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# INSTITUTO DE PESQUISAS IRI

CONSULTANT'S REPORT ON THE DIGITARIAS

by

Stanley G. Schank

November 12 to December 18, 1966

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## INTRODUCTION

During the time period 12 November to 18 December, 1966, my assignment was as a consultant on the *Digitaria* species in Brazil. This report covers the first four weeks of the consultantship. An addendum will be forwarded later which will cover the evaluation of *Digitarias* at Belém and also observations in Suriname.

Two major problems appear to be affecting the *Digitarias* in Brazil. The first is a scale insect, cochonilha (*Antonina graminis*), and the second is a stunting virus disease, transmitted by a delphacid leafhopper vector (*Sogota fruciferа*).

The purpose of the consultantship was to confer with Brazilian and IRI agronomists on these problems and to evaluate *Digitarias* and other grass species in several locations in Brazil.

## MATERIALS AND METHODS

Common pangolagrass (*Digitaria decumbens*) and Taiwan A-24 (*Digitaria pentzii*) were both introduced into Brazil by way of Florida. The common variety in 1952, and the Taiwan introduction in 1962.

Other grass introductions were also imported into Brazil in 1965. Source of these new varieties of *Digitaria* was the recent USDA collection trip into Africa made by A. S. Oakes and which was reported in Tropical Agriculture.

(1965) 42:323-331. Over 50 of the new grass introductions were shipped to R. W. Duell, IRI/USAID Forage Crops Specialist, and with the cooperation of many of his colleagues he was able to get these established in five locations, with partial collections in four other areas of Brazil.

Names and plant introduction numbers of all materials are found in "Inventário de gramineas e leguminosas" by IRI Agronomists Hymowitz and Steenmeijer (1966), and so are not described further in this report.

Methods of evaluation were formulated and research plans were developed to:

1. Score pangolagrass and A-24 for the two most common agronomic problems -- cochonilhas and virus. Special notice would be taken of indigenous species as well, and presence of cochonilha or virus on them.

2. Evaluate replicated plots of the new grass introductions at Matão and compare these plots with unreplicated plots at other locations. Again, cochonilha and virus ratings would be made.

3. Collect epidermal peels and leaf tissue of "virus stunted" plants of pangolagrass in three Brazilian locations and two Suriname locations for analysis with light and electron microscopes.

## RESULTS

Table 1 gives the results of observations at 5 locations in Brazil for cochonilha and virus. Most significant is the sporadic occurrence of the virus stunt

symptoms. These were most apparent at the Km. 47, Matão and Viçosa locations. Every precaution should be taken before shipping materials from these virus infested areas. No virus symptoms were observed on A-24.

The Taiwan introduction (A-24) has a greater infestation of cochonilhas than common pangolagrass. Since this is true at so many locations, it is believed that the genetic makeup of A-24 allows it to be attacked at a higher rate than most of the other grass species. The cochonilha affecting both pangola and A-24 was positively identified by three different insect taxonomists in 1966 as Antonina graminis.

This is no doubt the same scale reported to be on Angola (Brachiaria mutica) and Angolinha (Ericholoa polystachya) some five years ago by Brazilian entomologists. The evidence is rather clear -- pangolagrass lacks resistance to the virus and A-24 is highly susceptible to the cochonilhas. Other species, long grown in Brazil, also harbor the scale insect as shown in Table 1.

Replicated plot data at Matão is given in Tables 2 and 3. These scores show evaluation for cochonilha and virus only. These are the newest 50 introductions, and great importance was placed in this test for built-in genetic resistance against both the scale and the virus. An objective scoring system was developed which will permit a long-range outlook on rate of spread of these maladies.

Data collected by Hans Steenmeijer and Robert W. Duell at Matão were analyzed and compared with data from Florida. These data (Table 4) reflect desirable agronomic characteristics, and selections were then made of the more promising introductions. It is significant to note that genera other than Digitaria rank very high -- for example

some Brachiarias and Hemarthrias must be looked at in greater detail. Observations of these three genera at various locations in Brazil indicate that further testing is necessary, and a new program is being launched to do this testing. Many of the original introductions are inferior and should be discarded.

The microscopic studies of the stunt virus affecting pangolagrass will be completed at a later date by a cooperator, Dr. John Edwardson at the University of Florida. Treatments included:

Methyl Salisol, $H_2O$ and Alcohol (Epidermal peels)
Osmium Fixation of electron microscopic mounts
Glutaraldehyde for electron microscopic analysis

Locations selected from which samples were taken were Km 47, Matão, Belém and two locations in Suriname.

