CONTROL OF SUGARCANE MOSAIC IN LOUISIANA BY A NEW ROGUING TECHNIQUE

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SUMMARY

A cage experiment in which a mosaic-susceptible sugarcane variety was isolated from sugarcane mosaic vectors revealed the following:

(a) Mosaic spread occurred to a relatively high degree (26.6%) in the fall of the year before the first frost.
(b) The most rapid spread occurred in the spring from early April to early June with a rapid decrease between mid-June and late August.
(c) No mosaic spread occurred when caged plots were exposed to visitation by sugarcane mosaic vectors from early summer (June 12) until late summer (August 31). Shoots arising from cane stalks from the above plots uncovered on June 12 which were planted under screen cages on August 31 and examined 66 days later on November 5, were found to be 0.7% infected with mosaic.
(d) A mosaic-susceptible variety in an area of rapid spread of the disease may become 100% infected during one growing season.

Two tests conducted in 1967 on two different plantations showed that mosaic might be controlled in plant cane by removal of whole stools infected with the disease with a sugarcane knife in early July. This confirms results of two similar tests conducted the previous year. Results obtained from the two 1967 tests revealed the following:

(a) Removal of primary infection by digging of the whole stalk in early spring plus an early July roguing of infected stools with a sugarcane knife was the most effective technique used in these tests to control mosaic. The early July roguing apparently removed the secondary spread which occurred between April and early June.
(b) Two early roguing to remove primary infection plus a late June knife roguing of infected stools was not as effective as only one knife roguing of infected stools in early July.
(c) Of the various roguing techniques used, one late June knife roguing of infected stools was the least effective in reducing mosaic infection.
(d) Spraying the ratoon with Garlon (mixture of Dwayne and silvex) was effective in preventing regrowth from late June to fall. Previous studies have shown that Garlon will destroy sugar cane ratoons.

Results obtained with insect-proof cages in 1967 indicate that secondary spread is almost nonexistent from the early part of June until early September in an area where disease spreads very rapidly. If this is true for the entire sugarcane belt of Louisiana every year, a final roguing in early July should help in controlling mosaic in seed material to be planted in September.

INTRODUCTION

Mosaic disease is once again causing great concern in Louisiana. It was in the late twenties that mosaic and other diseases caused the Noble varieties to fail. The industry survived by introduction of the more tolerant POJ. and Co. canes. The CP.
canes replaced those introduced earlier after they failed because of mosaic, root rot
and red rot. The CP. canes replaced all others by the mid-forties. Co. 290 was the last
of the Co. canes to be grown commercially in Louisiana.

Mosaic was found to a relatively high degree in 1956 in some fields along the
Mississippi River and Bayou Lafourche, the two main cane areas in the northeastern
part of the sugar belt.

The leading commercial variety, CP. 44-101, released in 1950 and N:Co. 310
released in 1954 appeared to be susceptible. Later Abbott identified the mosaic
found on CP. 44-101 and N:Co. 310 as a new strain which was designated strain H.
CP. 52-68 released in 1958 was also found to be very susceptible. By 1964 all
major varieties, including CP. 55-30 released in 1963 were considered susceptible to
the new strain. A statewide survey in 1965 and 1966 revealed that mosaic in nonro-
gued fields had reached a level of 45.0 per cent as an average for all susceptible varie-
ties.

Fortunately, the secondary varieties such as CP. 48-103, C.P. 36-13 and CP.
44-155 being grown commercially are moderately resistant to strain H. CP. 47-193,
also a secondary variety, is resistant. The present recommendations are for farmers
to shift their planting program to include the secondary varieties.

With the release of L. 60-25, in 1966, an exceptional variety in both yield and
sugar per ton, but which is susceptible to mosaic, a need existed for a better roguing
program than the one presently recommended.

Results of 2 tests conducted by Steib and Chilton at 2 locations in 1963 and
1964 using 3 mosaic susceptible varieties while attempting to determine the effects
of hot-air treatment on spread of mosaic showed that there was less spread of mosaic
in August 9 planted cane than either September 6 or September 26 planted cane. The
greatest spread occurred in cane planted on September 26. Zummo reported fall
spread in cane planted on September 20, but not in cane planted on October 31.
Since results of these 2 large tests in 1963 and 1964 (54 replications 25 feet long at one
location and 27 replications 15 feet long at another location) seemed to indicate that
there was an apparent reduction in the amount of mosaic spread during August or
possibly in July, it was decided to rogue diseased plants in first stubble and plant cane
seed plots of the newly released L. 60-25 in early July (second week) instead of earlier
roguings in May and June. Tests conducted in 1966 showed that roguing in July by
removal of mosaic infected stools with a sugarcane knife reduced the level of mosaic
from 47.4% in July to 4.6% which was determined by planting the rogued cane and
emerging shoots examined for mosaic.

