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Effects of rate of planting on yield and some yield components of sugarcane

Ray Ricaud

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Effects of
Rate of Planting on Yield
And Some Yield Components Of Sugarcane

RAY RICAUD and
GILBERT LANDRY, JR.
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Ray Ricaud and Gilbert Landry, Jr.

Introduction

The culture of sugarcane in Louisiana has been based largely on traditions developed by generations of growers rather than on research. There are many variations in cultural practices employed in the production of sugarcane. Due to increasing costs of production and shortages of farm labor, growers are interested in using the best cultural practices to produce maximum yields.

Alternate methods of planting, such as narrow row spacing and double drill planting on wide rows, have been shown to increase stalk population and yield. However, cane planted on rows other than the standard width requires the modification of equipment and is difficult to cultivate and harvest without damaging the crop.

Although the recommended rate of planting sugarcane is two stalks with a 10 percent lap, the rates vary widely among growers and locations. The rates range from two to five stalks in a continuous line on rows six feet wide. Varieties which produce low plant populations are usually planted at higher rates. Also, soil areas which consistently produce low plant populations and yields are usually planted at higher rates.

In view of the wide variations in rates of planting now used and the problems involved with alternate methods of planting, more research has been needed on rates of planting. Also, the development of new varieties and better cultural practices has created the need for testing rates of planting to increase yields.

The objective of this study was to determine the effects of several rates of planting on the yield, stalk population, and other yield components of current sugarcane varieties at several locations in Louisiana.

Review of Literature

The planting of sugarcane in Louisiana was first described by DeBow (5) in 1846 as a process in which three cane stalks were laid in a row at a distance of four inches apart. In 1900, Stubbs (16) described the planting

1Professor and Graduate Assistant, respectively, Department of Agronomy, Louisiana Agricultural Experiment Station, Baton Rouge.

2Italic numbers in parentheses refer to Literature Cited, Page 28.
of sugarcane as involving the opening of a furrow in the center of the row with a double moldboard plow, depositing two to four continuous lines of cane into the furrow, and covering the cane with soil using a cultivator.

Hebert (7) reported that whole stalks were used for planting in Louisiana, whereas in other countries, discarded portions of stalks, cane tops, or short stalk pieces were used satisfactorily. He found that planting two stalks with a lap was more beneficial than planting two stalks or one-and-a-half stalks without a lap. Arceneaux (2) found that by using small seed pieces instead of whole stalks, yield was reduced because of cane rot. He obtained a slight increase in yield of sugar per ton of cane, but not in yield of cane per acre by increasing the rate of planting from two to three stalks. Matherne (13) reported that increasing planting rates often gave higher early plant populations, but that competition during the growing season eliminated most of the added shoots. These increased plant populations were accompanied by a corresponding decrease in stalk weight. The increase in yield by planting three and four stalks over the normal two-stalk rate was not significant.

Dillewijn (6) found that 25 percent of the stalk population at harvest was primary shoots, and that increasing the planting rate increased the initial number of shoots but not necessarily the millable stalk populations. Bains (3) in Calcutta found that seed rates of 30,000 to 35,000 setts produced higher yields than 25,000 setts per acre. Boyce (4) in Pangola found that the planting of excessive seed cane to insure maximum yields was justified under most conditions. Thompson (17) in Natal reported that the only real disadvantage to planting higher rates for maximum stalk number was the cost of the seed cane. Mathur and Singh (14) in India found that an increase in planting rate increased the number of tillers and millable cane, especially in low tillering varieties.

Matherne (12) obtained significant increases in stalk population by planting two drills on six-foot rows. Williams and Forte (20) reported that the mortality rate of the early shoots was higher with double drill than single drill planting, but not high enough to offset the significantly higher plant population and cane yield obtained with the double drill planting. Matherne (11) reported that significantly higher plant populations and cane yield were obtained by reducing the row width from six to three feet. He found that the cane on narrow rows was very difficult to cultivate and harvest.

Humbert (9) stated that sugarcane varieties have a very important role in determining the optimum row spacing or plant population to produce high yields. He also reported that stalks produced on narrow rows were smaller in diameter and lighter than those produced on wider spaced rows, and row widths of less than five feet were not economical.

Abbott (1) emphasized the importance of vigorous germination and production of good initial stands or populations of cane rather than the amount of seed cane required for planting. He pointed out that it was
important to use a high quality cane for planting and that poor germination was due largely to disease, insect, and mechanical damage to the seed cane.

Varma (19) in India obtained a significant positive correlation between cane yield and percent germination, cane height, and number of stalks. Cane yield was not associated with the number of tillers per plant or the diameter of stalks. Legendre (10) and Matherne (11) found a significant positive correlation between cane yield and number of stalks per acre. They also found a positive association between sugar yield and number of stalks per acre.

