SEASONAL GROWTH, SHADING POTENTIAL, AND YIELD OF SIX SUGARCANE CULTIVARS

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ABSTRACT

Weed control in sugarcane (Saccharum spp. hybrids) is dependent on both effectiveness of herbicides and competitive ability of the crop. Sugarcane cultivar selection could play a role in management of problematic weeds. Growth characteristics and shading ability of six sugarcane cultivars were compared during the first and second production years. Averaged over years, shoot population in April was greatest for L 99-226 and averaged 23% more than for HoCP 96-540 and approximately 14% more than for Ho 95-988 and L 97-128. In May, June, and July sugarcane height was greatest for L 97-128 and L 99-233. In June and July, height was lowest for LCP 85-384 and L 99-226, averaging 19% less than L 99-233 in June and 15% less in July. Canopy width in May was greatest for L 99-226 and averaged 34% more than LCP 85-384 and HoCP 96-540. In June, reduction in photosynthetically active radiation (PAR), a measure of light penetration into the crop canopy, was greatest for L 99-226 (87%) and lowest for LCP 85-384 and HoCP 96-540 (approximately 62%). Changes in growth characteristics of the six cultivars in the second production year were measured at 7 to 10 day intervals across the growing season in 2008. Seasonal changes in shoot population, canopy width, ground cover, height, and shading within the crop canopy were evaluated for the cultivars using trend analysis. For each of the cultivars analysis of data showed a significant linear trend. Differences in shoot emergence among the cultivars were observed beginning in early April and as the season progressed, shoot production and canopy height increased for Ho 95-988, L 97-128, L 99-226, and L 99-233 but lagged for LCP 85-384 and HoCP 96-540. Beginning in mid-April, ground cover increased most rapidly for L 99-233. In late May, ground cover was approximately 60% for LCP 85-384 and HoCP 96-540; approximately 70% for Ho 95-988, L 97-128, and L 99-233; and was approaching 90% for L 99-226. Sugarcane canopy height across the growing season was consistently greatest for L 97-128 and L 99-233 and averaged 21% more than for the other cultivars in early June and 15% more in mid-July. Based on PAR data collected in the row middles, sunlight in the sugarcane canopy at ground level was reduced an average of 61% in early June for L 97-128 and L 99-226 compared with 29% for LCP 85-384 and HoCP 96-540. By late July, PAR reduction was equal and averaged 90% for Ho 95-988, L 97-128, L 99-226, and L 99-233 compared with 78% for LCP 85-384 and HoCP 96-540. The early-season, aggressive growth and development of L 97-128, L 99-226, and L 99-233 could be especially beneficial in early season weed management. Differences observed among the cultivars in the ability to restrict sunlight within the crop canopy later in the growing season suggest that weeds would be more competitive in LCP 85-384 and HoCP 96-540 compared with the other cultivars.
INTRODUCTION

In 2007, sugarcane was grown on approximately 169,540 hectares by 609 producers in Louisiana (Anonymous 2008). The total value of the sugarcane crop to Louisiana growers, processors and landlords for sugar was $666.9 million, ranking sugarcane as the number one agronomic crop in Louisiana. Sugarcane is grown as a perennial with four to five annual harvests made from a single, vegetatively propagated planting. The sub-tropical climate in Louisiana is such that sugarcane is killed each year by winter freeze, and the growing season is much shorter than in more traditional sugarcane growing areas. Therefore, it is imperative that sugarcane cultivars be developed specifically for Louisiana. Cultivar releases are through a three way agreement among the American Sugarcane League, the LSU AgCenter, and USDA-ARS. This cultivar development team consists of breeders, plant pathologists, entomologists, and weed scientists, each contributing to the assessment of cultivar characteristics. Cultivar recommendations are based primarily on tonnage and sugar yield, stubble longevity, disease/insect reaction, cold tolerance and herbicide tolerance. Sugarcane cultivars can vary in regard to growth characteristics which can directly affect weed competition.