Due to the favorable results obtained with July roguing in 1966, 2 large tests
were conducted in 1967 to determine how effective a late June and an early July
roguing alone or in combination with earlier roguing would be in reducing mosaic in
plant cane of L. 60-25 at 2 locations in 1967. Also, insect proof cages were used to
cover a mosaic-susceptible variety in the fall, spring and summer. This was done in an
attempt to determine rate and time of mosaic spreads which may explain why early
July roguing — removal of infected stools with a sugar cane knife — was so effective
in reducing mosaic in 1966.
Insect-proof cage investigations

For the insect transmission studies, insect-proof cages with 32 mesh screen were used to cover plants of the mosaic-susceptible L. 61-52 after planting on August 29, 1966. Cages 12 feet long, 16 inches wide by 40 inches high were placed over the plots.

The following treatments were included in the test:
(b) Plots covered in the fall and through March 23, 1967 when they were uncovered in very early spring.
(c) Plots not covered in the fall, but covered in the spring on March 23, 1967 and remained covered until June 12, 1967.
(d) Check plots which were not covered.

Four plots 12 feet long on a standard Louisiana type row were used for the test. The test was planted in an area where mosaic was known to spread very rapidly. The field where the cages were located was planted with CP. 52-68 known to be almost 100% mosaic infected. Standard cultivation and fertilization practices were followed.

The cages were removed on June 12, 1967 and counts made of all plots to determine the per cent mosaic infection. Summer counts were made on July 25, 1967 to determine if the plots covered in the fall, spring and early summer had become infected after removal of the cages, and to determine if mosaic had increased in other plots since June 12, 1967 when the cages were removed. An examination of individual stalks grown under screen cages in the fall and following year until June 12 was made on August 31 to determine the amount of mosaic spread from June 12 to August 31.

Mosaic roguing in late June and early July

Plant cane fields of L. 60-25 located on two plantations in the Mississippi River sugar cane area were chosen as test sites for two mosaic-roguing tests in 1967. The aims of the tests were to determine the effectiveness of combining an early April roguing with a late June or an early July (5 to 7 July) roguing of mosaic stools with a sugarcane knife. One knife roguing (removal of the infected stool with a sugarcane knife) in late June and a similar one knife roguing in early July were included.

The remaining ratoon pieces which were left after cutting the infected stool at a height of 4 to 6 inches above ground level were well sprayed with a chemically fortified petroleum solvent. According to Stamper4, Garlon, a commercial material which contains 4 pounds of Dowpon (2,2-dichloro-propionic acid, sodium salt) and ½ pound of silvex (2,4,5-trichlorophenoxy)-propionic acid per gallon if mixed at the rate of 1–5 gallons of diesel oil is very effective in preventing regrowth of sugarcane ratoons.

Four replicated plots per treatment (single row) 100 feet long were used for the roguing tests at the 2 test locations. Individual stalks were examined to determine per cent mosaic. Each of the 2 tests included the following treatments:
(a) Two roguing (removal of whole diseased stalk from the plots), one in early
spring (April 4) and the other in late spring (May 16) followed by a June 28 knife roguing (removal of the whole mosaic stool if one stalk in the stool was diseased) and spraying with Garlon for destruction of the remaining ratoon.

(b) One roguing in early spring (April 4) followed by a July 5 knife roguing using the technique as in ("a") above.

(c) Only one roguing in late June as in ("a") above.

(d) Only one roguing in early July as in ("b") above.

(e) Check plots with no roguing.

EXPERIMENTAL RESULTS

Screen cage results

Sugarcane plants in plots covered in the fall and spring until uncovered on June 12 became infected with mosaic but with only a trace during the period June 12 through August 31.

Results in Table 1 show that plants not covered in the fall of 1966 but which

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Per cent mosaic found in the plots in 1967</th>
<th>Per cent mosaic found in shoots</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fall spread</td>
<td>Spring spread</td>
</tr>
<tr>
<td></td>
<td>April 17</td>
<td>May 16*</td>
</tr>
<tr>
<td>Covered in fall—</td>
<td>2.3</td>
<td>42.4</td>
</tr>
<tr>
<td>Uncovered in spring</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Not covered in fall—</td>
<td>19.3</td>
<td>—</td>
</tr>
<tr>
<td>Covered in spring</td>
<td>—</td>
<td>0.0</td>
</tr>
<tr>
<td>Covered fall and spring</td>
<td>0.0</td>
<td>—</td>
</tr>
<tr>
<td>Check—not covered</td>
<td>19.2</td>
<td>68.7</td>
</tr>
</tbody>
</table>

* Much evidence of secondary spread by May 16.
** From fall spread.
*** Plots uncovered on June 12. No evidence of mosaic spread by August 31. Plots were harvested on August 31 and stalks collected from these plots were planted under screen cages. Of 299 emerging shoots only 2 were found infected with mosaic on November 5.

were covered early the next spring before secondary spread occurred were found to be 25.9% infected on June 12. This was fall spread. On April 17, the check plots which had not been covered were found to be 19.2% infected (counted before spring secondary spread). The plots covered in the fall were found to be 2.3% infected in early spring on April 17. This probably resulted from spread which occurred from March 23 when the cages were removed until the reading was made on April 17 or primary infection. To verify the amount of mosaic spread in the area, an examination
on July 25 showed that 97.2% of the plants were infected in check plots which had not been covered.