**Experimental Procedure**

Seven experiments were conducted at four locations to determine the effects of rates of planting on the yield and some of the yield components of sugarcane varieties in Louisiana.

The experiments were conducted on the locations, soil types and in the years shown in Table 1. The experiments were numbered according to the soil type and cane varieties tested rather than chronologically by years. Experiment 1 was with plant cane in 1971 and Experiment 2 was with plant cane in 1972 and first stubble cane in 1973. Experiments 3 and 4 were with plant cane in 1973 and 1974, respectively. Experiment 5 was with plant cane in 1973. Experiment 6 was with plant cane in 1971 and Experiment 7 was with plant cane in 1972 and first stubble in 1973. All the experiments were conducted on silt loam soils except Experiment 5, which was conducted on a silty clay loam soil.

The rates of planting tested in each experiment were two, three, and four stalks. A two-plus-two rate was also included in the St. Gabriel

<table>
<thead>
<tr>
<th>Experiment number</th>
<th>Location</th>
<th>Soil type</th>
<th>Year conducted</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Alma Plantation</td>
<td>Commerce sil</td>
<td>1971</td>
</tr>
<tr>
<td>2</td>
<td>St. Gabriel Station</td>
<td>Commerce sil</td>
<td>1972-73</td>
</tr>
<tr>
<td>3</td>
<td>St. Gabriel Station</td>
<td>Commerce sil</td>
<td>1973</td>
</tr>
<tr>
<td>4</td>
<td>St. Gabriel Station</td>
<td>Commerce sil</td>
<td>1974</td>
</tr>
<tr>
<td>5</td>
<td>Woodlawn Plantation</td>
<td>Mhoon sicl</td>
<td>1973</td>
</tr>
<tr>
<td>6</td>
<td>Allain Plantation</td>
<td>Jeanerette sil</td>
<td>1971</td>
</tr>
<tr>
<td>7</td>
<td>Allain Plantation</td>
<td>Jeanerette sil</td>
<td>1972-73</td>
</tr>
</tbody>
</table>
experiments. This was a different method of planting the four-stalk rate in which two stalks were planted in two drills 12 inches apart on each row. The other rates were planted in one drill on each row. The rate of planting refers to the number of cane stalks planted in a continuous line with a 10 percent overlap in rows six feet wide.

The cane varieties in Experiments 1 through 5 on Commerce and Mhoon soils were CP 48-103, L 60-25, CP 61-37, and L 62-96. The varieties in Experiments 6 and 7 on Jeanerette soil were CP 52-68, L 60-25, CP 61-37, and L 62-96. The varieties were chosen according to their adaptation to the soil type at each location. Each rate of planting was tested with four varieties in factorial experiments using a randomized block design with three or four replications. The plots were three rows wide and from 35 to 60 feet long.

The cane in each experiment was harvested at a normal harvest time, usually in November for stubble cane and in December for plant cane. The cane yield on each plot, except in Experiments 2 and 3, was obtained by weighing the cane with tractor-mounted scales. In these two exceptions, the yield was calculated by multiplying the average stalk weight by the number of millable stalks. This method of measuring yield was described by Hebert (8).

A 10-stalk sample from each plot was crushed at harvest time with a sample mill for juice analysis. Percent brix in the cane juice was determined with a brix hydrometer, standardized at 20 degrees Centigrade. Polariscope readings of the juice were made with a Bausch and Lomb polarscope using the lead subacetate method described by Meade (15). Percent sucrose in the juice was obtained from conversion tables (15) using the percent brix and polarscope readings. The percent brix and sucrose were converted to normal juice brix and sucrose values using mill factors from a commercial sugar mill. Sugar yield per ton of cane was determined in accordance with the data published annually by the U.S. Department of Agriculture on sugar commercially recoverable from sugarcane (18). Sugar yield per acre was calculated from the sugar per ton and cane yield per acre.

The yield components measured were stalk number, weight, length, and diameter. Plant population counts were made during the first week of each month during the growing season in four of the experiments. All the shoots were counted from April through August and only the millable stalks were counted in September and October. The average stalk weight, length, and diameter were determined at harvest time in two of the experiments. A 40-stalk sample from each plot was used to make these determinations.

**Results and Discussion**

The cane and sugar yield data obtained in the seven experiments on rates of planting are presented in Tables 2, 3, and 4. The plant popula-
tion data are presented as means in Table 5 and in detail in Appendix Tables 9 through 14. The data on stalk weight, length, and diameter are reported as means in Tables 6 and 7 and in detail in Appendix Tables 15 and 16. Simple correlation coefficients between some of the variables are shown in Table 8. A factorial analysis of the data from each experiment showed that there were no significant interactions between varieties and rates of planting. Therefore, the mean effects of rates are included in the discussion.

**Cane and Sugar Yield**

The yield data obtained in Experiments 1 through 5 on Commerce and Mhoon soils are reported in Table 2.

