EFFECTS OF INTER-ROW SPACING ON SUGARCANE YIELDS IN LOUISIANA

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ABSTRACT

Higher plant populations are essential for higher yields of sugarcane per hectare in Louisiana. Rows 0,9 and 1,1 metres wide resulted in the highest populations and yields. Rows with 2 drills (38,1 cm apart) on 1,8 metres yielded significantly more than standard rows when planting technique was improved. They were easier to manage than narrow rows. Rows with a wide drill (opened 38,1 cm wide) did not increase yields. Higher planting rates are not practical.

Dual drills 0,5 to 0,9 metres apart on 2,1 to 2,7 metre rows will be studied to make machine operations easier and in the hope of obtaining higher yields.

INTRODUCTION

Continued experiments with row spacing since 1966 have shown that reducing the row width from the conventional 1,8 metre rows to 0,9 to 1,1 metre rows resulted in large yield increases of sugarcane in Louisiana.[3] Boyce,[1] in South Africa, reported a 4,5 t/ha increase per year for each 0,3 metre decrease in row width.

The increased yields in Louisiana were caused by higher mature stalk populations, obtained by a more efficient inter-row plant spacing.[3] High populations are essential for high sugarcane yields.[2] Increases in stalk population and yield of this magnitude cannot be obtained by increasing the planting rate on conventional rows.[3]

Narrow rows, however, are difficult to manage, and require extensive equipment modifications. Other methods of inter-row spacings might be used to obtain the optimum plant population and yield increases with a minimum of equipment changes. This paper reports yields from wide drills on 1,8 metre rows, dual drills on 1,8 metre rows, and narrow rows.

EXPERIMENTAL PROCEDURE

Although the factorial experiments A and B were described in a previous paper,[3] second stubble results of experiment B were not available at that time. A combined analysis of the 2 experiments is now presented, using only the variety CP 61-37, which was common to both experiments.

Experiment C was planted in 1970 with the variety CP 52-68, using a randomized block design. The experiment had 4 replications, and all plots were planted at the standard planting rate. Inter-row spacings were: 0,9 metre,

* Research at this location is done is co-operation with the Louisiana Agricultural Experiment Station.

1,8 metres, and 1,8 metres (double drills 38,1 cm apart). Plant cane and first stubble crop yields were obtained.

Experiment D was planted in 1971 with the variety CP 65-357, using 4 replications in a split plot design. Main plots were inter-row spacings, using the following: 1,8 metres with 2 drills 38,1 cm apart, 1,8 metres with 1 drill opened 38,1 cm wide, and 1,8 metres (standard). Subplots had 2 planting rates: 2 stalks plus a 10% lap (standard), and 4 stalks plus a 10% lap.

Fertilizer was applied, using 168 kg/ha of nitrogen for all treatments and all experiments. Cultivation, weed control, and insect control followed recommended procedures for Louisiana as closely as possible.

Cane on all plots was hand cut at harvest, weighed to obtain yields of cane per hectare, and sampled for sucrose analysis. Sugar per hectare was calculated.

RESULTS

Mature stalk populations were much higher for the 0,9 to 1,1 metre rows, compared to the 1,8 metre rows, as an average for plant cane, 1st stubble, and 2nd stubble crops (Table 1). No winter damage was noted in the stubble crops although plots damaged by loading and hauling machinery did decrease populations of the narrow rows. Table 2 shows the average yields for experiments A and B. In plant cane, the 0,9 metre and 1,1 metre rows outyielded the 1,8 metre rows by 41 and 25 t/ha, respectively. The 1st stubble crops showed increases of 31 and 38 t/ha in the 2 experiments. Yields were not significantly different for the combined 2nd stubble crops. As previously reported,[3] however, the 0,9 metre rows in the 2nd stubble crop of experiment A yielded significantly

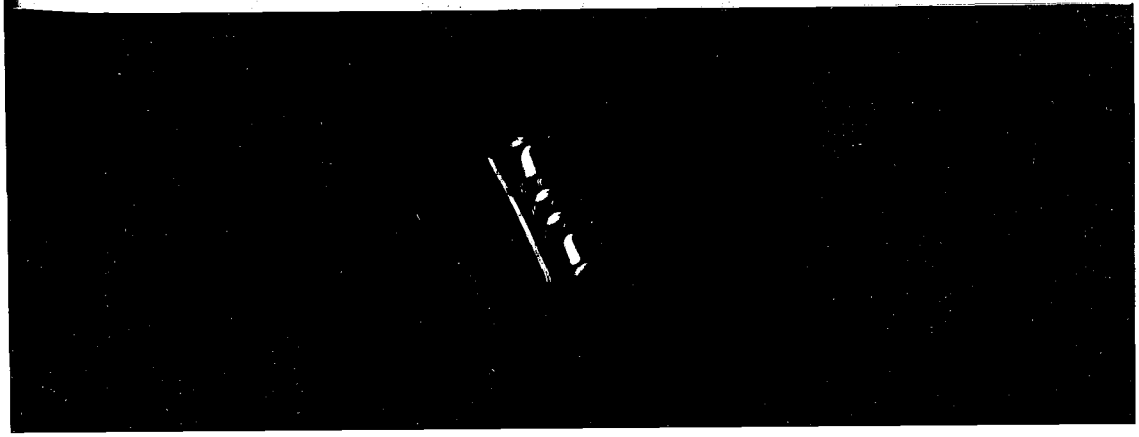
TABLE 1. Average mature stalk populations for 2 experiments using 3 row widths with variety CP 61-37 (experiments A & B).