The sugarcane cultivar LCP 85-384 was released in 1993 and in 2003 was grown on 88% of the total sugarcane hectarage in Louisiana (Robert et al. 2004). This cultivar has high plant population of small diameter stalks, good stubbling ability, good adaptation to all soil types, and cold tolerance. LCP 85-384 is considered to be an early-maturing cultivar with superior sugar and cane yields (LaBorde et al. 2008; Milligan et al. 1994). However, since 2000, LCP 85-384 has become susceptible to brown rust (Puccinia melanocephela) and has lost vigor and stubbling ability. In 2007, LCP 85-384 was grown on approximately 46% of the planted hectarage followed by the newer cultivars, HoCP 96-540 and L 97-128 with 31 and 12% of the hectarage, respectively, (Ben Legendre, personal communication).

Ho 95-988 was released for commercial planting in 2004 primarily because of its genetic diversity, resistance to several diseases and increased yield potential. Ho 95-988 is a medium maturing cultivar that has consistently yielded 7% more sugar than LCP 85-384 in both plant-cane and ratoon crops (Tew et al. 2005b). Ho 95-988 produces a high population of medium-sized stalks, has good stubbling ability, and is adapted to all soil types. The sugarcane cultivar HoCP 96-540 was released in 2003 (Tew et al. 2005a) and has yielded 10 to 15% more sugar than LCP 85-384 in both plant-cane and ratoon crops. HoCP 96-540 is a medium maturing cultivar that produces a moderate population of medium-sized stalks. The sugarcane cultivar L 97-128 was released in 1993 by the LSU AgCenter and is a very early maturing cultivar with early vigor, an average population of large-diameter stalks, good stubbling ability, and is adapted to all soil types (Gravois et al. 2008).

Two of the more recently released cultivars are L 99-226 and L 99-233. L 99-226 produces an average population of large-diameter stalks and has good stubbling ability (Anonymous 2006a; LaBorde et al. 2008). L 99-226 is a medium maturity cultivar with very good shading and high tonnage, and is adapted to all soil types (Robert et al. 2004). L 99-233 produces a high population of small diameter stalks and has excellent stubbling ability (Anonymous 2006b; LaBorde et al. 2008). L 99-233 is a medium maturity cultivar with good
shading ability and is adapted to all soil types. L 99-226 has sugarcane borer resistance, but L 99-233 is susceptible to sugarcane borers. Both cultivars are prone to lodging. In a preliminary study conducted in 2007 at St. Gabriel, LA, the plant-cane crop of HoCP 96-540 in mid-April had lower shoot population than LCP 85-384, L 97-128, and L 99-226 (Griffin and Boudreaux 2007). In mid-May, L 99-128 and L 99-233 were taller and produced a wider canopy than HoCP 96-540 and LCP 85-384. In June and July, L 97-128 and L 99-233 were taller than LCP 85-384.

Research has addressed sugarcane cultivar response to premergence and postemergence herbicides (Griffin and Kitchen 1990; Miller et al. 1998; Richard 1989, 1996). For the most part, sugarcane cultivars are consistent in their reaction to labeled herbicides. Some cultivars, however, are more sensitive to asulam, particularly when applied in late June or July (Richard and Griffin 1993). The differences among sugarcane cultivars in growth characteristics may affect their ability to compete with weeds. Sugarcane cultivars that emerge early in the spring following the winter dormant period and that produce a high population of stalks per hectare with leaves less upright in growth habit would be more competitive with early emerging weeds. Shading from the crop would be especially important after the layby cultivation in May as weeds reestablish. The degree of shading by the crop canopy would be especially critical to the reestablishment of bermudagrass (*Cynodon dactylon* L. Pers.), a major weed problem in sugarcane in Louisiana. Richard (1995) reported that bermudagrass biomass in July increased by 340% from the first production year to the second production year and 490% between the second and third production years.

Selection of a sugarcane cultivar could therefore play an important role in the management of problematic weeds. Our objective in this study was to quantify seasonal changes in sugarcane shoot production, canopy width and height, and light penetration into the crop canopy during the first and second production years for the cultivars LCP 85-384, Ho 95-988, HoCP 96-540, L 97-128, L 99-226, and L 99-233.