Results obtained with plant cane at Alma Plantation in Experiment 1 show the variety CP 48-103 produced a significantly lower yield with the two-stalk than with the four-stalk rate. The yields produced with varieties L 60-25 and L 62-96 were lower with the two-stalk than with the other rates. The yield with CP 61-37 was lower with the two-stalk than with the three-stalk rate.

The yield data obtained with plant cane at the St. Gabriel Experiment Station in Experiment 2 show that the cane yield produced with variety CP 48-103 was significantly lower with the two-stalk rate than with the other rates tested. Variety L 60-25 produced a lower cane yield with the two-stalk and four-stalk rates than with the two-plus-two rate. A lower cane yield was obtained with the two-stalk rate than with the four-stalk and two-plus-two stalk rates with variety CP 61-37. Variety L 62-96 produced a lower cane yield with the two-stalk rate than with the three-stalk rate. The data obtained with first stubble cane in Experiment 2 show that variety L 60-25 produced a lower cane yield with the two-stalk rate than with the three-stalk and two-plus-two rates. The cane yield produced with variety L 62-96 was lower with the two-stalk rate than with the four and two-plus-two rates.

The data obtained with plant cane at St. Gabriel in Experiment 3 show that varieties L 60-25 and L 62-96 produced lower cane yields with the two-stalk rate than with the four and two-plus-two rates. For both varieties, the three-stalk rate produced lower cane yields than the two-plus-two rate. The cane yield produced with variety CP 61-37 was lower with the two-stalk rate than with the two-plus-two rate.

Results from the plant cane at St. Gabriel in Experiment 4 indicate that the cane yields produced with varieties CP 48-103 and L 60-25 were significantly lower with the two-stalk rate than with the four and the two-plus-two rates. Variety L 62-96 produced a lower cane yield with the two-stalk rate than with the other rates tested. Varieties CP 48-103 and L 62-96 produced a lower cane yield with the three-stalk rate than with the two-plus-two rate.
Table 2.—Effects of rate of planting on the yield of four varieties of sugarcane in five experiments on Commerce and Mhoon soils

<table>
<thead>
<tr>
<th>Rate of planting1/ (stalks)</th>
<th>Cane yield of varieties (tons/a)</th>
<th>Mean yield Cane</th>
<th>Sucrose</th>
<th>Sugar (lb./a)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CP 48-103</td>
<td>L 60-25</td>
<td>CP 61-37</td>
<td>L 62-96</td>
</tr>
<tr>
<td>2</td>
<td>24.2</td>
<td>26.3</td>
<td>30.1</td>
<td>23.7</td>
</tr>
<tr>
<td>3</td>
<td>26.1</td>
<td>29.7</td>
<td>34.1</td>
<td>29.1</td>
</tr>
<tr>
<td>4</td>
<td>27.4</td>
<td>30.0</td>
<td>31.4</td>
<td>30.4</td>
</tr>
<tr>
<td>LSD (.05)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Plant cane, Exp. 1, Alma

|                             | 24.2                            | 26.3           | 30.1    | 23.7         | 26.1          | 14.0         | 5207          |
|                             | 26.1                            | 29.7           | 34.1    | 29.1         | 29.7          | 14.0         | 5976          |
|                             | 27.4                            | 30.0           | 31.4    | 30.4         | 29.8          | 14.5         | 6243          |
| LSD (.05)                   |                                 |                |         |              | 1.5           |              | 302           |

Plant cane, Exp. 2, St. Gabriel

|                             | 38.9                            | 42.1           | 42.6    | 42.5         | 41.5          | 12.9         | 7537          |
|                             | 44.0                            | 45.8           | 45.6    | 47.2         | 45.6          | 13.4         | 8631          |
|                             | 44.9                            | 44.7           | 47.0    | 46.1         | 45.7          | 13.0         | 8353          |
| 2 + 2                       | 44.6                            | 48.8           | 50.5    | 45.0         | 47.2          | 13.1         | 8627          |
| LSD (.05)                   |                                 |                |         |              | 1.9           |              | 353           |

Stubble cane, Exp. 2, St. Gabriel

|                             | 35.0                            | 33.2           | 36.1    | 30.1         | 33.6          | 13.1         | 6144          |
|                             | 36.4                            | 37.0           | 37.5    | 32.6         | 35.9          | 13.2         | 6636          |
|                             | 35.8                            | 36.2           | 36.4    | 34.0         | 35.6          | 13.1         | 6517          |
| 2 + 2                       | 38.0                            | 36.5           | 39.1    | 34.8         | 37.1          | 12.7         | 6523          |
| LSD (.05)                   |                                 |                |         |              | 1.6           |              | 311           |

(Continued)
Table 2.—(Continued)