Row width (metres)	3 crops (plant cane, 1st stubble, 2nd stubble)
	No per hectare
0,9	98 802 a [1]
1,1	88 900 b
1,8	63 782 c

[1] Means followed by the same letter are not significantly different at the 5% level of probability, as determined by the Duncan multiple range test.

TABLE 2. Average yields in tons cane per hectare for variety CP 61-37 (combined experiments A and B 1968-1972).

Row width (Metres)	Plant cane	1st stubble	2nd stubble	3 crops
0,9	108 a	103 a	99 a	103 a [1]
1,1	92 b	110 a	94 a	99 a
1,8	67 c	72 b	85 a	74 b



higher than 1,8 metre rows (18 t/ha increase). Table 3 (experiment B) shows a significant difference of 16 t/ha in favour of 0,9 metre rows for the 2nd stubble crop. Yield increases for the 3 crop total of the combined experiments were 86 tons for the 0,9 metre and 72 tons for the 1,1 metre rows. Damaged 0,9 metre row plots of CP 61-37 showed a decrease in yields of the stubble crops compared to plant cane, whereas undamaged 0,9 metre row plots of L 60-25 showed an increase.

TABLE 3. Average yields in tons cane per hectare for variety L 60-25 (experiment B 1970-1972).

Row width (Metres)	Plant cane	1st stubble	2nd stubble	3 crops
0,9	87 a	108 a	99 a	99 a [1]
1,1	78 a	96 a	92 b	90 a
1,8	56 b	76 b	83 c	72 b

The plant cane crop of experiment C also yielded significantly higher for the 0,9 metre rows compared to standard rows (Table 4). Yields of the 1st stubble crop were not significantly different. Again, cane in the narrow rows was damaged by loading and hauling equipment. One undamaged replication of the narrow rows yielded 121 t/ha in 1st stubble, an increase of 36 tons over standard. There was no significant difference in yield between 1,8 metre rows with 2 drills and conventional rows in the plant cane and 1st stubble crops. Stands, however, were weak for the dual drills.

TABLE 4. Average yields in tons cane per hectare at several row spacings with variety 52-68 (experiment C 1971-1972).

Row spacing (Metres)	Plant cane	1st stubble	2 crops
0,9	108 a	94 a	101 a [1]
1,8 (2 drills)	83 b	83 a	83 b
1,8 (1 drill)	74 b	83 a	78 b

Large differences did occur in populations and yields between the 2 drills and conventional rows in experiment D (Tables 5 - 6). Dual drills yielded 21 t/ha more than the conventional rows. The wide drills did not yield more than the conventional rows using the standard planting rate, but did yield slightly better at the higher planting rate.

TABLE 5. Average mature stalk populations for plant cane at several row spacings with variety CP 65-357 (Experiment D-1972).

Row spacing (Metres)	Planting rate	
	2 stalks	4 stalks
	No. per hectare	No per hectare
1,8 (2 drills)	89 297 a	96 075 a [1]
1,8 (1 drill—wide opening)	65 825 b	81 312 b
1,8 (1 drill—standard opening)	69 212 b	80 102 b

TABLE 6. Average yields in tons cane per hectare for plant cane at several row spacings with variety CP 65-357 (experiment D-1972).

Row spacing (Metres)	Planting rate	
	2 stalks	4 stalks
1,8 (2 drills)	99 a	108 a [1]
1,8 (1 drill—wide opening)	78 b	96 b
1,8 (1 drill—standard opening)	78 b	87 c

No significant differences were found in juice quality between treatments in any of the experiments. Because of this, kg sugar per ton of cane and kg sugar per hectare are not reported.