**MATERIALS AND METHODS**

The sugarcane cultivars: LCP 85-384, Ho 95-988, HoCP 96-540, L 97-128, L 99-226, and L 99-233 were planted using whole stalks in September, 2006 at the Sugar Research Station in St. Gabriel, LA. The soil type was a Commerce silt loam (fine silty, mixed, superactive, nonacid, thermic Fluvaquentic Endoaquept) with 1.01% organic matter and pH of 5.9. Cultivars were planted in a randomized complete block experimental design with four replications, and plots consisted of three rows, each 1.8 by 15.2 m in length. Cultural practices each year included February application of paraquat to control winter weeds, tillage of row sides and middles and application of pendimethalin at 4 kg ai/ha plus metribuzin at 1.5 kg ai/ha in March followed by side dress fertilization of UAN (32%) consisting of 134 kg N/ha and a layby tillage and application of pendimethalin at 3.36 kg/ha plus atrazine at 4.48 kg/ha. In this study weeds were eliminated as a factor affecting sugarcane growth.

Data collection was initiated in the spring of 2007 (first production year) and continued in 2008 (second production year) when plants were emerging following the winter dormant period. Sugarcane shoot population was determined by counting all shoots in the center row of each 3-
row plot. Canopy height and width were determined at five randomly selected areas in the center row of each plot. Height measurements were made to the uppermost leaves of the crop canopy, and width represented the distance between the outermost leaves of the canopy. Percent ground cover was determined visually and represented the total amount of sugarcane foliage covering the area from the center of the sugarcane drill to the center of the row middle. In 2007, shoot population data were collected April 11, canopy height data were collected May 15, June 27 and July 24, and canopy width data were collected May 15. In 2008, data were collected every 7 to 10 days for shoot population (March-April), canopy width and ground cover (March-May), and canopy height (March-July).

Beginning in June, photosynthetically active radiation (PAR) was measured during cloud-free days at noon using an AccuPAR Linear PAR Ceptometer\(^1\). Ten subsample measurements were made in each plot holding the Ceptometer 5 cm above ground level in the center of the row middles of each plot parallel to the sugarcane drill. Averages of the 10 subsamples were compared with those for a full sun light measurement to calculate PAR reduction. Measurements were made June 26, 2007 and in 2008 every 7 to 10 days beginning June 2 until August 28. Lodging caused by Hurricane Gustav on September 1, 2008, prevented data collection thereafter. Additionally, in June of 2008 five stalks in each plot were selected and marked. Measurements of height from the ground to the uppermost leaf collar were made every 7 to 10 days until August.

In mid-August of 2008, stalk population was determined by counting number of stalks from a randomly selected 6-m section from the center row of each plot. Sugarcane was harvested November 7, 2008 using a commercial single row chopper harvester and a dump wagon fitted with three load cells capable of being tared between plots to determine total sugarcane yield. Before harvesting, samples of six randomly selected stalks were hand harvested and weighed to determine average stalk weight. Stalk samples were then crushed and the juice was extracted for analysis of sugar concentration using near infrared spectroscopy as the standard methodology described by Berding et al. (2004). Sugar yield was calculated by multiplying theoretical recoverable sugar (TRS) (kg/mt) by sugarcane yield (mt/ha).

Data in common for both years including shoot population in April; canopy height in May, June, and July; canopy width in May, and PAR reduction in June were subjected to Mixed Procedure in SAS (SAS Institute 2003) with years and replications (nested within years) considered random effects. For canopy height inclusion of date (May, June, and July) as a variable allowed for comparison of cultivars in respect to canopy development early in the growing season. For all variables, considering years as environmental or random effects permit inferences about treatments to be made over a range of environments (Carmer et al. 1989; Hager et al. 2003). Type III statistics were used to test the fixed effects, and least square means were used for mean separation at \(P \leq 0.05\). Letter groupings were converted using the PDMIX800 macro in SAS (Saxton 1998). Data collected the second year every 7 to 10 days during the growing season for shoot population, canopy width, ground cover, canopy height, uppermost collar height, and PAR reduction for the six

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cultivars were analyzed separately in SAS. Significant cultivar by date interactions were observed for all parameters measured, and data for each cultivar were analyzed over time using trend analysis in Mixed Procedure in SAS. A significant cultivar effect was also observed for data collected over time, and mean separation was performed using Fisher’s protected LSD at $P \leq 0.05$. Stalk population in August and stalk weight, TRS, sugarcane yield, and sugar yield for the second year were also analyzed in SAS. Significant differences among sugarcane cultivars were observed only for sugarcane yield and sugar yield, and mean separation was performed using Fisher’s protected LSD at $P \leq 0.05$.