<table>
<thead>
<tr>
<th>Rate of planting(^1/) (stalks)</th>
<th>Cane yield of varieties</th>
<th>Mean yield</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CP 48-103</td>
<td>L 60-25</td>
</tr>
<tr>
<td>2</td>
<td>35.3</td>
<td>40.5</td>
</tr>
<tr>
<td>3</td>
<td>37.5</td>
<td>44.0</td>
</tr>
<tr>
<td>4</td>
<td>38.3</td>
<td>45.8</td>
</tr>
<tr>
<td>2 + 2</td>
<td>38.1</td>
<td>49.2</td>
</tr>
<tr>
<td>LSD (.05)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Plant cane, Exp. 3, St. Gabriel   |           |         |          |         |      |        |             |

| 2                                | 36.7      | 35.4    | 30.9     | 30.1    | 33.3 | 14.0   | 6617        |
| 3                                | 37.7      | 37.3    | 31.5     | 33.1    | 34.9 | 14.2   | 7056        |
| 4                                | 39.9      | 39.8    | 31.3     | 34.8    | 36.4 | 13.9   | 7236        |
| 2 + 2                            | 41.9      | 39.1    | 31.8     | 36.0    | 37.2 | 13.9   | 7354        |
| LSD (.05)                        |           |         |          |         | 1.4  |        | 284         |

| Plant cane, Exp. 4, St. Gabriel   |           |         |          |         |      |        |             |

| 2                                | 26.8      | 27.7    | 30.9     | 26.1    | 27.9 | 14.7   | 5875        |
| 3                                | 28.0      | 28.7    | 34.8     | 28.0    | 29.9 | 14.9   | 6412        |
| 4                                | 29.0      | 31.2    | 34.1     | 29.1    | 30.8 | 15.0   | 6705        |
| LSD (.05)                        |           |         |          |         | 1.5  |        | 326         |

\(^1/\) The 2 + 2 rate is 2 stalks in 2 drills planted 12 inches apart.
Results obtained with plant cane at Woodlawn Plantation in Experiment 5 show that lower cane yields were produced with varieties L 60-25 and L 62-96 with the two-stalk rate than with the four-stalk rate. Variety CP 61-37 produced a lower cane yield with the two-stalk rate than with the three-stalk and four-stalk rates.

The yield data obtained in Experiments 6 and 7 on Jeanerette soil at Allain Plantation are reported in Table 3. Results with plant cane in Experiment 6 indicate that variety CP 52-68 produced a lower yield with the three-stalk than with the four-stalk rate. The yields produced with variety CP 61-37 were lower with the two- and three-stalk rates than with the four-stalk rate. Variety CP 62-96 produced less with the two-stalk rate than with three- and four-stalk rates.

Results with plant cane in Experiment 7 indicate that the cane yield produced with variety CP 61-37 was significantly lower with the two-stalk rate than with the three-stalk rate. Variety L 62-96 produced a lower yield with the two-stalk rate than with the three-stalk and four-stalk rates. Data from the first stubble cane in Experiment 7 indicate that variety CP 61-37 produced a lower cane yield with the two-stalk rate than with the three-stalk and four-stalk rates. The differences in cane yields due to the rate of planting were small with the other varieties.

The differences in cane yields between the rates of planting as an average of varieties in each experiment are presented in Table 4. The two-stalk rate produced a significantly lower cane yield than the three-stalk rate in six out of seven experiments, with an average difference of 2.3 tons per acre. The two-stalk rate produced a significantly lower cane yield than the four-stalk rate in all the experiments, with an average difference of 2.8 tons per acre. The three-stalk rate produced a significantly lower cane yield than the four-stalk rate in two of the experiments, with an average difference of 0.5 ton. In the three experiments in which the two-plus-two rate was tested, it produced a significantly higher cane yield than the four-stalk rate in one experiment, with an average increase of 1.4 tons. The two-plus-two rate produced a significantly higher cane yield than the two-stalk rate in each of the three experiments, with an average increase of 4.7 tons. This increase was due to the combined effect of increasing the planting rate and using the double drill method of planting.

The rate of planting did not significantly affect the percent sucrose in the normal juice of the varieties in each experiment. Therefore, the effects of rate of planting on the sugar yields were similar to those on the cane yields except for the small differences in the sugar yield in Experiment 7. The increases in the cane and sugar yields due to increasing the planting rate were more pronounced on the Commerce and Mhoon soils than on the Jeanerette soil and more with plant cane than with stubble cane.
Table 3.—Effects of rate of planting on the yield of four varieties of sugarcane in two experiments on Jeanerette soil