The most rapid spread of mosaic occurred between April 17 and May 16 as evidenced by the rapid rise in mosaic in the plots which were covered only in the fall and uncovered in the spring, and also from the increase noted in the check.

Spread continued to occur between May 16 and June 12, but to a lesser degree. The mosaic spread between June 12 and July 25 in the plots uncovered in early spring continued at much lesser rate. This was apparent infection which had occurred prior to June 12 because plots uncovered for the first time on June 12, had not become infected by August 31 when a check was made of the plots. Stalks harvested from plots uncovered after June 12 were planted on August 31 under screen cages. An examination of emerging shoots on November 5, 67 days later, showed that of 299 shoots only 2 were infected with mosaic. This showed that in 1967, at this test site, mosaic did not spread to any degree after June 12.

Late June and early July roguing results

Roguing of L. 60–25 plant cane in an area of rapid mosaic spread (Table 2) showed that July 7 roguing of entire stools of infected cane was more effective than roguing 10 days earlier. Two early rogunings and a late June roguing were not as effective as one

<table>
<thead>
<tr>
<th>Treatment</th>
<th>April 5</th>
<th>May 16</th>
<th>April 16</th>
<th>June 16</th>
<th>June 28</th>
<th>July 7</th>
<th>July 25</th>
<th>October 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two spring roguing</td>
<td>21.9</td>
<td>7.3</td>
<td>—</td>
<td>—</td>
<td>12.7</td>
<td>—</td>
<td>5.4</td>
<td>7.5</td>
</tr>
<tr>
<td>One summer (June 28) roguing</td>
<td>—</td>
<td>—</td>
<td>26.5</td>
<td>29.7</td>
<td>45.2</td>
<td>—</td>
<td>5.6</td>
<td>5.8</td>
</tr>
<tr>
<td>One spring roguing</td>
<td>20.6</td>
<td>—</td>
<td>5.3</td>
<td>—</td>
<td>32.6</td>
<td>1.5</td>
<td>2.5*</td>
<td></td>
</tr>
<tr>
<td>One summer (July 7) roguing</td>
<td>—</td>
<td>—</td>
<td>19.6</td>
<td>27.2</td>
<td>43.4</td>
<td>2.0</td>
<td>3.6*</td>
<td></td>
</tr>
<tr>
<td>Check—not rogued</td>
<td>—</td>
<td>—</td>
<td>9.2</td>
<td>17.2</td>
<td>—</td>
<td>29.2</td>
<td>28.6</td>
<td></td>
</tr>
</tbody>
</table>

* Average per cent mosaic of two July roguing—3.1%.

early July roguing. The most efficient combination was one early April roguing followed by an early July roguing. For example (Table 2) in the area of rapid mosaic spread, two early rogunings plus one late June roguing resulted in a mosaic infection of 7.5% as determined by an examination of individual stalks on October 10. Plots rogued once earlier plus an early July roguing were found to be 2.5% infected on October 10.
Plots rogued in early July without any earlier roguing were found to be 3.6% infected on the same date. Infection in the check was 28.6% on the same date. Generally, similar results were obtained in an area of low mosaic spread (Table 3).

### TABLE 3

RESULTS OBTAINED WITH A NEW TECHNIQUE FOR ROGUING SUGARCANE MOSAIC BY REMOVAL OF PRIMARY INFECION IN EARLY SPRING FOLLOWED BY ROGUING OF SPRING AND MID-SUMMER SECONDARY SPREAD DURING THE SUMMER BY REMOVAL OF INFECTED STOOLS WITH A SUGARCANE KNIFE. Variety L. 60-25

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Rogued in spring only</th>
<th>Mosaic count</th>
<th>Rogued in summer only</th>
<th>Summer exam. stools harvested</th>
<th>Fall exam. stools harvested</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>April 13</td>
<td>May 17</td>
<td>April 13</td>
<td>May 17</td>
<td>June 1</td>
</tr>
<tr>
<td>Two spring roguing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>June 28</td>
</tr>
<tr>
<td>(June 28) roguing</td>
<td>5.5</td>
<td>1.6</td>
<td>0.3</td>
<td>1.6</td>
<td>0.5</td>
</tr>
<tr>
<td>One summer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(June 28) roguing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>One spring roguing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(July 7) roguing</td>
<td>7.0</td>
<td>3.6</td>
<td>2.4</td>
<td>2.7</td>
<td>0.3</td>
</tr>
<tr>
<td>One summer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(July 7) roguing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check—not rogued</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Average per cent mosaic of two July roguing—1.9%.

