 5 Nov. 2018.

[b] Days after application.

TABLE 8 Disease and insect reactions of L 12-201 and other commercial sugarcane cultivars

Cultivar	Mosaic	Yellow leaf	Smut	Brown rust	Leaf scald	Ratoon stunt	Sugarcane borer
L 12-201	R	S	R	MR	R	R	S
HoCP 96-540	R	S	R	S	R	S	S
L99-226	MR	R	MS	S	MS	S	MR
HoCP 00-950	R	R	R	R	R	S	S
L 01-283	R	S	R	S	R	S	S
L 01-299	R	S	S	R	R	S	R
HoCP 04-838	R	MS	R	R	MR	R	R
HoCP 09-804	S	R	MS	S	MS	MS	MS
L 11-183	MS	MR	R	MS	MR	MR	S
Ho 13-739	R		R	MS	R	MS	MR

Note. MR, moderately resistant; MS, moderately susceptible; R, resistant; S, susceptible.

TABLE 9 Botanical descriptions of L 12-201 as determined at the Sugar Research Station in St. Gabriel, LA, in 2019

Trait	L12-201
Leaf sheath	pubescence on green leaves
Stalk height, cm	251 ± 13.88
Stalk diameter, cm	2.5 ± 0.16
Leaf shape	erect with slight droop
Leaf length, cm	137 ± 6.49
Leaf width, cm	3.4 ± 0.79
Stalk bud shape	narrow ovate bud
Auricle shape	long lanceolate
Auricle length, cm	2.4 ± 1.0
Internode	
Length, cm	13.1 ± 2.30
Shape	cylindrical to slightly conoidal
Waxiness	moderate to heavy
Growth ring width, mm	0.33 ± 0.01
Root band width, mm	0.63 ± 0.05
Dewlap	double crescent deltoid
Ligule shape	linear

Note. Stalk and leaf measurements were means of 10 stalks. Stalk height was measured from the ground to the top visible dewlap. Stalk diameter and internode lengths were means taken from the fourth internode above ground level. Growth ring, root band, and bud measurements and descriptions were from the fourth internode above ground level. Leaf measurements were from top visible dewlap. Auricle and ligule measurements and descriptions were taken from five nodes below the top visible dewlap.

distinguishing characteristic of L 12-201 is the heavy pubescence on the green leaf sheath with margins that are purple in color. The leaf sheaths adhere more tightly to the stalk compared with those of L 01-299. Mature stalks of L 12-201 can grow up to 251 ± 13.88 cm tall and 2.5 ± 0.16 cm in diameter about 180 d after the plant emerges in the spring. The canopy can be described as moderately drooping and provides excellent shading of rows, with leaves that tend to be erect and bent toward the tip. The leaf blades are smooth with no pubescence and acuminate in appearance with an average length and width of 137 ± 6.49 and 3.4 ± 0.79 cm, respectively. The margins on the leaf blade are slightly serrated but not as serrated as that of L 01-299. The midribs appear concave and white in color on the adaxial side. On the abaxial side, the midribs are raised and similar in color to the leaf blade. Auricles are very prominent on L 12-201 and measure about 2.4 ± 1.0 cm in length and are lanceolate in shape. The ligules appear linear or horizontal in shape with fringes of hair around the margins. The dewlap of L 12-201 is double crescent deltoid in shape and olive green in color.

Compared with its male parent HoCP 96-540, which has heavy wax on its stalks that does not rub off easily, the stalks of L 12-201 are covered with a moderate amount of wax that rubs off easily. Under the wax, the stem color of L 12-201 is yellow with a shade of green but with yellow being the predominant color. The stalk color becomes darker when exposed to direct sunlight. The internodes on the stem are cylindrical to slightly conical in shape and measured 13.1 ± 2.3 cm in length with no bud furrows or growth cracks. The growth ring (intercalary meristem) and root band measured 0.33 ± 0.01 and 0.63 ± 0.05 cm, respectively. The buds of L 12-201 are round and prominent and are slightly raised (with reference to the leaf scar), and the tips do not grow beyond the growth ring. Bud grooves are absent. A wax ring is prominent below the leaf scar.

