EFFECTS OF CULTIVARS, FUNGICIDES, AND FERTILZATION AT PLANTING ON YIELDS OBTAINED FROM WHOLE STALK AND BILLET PLANTING IN LOUISIANA

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ABSTRACT

Whole stalk planting has been traditional for sugarcane production in Louisiana. An industry-wide switch to billet harvesting stimulated interest in changing planting methods creating a need for research on billet planting under Louisiana conditions. Therefore, the effects of two cultivars, fungicides, and fertilization at planting on yields obtained from whole stalk and billet planting were evaluated in five field experiments. Variability was detected between cultivars in response to billet planting. CP 70-321 was erratic, showing both increased and decreased cane and sugar yield in billet compared to whole stalk plantings. LCP 85-384 exhibited a pattern of lower yield in plant cane for billet plantings. Yield differences between billet and whole stalk plantings were less or not detected in ratoon crops. The results suggest that cultivars vary in tolerance to billet planting. Fungicides had no effect on yield in two experiments, but one fungicide, propiconazole, increased plant cane yield obtained from billet planting in a third experiment. Fertilizer applied at planting had either no effect or increased yield of both billet and whole stalk planting. The risk of stand problems and reduced yield appears to be less with whole stalk planting. However, severe stand problems and yield reductions were not encountered, so billet planting could provide an alternative planting method under Louisiana conditions.

INTRODUCTION

In most regions of the world where sugarcane (interspecific hybrids of *Saccharum*) is grown, the crop is planted as stalk sections or billets. However, sugarcane has traditionally been planted as whole stalks in Louisiana. This practice was adopted to overcome an often harsh winter climate and stalk rot damage. Sugarcane is planted in late summer and begins to germinate and produce shoots, but it then must survive winter conditions that typically include saturated soils and several freezes before finally establishing a stand in the spring. Four stalk rots, red rot (caused by *Colletotrichum falcatum* F.A. Went), Fusarium sett rot (caused by *Fusarium moniliforme* J.L. Sheldon), pineapple disease (caused by *Ceratocystis paradoxa* (Dade) C. Moreau), and Phytophthora seed piece rot (caused by *Phytophthora megasperma* Drechsler and *P. erythroseptica* Pethybr.), can cause rotting of planted cane stalks in Louisiana. Red rot is the most common stalk rot, and it has been shown to be more severe when cane stalks are exposed to environmental stress (Yin and Hoy, 1997; Yin and Hoy, 1998).

In 1994, combine (chopper) harvesters began to be used in place of whole stalk harvesters for the commercial harvest of sugarcane in Louisiana. The widespread planting of LCP 85-384 (Milligan, et al., 1994), a high tonnage cultivar that often lodges, resulted in the rapid adoption of chopper harvesting by the Louisiana sugarcane industry. This created strong interest in billet planting.

Past experience in the industry suggested that the potential for stand problems and lower yields were greater with billet planting than with whole stalk planting. In addition, it was found that resistance to red rot was infrequent in the cultivar breeding and selection populations (Yin et al., 1996). There was an obvious need for research to develop methods to maximize the chances for success in billet planting. Therefore, experiments were initiated to evaluate the effects of cultivars, fungicides, and fertilization at planting on billet planting as compared to whole stalk planting.

MATERIALS AND METHODS

Five field experiments were conducted to compare the effects of different cultivars, fungicides, and fertilization at planting on yields obtained from whole stalk and billet planting. Two experiments were planted on commercial farms during 1995. One experiment was planted in Pointe Coupee Parish on August, 30, and the second experiment was planted in St. Mary Parish on September 29. The soil types were Commerce silt-loam and Sharkey clay, respectively. Two experiments were planted during 1996. One was planted on a farm in Pointe Coupee Parish on September 10, and the second experiment was planted at the Sugar Research Station of the LSU Agricultural Experiment Station at St. Gabriel, LA on September 6. One experiment was planted on a Lafourche Parish farm on September 18, 1997. The soil type for the 1996 and 1997 experiments was Commerce silt-loam. For all farm experiments, whole stalks and billets were mechanically harvested and then planted with drum-type planters. Average billet length ranged from 46-56 cm; whole stalk length was approximately 1.7-2.0 m. Planting rates were whatever resulted from equipment settings used by each farming operation. Whole stalks and billets were machine-cut then hand planted for the 1996 Sugar Research Station experiment.

