

Incidence of Sugarcane Smut in Louisiana and Its Effect on Yield

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ABSTRACT

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Sugarcane (interspecific hybrids of *Saccharum*) infected by *Ustilago scitaminea* was observed in 13 of 15 sugarcane-growing parishes in 1984. Frequency of observed infested fields and incidence of diseased plants within fields were highest in susceptible cultivars CP 73-351 and NCo 310, intermediate in moderately susceptible cultivars CP 65-357 and CP 74-383, lowest in resistant cultivars CP 70-330 and CP 72-370, and absent in CP 70-321 and CP 72-356. Cane tonnage yields were negatively correlated ($P = 0.01$) with increasing levels of smut incidence observed in small plots in three plant-cane and one ratoon-cane field of CP 73-351. The most significant effect of smut on yield was a reduction in number of healthy stalks in diseased plots.

Smut, caused by *Ustilago scitaminea* Syd., is an important disease of sugarcane (interspecific hybrids of *Saccharum*) that has spread to all of the major cane-growing areas of the world except Australia (5,6).

Smut was first observed in Louisiana in May 1981 (5). Smut-infected plants of sugarcane cultivars CP 65-357, NCo 310, and CP 73-351 were found in surveys conducted during the 1981 growing season (5).

In 1981, CP 65-357 was the major cultivar in Louisiana, occupying 71% of the sugarcane acreage, whereas NCo 310 and CP 73-351 occupied 7% and less than 1% of the acreage, respectively. Four cultivars resistant to smut, CP 70-321, CP 70-330, CP 72-356, and CP 72-370, were planted on only 6% of the total acreage (3).

Within smut-infested fields, about 2.5% of the stools of cane were estimated to be diseased (5), and no economic losses were anticipated from this level of infection. Yield losses as high as 42% have been reported in smut-susceptible cultivars (1); however, a clear assessment of the economic importance of smut is lacking because outbreaks are usually reported in terms of disease incidence with no mention of yield loss (6).

A statewide survey was conducted during the 1984 growing season to determine what changes had occurred in the distribution and incidence of sugarcane smut since 1981. In addition, the effects of different levels of smut incidence on yield were determined

within four commercial fields of CP 73-351 in which smut had spread naturally.

MATERIALS AND METHODS

Survey. A survey was conducted on 61 randomly selected farms in the 15 sugarcane-growing parishes in Louisiana during the last week of June through the first week of August 1984. On each farm, two plant-cane and two first or second ratoon-cane fields, comprising two to four cultivars, were surveyed for smut-infected cane stalks.

Total cane stalks were counted in four to 14 sections of row 15.24 m long distributed throughout each field, and stalks showing the whiplike structure at the stalk apex, characteristic of diseased stalks (2), were counted in 10-40 sections of row 15.24 m long. The ratio of means for number of diseased stalks per plot and total number of stalks per plot was then used to estimate the disease level for each field.

Yield loss estimates. The effects of different levels of disease on sugarcane yield were determined in three commercial plant-cane fields (A, B, and C) and one second ratoon-cane field (D) of CP 73-351 with estimated disease levels of 8.9, 6.8, 8.6, and 8.9%, respectively. Within each field, total stalks and diseased stalks or stalks with whips were counted in 25 single-row plots 4.35 m long running end to end along two adjacent rows. The disease level was determined for each plot from the ratio of the total number of whips and total number of stalks. The disease levels for individual plots ranged from 0 to more than 40% in each field.

A yield estimate was determined for each plot by obtaining a mean weight for smutfree stalks (stalks without a smut whip at the apex) and multiplying it by the number of smutfree stalks in each plot. Plot yields were then converted to

an estimate of cane yield in tons per hectare. All cane stalks were cut by hand at ground level, topped above the last hard stalk internode, and stripped of all leaf and leaf sheath material.

