# THE HANDLING OF SUGARCANE TRASH

## I. YIELD AND ECONOMIC CONSIDERATIONS

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### Introduction

The proper handling of trash in sugarcane fields is an item of great importance to Puerto Rican sugarcane growers because of its direct bearing on the cost of production, yield of cane, and such various aspects of soil conservation as erosion, infiltration, organic-matter content, and structure. The handling of trash is an essential part of the agronomic practices used with sugarcane. Its proper management can mean greater profits to the sugarcane grower not only because of savings in labor costs but also from increases in yields.

Sugarcane trash is the material left on the surface of the ground after harvesting sugarcane, and consists of all the leaves and the upper immature part of the stalk. For 1949, when 10,998,026 tons of cane were ground in Puerto Rico with an average acre yield of 31.2 tons of cane per acre (4),[2] this represented 2,749,506 tons of dry sugarcane trash.[3] This trash contained 93 pounds of combined nitrogen per acre. If handled properly this trash becomes an asset; if misused it can become a liability to the sugarcane grower.

The utilization of the trash presents practical difficulties, and many sugarcane planters burn it. The trash is very bulky and difficult to plow under or to plow through in the cultivation of the crop. If it is buried or plowed under deeply, the decomposition may be too slow and effective use of soil nitrogen is hindered. Should the trash remain undecomposed, there is also the possibility that it may serve to protect the resting stage of insects injurious to the cane, and that under conditions of excessive moisture and low temperature its presence may increase the infection of the cane by facultative parasitic fungi in the soil.

Bonazzi (1), Bonnet (2), and Sturgis (6) have reported that the incorporation of sugarcane trash into the soil increased the total soil nitrogen as it decomposed. They also found the addition of inorganic nitrogen to the trash in the soil hastened its decomposition.

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[2] Numerals in parentheses refer to Literature Cited, p. 245.

[3] Calculated from a cane-trash ratio of 4:1 as estimated by Hardy (3).

## Procedures

In order to study and determine the effects of different ways of handling the trash on yields of sugarcane, experiments were established at Río Piedras and at Isabela. The treatments and other field information are given in table 1.

The procedures for the handling of the trash for each treatment were as follows:

*Trash burned:* The trash was spread evenly over the plot and then burned.

*Trash aligned:* The trash was aligned in alternate banks or rows.

*Trash buried:* A furrow was made about 1 foot deep between rows; the trash was placed in the furrow and covered with soil.

*No manipulation:* The trash was left untouched as found in the field after harvesting the cane.

Table 1.—*Treatments and field information of trash experiment*

| Item | Río Piedras experiment | Isabela experiment |
|---|---|---|
| Treatment A | Trash burned | Trash aligned |
| Treatment B | Trash buried | Trash aligned and plowing |
| Treatment C | Trash aligned | Nonmanipulation of trash |
| Treatment D | — | Trash burned |
| Planting date | June 21, 1944 | February 10, 1946 |
| Soil type | Vega Alta silty clay | Coto clay |
| Replication | 20 | 9 |
| Sugarcane variety | P.O.J. 2878 | P.R. 905 |
| Planting rate | 12,000 3-eye seed pieces per acre | 10,200 3-eye seed pieces per acre |

*Trash aligned and plowed:* The trash was aligned in alternate banks or rows and a shallow furrow was opened in the clean banks.

The planting, cultivation, and fertilizer application were carried out in the normal manner used by the cane growers in their respective regions.

## Experimental Results

### Río Piedras experiment

The results for a plant cane and six ratoon crops are presented in table 2.

The results for the plant cane were utilized as a uniformity test of the field because the various treatments were not applied until after the harvest of the plant cane. The results showed no significant differences between treatments or plots which indicated that the experimental site selected had no differences in fertility which might tend to obscure the results of the various treatments. This uniformity in fertility was of importance in that the

differences obtained by subsequent treatments could be attributed to the treatment effect and not to soil variations.