<table>
<thead>
<tr>
<th>Rate of planting (stalks)</th>
<th>Cane yield of varieties</th>
<th>Mean yield</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CP 52-68</td>
<td>L 60-25</td>
</tr>
<tr>
<td>2</td>
<td>29.1</td>
<td>33.3</td>
</tr>
<tr>
<td>3</td>
<td>28.4</td>
<td>33.5</td>
</tr>
<tr>
<td>4</td>
<td>31.1</td>
<td>32.0</td>
</tr>
<tr>
<td>LSD (.05)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Plant cane, Exp. 6, Allain

| 2                         | 34.5     | 32.3    | 38.8     | 31.9     | 34.4 | 14.2       | 7003         |
| 3                         | 34.4     | 32.6    | 41.8     | 37.3     | 36.5 | 13.9       | 7233         |
| 4                         | 35.6     | 34.4    | 41.0     | 35.8     | 36.7 | 13.6       | 7070         |
| LSD (.05)                 |          |         |          |          | 1.5  |            | NS           |

Plant cane, Exp. 7, Allain

| 2                         | 22.8     | 21.2    | 26.9     | 23.4     | 23.6 | 14.3       | 4844         |
| 3                         | 21.8     | 23.2    | 29.0     | 25.7     | 24.9 | 14.0       | 4980         |
| 4                         | 22.3     | 22.1    | 29.3     | 25.2     | 24.7 | 14.2       | 4984         |
| LSD (.05)                 |          |         |          |          | 1.2  |            | NS           |
Table 4.—Differences in cane yield between rates of planting as an average of varieties in each experiment

<table>
<thead>
<tr>
<th>Rate of planting Lower (stalks)</th>
<th>Experiment number and yield differences¹/</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1P</td>
<td>2P</td>
</tr>
<tr>
<td>2 3</td>
<td>3.6*</td>
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<tr>
<td>2 4</td>
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<td>0.1</td>
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<tr>
<td>2 2 + 2</td>
<td>-</td>
<td>5.7*</td>
</tr>
<tr>
<td>3 2 + 2</td>
<td>-</td>
<td>1.6</td>
</tr>
<tr>
<td>4 2 + 2</td>
<td>-</td>
<td>1.5</td>
</tr>
</tbody>
</table>

¹/The yield differences represent the increases in cane yield due to increasing the rate of planting from a lower to a higher rate. P is for plant cane and S is for first stubble cane.

*Significant at the .05 level of probability.
Plant Population

The plant population data obtained in Experiments 2, 3, 5, and 7 are reported as means in Table 5 and in detail for each variety in Appendix Tables 9 through 14. The total number of shoots or plants per acre are reported monthly from April to August and only the number of millable stalks are reported in September and October.

The data in Table 5 show that the plant population in each experiment increased with each increase in the rate of planting during the growing season. However, the increases were considerably larger in the total plant population early than in the number of millable stalks late in the season.

The data obtained in Experiment 2 at St. Gabriel indicate that the number of millable stalks produced with the two-stalk rate was lower than with the two-plus-two rate in the stubble cane.

Results with plant cane in Experiment 3 at St. Gabriel indicate that the millable stalk population in October with the two-stalk rate was lower than with the four-stalk rate. The stalk population with the two-plus-two rate was higher than with the other rates. This was the only experiment in which the two-plus-two rate produced significantly more millable stalks and cane yield than the four-stalk rate.

The data obtained with plant cane in Experiment 5 at Woodlawn Plantation show that the two-stalk rate produced a lower number of millable stalks than the four-stalk rate. The relatively low plant population obtained during the entire season at this location was probably due to poor weed control.

The data obtained in Experiment 7 at Allain indicate that the number of millable stalks in October with the two-stalk rate was lower than with the other rates in stubble cane but not in plant cane. The plant population in the stubble cane was unusually low, especially early in the growing season. It is not normal for plant cane to respond less to rates of planting and have a higher plant population than stubble cane. This was probably due to a poor rainfall distribution and is probably the reason that the differences in the sugar yield were unusually small at this location.

The plant population of all varieties increased rapidly during April and May to a maximum in June or July and decreased until October. This decrease was due to the dying of the weaker plants from plant competition, leaving only the millable stalks at harvest time. The plant population during the entire growing season was higher with variety L 60-25 and lower with variety L 62-96 than the other varieties tested (Appendix Tables 9-14).
Table 5.—Mean effect of rate of planting on the plant population in four of the experiments

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
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<th></th>
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<tbody>
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<td>71.4</td>
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<tr>
<td>LSD (.05)</td>
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<td>4.9</td>
<td>6.4</td>
<td>4.8</td>
<td>4.5</td>
<td>1.6</td>
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Plant cane, Exp. 2, St. Gabriel

<table>
<thead>
<tr>
<th>Plant population(^1/) (1000/\text{acre})</th>
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</thead>
<tbody>
<tr>
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<td>3</td>
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<tr>
<td>4</td>
</tr>
<tr>
<td>2 + 2</td>
</tr>
<tr>
<td>LSD (.05)</td>
</tr>
</tbody>
</table>