The two 1995 experiments used a randomized complete block design with four replications. Entire rows were planted with either whole stalks or billets of two cultivars, CP 70-321 and LCP 85-384. Treatment replicates were blocked with each block containing four rows consisting of one row of each cultivar planted as whole stalks or billets in random order. Eight, split plot treatments were then randomized along rows within each four-row block. The treatments included six fungicides, one combination of two fungicides, and a non-treated control. Treatment plots were 23 m in length, and data were collected from the center 15.25 m. Data collected included spring shoot population (determined in April), millable stalk population (determined in August), stalk weight (determined from 15 stalks collected at harvest), cane tonnage (estimated from the stalk population and weight means), sucrose per ton of cane (analysis conducted at the Sugar Research Station), and tons of sucrose per hectare (calculated using tonnage and sucrose per ton estimates). Yield components were determined for the plant cane crop and two subsequent ratoon crops.

The fungicide treatments were: azoxystrobin (Quadris 80 WG, Syngenta, Greensboro, NC) applied at 280 g formulated product (FP) per hectare (0.25 lb acre^{-1}); benomyl (Benlate 50 F, DuPont, Wilmington, DE) applied at 2.2 kg FP per hectare (2 lb acre^{-1}); captan (50 WP, Gustafson, Plano, TX) applied at 4.4 kg FP per hectare (4 lb acre^{-1}) (included in Pointe Coupee experiment only); mancozeb (Dithane 80 WP, Rohm and Haas, Inc., Philadelphia, PA) applied at 3.3 kg FP per hectare (3 lb acre^{-1}); metalaxyl (Ridomil 2E, Syngenta) applied at 2.3 L FP per hectare (1 qt acre^{-1}); metalaxyl/mancozeb combination (Ridomil MZ58, Syngenta) applied at 5.5 kg FP per hectare (5 lb acre^{-1}); and propiconazole (Tilt, Syngenta) applied at 0.73 L FP per hectare (10 oz acre^{-1}). Fungicides were applied on a 1 m band using a CO_2-sprayer in 140 L of water per hectare (15 gal acre^{-1}) over the planted stalks lying in the open planting furrow prior to row closing.

The Pointe Coupee experiment planted in 1996 consisted of the same two cultivars, CP 70-321 and LCP 85-384, planted as whole stalks or billets. Cultivars were planted in entire rows in four-row blocks as in the 1995 experiments. Treatments consisted of three fungicides and one combination of two fungicides, each applied with and without 0.125 % organosilicone surfactant (Silwett, Loveland Industries, Inc., Greeley, CO), and a non-treated control. Fertilizer was then applied at 16.8-33.6-33.6 kg ha^{-1} (15-45-45, lb acre^{-1}), N-P-K to each treatment at planting in a split plot design for a total of 18 treatments, each replicated four times. Plots were 23 m in length, and data were collected from the center 15.25 m of each row. Yield component data were collected as in the 1995 experiments. The experiment was continued through second ratoon.

Fungicides applied were azoxystrobin applied at 0.55 kg FP per hectare (0.5 lb acre^{-1}), metalaxyl applied at 2.3 L FP per hectare (1 qt acre^{-1}), propiconazole applied at 0.73 L FP per hectare (10 oz acre^{-1}), and metalaxyl and propiconazole combined. Fungicides were applied as before over stalks in the planting furrow prior to row closing.

An experiment was planted on the Sugar Research Station during 1996 to compare yields obtained from whole stalk and billet plantings of CP 70-321 and LCP 85-384. Billets of each cultivar were divided into four treatments: application of metalaxyl at 3.3 kg FP per hectare (3 lb acre^{-1}) (Ridomil Gold EC), application of propiconazole at 0.73 L FP per hectare (10 oz acre^{-1}), application of metalaxyl and propiconazole, and non-treated billets. Treatments were planted in four replicates consisting of three rows 6.6 m in length with a 1 m alley between plots. A randomized complete block design was used. Fungicides were applied as described above to cane in the planting furrow prior to covering. Yield component data were collected through second ratoon.