The mean weight for smutfree stalks was estimated for the entire field in two plant-cane fields (A and B) by determining the mean stalk weight from five 15-stalk samples collected at different locations within the field. In the third plant-cane field (C) and the ratoon-cane field (D), a mean weight for smutfree stalks was determined for each individual plot from the total weight of the first 15 smutfree stalks in each plot.

Stalk samples collected from individual plots in fields C and D were milled, and percent sucrose and fiber content estimates were calculated (7).

Regression analysis was used to determine whether smut incidence levels in individual plots were correlated with plot yield estimates and smutfree stalk numbers for each field and with smutfree stalk weight, percent sucrose, and percent fiber content means for plots in fields C and D.

RESULTS AND DISCUSSION

Survey. Smut-infected plants were observed in 13 of 15 parishes where sugarcane is grown. The disease was observed in the eight parishes where it was found in 1981 (5) and in Ascension, Iberville, St. James, Terrebonne, and West Baton Rouge parishes. Sugarcane smut has still not been observed in two parishes, Pointe Coupee and St. Charles.

The highest incidence of plants infected by *U. scitaminea* and the highest frequency of infested fields were found in the susceptible cultivars CP 73-351 and NCo 310 (Table 1). Fewer infested fields with a lower incidence of disease were observed in the moderately susceptible cultivars CP 65-357 and CP 74-383 (Table 1), and trace amounts of smut were found in only two of 107 (1.8%) fields of resistant cultivars CP 70-321, CP 70-330, CP 72-356, and CP 72-370 (Table 1). Apparently, the levels of smut incidence occurring within infested fields have not increased since 1981.

In many sugarcane-growing regions of the world, the introduction of smut has resulted in severe epidemics in susceptible cultivars followed by almost complete eradication of the disease through adoption of adequate control measures

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Table 1. Results of 1984 Louisiana survey for sugarcane smut caused by *Ustilago scitaminea*

Cultivar	Fields surveyed ^a (no.)	Fields with smut ^b (%)	Mean level of disease ^c (%)	Field mean incidence range (%)
CP 73-351	41	53.7	2.0	0.0–20.1
NCo 310	5	80.0	1.0	0.0–2.0
CP 74-383	57	38.6	0.7	0.0–3.0
CP 65-357	62	33.9	0.4	0.0–1.3
CP 70-321	55	0.0	0.0	...
CP 70-330	9	11.1	0.1	...
CP 72-356	23	0.0	0.0	...
CP-72-370	20	5.0	0.1	...

^a Plant-cane and ratoon-cane fields combined.

^b Smut infection determined by observation of characteristic whiplike structure at shoot apex.

^c Ratio of means for diseased stalks and total number of stalks per 15.24-m row section.