Stubble cane, Exp. 2, St. Gabriel

<table>
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<th>Plant cane, Exp. 3, St. Gabriel</th>
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</thead>
<tbody>
<tr>
<td>Plant population(^1/) (1000/\text{acre})</td>
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<td>--------------------------</td>
</tr>
<tr>
<td>2</td>
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<tr>
<td>3</td>
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<tr>
<td>4</td>
</tr>
<tr>
<td>2 + 2</td>
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<tr>
<td>LSD (.05)</td>
</tr>
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(Continued)
Table 5.—(Continued)

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<tbody>
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</table>

Plant cane, Exp. 5, Woodlawn

2 12.7 15.1 34.3 45.9 38.8 28.1 25.6
3 17.1 20.6 43.6 51.2 41.2 28.9 26.4
4 21.2 25.0 44.6 53.6 41.4 30.5 28.2
LSD (.05) 2.1 2.4 4.5 4.0 2.6 1.7 2.1

Plant cane, Exp. 7, Allain

2 25.0 31.2 59.2 66.2 50.5 33.6 30.8
3 28.0 33.8 64.2 69.8 53.6 34.0 32.3
4 31.0 37.7 67.5 72.2 57.0 35.3 32.6
LSD (.05) 2.3 2.9 4.3 2.4 4.7 NS NS

Stubble cane, Exp. 7, Allain

2 27.0 28.8 34.2 40.4 30.3 29.0 26.1
3 30.0 32.3 37.5 44.1 32.0 30.3 28.1
4 32.0 34.5 40.2 44.5 32.0 32.0 28.7
LSD (.05) 4.2 4.7 4.6 NS NS 1.8 1.9

\(^1/\)Average of four varieties.
Stalk Weight, Length, and Diameter

The data obtained on stalk size in Experiments 2 and 3 at the St. Gabriel Station are reported as means in Tables 6 and 7 and in detail for each variety in Appendix Tables 15 and 16. The rates of planting had no significant effects on the stalk weight, length, or diameter. The stalk weight decreased from plant to stubble cane for all varieties and rates of planting. The stalk weight, length, and diameter were largest in variety L 62-96 and smallest in variety L 60-25. Varieties CP 48-103 and CP 61-37 produced similar stalk sizes.

Correlations

Correlation coefficients between rate of planting, cane yield, and the yield components in four of the experiments are reported in Table 8. The degree of association between rate of planting and plant population decreased progressively during the growing season. This was apparently due to the more pronounced effect of rate of planting on the total plant population early than on the millable stalk number late in the season.

Significant positive correlations were obtained between the rate of planting and cane yield and between cane yield and the number of millable stalks in all experiments except one. However, the correlations between rate of planting and number of millable stalks were not significant. Generally, significant negative correlations were obtained between plant population and stalk weight, length, and diameter.

The correlations indicate that there was an unknown factor affecting the cane yield and millable stalk population during a short period of time late in the growing season. This was indicated by the higher correlations between cane yield and millable stalk population than the correlations between rate of planting and millable stalk population. The effect could possibly be due to gaps in the stand of cane within plots. As reported by Arceneaux (2), it is important to obtain a uniform germination of seed cane to produce a high yield. Excessive tillering can produce a high shoot population with a gappy stand. However, these shoots do not necessarily develop into millable stalks due to plant competition.

Summary and Conclusions

Experiments were conducted at several locations in Louisiana to determine the effects of rate of planting on yield and some of the yield components of sugarcane. The rates of planting tested were two, three, four, and two-plus-two stalks in a continuous line with a 10 percent overlap in rows six feet wide. The two-plus-two rate was two stalks in two drills planted 12 inches apart on each row. The other rates were planted in one drill on each row. Each rate was tested with four commercial varieties of sugarcane.
Table 6.—Mean effect of rate of planting on stalk weight, length, and diameter of plant and first stubble cane in Experiment 2 at the St. Gabriel Station

<table>
<thead>
<tr>
<th>Rate of planting (stalks)</th>
<th>Plant cane stalk weight (lb.)</th>
<th>First stubble cane stalk weight (lb.)</th>
<th>stalk length (ft.)</th>
<th>stalk diameter (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>2.41</td>
<td>1.93</td>
<td>7.3</td>
<td>24.8</td>
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<tr>
<td>3</td>
<td>2.48</td>
<td>1.98</td>
<td>7.3</td>
<td>25.0</td>
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<tr>
<td>4</td>
<td>2.41</td>
<td>1.96</td>
<td>7.2</td>
<td>24.0</td>
</tr>
<tr>
<td>2 + 2</td>
<td>2.43</td>
<td>1.96</td>
<td>7.3</td>
<td>24.5</td>
</tr>
<tr>
<td>LSD (.05)</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
</tbody>
</table>