An experiment comparing yields of LCP 85-384 from billet and whole stalk plantings as affected by fertilizer applied at planting was started on a Lafourche Parish farm during 1997. Two N-P-K fertilizer treatments were used: 33.6-33.6-33.6 and 67.2-67.2-67.2 kg ha^{-1} (45-45-45 and 90-90-90 lb acre^{-1}). Fertilizer was applied as a liquid into open planting furrows. Whole stalks or billets were planted as entire rows in three row replicates with each treatment replicated six times in a randomized complete block design. Yield component data were collected through second ratoon.

SAS versions 6.0-8.2 (SAS Institute Inc., Cary, NC) were used for data analysis. Variables treated as main effects in the analysis of variance were location, cultivar, planting method, and fungicide treatment in the 1995 experiments; cultivar, planting method, fungicide, and fertilizer application in the 1996 Pointe Coupee experiment; cultivar, planting method, and fungicide treatment in the Sugar Research Station experiment; and planting method and fertilizer application in the 1997 experiment. Appropriate interactions were tested for in each experiment. Yield component means were compared by Fisher's protected least significant difference at the 5 % level of probability.

RESULTS

Cultivars responded differently to planting method and fungicides at the different locations in the two experiments planted in 1995. Therefore, the results are presented separately. At the Pointe Coupee Parish location, spring shoot population in the plant cane crop was increased by several fungicide treatments (Table 1). Propiconazole increased the spring shoot population of CP 70-321 planted as billets, and metalaxyl and captan treatments increased the spring shoot population of LCP 85-384 planted as billets. Five fungicides increased the spring shoot population of LCP 85-384 planted as whole stalks. At the St. Mary Parish location, propiconazole increased spring shoot population in CP 70-321 planted as billets (Table 1). No other fungicide treatment increased spring shoot population in either cultivar. Fungicides did not affect final yield, so the results were combined.

At the Pointe Coupee location, plant cane tonnage and sugar per hectare yield was greater for billet planted CP 70-321 compared to the whole stalk planting (Table 2). The higher yield persisted in first ratoon, but the second ratoon yields were similar for billet and whole stalk plantings. In contrast, yield of sugar per hectare for the plant cane crop was greater for whole stalk planted LCP 85-384 compared to the billet planting, but yields for billet and whole stalk plantings were similar in first and second ratoon.

At the St. Mary location, plant cane tonnage yields were higher for whole stalk compared to billet plantings of both CP 70-321 and LCP 85-384, and sugar per hectare was higher for whole stalk planted CP 70-321 (Table 3). Tons of cane per hectare also were higher for whole stalk plantings of both cultivars in first ratoon, and sugar per hectare was again higher for whole stalk planted CP 70-321. In second ratoon, yields of whole stalk and billet plantings were similar for both cultivars.

For the plant cane crop of the fungicide/fertilizer experiment planted on a farm in Pointe Coupee Parish during 1996, significant interactions were detected among cultivars, planting method, and fertilization. Therefore, results are reported separately to highlight the variable effects of different treatments. Spring shoot population was increased only by the metalaxyl treatment on billet planted CP 70-321 (data not shown). Propiconazole, azoxystrobin, and fungicide combination treatments had no effect on spring shoot populations of CP 70-321 or LCP 85-384, and no fungicide treatment had any effect on plant cane yield of either cultivar. Significant increases in yield resulted from application of fertilizer at planting in some treatments, and there were differences in yield between billet and whole stalk plantings of both cultivars in some crop cycle years (Table 4). Fertilizer increased plant cane yield of CP 70-321 planted as billets but not whole stalks. The fertilizer effect was not evident in first or second ratoon. Billet and whole stalk planting yields in plant cane were similar when fertilizer was applied, whereas the whole stalk planting yield was higher compared to billet planting when no fertilizer was applied. For LCP 85-384, fertilizer did not increase yields obtained with either planting method, and whole stalk planting yields were higher than billet plantings in plant cane regardless of whether fertilizer was applied or not. The fertilizer effect was not evident in first ratoon, but differences were again detected in the second ratoon crop. The yield of whole stalk planted LCP 85-384 treated with fertilizer was higher in tonnage for billet plantings with or without fertilizer and higher in sugar per hectare for the billet planting without fertilization.