**DISCUSSION**

Mosaic counts of plots covered with insect proof cages during different periods of the growing season showed that mosaic spread occurred in the fall, and the following spring and early summer (April, May and early June). Fall covered plots which were uncovered early the next spring on March 23 were found to be 42.4% infected 55 days later on May 16. By June 12 infection in the same plots was 65.5%, while on July 25, the per cent infection was 76.4. The rate of spring and early summer spread in the check plots which were never covered was very similar to the rate of spread found in plots uncovered in the spring after being covered the previous fall. This showed that in the area where the test was located, the period of very rapid spread was from mid-April to mid-June. Fall spread as determined by a final reading on July 25 was 26.6%. A period of 65 days growth, after planting on August 31 was terminated by a heavy freeze on November 3.

The plants in the plots covered in the fall after planting and which remained covered in the spring were found free of mosaic when they were uncovered on June 12, indicating complete isolation from insects during that period. The 4 above plots found free of mosaic were left uncovered after the mosaic count was made on June 12, 1967. An examination of the same 4 plots 43 days later on July 25 revealed that the uncovered plants had not become infected with mosaic after 43 days exposure to insect visitation. A stalk examination on August 31 revealed the above plots were
still free of mosaic. The incubation period for mosaic is generally considered to be 3 weeks in Louisiana. An examination of 2-month-old shoots (shoots germinated under screen cages from stalks from the above plots) revealed that only 2 shoots were infected with mosaic out of 299 emerging.

The apparent lack of mosaic spread after June 12 may be influenced by some of the factors given below:
(a) Grasses found on ditchbanks, headlands and other adjacent non-cane land may not be suitable for aphid multiplication since most of them are mature by mid-June.
(b) A temperature of 90°F or above which prevails in June, July and August may preclude the multiplication of the mosaic virus in the sugarcane plant.
(c) The stage of maturity of mosaic-diseased grasses and sugarcane in Louisiana by the second week in June may be such that the insect cannot become viruliferous.

The apparent lack of spread of mosaic after June 12 is probably the reason why early July roguing was found effective in reducing mosaic in tests conducted in 1966 and 1967.

Control of mosaic by roguing is recommended in Louisiana if not more than 2% of the shoots emerging from mother stalks in plant cane are diseased. Roguing should commence in the spring as soon as the effects of frost and herbicides have disappeared. Removal of the whole stalk if one shoot is diseased is recommended. Roguing should be practiced in May and June at about 2-week intervals.

Tests conducted during the past 2 years showed that one early April roguing of infected mother stalks plus one roguing early in July of infected stools were very effective in reducing the amount of mosaic in L 60-25 to be used for seed.

Two early roguingd, April 5 and May 16, plus a late June 28 roguing were not as effective as only one early July roguing. One early, April 5 and one early July 5 or 9 roguing were most effective in reducing the amount of mosaic in seed cane.

The apparent reason why an early July roguing is effective is because spread apparently does not occur to a great degree after June 12 as shown by the cage experiment conducted in 1967. As previously stated, plants of a very susceptible variety were found to be only 0.7% infected with mosaic after exposure to insect visitation after June 12.

Even though one April roguing of infected mother stalks plus an early July roguing were found to be effective in reducing the amount of mosaic in seed cane, it would probably be best until further information is obtained to recommend a July roguing in addition to the present roguing recommended in May and June. This seems desirable for the following reasons:
(a) removal of infected stalks early eliminates a source of inoculum from the area;
(b) an earlier roguing makes the job of roguing in July easier when temperatures are high.

The technique of cutting the mosaic-affected stool 4-6 inches above ground level followed by spraying with Garlon was found to be very effective in preventing regrowth of the remaining ratoon. Removal of the affected stools in a seed plot of a valuable new variety or progeny of seed cane treated for control of the ratoon stuntling disease is very desirable if the ratoon is to be used for seed the following year.
REFERENCES


Discussion

R. Mathis: Could you please describe the knife technique for roguing diseased stalks which is mentioned in the paper?

E. Graugnard: Disease stools are cut off a few inches above ground. The herbicide is then applied to the stubble.

P. B. Hutchinson: Who are the actual people who do the roguing? Is it compulsory for growers to rogue infected cane?

E. Graugnard: There are 3 main ways that inspection and roguing may be done—by the farmer himself on small farms, by the farmer’s own trained crew or by contractors. The latter often employ college or high school students. Naturally, the standard of work varies considerably and anything that simplified the operation makes for better overall control. There is no legislation to force roguing. And in the main, growers realized the importance of the operation.