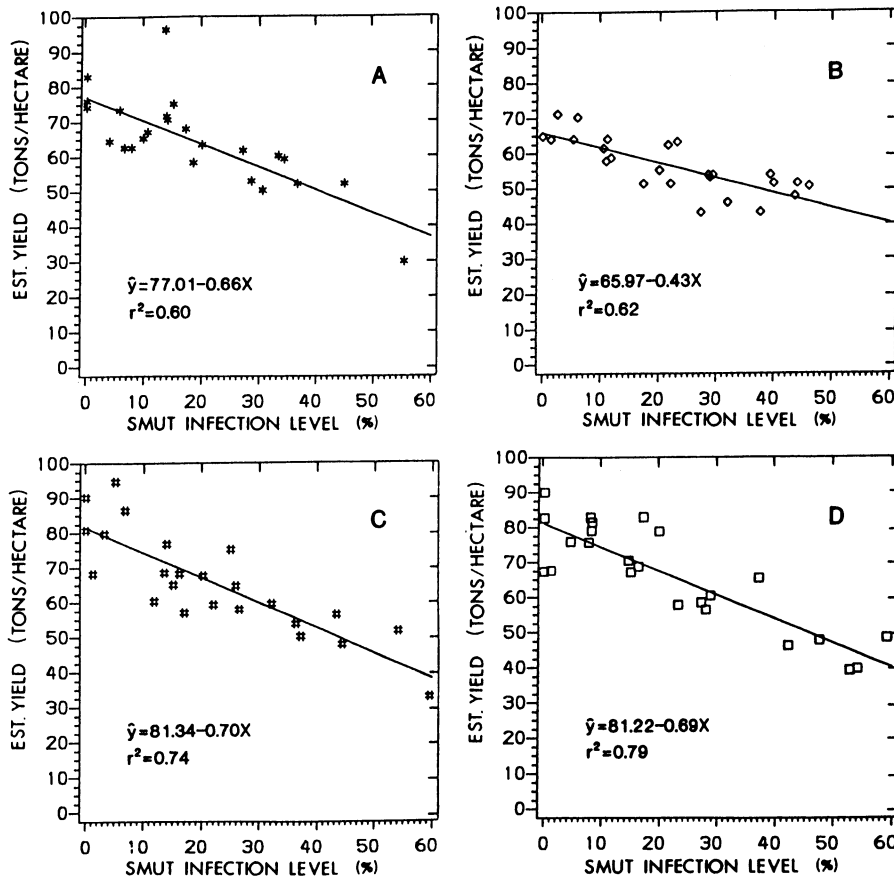


Fig. 1. Relation of estimated sugarcane tonnage yields to increasing levels of smut incidence (A–C) in 25 small plots in three plant-cane fields and (D) in one second ratoon-cane field of cultivar CP 73-351.

(usually replacement of smut-susceptible cultivars with resistant ones) (2). In Louisiana, a severe smut epidemic has not been observed in susceptible cultivars in the 4 yr since the disease was first observed. In 1981, CP 65-357, NCo 310, and CP 73-351 were planted on 71, 7, and <1% of the acreage, respectively (3), and CP 74-383 had not been released. In 1984, the amount of acreage planted with the resistant cultivars CP 70-321, CP 70-330, CP 72-356, and CP 72-370 had increased

from 6 to 51% (4). However, CP 65-357, NCo 310, CP 73-351, and CP 74-383 were planted on 38.8, 1.2, 2.8, and 3.8% of the acreage, respectively (4), so a considerable amount of acreage (46.6%) was still planted with susceptible cultivars. It appears from a comparison of the 1981 and 1984 survey results and cultivar census data that certain factors are limiting the incidence of sugarcane smut in Louisiana.

Yield loss estimates. Cane tonnage

yields were negatively correlated with levels of smut incidence ($P = 0.01$, $r = -0.574$) in the three plant-cane fields (A–C) and one ratoon-cane field (D) of CP 73-351 (Fig. 1). In all four fields, the level of smut incidence and the number of smutfree stalks in each plot were also negatively correlated. Coefficients of determination from comparisons of the numbers of smutfree stalks per plot and percent smut incidence for fields A, B, C, and D were 0.61, 0.62, 0.79, and 0.77, respectively. It has been suggested that smut reduces yield mainly by decreasing stalk diameter and reducing the ratio of sucrose to fiber in infected canes (6). At harvest, most whip-bearing cane stalks of CP 73-351 are necrotic and deteriorated to the extent that they contribute very little to yield after routine mechanical harvesting and burning. In addition, in fields C and D, no significant correlations were detected between plot levels of smut incidence and means for smutfree stalk weight ($r^2 = 0.01$ and 0.13 , respectively), smutfree stalk percent sucrose ($r^2 = 0.01$ and 0.07), or smutfree stalk percent fiber ($r^2 = 0.15$ and 0.02). The significant effect of smut on yield of CP 73-351 in Louisiana appears to result from the reduction in number of healthy, millable stalks in diseased fields.

Although smut is spreading through the Louisiana sugarcane-growing regions, the disease is not increasing in severity. The natural infection levels of smut now occurring in susceptible cultivars are not high enough to cause appreciable yield loss. However, smut incidence levels ranging from 10 to 20% have been observed in a few fields of CP 73-351, so highly susceptible cultivars such as CP 73-351 should not be grown commercially in Louisiana.

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