Table 1. Effects of fungicide treatments at two locations on 1996 spring shoot populations of CP 70-321 and LCP 85-384 planted as either whole stalks or billets.

	Shoot population (fungicide treatment)[1]			
Location	CP 70-321 Whole stalk	CP 70-321 Billet	LCP 85-384 Whole stalk	LCP 85-384 Billet
Point Coupee	25.8 (M2) a	18.0 (P) a	29.7 (M) a	19.4 (Mt) a
	21.8 (P) a	15.5 (C) ab	26.0 (P) ab	19.0 (C) a
	21.2 (A) a	14.8 (Mt) ab	24.9 (C) ab	17.0 (Mz) ab
	21.2 (C) a	14.8 (M2) ab	23.8 (Mz) abc	16.4 (P) ab
	20.5 (B) a	14.7 (A) ab	23.6 (B) abc	16.4 (B) ab
	19.8 (Mz) a	14.4 (Mz) ab	20.4 (M2) bcd	15.0 (A) ab
	19.8 (Ck) a	12.5 (Ck) bc	17.0 (A) cd	12.5 (M2) b
	19.4 (Mt) a	10.8 (B) c	13.6 (Ck) d	12.3 (Ck) b
St. Mary	12.8 (M2) a	9.9 (P) a	24.1 (M2) a	27.1 (A) a
	12.7 (B) a	9.6 (Mt) ab	23.9 (Mt) a	26.5 (M2) a
	12.2 (A) a	8.8 (M2) ab	23.6 (Ck) a	26.2 (Mt) a
	12.0 (Ck) a	8.8 (B) ab	23.6 (A) a	25.3 (P) a
	11.9 (Mz) a	8.2 (Mz) ab	22.8 (Mz) a	23.5 (B) a
	11.0 (Mt) a	8.0 (A) ab	21.5 (P) a	21.7 (Mz) a
	10.9 (P) a	7.4 (Ck) b	20.4 (B) a	21.0 (Ck) a

[1] Shoot population values are mean number of shoots per meter of row. Fungicide treatments (in parentheses) were: A = azoxystrobin, B = benomyl, C = captan, Ck = non-treated control, Mt = metalaxyl, Mz = mancozeb, M2 = metalaxyl + mancozeb, and P = propiconazole. Values within a column and location followed by the same lower case letter were not significantly different (P = 0.05).

Table 2. Cane and sugar yields from a 3-year crop cycle comparing billet and whole stalk planting of CP 70-321 and LCP 85-384 in an experiment conducted in Pointe Coupee Parish.

		Cane yield[1] ---------------Mt ha^{-1}-------------				Sugar yield[1] ---------------Mt ha^{-1}---------------			
Cultivar	Planting	1996	1997	1998	Total	1996	1997	1998	Total
70-321	Billet	112.6*	112.9*	89.8	315	12.46*	13.38*	8.79	34.6
	Whole	103.1	96.8	93.0	293	11.46	11.51	8.96	21.9
85-384	Billet	123.8	132.7	129.7	386	13.62	15.02	12.94	41.6
	Whole	137.4	134.1	120.5	392	15.35*	15.36	12.16	42.9

[1] Mean values followed by an asterisk were significantly higher ($P < 0.05$) than the mean for the other planting type within the same year and cultivar. No statistical analysis was performed on the total crop cycle yield data.

Table 3. Cane and sugar yields from a 3-year crop cycle comparing billet and whole stalk planting of CP 70-321 and LCP 85-384 in an experiment conducted in St. Mary Parish.