Dr. Santos Costa at Instituto Agronômico, Campinas has successfully transmitted the stunt virus of pangolagrass using Sogota, and thereby has positively identified the viral nature of stunting. Transmission rates were very low - only about 3%. One other report exists where the virus was transmitted by insect vectors (Dirven and Van Hoof, 1960). The spread of the stunt virus must be watched closely in the coming months and years, for it has completely wiped out the pangolagrass industry in several locations, viz. Suriname, Fiji, and is severely attacking pangolagrass fields in British Guinea, Venezuela and Peru.

## RECOMMENDATIONS

1) Efforts should be made to maintain and expand the grass (and legume) introduction service in Brazil. Without a good source of materials within a country, forage evaluation will never grow.

2) Great care should be taken in shipment of materials from one state to another. This is imperative now that good evidence exists that the stunt virus of pangolagrass occurs within several locations within Brazil. Inadvertent shipment of either the virus or its vector would be unfortunate.

3) Within IRI, the recommendations on cochonilha should be adhered to explicitly and without compromise.

4) It is urged that Roger Williams study both chemical and biological control of cochonilhas, and other agronomists throughout Brazil continue evaluation of the genetically resistant strains of Digitaria. The widespread occurrence of cochonilhas on dozens of grass species indicates the gravity of this problem.

5) Past experience on nearly all introduced species is that they often succumb to outbreaks of new disease or insect epidemics. It is only with a continuing program of introductions and with the cooperation of plant breeders that new varieties can be released. Such cooperation should be closely maintained in Brazil where no grass breeding program exists.

6) The establishment of several grass species on a single farm or ranch should be encouraged. Possibly the ecological niche of Brachiarias is on lower damp areas, with Digitarias on hillsides where favorable precipitation falls, and Colonião on the better sites. Every effort should be made by IRI, the Ministry stations, and the state secretariat stations to answer the questions on

management, fertility and grass productivity that will be asked in the next two decades.

## CONCLUSIONS

There is no "miracle" grass or panacea. Even the standard variety of *Digitaria decumbens* (pangolagrass) is rapidly falling into disfavor because of attacks of stunt virus. Such attacks have been reported in Suriname, 1961; British Guiana, 1966; Peru, 1965; and Venezuela. A replacement for pangolagrass, namely *Digitaria pentzii* (A-24) has been found to be very susceptible to the scale insect cochonilha, and may not persist in several locations in Brazil.

For these reasons, a program of introductions and their evaluation must be intensified. Then replicated trials of the best materials should be conducted. The next stage is grazing trials. Fortunately, germ plasm of various *Digitaria*, *Brachiarias*, *Hemarthreas*, *Bermudas* and other grasses have been introduced into Brazil and an active program is under way. It has been a pleasure to see many stages of evaluation under way and to give counsel on the establishment of new programs.

TABLE 1. Scale and virus infections on pangolagrass and A-24 at 15 locations in Brazil, November-December, 196[illegible]

| Locations | Pangola | | A-24 | | Other grass species | | |
|---|---|---|---|---|---|---|---|
| | Cochonilhas | Virus | Cochonilhas | Virus | Species | Cochonilhas | Virus |
| Km 47 | M | + | VH | - | Gordura | VH | - |
| | | | | | Angola | M | - |
| | | | | | Suwannee Bermuda | H | - |
| | | | | | Rhodesgrass | H | - |
| Fazenda Sta. Helena (Pindamonhangaba) | O | +[a] | M | - | Gordura | H | - |
| Fazenda Bela Vista (Pindamonhangaba) | L | - | not growing | | Gordura | M | - |
| Campinas (Instituto Agronômico) | O | +[b] | not growing | | Angola | M | - |
| Matão (Replicated plots) | M | + | VH | - | D. diversinervis | VL | - |
| | | | | | D. milanjiana | L | + |
| (Test with 3 pangolas) | M | +[a] | H | - | | | |
| (10-year-old field) | L | - | not growing | | Suwannee Bermuda | L | - |
| Fazenda Cruz das Palmas (Bauru) | H | - | not growing | | Gordura | M | - |
| Fazenda Água Milagrosa (Tabapuã) | M | - | M | - | Brachiaria | O | - |
| Sete Lagoas (IPEACO) | L | - | VH | - | | L | - |
| Viçosa (UREMG) | M | + | VH | - | Angola | M | - |
| Campos | L | - | M | - | | | |
| Salvador (plots in town) | L | - | M | - | D. diversinervis | VH | - |
| | | | | | Angolinha | H | |
| Cruz das Almas (IPEAL) | M | - | H | - | D. diversinervis | VH | - |
| | | | | | Angola | H | |
| Itapetinga (Fazenda Espinheiro) | L | - | L | - | | | |
| Itapetinga (Fazenda Oliveira) | L | - | not growing | | | | |
| Belém (IPEAN) | | | | | | | |

