AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D. C. 20523

BIBLIOGRAPHIC INPUT SHEET

FOR AID USE ONLY

1. SUBJECT CLASSIFICATION

A. PRIMARY: Agriculture

B. SECONDARY: Cereal Crops

2. TITLE AND SUBTITLE

Development of improved high yielding sorghum cultivars; research progress report, 1975/1976

3. AUTHOR(S)

Texas A&M University

4. DOCUMENT DATE	5. NUMBER OF PAGES	6. ARC NUMBER
1976	196 p.	ARC

7. REFERENCE ORGANIZATION NAME AND ADDRESS

Texas Agricultural Experiment Station, Texas A&M University, College Station, Texas 77240

8. SUPPLEMENTARY NOTES *(Sponsoring Organization, Publishers, Availability)*

(Research summary)

9. ABSTRACT

This second project-progress report states that among the accomplishments during 1975, were three large disease and insect screening nurseries grown in the Beeville, Texas area. Primary disease screening was for head smut and downy mildew; however, ratings also were made on advanced materials and tests for bacterial stripe, grey leaf spot, and zonate leaf spot. General observations were made on general adaptation, yield potential, standability, and grain weathering resistance. At Lubbock, large nurseries were planted specifically for lodging, MDM evaluation, and greenbug resistance. During 1975, several food sorghums, grain weathering-resistant sorghums, and high-yielding grain sorghums from Coimbatore, India were introduced and are growing in quarantine. Thirteen new entries were added to the 1975 All Disease Nursery. These included new or improved sources of resistance to diseases, grain weathering (seed mold), lodging, charcoal rot, and greenbugs.

10. CONTROL NUMBER: PN-AAC-137

11. PRICE OF DOCUMENT:

12. DESCRIPTORS: Sorghum

13. PROJECT NUMBER:

14. CONTRACT NUMBER: AID/ta-C-1092 Res.

15. TYPE OF DOCUMENT:

AID 590-1 (4-74)

SECOND
PROGRESS REPORT

on

Development of Improved High Yielding Sorghum Cultivars with Disease and Insect Resistance

Contract No. AID/ta-c-1092

February 15, 1975 - February 14, 1976

Prepared by

Texas Agricultural Experiment Station
Department of Plant Sciences
Department of Entomology
and
Texas Agricultural Experiment Station
Lubbock

Submitted to

Agency for International Development
Department of State
Washington, D.C.

INDEX

PAGE

I. GENERAL BACKGROUND

II. RESULTS IN 1975

A. Nurseries 4

B. Sorghum Introductions 6

C. Disease Studies

C-1. All disease nursery 7

C-2. International disease and insect nursery 25

C-3. International sorghum anthracnose virulence nursery 48

C-4. Head smut nurseries 51

C-5. Leaf blight 69

C-6. Chemical control 74

C-7. Grain weathering (seed mold) 81

C-8. Lodging resistance 87

C-9. Population breeding 108

D. Insect and Mite Studies

D-1. Greenbug resistance 119

D-2. Midge resistance 147

D-3. Corn leaf aphid resistance 158

D-4. Mite resistance 172

E. Seed Releases 117

PERSONNEL

Department of Plant Sciences
Texas Agricultural Experiment Station
College Station, Texas 77843

R. A. Frederiksen

James Foster (Technician)
Melvin Keener (Data Programming)

Texas Agricultural Experiment Station
Lubbock, Texas 79401

D. T. Rosenow

Charles Woodfin (Technician)

J. W. Johnson

James Phillips (Technician)

Department of Entomology
Texas Agricultural Experiment Station
College Station, Texas 77843

G. L. Teetes

Co-workers:

J. Craig, Plant Pathologist, USDA, Dept. of Plant Sciences
Texas Agricultural Experiment Station

F. R. Miller, Sorghum Breeder, Soil & Crop Sciences
Texas Agricultural Experiment Station

L. Reyes, Agronomist,
Texas Agricultural Experiment Station, Corpus Christi

L. W. Rooney, Cereal Chemist, Soil & Crop Sciences
Texas Agricultural Experiment Station

K. F. Schertz, Research Geneticist, USDA, Soil & Crop Sci.
Texas Agricultural Experiment Station

R. W. Toler, Virologist, Department of Plant Sciences
Texas Agricultural Experiment Station

L. E. Clark, Agronomist,
Texas Agricultural Experiment Station, Chillicothe-Vernon

ANNUAL PROGRESS REPORT

I. General Background

Sorghum (*Sorghum bicolor* (L.) Moench) is one of the principal food and feed commodities of the world. Sorghum is considered by many authorities as the third most important food grain, exceeded in utilization for food only by wheat and rice. Furthermore, sorghum is well adapted to cultivation under wide extremes in environmental conditions including arid, semi-arid, and subtropical areas of the world where other food commodities are often less well adapted.