		Cane yield[1] ---------------Mt ha^{-1}-------------				Sugar yield[1] ---------------Mt ha^{-1}-------------			
Cultivar	Planting	1996	1997	1998	Total	1996	1997	1998	Total
70-321	Billet	86.8	46.0	60.1	193	9.85	5.16	6.23	21.2
	Whole	99.0*	53.0*	58.5	121	11.2*	6.53*	5.69	23.4
85-384	Billet	121.6	97.4	82.1	301	14.21	10.15	10.00	34.4
	Whole	134.1*	107.2*	83.5	323	15.05	11.66	9.68	36.4

[1] Mean values followed by an asterisk were significantly higher ($P < 0.05$) than the mean for the other planting type within the same year and cultivar. No statistical analysis was performed on the total crop cycle yield data.

In the experiment conducted at the Sugar Research Station, a significant cultivar x fungicide interaction was detected. Fungicides did not significantly increase the plant cane yield of CP 70-321 billet plantings (Table 5). Whole stalk planting produced higher yields in both tonnage and sugar per hectare in plant cane than billet plantings regardless of fungicide application. Propiconazole increased the plant cane sugar per hectare yield of LCP 85-384 planted as billets. This increase made the yield equivalent to the yield of whole stalk planting. Propiconazole applied in combination with metalaxyl did not increase yield. There were no yield differences between whole stalk and billet plantings in first or second ratoon of either cultivar.

In the experiment conducted on a Lafourche Parish farm with LCP 85-384, application of fertilizer at planting increased the plant cane yield of billet and whole stalk plantings (Table 6). The high rate of fertilizer did not increase yield any more than the low rate. In this experiment, the plant cane yields obtained from billet and whole stalk planting were similar within fertilizer treatments. However, the application of fertilizer to billets did not increase yield compared to whole stalk planting without fertilizer. Tonnage yield from the whole stalk planting without fertilizer was higher than most of the other treatments in first ratoon. Yield differences were not detected among any treatments in second ratoon.

Table 4. Cane and sugar yields from a 3-year crop cycle comparing billet and whole stalk planting of CP 70-321 and LCP 85-384 in an experiment conducted in Pointe Coupee Parish.

			Cane yield[1] -----------Mt ha^{-1}----------			Sugar yield[1] -----------Mt ha^{-1}-----------		
Cultivar	Planting	Fertilizer	1997	1998	1999	1997	1998	1999
70-321	Billet	No	112.6b	115.9a	80.8a	12.50c	13.91a	9.30a
	Whole	No	142.5a	121.3a	83.8a	15.88a	14.21a	9.07a
	Billet	Yes	132.7a	120.5a	89.2 a	14.40b	15.10a	9.84a
	Whole	Yes	139.0a	112.9a	78.1a	14.95ab	13.70a	8.68a
85-384	Billet	No	138.2b	130.6a	89.5b	15.28b	15.52a	8.90b
	Whole	No	165.4a	135.2a	107.4ab	18.37a	16.37a	10.37ab
	Billet	Yes	143.1b	126.8a	94.9b	15.99b	14.45a	10.43ab
	Whole	Yes	171.9a	144.7a	114.5a	19.29a	16.98a	11.99a

[1] Mean values within a year and cultivar followed by the same letter were not significantly different (P = 0.05).

DISCUSSION

The potential for stand failures due to adverse environmental conditions and stalk rot when planting billets resulted in the adoption of whole stalk planting in Louisiana many years ago. Whole stalks could usually sustain stalk rot damage and still have enough sound buds to produce an adequate stand even under adverse conditions. Because of the lack of success with billet planting in the past, it was uncertain what the potential was for success under current conditions. The tolerance of modern cultivars to billet planting and potential efficacy of fungicides for disease control were factors that needed to be evaluated.

In the past, clones in the cultivar selection program were screened for resistance to red rot using a detached stalk inoculation method, but this practice was discontinued. With the widespread occurrence of the red rot pathogen and disease, it was possible that exposure to natural infection during the 14 year selection program would result in clones susceptible to red rot being eliminated due to poor yields. This process could result in the natural selection of clones with disease resistance. However, it was determined that the frequency of resistance in the current parent and selection populations was low (Yin et al., 1996). Another possible factor that could affect resistance to stalk rots was the increased incorporation of genetic material from the basic breeding program operated by the USDA-ARS Sugarcane Research Unit. LCP 85-384 is a product of this program.