During cultivar development, experimental cultivars that flower freely in the field are usually discarded. This is because flowering signals the end of the vegetative growth phase, and this is likely to negatively affect cane yield potential. Therefore, sugarcane cultivars including L 12-201 rarely flower naturally under Louisiana environmental conditions and need artificial photoperiod treatment to induce flowering. Since 2014, numerous attempts, using different artificial photoperiod regimes, have failed to induce L 12-201 to flower (Daigle et al., 2019; Finger et al., 2014).

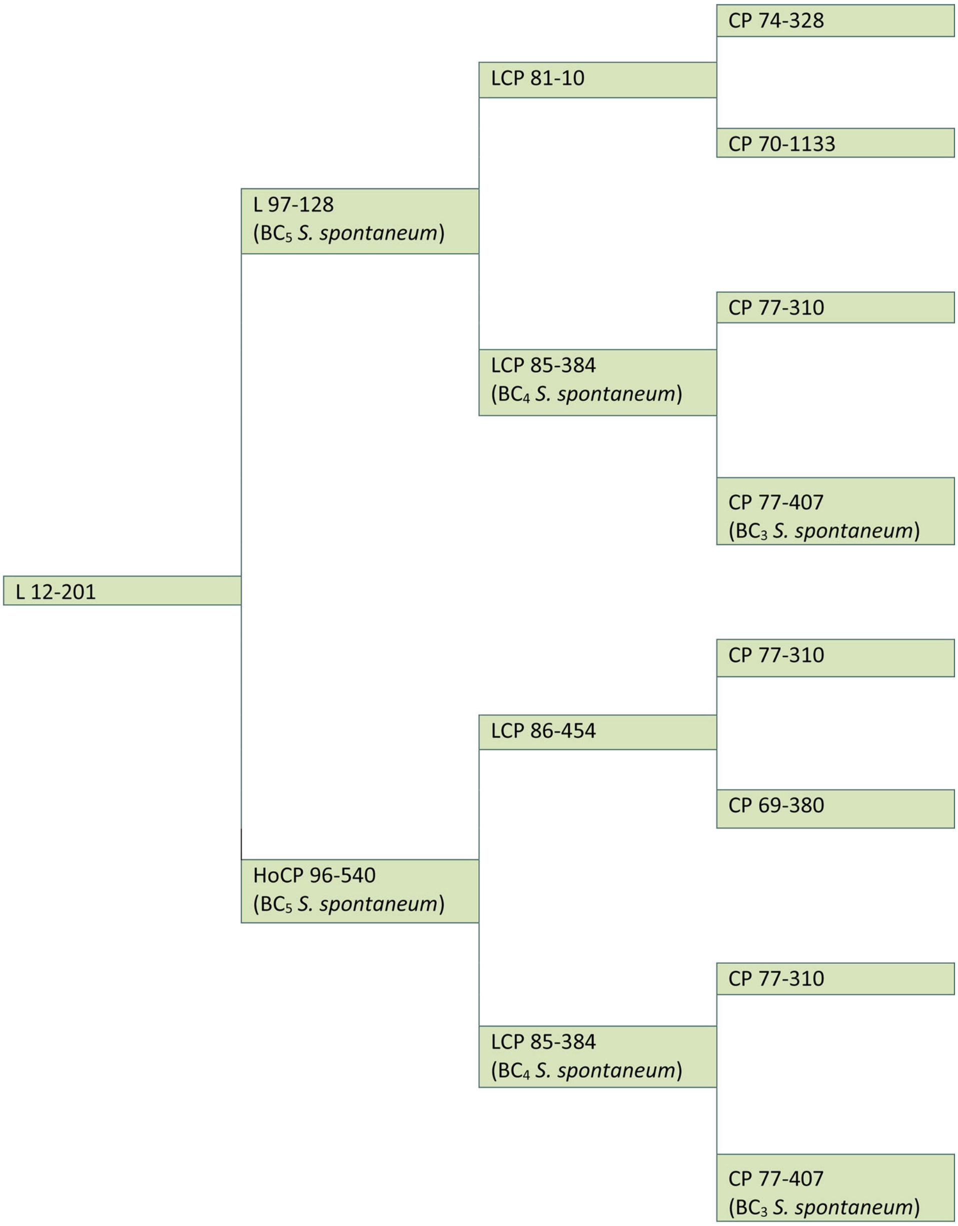

FIGURE 1 Four-generation pedigree of L 12-201

The true hybridity of L 12-201 was validated by 16 out of 72 alleles generated by the 12 SSR primer pairs that were contributed by the male parent HoCP 96-540 (Figure 1). These 16 alleles were present in L 12-201 and the male parent but not the female L 97-128. For example, two alleles (∼500 and ∼190 bp) at the LAPS0733 locus were present in L 12-201 and its male parent but absent in the female parent. Similarly, 11 alleles were present in L 12-201 and the female parent but were absent in the male parent. For example, the SSR primer SCES0890 amplified two fragments (∼700 and ∼365 bp) that were present in L 12-201 and its female parent L97-128 but absent in the male parent HoCP 96-540. A ∼350-bp allele amplified at the CA192210 locus was unique to L 12-201 and its female parent L 97-128. A ∼800-bp allelic fragment generated by CA120853 was uniquely present in L 12-201, its female parent, and Ho12-615. On the other hand, a ∼765-bp fragment amplified by LAPS0252 was uniquely present in L 12-201 and both of its parents along with 'L 11-183' (Pontif et al., 2021), 'HoCP 04-838', and 'LCP 85-384'. Similarly, a ∼1,125-bp fragment generated by SCES0890 was present in L 12-201, its male parent, and three recently released cultivars (Ho 12-615, 'Ho 13-739', and L 11-183).

A neighbor-joining tree generated using (dis)similarity matrix using the alleles amplified by the SSR primers grouped the cultivars into two major clusters (Figure 2). L 12-201 grouped with its male parent HoCP 96-540 and LCP 85-384 in a subcluster IA at 73 and 78% similarity, respectively. HoCP 96-540 is a progeny of LCP 85-384. The female