In southwestern USA, where sorghums are a principal agricultural commodity, serious disease and insect problems have occurred repeatedly. During the past few years, there have been grave losses caused by head smut (*Sphacelotheca reiliana*); downy mildew (*Sclerospora sorghi*); maize dwarf mosaic (MDMV); anthracnose (*Colletotrichum graminicola*); charcoal rot (*Macrophomina phaseoli*); Fusarium stalk rot (*Fusarium moniliforme*); and a number of common foliage diseases.

Insects causing significant yield losses in grain sorghum annually are the sorghum midge (*Contarinia sorghicola*) and greenbug (*Schizaphis graminum*). Banks grass mite (*Olingonychus pratensis*) is a severe problem in the great plains region. Economically injurious insects that appear to be increasing in severity and distribution are white grubs (*Phyllophaga crinita*),

sugarcane rootstalk weevil (Anacentrinus deplanatus), corn leaf aphid (Rhopalosiphum maidis), and yellow sugarcane aphid (Sipha flava). Consequently, the need for superior sources of disease and insect resistance in sorghums is urgently needed in Texas as well as throughout the world.

In 1963, the Texas Agricultural Experiment Station and the United States Department of Agriculture initiated a program whereby exotic sorghums from the World Sorghum Collection were converted from tall, late maturing, photoperiod-sensitive types to shorter, earlier maturing, less photoperiod-sensitive lines. Conversion is accomplished by a crossing and backcrossing program using the short winter days of Puerto Rico for crossing and growing F_1's, with selection for short, early plants within segregating populations during the long summer days in Texas. Many exotic lines have been reported to be resistant to a number of diseases and insects, but until converted or partially converted, most of these lines are not available for use in temperate areas of the world. During the conversion process, we have been able to evaluate resistance from some partially converted exotic sorghums to diseases prevalent in the United States and to some insects. Some of these sorghums possess extraordinarily high levels of disease and insect resistance.

Statement of Project Objectives

1. To identify and define potential sources of multiple disease resistance and insect resistance in partially converted and converted exotic sorghums.
2. To develop agronomically elite populations of sorghum with high levels of multiple disease resistance and insect resistance.
3. To experimentally evaluate effectiveness and types of disease resistance from lines obtained through primary screening and from artificially synthesized populations.
4. To develop uniform methods of determining insect and disease resistance and to study, where appropriate, mechanisms of resistance.

A. Nurseries

Three large disease and insect screening nurseries were grown in the Beeville, Texas area in 1975; Berclair Head Smut Nursery, Berclair Downy Mildew Nursery, and Beeville Station Nursery. The total number of plots in sorghum in each nursery was 3168, 2800, and 7850, respectively. Primary disease screening was for head smut and downy mildew; however, ratings were also made on advanced materials and tests for bacterial stripe, grey leaf spot and zonate leaf spot. General observations were made for general adaptation, yield potential, standability, and grain weathering resistance.

In the disease nurseries in the Beeville area, 800 plots of partially converted lines, mostly BC_1 and BC_2, were screened for disease resistance. Of these, 600 were items not previously screened. From these materials, 210 individual head selections were made.

In the Beeville area nurseries, 2630 F_2 through F_8 breeding lines involving partially converted or converted lines and U.S. elite lines were planted for disease screening. Additionally, 1400 S_1's and 290 S_2's from various populations were evaluated for disease reaction. Within the S_1's, approximately 300 were selections made at Lubbock in 1974 for weathering resistant grain. From these South Texas nurseries, 1693 individual head selections were made in the regular pedigree breeding material. From S_1 and S_2 rows, 573 selections were made, of which 151 were specifically for weathering resistance.

In the Beeville Station Nursery, 2800 plots were planted late in the season specifically for midge resistance evaluations.

From this nursery, 1593 selections were made and planted at Weslaco. Selections totaling 705 were made from the Weslaco nursery.