No significant differences in the yield of available 96° sugar in hundredweights per acre were obtained for the first four ratoon crops. Significant differences in yields, however, were obtained in the fifth and sixth ratoons. For the fifth ratoon the aligned-trash treatment was significantly better at the 5-percent level over the burned-and buried-trash treatments. This increased to a significance at the 1-percent level for the sixth ratoon. There were no significant differences between the burned- and buried-trash treatments.

The results of a combined analysis of the mean yield of the sixth ratoon crops show no significant differences between the treatments in yields of sugar per acre. It is important, however, to give attention to the fifth and

TABLE 2.—*Mean yields of available 96° sugar of a plant cane and 6 ratoon crops at Río Piedras*

| Treatment letter | Treatments | Mean available 96° sugar per acre for— | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Plant cane | First ratoon | Second ratoon | Third ratoon | Fourth ratoon | Fifth ratoon | Sixth ratoon | Mean yield of 6 ratoon crops |
| | | *Cwts.* | *Cwts.* | *Cwts.* | *Cwts.* | *Cwts.* | *Cwts.* | *Cwts.* | *Cwts.* |
| A | Trash burned | 55 | 106 | 127 | 109 | 107 | 114 | 91 | 109 |
| B | Trash buried | 54 | 107 | 125 | 108 | 109 | 115 | 96 | 110 |
| C | Trash aligned | 54 | 106 | 127 | 105 | 105 | 122 | 99 | 111 |
| Least significant difference at: | | | | | | | | | |
| | 1-percent level..... | 5.35 | 7.98 | 11.07 | 9.18 | 8.60 | 8.64 | 7.27 | 6.11 |
| | 5-percent level..... | 3.99 | 5.96 | 8.27 | 6.86 | 6.43 | 6.46 | 5.44 | 4.56 |

sixth ratoon crops. The effect of the treatments after 5 years of continuous cultivation began to produce significant differences in yields. The first few years these differences are not observed and the results tended to give a false picture. With increases in time of cultivation, the small differences accumulated and made themselves known.

Field observations made during the early stages of growth of this fifth and sixth ratoon crops showed that the burning and burying of the trash retarded the growth of the cane as compared with the aligned-trash treatment. This growth delay may be caused by the intense heat of burning or the destruction of roots in burying. At later stages of growth no differences in growth height was observed. However, plots under the burned- and buried-trash treatments were more quickly overgrown with weeds than those under the aligned-trash treatment. This means that cultivation costs

will be higher in the burned- and buried-trash plots than in those where the trash was aligned.

ISABELA EXPERIMENT

The results of two plant-cane and two ratoon crops are given in table 3. There were no significant differences in yield attributable to any treatments used. In this experiment no manipulation, which of course had the lowest labor cost, gave yields equal to the other treatments whose labor costs were higher. Aligning the trash showed no superiority over the other treatments. It must be remembered, however, that significant differences in yield from treatments were not obtained until the fifth ratoon at Río Piedras.

TABLE 3.—*The mean yield of cane and sugar for 4 crops at the Isabela Substation*

| Treatment | Treatment | Mean yield of cane per acre from plant cane, 1946–47 | Mean yield of available 96° sugar per acre from— | | |
|---|---|---|---|---|---|
| | | | First ratoon 1947–48 | Second ratoon 1948–49 | New planting 1949–50 |
| | | *Tons* | *Hundredweights* | *Hundredweights* | *Hundredweights* |
| A | Trash aligned | 40.1 | 98 | 83 | 101 |
| B | Trash aligned and plowing | 39.7 | 94 | 75 | 101 |
| C | No manipulation | 40.9 | 104 | 82 | 98 |
| D | Trash burned | 38.1 | 96 | 70 | 107 |
| Least significant difference at: | | | | | |
| | 1-percent level | 6.6 | 17.91 | 41.09 | 17.06 |
| | 5-percent level | 4.9 | 13.20 | 30.29 | 12.59 |