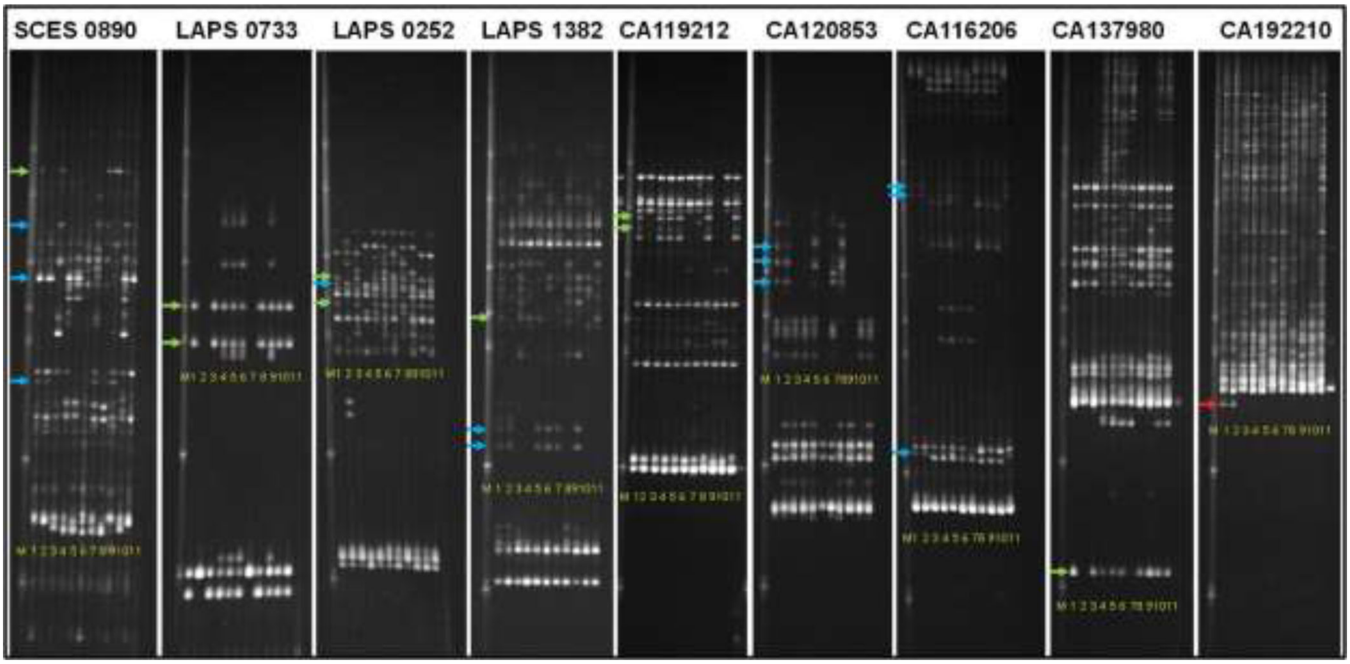

FIGURE 2 Representative gel images showing alleles confirming the parentage of and uniqueness of L 12-201. Blue arrows represent maternal alleles from L 97-128, green arrows represent paternal alleles from HoCP 96-540, and the red arrow indicates the unique maternal allele of L 12-201

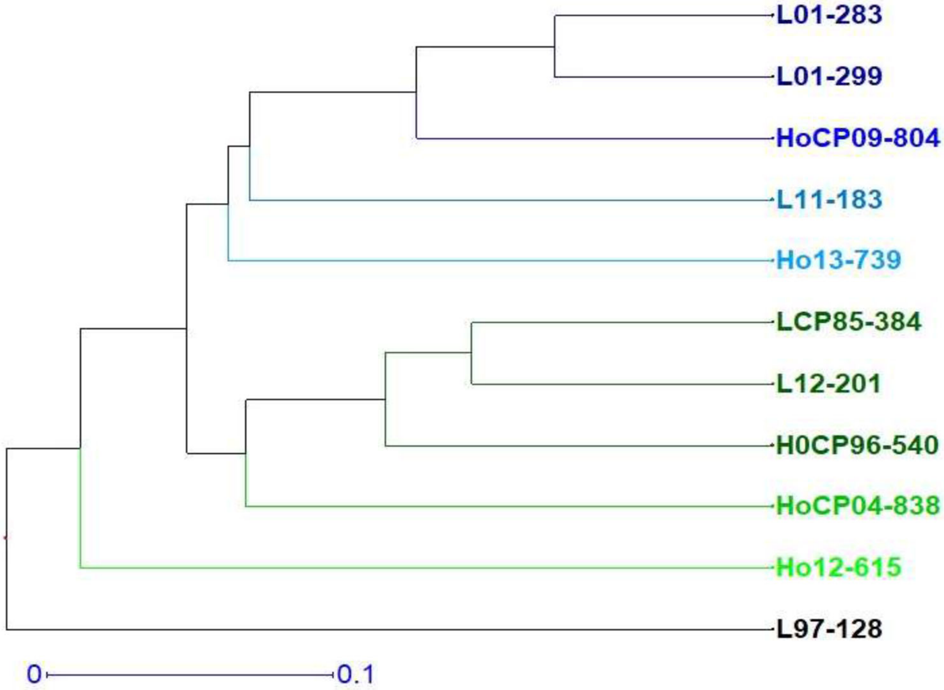

FIGURE 3 The dendrogram shows L 12-201 in the same subcluster with its male parent HoCP 96-540 and grandparent LCP 85-384 (the male parent of HoCP 96-540)

parent L 97-128 shared the same cluster with L 12-201 at 70% similarity but formed a subcluster that was close to the subcluster containing HoCP 04-838 and Ho 12-615 (Figure 2). LCP 85-384 grouped closest to L 12-201 probably because it is a grandparent on both sides of the parental lineages (Figure 3).