The overall objective of this large disease resistance breeding effort in South Texas is to develop disease resistance in agronomically desirable, high yielding materials in the following breeding areas; waxy endosperm B and R lines, zera-zera derivative B and R lines, lodging resistant B and R lines, grain weathering resistant material, greenbug resistant material, midge resistant material, and mite resistant material. Additionally, identifying breeding lines with superior levels of disease and insect resistance is a major objective of these large nurseries.

At Lubbock, large nurseries were specifically planted for lodging, MDM evaluation, and greenbug resistance, in addition to other nurseries for regular breeding material involving such things as other disease and insect resistant material, yield, adaptation, grain quality, and standability. In the regular lodging and disease resistance breeding nurseries at Lubbock, 1917 selections were made. Also, 720 selections were made for lodging resistance in random mating populations, S_1, and S_2 rows.

TP1R was grown under large natural greenbug populations at Lubbock and 136 agronomically desirable plants resistant to the greenbug were selected. Over 1000 selections were

made from 38 F_2 populations from crosses among greenbug resistant sources and lines containing mite resistance, lodging resistance, disease resistance, midge resistance and waxy endosperm.

A mite resistance breeding nursery was planted near Pecos, Texas containing three replicated tests with a wide range of germplasm as well as 383 F_3 head rows. Selections numbering 124 were made from 47 F_3 rows that appeared to combine mite resistance with improved agronomic traits.

B. Sorghum Introductions

Seed were harvested from 37 midge resistant sorghums. These were entered in the sorghum conversion program and also distributed to A. J. Casady at Kansas.

During 1975, several food sorghums, grain weathering resistant sorghums, and high yielding grain sorghums from Coimbatore, India were introduced and are growing in quarantine.

C. Disease Studies

C-1. All Disease Nursery (ADN)

The ADN contains lines with a broad spectrum of resistance, as well as lines which possess one unique resistance source. The ADN is tested against the widest range of diseases possible under a wide range of environmental conditions. The ADN is updated yearly, as new breeding lines, which combine superior disease resistance with improved agronomic traits, are identified. The best lines from the ADN eventually become candidates for the International Disease and Insect Nursery (IDIN).

Thirteen new entries were added to the 1975 All Disease Nursery (Table 1.1). These included new or improved sources of resistance to diseases, grain weathering (seed mold), lodging, charcoal rot, and greenbugs. Twenty-three, 70-entry, 2 replication tests were planted at 15 locations in 1975 (Table 1.2). Thirty-two entries in the ADN were highly resistant to downy mildew at both Berclair nurseries. Downy mildew resistance has remained stable from year to year. This has not been true for head smut. Some 22 lines identified as resistant last year either lost resistance because of race 4 or had erosion of resistance at Berclair. Only 14 entries were resistant at all 3 head smut locations (Table 1.3). Ten of these head smut resistant lines were also among the best multiple disease resistant lines. Some erosion of resistance was also noted for anthracnose. TX 2536 appears to have more anthracnose now than it had a few years ago

(Table 2.7). Excellent resistance to Cercospora leaf spot has been identified under field conditions in ADN entry 56 (IS 2936 x IS 3922) (Table 1.4) whereas little good resistance to zonate leaf spot exists among the ADN entries. Zonate leaf spot develops very rapidly in maturing plants. Consequently differences at times may be attributed to maturity as well as genetic differences. During the past few years naturally occurring maize dwarf mosaic has been compared with artificial inoculations (Table 1.5). For some items, such as TAM 2566 and SC 599, artificial inoculation results in a high incidence of severely diseased plants while under natural conditions only 0 to 10 percent of the plants become diseased. This reaction known as the "Rio reaction" constitutes a previously undescribed source of resistance (escape) to MDM. The "Rio reaction" has been found in SC 112, SC 120, SC 175, SC 228, SC 326, and SC 599. A high frequency of escape may be related to insect preference, feeding habits or some other factor which protects the plant from insect virus transmission. The "Rio reaction" is dominant and present in F_1 Hybrids entry (SC 599 x SC 110).

Various agronomic data including date to 50 percent bloom at Lubbock, plant height, head exsertion and desirability are presented along with leaf and plant death ratings, lodging, seed weathering and the late season disease complex from El Centro, California (Table 1.6). Some of the items specifically

screening in the ADN. These results suggest that weathering at both Corpus Christi and College Station were quite similar. The late season disease complex known in other circles as Arizona root rot problem remains as an etiologic mystery. The disease was controlled by massive applications of specific fungicides (M. Burns and R. Voigt) but to date, the pathogen cause has not been demonstrated. Nevertheless, several sorghums in the ADN were highly resistant.