Table 7.—Mean effect of rate of planting on stalk weight, length, and diameter of plant cane in Experiment 3 at the St. Gabriel Station

<table>
<thead>
<tr>
<th>Rate of planting (stalks)</th>
<th>Stalk weight (lb.)</th>
<th>Stalk length (ft.)</th>
<th>Stalk diameter (mm)</th>
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</thead>
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<tr>
<td>2</td>
<td>2.38</td>
<td>8.2</td>
<td>26.2</td>
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<tr>
<td>3</td>
<td>2.44</td>
<td>8.4</td>
<td>26.1</td>
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<tr>
<td>4</td>
<td>2.43</td>
<td>8.3</td>
<td>25.9</td>
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<td>2 + 2</td>
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<td>8.2</td>
<td>26.0</td>
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<tr>
<td>LSD (.05)</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
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</table>
Table 8.—Correlation coefficients between rate of planting, cane yield and some yield components in four of the experiments

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<th></th>
<th>Plant population</th>
<th>Cane yield</th>
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<tbody>
<tr>
<td></td>
<td>April</td>
<td>July</td>
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<tr>
<td>Plant cane, Experiment 2, St. Gabriel</td>
<td></td>
<td></td>
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<tr>
<td>Rate of planting</td>
<td>.66</td>
<td>.46</td>
</tr>
<tr>
<td>Cane yield</td>
<td>.53</td>
<td>.35</td>
</tr>
<tr>
<td>Millable stalk weight</td>
<td>-.32</td>
<td>-.56</td>
</tr>
<tr>
<td>Stubble cane, Experiment 2, St. Gabriel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rate of planting</td>
<td>.27</td>
<td>.19</td>
</tr>
<tr>
<td>Cane yield</td>
<td>.58</td>
<td>.56</td>
</tr>
<tr>
<td>Millable stalk weight</td>
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<td>-.77</td>
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<tr>
<td>Millable stalk length</td>
<td>-.69</td>
<td>-.66</td>
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<tr>
<td>Millable stalk diameter</td>
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<td>-.65</td>
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<td>Plant cane, Experiment 3, St. Gabriel</td>
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<td></td>
</tr>
<tr>
<td>Rate of planting</td>
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<td>.47</td>
</tr>
<tr>
<td>Cane yield</td>
<td>.49</td>
<td>.30</td>
</tr>
<tr>
<td>Millable stalk weight</td>
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<td>-.50</td>
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<tr>
<td>Millable stalk length</td>
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<td>-.36</td>
<td>-.40</td>
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<td>Plant cane, Experiment 5, Woodlawn</td>
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<td>Rate of planting</td>
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<tr>
<td>Cane yield</td>
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<td>.61</td>
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<td>Plant cane, Experiment 7, Allain</td>
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<td>Rate of planting</td>
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<tr>
<td>Cane yield</td>
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<td>-.24</td>
</tr>
<tr>
<td>Stubble cane, Experiment 7, Allain</td>
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<td></td>
</tr>
<tr>
<td>Rate of planting</td>
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<td>.17</td>
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<tr>
<td>Cane yield</td>
<td>.58</td>
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</table>

r value required for significance at 5% = .33.
The interaction between varieties and rate of planting was small in the yield and yield component data obtained in each experiment. As an average of varieties in seven experiments conducted, the two-stalk rate produced a significantly lower cane yield than the three-stalk rate in six experiments. The two-stalk rate produced a lower yield than the four-stalk rate in all the experiments. The differences in the cane yield between the three-stalk and four-stalk rates were not significant.

The rate of planting did not affect the percent sucrose in the cane juice and increases in sugar yields were similar to increases in cane yields. The increases in yield were more pronounced on Commerce and Mhoon soils than on Jeanerette soil. In the two experiments in which first stubble data were obtained, the increases in yield were more pronounced with plant cane than with stubble cane.

In four experiments in which the plant population was studied, the two-stalk rate produced a significantly lower number of millable stalks than the three-stalk rate in two of the experiments and a lower number than the four-stalk rate in three of the experiments. The differences in the number of millable stalks between the three-stalk and four-stalk rates were small. The two-plus-two rate produced a significantly higher number of millable stalks and a significantly higher cane yield than the four-stalk rate in one out of three experiments in which it was tested.

The plant population of all varieties increased rapidly during April and May to a maximum in June or July, then decreased until October. The increases due to rate of planting were considerably larger in the total plant population early in the growing season than in the number of millable stalks in October. The rate of planting had no significant effect on stalk weight, length, and diameter.

A significant positive correlation was obtained between rate of planting and cane yield and between cane yield and the number of millable stalks in all experiments except one. The correlations between rate of planting and the number of millable stalks were not significant. These relationships indicate that there was an unknown factor affecting the cane yield and number of millable stalks. Significant negative correlations were obtained between the number of millable stalks and stalk weight, length, and diameter.