RESULTS AND DISCUSSION

First and Second Production Years

Averaged across the 2007 and 2008 growing seasons shoot population in April was greatest for L 99-226 and averaged 23% more than for HoCP 96-540 and approximately 14% more than for Ho 95-988 and L 97-128 (Table 1). Moreover, LCP 85-384 and L99-233 had greater shoot population in April (104, 090 and 107, 630 shoots/ha) compared to HoCP 96-540 (92,300 shoots/ha). A cultivar that emerges rapidly and produces high shoot population should be competitive with early emerging weeds. Plant height for all cultivars increased from May through July an average of 2.3 to 2.9 fold (Table 1). In May, June, and July, height was greatest for L 97-128 and L 99-233. In June and July, height was lowest for LCP 85-384 and L 99-226, averaging 19% less than L 99-233 in June and 15% less than L 99-233 in July. Canopy height for all varieties increased from May through July and the increase ranged from 119 cm for LCP 85-384 to 146 cm for L 99-233. Comparing across dates, canopy height of LCP 85-384 in July was equal to that of L 97-128 and L 99-233 in June further showing the growth disadvantage of LCP 85-384. Sugarcane canopy width in May was greatest for L 99-226 (104 cm), intermediate for Ho 95-988, L 97-128, and L 99-233 (average of 91.4 cm), and lowest for LCP 85-384 and HoCP 96-540 (average of 77.9 cm) (Table 1). Reduction in PAR provides a measure of the ability of cultivars to reduce light penetration into the crop canopy and would be affected by shoot population, height, and canopy width. In June, reduction in PAR was 80 to 87% for Ho 95-988, L 97-128, L 99-226, and L 99-233 but no more than 62% for LCP 85-384 and HoCP 96-540 (Table 1).

Comparing growth parameters for L 99-226 and HoCP 96-540, height in May and June for the two cultivars was equal, but early season shoot population, canopy width, and PAR reduction was greater for L 99-226 (Table 1). Additionally, height, canopy width, and PAR reduction were greater for L 97-128 and L99-233 in comparison with HoCP 96-540. These findings suggest that HoCP 96-540 would be a weak competitor with weeds across the growing season. A rapid increase in shoot population and canopy development would be especially important where bermudagrass is a problem. Bermudagrass is difficult to control with herbicides (Richard 1995). The suppression of bermudagrass with herbicide along with early competition from the crop could enhance the ability to manage bermudagrass infestations.
Second Production Year

Changes in growth characteristics of the six cultivars were measured at 7 to 10 day intervals across the growing season in 2008. For changes in shoot population from March through April, a significant linear trend was observed for all cultivars (Table 2). Sugarcane shoot emergence was slow during March but in April, differences in shoot population among the cultivars were evident (Figure 1). Shoot population tended to be lowest for HoCP 96-540 and highest for L 99-233. For changes in sugarcane canopy width from March through May, significant linear and quadratic trends were observed (Table 2). Canopy width changed little for the cultivars in March (Figure 2). In early April, sugarcane growth and canopy development increased for all cultivars. During April and May, canopy width for LCP 85-384 and HoCP 96-540 tended to be less than the other cultivars.