Table 1.1 All disease nursery (ADN), 1975

Entry no.	Designation	IS no.	Variety, kind, group or derivation
1	SC 56-14	12568	Cau-Nig
2	SC 89-9	12598	Cau-Nig
3	SC 97-14	12602	Conspicuum
4	SC 103-12	2403	Caudatum
5	SC 108-14	12608	Zerazera
6	SC 109-12	12609	Zerazera
7	TAM 428 (110-9)	12610	Zerazera
8	SC 110-14	12610	Zerazera
9	SC 111-9	12611	Zerazera
10	SC 112-14 (no uc)	12612	Zerazera
11	SC 112-14 (uc)	12612	Zerazera
12	SC 115-11E-1	2683	Cau-Nig
13	SC 120-14-1	2816	Zerazera
14	SC 170-6-8-3 (4244)	12661	Zerazera
15	SC 170-6-8-8 (4252)	12661	Zerazera
16	SC 170-6-17 (4267)	12661	Zerazera
17	SC 170-14E-3	12661	Zerazera
18	SC 173-12-6	12664	Zerazera
19	TAM 2566 (175-9)	12666	Zerazera
20	SC 175-14	12666	Zerazera
21	SC 228-14	2549	Zerazera
22	SC 237-14	3071	Dobbs
23	SC 239-14	3574	Zerazera
24	SC 279-14	7419	Conspicuum
25	SC 324-12-2	2681	Nigricans
26	SC 325-12-P1	2462	Nigricans
27	SC 326-6	3758	Nigricans
28	SC 330-9-P1	8187	Nig-Fet
29	SC 333-14	3063	Caudatum
30	SC 334-9-P1	3499	Caudatum
31	SC 414-12E	2508	Cau-Kafir
32	SC 420-12	7064	Cau-Kafir
33	SC 423-14 (2680)	2579	Zerazera
34	SC 423-14 (2686)	2579	Zerazera
35	SC 546-14	7550	Conspicuum

Continued

Table 1.1 - Continued

Entry no.	Designation	IS no.	Variety, kind, group or derivation
36	SC 574-6-P1	8337	Cau-Nig
37	SC 599-6-3 (9054)	-	Rio deriv.
38	SC 599-6-3 (9245)	-	Rio deriv.
39	SC 599-6-3 (9247)	-	Rio deriv.
40	SC 599-6-10 (9188)	-	Rio deriv.
41	SC 599-6-10 (9193)	-	Rio deriv.
42	SC 599-11E	-	Rio deriv.
43	SC 680-3-2	8264	Dobbs
44	SC 748-5-3	3552	Cau-Guin
45	SC 167-14	12658	Dur-Bic
46	NSA 440-12	-	Kafir deriv.
47	NSA 817-3	-	Y.E. deriv.
48	NSA 837-1	-	Y.E. deriv.
49	NSA 935-6	-	Y.E. deriv.
50	QL3 (sel)	-	C. Kafir deriv.
51	(B 3197 X 170-6) 1750	-	Kafir X Zerazera
52	(B 3197 X 170-6) 1753-2	-	Kafir X Zerazera
53	(SC 110-9 X SC 120-6)(4130)	-	Zerazera
54	(SC 599-6 X SC 134-6)(1880)	-	Rio X Dur. Doc.
55	(SC 120-6 X Tx 7000)	-	Zerazera-Caprock
56	(IS 2930 X IS 3922)	-	Y.E. deriv.
57	(SC 56 X SC 170) 1584	-	Cau-Nig X Zera
58	(SC 56 X SC 170) 1922	-	Cau-Nig X Zera
59	(SC 56 X SC 33) 1778	-	Cau-Nig X Durra
60	(B 406 X Rio)-2	-	Martin-Rio
61	TAM 2567	-	Tx 2536 Gb. res. der.
62	(Tx 2536 X 170-6)-10 (5252)	-	Y.E. X Zera
63	(SC 599-6 X 110-P1)-24(5396)	-	Rio X Zera
64	(B 3197 X SC 170-6)-7(5451)	-	Kafir X Zera
65	Tx 2536	10542	Y.E. Fet. deriv.
66	Tx 09	87	C. Wh. Fet.
67	Tx 7078	415	Comb. 7078
68	B Tx 398	412	Martin
69	B Tx 378	413	Redlan
70	Sweet Sudan	721	Sudangrass