(Footnotes follow)

Cochonilha rating

VH - Very Heavy

H - Heavy

M - Moderate

L - Light

O - Not infested

Virus rating

+ virus symptoms observed

- no virus symptoms observed

+[a] symptoms found, but every time a damaged stem was also found

+[b] symptoms observed on greenhouse potted material

Table 2. *Digitaria* competition trial - IRI, Matão (4 replications)
IPEAL, Cruz das Almas (1 replication)

Ratings on scale (cochonilha) per plot per rep.

| IRI No. | Matão I | II | III | IV | Cruz das Almas | IRI No. | Matão I | II | III | IV | Cruz das Almas |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 406 | 7 | 7 | 7 | 7 | 7 | 431 | 7 | 7 | 6 | 5 | 7 |
| 407 | 6 | 7 | 5 | 4 | 7 | 432 | 7 | 7 | 7 | 7 | 7 |
| 408 | 7 | 7 | 5 | 7 | 7 | 433 | 7Rhizomes | 7 | 7 | 1 | 7 |
| 409 | 7 | 7 | 7 | 7 | 7 | 434 | 7 | 5 | 6 | 7 | 7 |
| 410 | 4 | 4 | 3 | 7 | 7 | 435 | 3 | 1 | 2 | 7 | 7 |
| 411 | 7 | 7 | 5 | 6 | 7 | 436 | 7 | 2 | 6 | 6 | 7 |
| 412 | 6 | 6 | 7 | 4 | 6 | 437 | 7 | 5 | 7 | 7 | 7 |
| 413 | 7 | 6 | 4 | 1 | 7 | 438 | 4 | 7 | 7 | 6 | 6 |
| 414 | 7 | 3 | 6 | 7 | - | 439 | 2 | 7 | 3 | 5 | 5 |
| 415 | 7 | 5 | 7 | 2 | 7 | 440 | 6 | 7 | 7 | 7 | 5 |
| 416 | 7 | 5 | 6 | 5 | 7 | 441 | 2 | 1 | 2 | 1 | 4 |
| 417 | 7 | 6 | 7 | 7 | 2 | 442 | 7 | 5 | 4 | 5 | 6 |
| 418 | 6 | 7 | 7 | 3 | 6 | 443 | 7 | 7 | 7 | 6 | 7 |
| 419 | 6 | 7 | 7 | 7 | 7 | 444 | 7 | 7 | 7 | 6 | 7 |
| 420 | 1 | 7 | 2 | 7 | 5 | 445 | 1 | 1 | 2 | 7 | 1 |
| 421 | 7 | 7 | 7 | 5 | - | 446 | 7 | 5 | 6 | 7 | 7 |
| 422 | 7 | 2 | 5 | 6 | 7 | 447 | 7 | 6 | 3 | 7 | 7 |
| 423 | 7 | 7 | 4 | 7 | 6 | 448 | 6 | 1 | 6 | 7 | 7 |
| 424 | 7 | 7 | 4 | 7 | 6 | 449 | 6 | 7 | 7 | 6 | 7 |
| 425 | 7 | 7 | 7 | 7 | 7 | 452 | 2 | 7 | 2 | 7 | 7 |
| 426 | 7 | 4 | 7 | 6 | 7 | 453 | 2 | 5 | 6 | 1 | 6 |
| 427 | 1 | 2 | 1 | 7 | 1 | C.E. | 4 | 7 | 5 | 2 | 3 |
| 428 | 7 | 6 | 7 | 6 | 7 | A24(200) | 1 | 6 | 1 | 7 | 1 |
| 429 | 5 | 7 | 5 | 1 | 4 | A82(349) | 1 | 6 | 1 | 7 | |
| 430 | 7 | 6 | 7 | 7 | 7 | | | | | | |

Rating code: 7 = No cochonilha
6 = 1 sample of 5 infested
5 = 2 samples of 5 infested
4 = 3 samples of 5 infested
3 = 4 samples of 5 infested
2 = 5 samples of 5 infested
1 = 5 samples of 5 heavily infested

TABLE 5. *Digitaria* competition trial - IRI, Matão

Ratings on virus per plot per rep.