Sugarcane ground cover is a reflection of shoot population, biomass accumulation, and growth characteristics of the cultivars. Changes in ground cover from March through May followed a linear trend for all cultivars (Table 2). LCP 85-384 and HoCP 96-540 have an upright growth habit whereas leaf blades of L 99-226 tend to grow outward from the stalk rather than upright (Ben Legendre, personal communication). Because of these differences, leaves of L 99-226 could shade row middles more quickly than other commercial cultivars. Percentage ground cover was consistently less for LCP 85-384 and HoCP 96-540 compared with the other cultivars (Figure 3). Beginning in mid-April, ground cover increased rapidly for L 99-226 and L 99-233. In late May, ground cover was leveling off and was approximately 60% for LCP 85-384 and HoCP 96-540 and approximately 70% for Ho 95-988, L 97-128, and L 99-233. In contrast, ground cover in late May for L 99-226 was approaching 90%. The more open growth habit of L 99-226 would contribute to more rapid canopy closure and reduced sunlight in the row middles. For all cultivars, changes in sugarcane canopy height from March through July and uppermost leaf collar height from June through August followed highly significant linear trends (Table 2). For both canopy height and collar height, values were consistently greater for L 97-128 and L 99-233 (Figures 4 and 5). On August 28, uppermost collar height was 226 cm for LCP 85-384, 239 cm for HoCP 96-540, 238 cm for Ho 95-988, and 215 cm for L 99-226 compared with 245 cm for L 97-128 and 240 cm for L 99-233.

Sugarcane shoot population, canopy width, ground cover, and height would all affect light penetration into the sugarcane canopy. Based on PAR data collected at ground level in the row middles from June through August, light reduction across the growing season followed a linear trend (Table 2) and PAR reduction was lowest for LCP 85-384 and HoCP 96-540 (Figure 6). In early June, PAR was reduced an average of 61% for L 97-128 and L 99-226 compared with 29% for LCP 85-384 and HoCP 96-540. Reduction in PAR for LCP 85-384 and HoCP 96-540 in mid-July was less than 60% compared with approximately 75 to 85% PAR reduction for the other cultivars. PAR reduction of 90% was reached in late July for Ho 95-988, L 97-128, L 99-226, and L 99-233. For LCP 85-384 and HoCP 96-540 90% PAR reduction was not attained until late August.

A significant cultivar effect was observed for shoot population, canopy width, ground cover, and canopy height data collected from March through July (Table 3). Shoot population for L 99-226 and L 99-233 averaged 97,600 shoots/ha. Shoot population was lowest for HoCP 96-540 (83,440 shoots/ha) and equal to that for LCP 85-
Canopy width and ground cover were greatest for L 97-128, L 99-226, and L 99-233 (average of 85.9 cm and 48%), intermediate for Ho 95-988 (82.8 cm and 42%), and lowest for LCP 85-384 and HoCP 96-540 (average of 75.7 cm and 33%). Canopy height was greatest for L 97-128 and L 99-233 (average of 153.3 cm), intermediate for Ho 95-988 (141.8 cm), and lowest for LCP 85-384, HoCP 96-540, and L 99-226 (average of 128.8 cm). Differences observed among the six sugarcane cultivars suggest that cultivar selection could play an important role in weed management. Based on growth characteristics, L 99-233 and L 97-128 were most aggressive early in the season and followed closely by L 99-226. The wide canopy and ground cover with L 99-233 and L 99-226 would be especially beneficial in early season weed management. In other research where sugarcane was grown with purple nutsedge (Cyperus rotundus L.), L 97-128 shoot and root dry weight averaged approximately twice that for LCP 85-384, Ho 95-988, and HoCP 96-540 (Etheredge et al. 2006). Of the cultivars, L 97-128 produced the greatest shoot population and height indicating that growth characteristics of sugarcane cultivars affect the ability to compete with purple nutsedge.