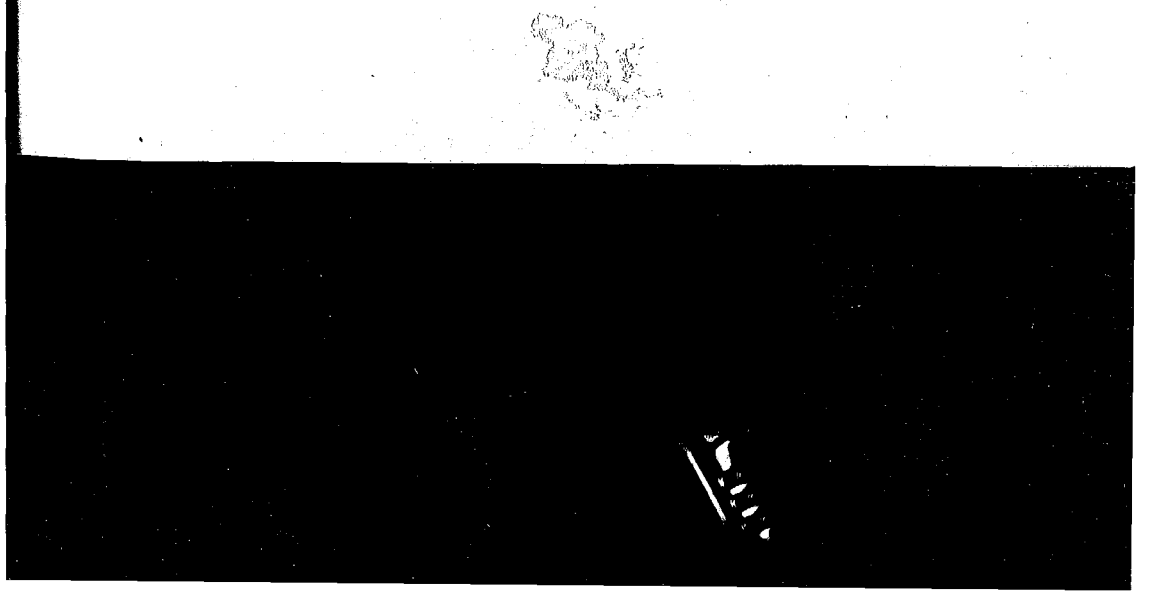
DISCUSSION

Because higher populations are essential for higher yields, these experiments were conducted to determine the best means of achieving them. Data reported herein involve 9 crop years. Different methods of row spacing have produced substantially higher plant populations and yields.

Of the methods used, 0,9 to 1,1 metre rows consistently gave the highest yield. Increases obtained for the 3 crop total were equivalent to an additional crop year. However, narrow rows are very difficult to plant, cultivate, and harvest. Damaged narrow rows resulted in cumulative injuries, which depressed stubble yields.

Although wide drills on 1,8 metre rows did not increase yields, this practice should save on labour requirements for mechanical planters. Labourers follow the planters to place properly the "seed cane" that falls outside the planting drill. Less cane falls outside the wide drills, thus saving time and labour.

Increased yields obtained by using 2 drills 38,1 cm apart on 1,8 metre rows were smaller and less consistent than those obtained on narrow rows. The failure to obtain yield increases by double drills in experiment C was probably caused by a failure to obtain adequate stands. Planting technique was improved for experiment D, and yield increases were highly significant. The planting rate is high, and it is not practical to consider increasing it.



Plant competition plays an important role when high populations are reached. Plant competition was less for the 0,9 to 1,1 metre rows than for 2 drills, 38,1 cm apart, but management was more difficult. A better row spacing might use 2 drills 0,5 to 0,9 metres apart on 2,1 to 2,7 metre rows. These spacings would approach the plant efficiency of 0,9 metre rows and also be more adaptable to machinery.

Investigations are being continued on narrow and wide rows to find the optimum row width and spacings for obtaining higher yields in Louisiana.

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EFECTO DE ESPACIAMIENTO ENTRE SURCOS SOBRE LOS RENDIMIENTOS DE CAÑA DE AZUCAR EN LOUISIANA

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RESUMEN

Una población más alta de plantas es esencial para rendimientos más altos de caña de azúcar por hectárea en Louisiana. Surcos 0,9 y 1,1 metros de ancho dieron como resultado poblaciones y rendimientos más altos. Surcos con dos hileras (38,1 cm aparte) en 1,8 metros produjeron significativamente más que surcos normales cuando se mejoró la técnica de siembra. Eran más fácil manejar que surcos más estrechos. Surcos con una hilera ancha (abierta a una anchura de 38,1 cm.) no aumentaron los rendimientos. No son prácticas dosis de siembra más altas.

Hileras duales 0,5 a 0,9 metros aparte en surcos de 2,1 a 2,7 metros serán estudiadas para hacer las operaciones más fáciles y obtener más altos rendimientos.