| IRI No. | Reps. I | II | III | IV | IRI No. | Reps. I | II | III | IV |
|---|---|---|---|---|---|---|---|---|---|
| 406 | 555* | 555 | 555 | 555 | 431 | 443 | 454 | 444 | 444 |
| 407 | 444 | 554 | 554 | 555 | 432 | 555 | 555 | 555 | 555 |
| 408 | 232 | 333 | 112 | 321 | 433 | 444 | 444 | 444 | 545 |
| 409 | 555 | 555 | 555 | 555 | 434 | 555 | 555 | 555 | 555 |
| 410 | 334 | 434 | 222 | 223 | 435 | 555 | 555 | 454 | 555 |
| 411 | 554 | 444 | 344 | 444 | 436 | 353 | 555 | 454 | 554 |
| 412 | 555 | 555 | 555 | 555 | 437 | 555 | 455 | 555 | 555 |
| 413 | 444 | 444 | 554 | 545 | 438 | 555 | 454 | 555 | 554 |
| 414 | 454 | 555 | 344 | 454 | 439 | 443 | 222 | 333 | 332 |
| 415 | 344 | 322 | 433 | 232 | 440 | 555 | 555 | 555 | 555 |
| 416 | 454 | 555 | 555 | 554 | 441 | 121 | 111 | 111 | 121 |
| 417 | 555 | 555 | 555 | 555 | 442 | 555 | 555 | 555 | 555 |
| 418 | 555 | 555 | 555 | 555 | 443 | 555 | 555 | 555 | 555 |
| 419 | 555 | 554 | 555 | 555 | 444 | 554 | 554 | 444 | 555 |
| 420 | 555 | 555 | 553 | 555 | 445 | 444 | 555 | 555 | 554 |
| 421 | 554 | 554 | 554 | 555 | 446 | 444 | 544 | 444 | 454 |
| 422 | 232 | 554 | 454 | 441 | 447 | 443 | 444 | 443 | 432 |
| 423 | 555 | 554 | 554 | 555 | 448 | 233 | 423 | 333 | 321 |
| 424 | 444 | 554 | 555 | 454 | 449 | 112 | 112 | 111 | 553 |
| 425 | 444 | 444 | 444 | 444 | 452 | 444 | 443 | 232 | 122 |
| 426 | 555 | 555 | 555 | 555 | 453 | 323 | 444 | 332 | 332 |
| 427 | 555 | 555 | 555 | 555 | C.P. | 433 | 233 | 444 | 434 |
| 428 | 555 | 555 | 554 | 555 | A24(200) | 455 | 555 | 555 | 555 |
| 429 | 322 | 443 | 445 | 443 | A82(349) | 555 | 555 | 555 | 553 |
| 430 | 554 | 544 | 444 | 455 | | | | | |

* Represents three independent ratings per plot.

Ratings: 1 = 51-100% Stunted
2 = 26- 50% "
3 = 11- 25% "
4 = 1- 10% "
5 = Not stunted

Table 4. Best grass introductions (IRI numbers are used) — data from Matopo and Florida

| July 11 - Best 20 in dry season | | May 28 - Best 20 | | Sept. 2 - Best 19 in Florida | | Dec. 1966 - Best 16 in spring | |
|---|---|---|---|---|---|---|---|
| | Yield | | Height | | Yield | | Yield |
| Best | 442 | Tallest | 442 | Best | Pangola | Best | 442 |
| | 440 | | 440 | | 482 | | 424 |
| | 443 | | 415 | | 409 | | 409 |
| Decreasing yields | 424 | Decreasing height | 420 | Decreasing yields | 412 | Decreasing yields | 412 |
| | 445 | | 421 | | 443 | | 414 |
| | 412 | | 424 | | 424 | | 417 |
| | 482 | | 445 | | 441 | | 420 |
| | 439 | | 432 | | 408 | | 432 |
| | 432 | | 447 | | 440 | | 434 |
| | 434 | | 443 | | 434 | | 440 |
| | 452 | | 406 | | 453 | | 441 |
| | 420 | | 428 | | 425 | | 443 |
| | Pangola | | 446 | | 438 | | 446 |
| | 441 | | 482 | | 417 | | 425 |
| | 453 | | 419 | | 437 | | 424 |
| | 427 | | 410 | | 435 | | 425 |
| | 413 | | 430 | | 413 | | |
| | 436 | | 437 | | 426 | | |
| | 437 | | 444 | | 442 | | |
| | 414 | | 425 | | | | |

Best in at least three of the above columns and relatively free of cochonilha and virus:

442 Brachiaria ruziziensis (tanner grass)
440 Hemarthria altissima (Richmondgrass)
445 Digitaria decumbens from Oakes (check classification)
412 D. pentzii (Crocodile River)
432 Digitaria sp. (Umfolozi Group)
434 D. swazilandensis