A significant cultivar effect was also observed for uppermost collar height and PAR reduction data collected from June through August (Table 3). Average uppermost collar height for HoCP 96-540 was 11.4 cm greater than that of L 99-226. Differences in growth habit among the cultivars were reflected in light interception within the sugarcane canopy. Reduction in PAR was highest for L 97-128 and L 99-226 (average of 81%), intermediate for Ho 95-988 and L 99-233 (average of 74%), and lowest for LCP 85-384 and HoCP 96-540 (average of 58%). Differences observed among the cultivars in the ability to restrict sunlight within the crop canopy could have a significant effect on weed emergence and growth. In other research, purple nutsedge shoot population and shoot dry weight when grown under 70 and 90% shade were reduced an average of 82 and 92%, respectively (Etheredge et al. 2006). Exposure to 70 and 90% shade decreased red morningglory (Ipomoea coccinea L.) plant population 37 and 43%, respectively, and biomass per plant 27 and 48%, respectively (Jones et al. 2006). In a preliminary study, bermudagrass ground cover and above ground biomass were reduced approximately 50% more when exposed to 90% shade compared with 70% shade (Bittencourt and Griffin 2009). Using results from the bermudagrass study and the PAR reduction observed for the sugarcane cultivars in the present study, it would be expected that bermudagrass would more readily reestablish in June and July in LCP 85-384 and HoCP 96-540 compared with L 97-128, Ho 95-988, L 99-226, and L 99-233.

In 2008, stalk population in August and stalk weight and TRS did not differ among the sugarcane cultivars (data not shown). Sugarcane yield was equivalent for Ho 95-988, HoCP 96-540, L 97-128, L 99-226, and L 99-233 and averaged 53.18 mt/ha (Table 3). Sugarcane yield for LCP 85-384 averaged 30% less compared with that for Ho 95-988, HoCP 96-540, and L 99-226. Highest sugar yield was observed for HoCP 96-540 (7.39 mt/ha) which was equivalent to that for Ho 95-988, L 99-226, and L 99-233. For LCP 85-384 and L 97-128 sugar yields averaged 31% less than for HoCP 96-540.

Sugarcane cultivar recommendations in Louisiana are based primarily on yield (tonnage and sugar), stubble longevity, disease/insect reaction, and cold tolerance. This research shows
that sugarcane cultivars vary in regard to growth characteristics which can affect their ability to compete with weeds. It should be noted that weeds were not a limiting factor in this study. In a sugarcane production system weed control measures represent a major investment. Findings from this research could be applicable to the development of effective and season long weed control programs that consider specific characteristics of sugarcane cultivars and their impact on weed competition. It may be possible for growers to select cultivars that would be most productive where specific weed problems exist and to customize weed control programs based on cultivar selection.

ACKNOWLEDGMENTS

Partial funding for this research was provided by the American Sugar Cane League.

REFERENCES CITED


### Table 1. Average shoot population and canopy height, width, and percentage PAR reduction for six sugarcane cultivars during the 2007 and 2008 growing seasons.

<table>
<thead>
<tr>
<th>Cultivars</th>
<th>Shoot population no./ ha</th>
<th>Canopy height May cm</th>
<th>Canopy width June cm</th>
<th>PAR % reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCP 85-384</td>
<td>104,090 ab</td>
<td>86.4 i</td>
<td>157.8 g</td>
<td>61 c</td>
</tr>
<tr>
<td>Ho 95-988</td>
<td>99,320 bc</td>
<td>83.4 ij</td>
<td>175.9 e</td>
<td>80 b</td>
</tr>
<tr>
<td>HoCP 96-540</td>
<td>92,300 c</td>
<td>76.4 ij</td>
<td>168.7 ef</td>
<td>62 c</td>
</tr>
<tr>
<td>L 97-128</td>
<td>100,180 bc</td>
<td>100.5 h</td>
<td>194.7 d</td>
<td>83 ab</td>
</tr>
<tr>
<td>L 99-226</td>
<td>113,490 a</td>
<td>75.8 j</td>
<td>164.6 fg</td>
<td>87 a</td>
</tr>
<tr>
<td>L 99-233</td>
<td>107,630 ab</td>
<td>97.1 h</td>
<td>197.9 cd</td>
<td>81 b</td>
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</tbody>
</table>

1 Data averaged for 2007 (first production year) and 2008 (second production year). Canopy light penetration was determined by measuring PAR (photosynthetically active radiation) using an AccuPAR Ceptometer placed 5 cm above ground level in the center of row middles of each plot. Data expressed as percent reduction compared with full sunlight measurements.