A breakthrough in sugarcane breeding occurred in the late 19th to early 20th centuries when yield and disease resistance were increased by crossing *Saccharum officinarum* (the erstwhile cultivated species) to *Saccharum spontaneum*, a wild and vigorous relative, and then backcrossing the hybrids to *S. officinarum* for a few generations. Most modern cultivars, especially those in the tropics, are descendants of these early interspecific hybrids, which have undergone about 10–15 cycles of intercrossing and selection (Deren, 1995; Raboin et al., 2008). Louisiana sugarcane germplasm is unique from the rest of the world's because, in the late 1950s, sugarcane breeders initiated a new round of crossing between successful Louisiana cultivars and *S. spontaneum*. Because of Louisiana's temperate environment and past experiences with disease outbreaks, an intentional effort was made to cross with *S. spontaneum* clones to bring in genes for resistance to mosaic and general hardiness, including cold tolerance, and ratooning ability (Dunkelman & Breaux, 1972). Thus, whereas Deren (1995) showed in the early 1990s, using pedigree information, that only two ancestral interspecific hybrids had contributed to the parentage of 90% or more of U.S. germplasm, a similar analysis 10 yr later (Arro et al., 2004) and 20 yr later (Pinnamaneni et al., 2017), using AFLP markers, showed that the Louisiana sugar industry had systematically benefitted from an infusion of novel alleles from *S. spontaneum*. LCP 85-384 (Milligan et al., 1994), a grandparent of L 12-201 (Figures 2 and 3), is credited as the first success story of the introgression program.

4 | AVAILABILITY

Small quantities of seed cane (vegetative stalks) for research purposes may be obtained from the LSU AgCenter, Sugar Research Station, in St. Gabriel, LA, where L 12-201 will be maintained for at least five years from the date of this publication. Seed cane for commercial plantings can be obtained from the American Sugar Cane League of the U.S.A., Inc. It is not anticipated that a plant patent will be sought for L 12-201.

ACKNOWLEDGMENTS

L 12-201 was developed with financial support from the LSU AgCenter and the American Sugar Cane League. All personnel from the LSU AgCenter Sugarcane Variety Development Program, the USDA-ARS, and the American Sugar Cane League who participated in a cooperative effort towards the release of L 12-201 are gratefully acknowledged.

AUTHOR CONTRIBUTIONS

Michael Pontif: Data curation; Formal analysis; Funding acquisition; Investigation; Writing-review & editing. Collins Kimbeng: Conceptualization; Data curation; Formal analysis; Funding acquisition; Investigation; Methodology; Project administration; Resources; Software; Supervision; Validation; Visualization; Writing-original draft; Writing-review & editing. Kenneth Gravois: Data curation; Software; Writing-review & editing. Keith Bischoff: Data curation; Investigation. David Sexton: Investigation. Christopher LaBorde: Investigation. Gertrude Hawkins: Investigation. Jeffrey Hoy: Formal analysis; Investigation; Writing-review & editing. Niranjan Baisakh: Investigation; Methodology. Blake Wilson: Formal analysis; Investigation; Methodology. Albert Orgeron: Formal analysis; Investigation; Methodology. James Todd: Investigation; Methodology; Writing-review & editing. Herman Waguespack: Investigation.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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How to cite this article: Pontif, M., Kimbeng, C., Gravois, K., Bischoff, K., Sexton, D., LaBorde, C., Hawkins, G., Hoy, J., Baisakh, N., Wilson, B., Orgeron, A., Todd, J., & Waguespack, H. (2022). Registration of 'L 12-201' sugarcane. *Journal of Plant Registrations*, *16,* 363–377. https://doi.org/10.1002/plr2.20185