The results obtained indicate that burning or burying the trash is detrimental to sugarcane production when continued over a period of years. However, where burning is necessary, and where sugarcane trash must be eliminated for easier harvesting, it is safe to follow this practice for 1 or 2 years. In general, this practice should be avoided by sugarcane growers because the costs of cultivation increase because of rapid weed infestation. It would be of greater benefit to the farmers to leave the trash untouched in the field; however, this practice can be followed only in areas where irrigation is not normally used; where irrigation is practiced, it has to be avoided because the presence of the trash hinders irrigation. As the cost of sugarcane production is increasing every year, it is recommended that the trash be left in the field untouched. The cost of cultivation is decreased greatly by following this method.

## Discussion

The handling of sugarcane trash should not be considered merely for its effect on the yield of sugarcane. Consideration must also be given to the effects of the various methods of trash disposal on the costs of cane cultivation. A method that gives high yields may cancel this benefit by its higher labor costs. An important consideration also is the long-range effect of treatments on the soil in relation to erosion, water infiltration, drainage, aeration, and organic-matter content. Although the soil appears to assume a passive role, it may become quite an active factor if the methods of trash disposal are deleterious to it.

From an economic standpoint, no manipulation of the trash is, of course, the cheapest. The low cost of cultivation by this method arises not only because no labor is used to handle the trash after harvesting, but also because the carpet of trash deters weed growth and lowers weeding costs. It also offers excellent protection against soil erosion. The carpet of trash prevents washing away of the soil by heavy rains just after harvesting the cane. In an experiment at Mayagüez (5) 14,000 pounds of soil were washed away where trash was burned, as compared with only 1,200 pounds during the same time where the trash was undisturbed. Bonazzi (1) reported in Cuba that leaving the trash on the ground (no manipulation) formed an effective mulch which retained soil moisture during dry periods. Covering the soil with trash fostered the accumulation of considerable quantities of nitrogen under the optimum moisture conditions thus provided. When the trash was incorporated into the soil by Bonazzi lower available nitrate nitrogen resulted than when the trash was undisturbed on the surface. Thus, no manipulation of trash has another advantage in its control of soil moisture and available soil nitrates, but it has the disadvantage that it tends to smother the new ratoon, and replanting is necessary with varieties which ratoon vigorously. Another disadvantage is that it reduces the efficiency of the drainage ditches by clogging them. On level soils or areas of poor drainage in the humid part of Puerto Rico this method may give lower yields because the excess moisture is not carried away by the ditches. Of course, this method is not much used in irrigated areas where the ditches must be kept free of the trash for efficient irrigation.

Burying or burning the trash offers no increase in yields, and over a period of years, gives lower yields than the normal practice of aligning it. Burying the trash is not cheaper than aligning. Burning the trash is cheaper than aligning or burying, but, on continued use, lowers yields, increases soil erosion, and necessitates higher weeding costs.

From the information obtained in these experiments, supplemented with field observations, the alignment of trash is now the best general practice for Puerto Rico from a standpoint of yields, labor costs, and soil erosion

control. In areas where irrigation is not used or drainage is not a serious problem no manipulation of the trash is a more economical practice, but this method should be limited to certain areas of the Island only.

## Summary

1. Experiments on handling of sugarcane trash were established at Río Piedras and Isabela, with treatments consisting of burning, burying, and aligning the trash.

2. In Río Piedras there was no difference in sugarcane yields that could be attributed to any of the treatments until the fifth and six ratoon. Here significant differences in yields were obtained from aligning trash accompanied with burning or burying it.

3. At Isabela, no differences in yields were obtained for four crops of a plant cane, two ratoons, and a plant cane. No manipulation of the trash gave yields equal to aligning, burning, or burying it.

4. Field observations indicated that weeding costs were greater when the trash was burned or buried, as compared with aligning or with no manipulation of the trash.

5. The various practices and their value from the standpoint of yields, costs of cultivation, and soil erosion value are discussed. The general recommendation from present data for Puerto Rico is that the sugarcane trash should be aligned.

## Literature Cited

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