In sugarcane, most traits are quantitative in inheritance and expression. This means that resistance to stalk rots and tolerance to billet planting will show a range of reactions across different genotypes. The two cultivars in this study exhibited some variation in tolerance to billet planting. Billet planted CP 70-321 showed both positive and negative differences in yield compared to whole stalk plantings. LCP 85-384 exhibited a pattern of reduced plant cane yields in billet plantings relative to whole stalk plantings that then lessened or disappeared in the ratoon crops. Cultivar traits that are associated with ability to tolerate billet planting are unknown. LCP 85-384 is a high stalk population, strong ratooning cultivar. It appears that ratooning ability may allow for recovery from lower plant cane yield, as long as the lower yield was not due to large gaps in the initial stand.

Table 5. Cane and sugar yields from a 3-year crop cycle comparing CP 70-321 and LCP 85-384 planted as whole stalks or billets treated with fungicides in an experiment at the Sugar Research Station.

Cultivar/ treatment[1]	Planting	Cane yield[2] ---Mt ha^{-1}--- 1997	1998	1999	Sugar yield[2] ---Mt ha^{-1}--- 1997	1998	1999
70-321/ none	Whole	165.4 a	170.0 a	148.2 a	16.19 a	18.46 a	13.86 a
70-321/ none	Billet	133.8 b	133.8 a	131.9 a	10.21 b	14.19 a	11.90 a
70-321/ propicon	Billet	125.7 b	142.8 a	144.2 a	11.81 b	15.22 a	13.08 a
70-321/ metalaxyl	Billet	121.0 b	131.1 a	129.7 a	11.43 b	13.33 a	12.25 a
70-321/ prop+met	Billet	124.0 b	136.5 a	150.4 a	11.27 b	14.80 a	14.38 a
85-384/ none	Whole	166.2 a	152.3 a	197.5 a	17.37 a	17.13 a	18.57 a
85-384/ none	Billet	140.9 b	130.8 a	188.8 a	13.61 c	13.51 a	18.79 a
85-384/ propicon	Billet	155.3 ab	153.1 a	171.1 a	15.65 ab	16.13 a	17.02 a
85-384/ metalaxyl	Billet	146.1 b	141.4 a	176.3 a	14.83 bc	15.68 a	16.67 a
85-384/ prop+met	Billet	152.9 ab	143.3 a	184.7 a	15.12 bc	15.20 a	19.35 a

[1] Treatments were no fungicide applied (none), propiconazole (propicon) applied, metalaxyl applied, and both propiconazole and metalaxyl applied.
[2] Mean values within a year and cultivar followed by the same letter were not significantly different (P = 0.05).

Breeding and selection of cultivars with tolerance to billet planting should be possible but may not be easy to accomplish. It could offer a long-term solution to the problem but would require major emphasis in the breeding program. The potential variability in response to billet planting among genotypes means that experimental cultivars in the selection program will need to be evaluated for billet planting tolerance, if this planting system is adopted by the industry. This represents a challenge for the selection program.

Table 6. Cane and sugar yields from a 3-year crop cycle comparing billet and whole stalk plantings of LCP 85-384 with and without two rates of fertilizer applied at planting in an experiment in Lafourche Parish.

		Cane yield[2] -------------Mt ha^{-1}-------------			Sugar yield[2] -------------Mt ha^{-1}-------------		
Planting	Fertilizer[1]	1998	1999	2000	1998	1999	2000
Billet	None	120.0 c	152.2 b	125.9 a	12.90 c	17.50 a	13.18 a
Billet	34-34-34	144.2 ab	159.7 ab	123.8 a	15.24abc	18.47 a	12.89 a
Billet	67-67-67	140.4 ab	149.1 b	117.2 a	15.49abc	17.11 a	12.13 a
Whole	None	125.9 bc	174.1 a	121.3 a	13.69 bc	20.14 a	12.82 a
Whole	34-34-34	152.3 a	150.4 b	122.7 a	17.30 a	17.42 a	13.04 a
Whole	67-67-67	146.9 a	151.5 b	113.4 a	16.17 ab	17.79 a	11.69 a

[1] At-planting fertilizer treatments were none applied, N-P-K = 34-34-34 kg ha^{-1} (45-45-45 lbs $acre^{-1}$), and N-P-K = 67-67-67 kg ha^{-1} (90-90-90 lbs $acre^{-1}$).
[2] Mean values within a year followed by the same letter were not significantly different (P = 0.05).