2 Means within columns followed by the same letter are not significantly different according to the \( t \) test on least square means at \( P=0.05 \). For height data, mean comparisons can be made within and among columns.
Table 2. Trend Analysis of shoot population, canopy width, ground cover, canopy height, uppermost collar height, and percentage PAR (photosynthetically active radiation) reduction for six sugarcane cultivars during the 2008 growing season.¹

<table>
<thead>
<tr>
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<td>Shoot population</td>
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<td>Canopy width</td>
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</table>

¹ For all parameters measured significant cultivar by date interactions were not observed. Data for each cultivar over time were analyzed using Trend Analysis to evaluate significance of linear and quadratic responses. Where trends were significant p-values are provided. NS= not significant. Data presented in Figures 1 through 6.
Table 3. Average shoot population, canopy width, ground cover, canopy height, uppermost collar height, percentage PAR (photosynthetically active radiation) reduction, and yield for six sugarcane cultivars during the 2008 growing season.1

<table>
<thead>
<tr>
<th>Cultivars</th>
<th>Shoot population no./ha</th>
<th>Canopy width cm</th>
<th>Ground cover %</th>
<th>Canopy height cm</th>
<th>Uppermost collar height cm</th>
<th>Reduction in PAR %</th>
<th>Sugarcane yield mt/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCP 85-384</td>
<td>86,710 bc d</td>
<td>77.3 c</td>
<td>33 d</td>
<td>127.7 c</td>
<td>174.8 bc</td>
<td>58 c</td>
<td>4.60 c</td>
</tr>
<tr>
<td>Ho 95-988</td>
<td>89,430 bc</td>
<td>82.8 b</td>
<td>42 c</td>
<td>141.8 b</td>
<td>180.0 bc</td>
<td>73 b</td>
<td>6.92 ab</td>
</tr>
<tr>
<td>HoCP 96-540</td>
<td>83,440 c</td>
<td>74.1 c</td>
<td>32 d</td>
<td>131.3 c</td>
<td>184.3 b</td>
<td>58 c</td>
<td>7.39 ab</td>
</tr>
<tr>
<td>L 97-128</td>
<td>88,140 bc d</td>
<td>84.9 c</td>
<td>46 bc</td>
<td>152.9 a</td>
<td>213.1 a</td>
<td>80 a</td>
<td>5.60 bc</td>
</tr>
<tr>
<td>L 99-226</td>
<td>88,580 ab</td>
<td>87.2c</td>
<td>47 ab</td>
<td>175.5 c</td>
<td>203.9 c</td>
<td>81 a</td>
<td>6.26 ab</td>
</tr>
<tr>
<td>L 99-233</td>
<td>100,620 a</td>
<td>85.6 ab</td>
<td>51 a</td>
<td>153.7 c</td>
<td>203.9 c</td>
<td>74 b</td>
<td>6.19 ab</td>
</tr>
</tbody>
</table>

1 Data represent averages for data collected every 7 to 10 days for shoot population (March-April), canopy width and ground cover (March-May), canopy height (March-July), and uppermost collar height and reduction in PAR (June-August). Sugarcane was harvested on November 7.

2 Means within columns followed by the same letter are not significantly different using Fisher’s protected LSD at P ≤ 0.05.
Figure 1. Changes in shoot population for six sugarcane cultivars from March through April, 2008. See Table 2 for Trend Analysis of linear and quadratic responses.

Figure 2. Changes in canopy width for six sugarcane cultivars from March through May, 2008. See Table 2 for Trend Analysis of linear and quadratic responses.
Figure 3. Changes in ground cover for six sugarcane cultivars from March through May, 2008. See Table 2 for Trend Analysis of linear and quadratic responses.

![Ground Cover Graph]

Figure 4. Changes in canopy height for six sugarcane cultivars from March through July, 2008. See Table 2 for Trend Analysis of linear and quadratic responses.

![Canopy Height Graph]
Figure 5. Changes in uppermost collar height for six sugarcane cultivars from June through August, 2008. See Table 2 for Trend Analysis of linear and quadratic responses.

Figure 6. Changes in percentage PAR (photosynthetically active radiation) reduction for six sugarcane cultivars from June through August, 2008. See Table 2 for Trend Analysis of linear and quadratic responses.