This study indicates that sugarcane yields can be increased with the current varieties with rates of planting higher than the recommended two-stalk rate. The increases in yield were consistent but relatively small and may not be profitable due to the increase in the cost of seed cane and labor required to plant higher rates. However, these increases were obtained with a high quality seed cane under good germinating conditions. A three-stalk rate could be profitable when planting a low quality seed cane under poor germinating conditions, especially with low tillering varieties.
## APPENDIX

Table 9.—Effect of rate of planting on the plant population of four varieties of plant cane in Experiment 2 on Commerce silt loam soil at the St. Gabriel Experiment Station, Iberville Parish, 1972

<table>
<thead>
<tr>
<th>Variety of cane</th>
<th>Rate of planting (stalks)</th>
<th>April</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>Aug.</th>
<th>Sept.</th>
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<tr>
<td>CP 48-103</td>
<td>2</td>
<td>12.6</td>
<td>25.3</td>
<td>49.5</td>
<td>74.9</td>
<td>59.3</td>
<td>33.8</td>
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<tr>
<td></td>
<td>3</td>
<td>16.9</td>
<td>32.6</td>
<td>56.6</td>
<td>89.6</td>
<td>71.1</td>
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<td>4</td>
<td>21.8</td>
<td>37.6</td>
<td>60.4</td>
<td>90.1</td>
<td>71.0</td>
<td>37.9</td>
</tr>
<tr>
<td></td>
<td>2 + 2</td>
<td>27.2</td>
<td>46.1</td>
<td>74.6</td>
<td>94.6</td>
<td>79.7</td>
<td>38.6</td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td>19.6</td>
<td>35.4</td>
<td>60.3</td>
<td>87.3</td>
<td>70.3</td>
<td>36.9</td>
</tr>
<tr>
<td>L 60-25</td>
<td>2</td>
<td>17.6</td>
<td>34.8</td>
<td>67.2</td>
<td>68.2</td>
<td>63.1</td>
<td>38.6</td>
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<tr>
<td></td>
<td>3</td>
<td>23.2</td>
<td>41.8</td>
<td>76.2</td>
<td>75.5</td>
<td>69.2</td>
<td>40.5</td>
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<td>48.8</td>
<td>88.6</td>
<td>83.4</td>
<td>76.2</td>
<td>43.4</td>
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<tr>
<td></td>
<td>2 + 2</td>
<td>35.3</td>
<td>57.5</td>
<td>99.8</td>
<td>90.8</td>
<td>80.3</td>
<td>43.8</td>
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<tr>
<td>Mean</td>
<td></td>
<td>26.3</td>
<td>45.7</td>
<td>82.9</td>
<td>72.5</td>
<td>72.2</td>
<td>41.6</td>
</tr>
<tr>
<td>CP 61-37</td>
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<td>13.0</td>
<td>34.4</td>
<td>50.4</td>
<td>73.5</td>
<td>53.7</td>
<td>38.0</td>
</tr>
<tr>
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<td>17.8</td>
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<td>59.3</td>
<td>82.2</td>
<td>58.8</td>
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<td>28.1</td>
<td>36.8</td>
<td>53.9</td>
<td>50.9</td>
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<td>12.8</td>
<td>9.6</td>
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<tr>
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<td>4.9</td>
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Table 10.—Effect of rate of planting on the plant population of four varieties of first stubble cane in Experiment 2 on Commerce silt loam soil at the St. Gabriel Experiment Station, Iberville Parish, 1973

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Table 13.—Effect of rate of planting on the plant population of four varieties of plant cane in Experiment 7 on Jeanerette silt loam soil at A. V. Allain Plantation, St. Mary Parish, 1972

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Table 14.—Effect of rate of planting on the plant population of four varieties of first stubble cane in Experiment 7 on Jeanerette silt loam soil at A. V. Allain Plantation, St. Mary Parish, 1973

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Table 15.—Effect of rate of planting on stalk weight, length, and diameter of plant and first stubble cane in Experiment 2 on Commerce silt loam soil at the St. Gabriel Experiment Station, Iberville Parish, 1972-73

<table>
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<th>Variety of cane</th>
<th>Rate of planting (stalks)</th>
<th>Plant cane stalk wt. (lb.)</th>
<th>First stubble cane stalk wt. (lb.)</th>
<th>stalk length (ft.)</th>
<th>stalk diameter (mm)</th>
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Table 16.—Effect of rate of planting on stalk weight, length, and diameter of plant cane in Experiment 3 on Commerce silt loam soil at the St. Gabriel Experiment Station, Iberville Parish, 1973

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<th>Stalk diameter (mm)</th>
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LSD (.05) for treatment: 0.24, 0.7, 1.5
LSD (.05) for means: 0.15, 0.3, 0.8
Literature Cited