Soil type is a variable that can affect cultivar yield potential. Soil type differed among experiments only in 1995 when experiments with similar design were planted in silt-loam and clay soil types. Cultivar yield in relation to planting method and response to fungicides varied in the two experiments. The results suggest that soil type might be a variable that can affect billet planting performance, but more information is needed before drawing conclusions.

Plant cane stand establishment is related to cultivar stalk rot susceptibility and damage. In the past, field observations over seasons revealed differences between cultivars in susceptibility to problems in stand establishment with whole stalk planting. Environmental stress and severe stalk rot damage were typically associated with stand problems. The strength of association between disease resistance and billet planting tolerance is uncertain. The likelihood of a relationship between the two led to the evaluation of fungicides for the ability to improve stand establishment and yield in billet plantings.

A range of fungicides with different modes of action were evaluated in this study. Some increased spring shoot population but then failed to increase plant cane yield. Propiconazole increased plant cane yield in one of three experiments. Fungicides have been evaluated previously for effects on billet planting yield in Florida. Captafol increased yield in one study (Eiland and Dean, 1981), and propiconazole increased yield in another (Raid et al., 1991). Pineapple disease is the main stalk rot damaging planted cane in Florida, whereas red rot is the most important disease in Louisiana. Also, cane planted in Louisiana must endure a winter period then resume growth the following spring. Controlling a disease of the internal tissues of buried stalks over an extended period of time is a difficult thing to accomplish for any chemical. The application method of spraying fungicides over the stalks in the planting furrow could be easily achieved by farmers, but the coverage of stalks would be incomplete. A dip application of propiconazole was found to be more effective than an in-furrow spray in Florida (Raid et al., 1991). Fungicide dips, including propiconazole, were evaluated in separate studies in Louisiana not reported here and failed to increase yield (Hoy and Savario, 2000). The results suggest that chemical control of stalk rot is not an effective option for increasing success with billet planting under Louisiana conditions.

The effect of fertilizer application at planting was variable but generally positive. Increased plant cane yield was obtained in one additional experiment conducted at the Sugar Research Station (Hoy et al., 2001). This cultural practice appears to have promise as a method to maximize the chances of success with billet planting in Louisiana.

The amount of seedcane placed in the furrow by mechanical planters was greater with billets than whole stalks in this study, but the difference was not quantified. In the absence of an effective disease control option, one factor that could allow compensation for increased stalk rot damage with billets would be increasing the amount of seedcane planted. However, this will increase the cost of planting. In addition, when large amounts of seedcane are planted, incomplete soil coverage and seedcane soil contact within rows can lead to poor stands.

Stalk rot pathogens can infect through wounds. Factors, such as billet length and amount of physical damage, will therefore affect stalk rot severity. Stalk rot also is more severe when stressful environmental conditions occur (Yin and Hoy, 1997; Yin and Hoy, 1998). Seedcane harvesting practices that minimize wounding and cultivation practices that minimize the occurrence of stress conditions will likely have a positive effect on stand establishment in billet plantings.

The yield components of greatest interest to farmers, cane tonnage and sucrose per hectare, were used to compare treatments in experiments. Stalk sucrose content was not affected by planting method, fungicides, or fertilization at planting. In most cases, millable stalk population was the yield component that was affected by treatments. As a result, cane tonnage and sucrose per hectare yields were closely paralleled.

Plant cane yields were often lower in billet compared to whole stalk plantings in this study. The results indicate that the maximum yield over a crop cycle will be obtained with whole stalk planting. However, severe stand problems were not encountered in billet plantings. Under conditions of severe cane lodging, lack of equipment or labor availability, billet planting appears to be an option for the Louisiana sugarcane industry.

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