Table 1.2 Location of the 1975 All Disease Nurseries

Location	Principal Diseases
Berclair, Texas (head smut nursery)	Head smut, downy mildew
Berclair, Texas (downy mildew nursery)	Downy mildew, foliage diseases
Chilicothe, Texas	Periconia root rot
College Station, Texas (2)	Maize dwarf mosaic, Helminthosporium blight
Corpus Christi, Texas	Head smut
Halfway, Texas	Charcoal rot
Lubbock, Texas (6)	Rust, seed weathering, charcoal rot, lodging, Fusarium head blight, corn leaf aphid, MDM
Pecos, Texas (2)	Mites
Victoria, Texas	Head smut
Meridian, Mississippi	Foliage diseases
Experiment, Georgia	Anthracnose
Manhattan, Kansas (2)	MDM
El Centro, California	Late summer disease complex
Isabela, Puerto Rico	Anthracnose, rust, zonate leaf spot
Tampico, Mexico (2)	Leaf blight, rust

Table 1.3. Incidence of head smut (Sphacelotheca reiliana) race 3 and downy mildew (Sclerospora sorghi) in the All Disease Nursery at Berclair and Victoria, Texas, and anthracnose (Colletotrichum graminicola) at Experiment, Georgia and Meridian, Mississippi in 1975.

Entry no.	Designation	Downy mildew % systemic[a]		Head smut (%)			Anthracnose[b]	
		Berclair head smut nursery	Berclair downy mildew nursery	Victoria head smut nursery	Berclair head smut nursery	Berclair downy mildew nursery	Experiment Georgia	Meridian Miss.
1	SC 56-14	0.0	0.0	5.9	15.6	6.3	2.7	1.5
2	SC 89-9	0.0	0.8	0.0	2.7	0.0	1.8	1.0
3	SC 97-14	0.0	0.0	0.0	4.8	0.0	3.2	1.0
4	SC 103-12	0.0	0.0	0.0	3.1	0.0	1.0	1.0
5	SC 108-14	0.0	0.0	1.9	35.0	20.0	5.0	1.0
6	SC 109-12	0.0	0.0	0.0	18.5	11.0	1.8	1.0
7	TAM 428(110-9)	0.0	0.0	0.0	0.0	0.0	1.5	1.0
8	SC 110-14	0.0	0.0	0.0	0.0	0.0	1.2	1.1
9	SC 111-9	0.0	1.6	0.0	3.6	0.0	1.2	1.0
10	SC 112-14(no uc)	0.0	0.0	0.0	6.1	0.0	1.5	1.8
11	SC 112-14(uc)	0.0	0.0	0.0	4.8	5.2	1.5	1.1
12	SC 115-11E-1	0.0	0.0	1.6	2.6	2.7	1.0	1.0
13	SC 120-14-1	0.0	0.0	0.0	17.5	0.0	1.0	1.0
14	SC 170-6-8-3(4244)	0.0	0.0	1.5	0.0	0.0	1.0	1.0
15	SC 170-6-8-8(4252)	0.0	0.0	1.2	0.0	0.0	1.2	1.0
16	SC 170-6-17(4267)	0.0	1.6	19.6	2.9	4.8	4.0	1.0
17	SC 170-14E-3	0.0	0.0	50.0	0.0	0.0	1.2	2.3
18	SC 173-12-6	0.0	0.0	0.0	0.0	0.0	1.0	1.0
19	TAM 2566(175-9)	0.0	3.0	0.0	7.9	0.0	2.8	1.0
20	SC 175-14	0.0	0.0	8.5	34.8	0.0	1.3	2.6
21	SC 228-14	16.1	0.0	0.0	3.6	0.0	1.0	1.0
22	SC 237-14	0.0	2.5	3.6	0.0	0.0	1.3	1.0
23	SC 239-14	0.0	0.0	0.0	2.0	0.0	1.0	1.0
24	SC 279-14	5.0	0.0	12.0	11.6	10.7	2.2	1.0
25	SC 324-12-2	0.0	0.0	0.0	0.0	0.0	1.3	1.0

Continued

Table 1.3 Continued

Entry no.	Designation	Downy mildew % systemic[a/] Berclair head smut nursery	Downy mildew % systemic[a/] Berclair downy mildew nursery	Head smut (%) Victoria head smut nursery	Head smut (%) Berclair head smut nursery	Head smut (%) Berclair downy mildew nursery	Anthracnose[b/] Experiment Georgia	Anthracnose[b/] Meridian Miss.
26	SC 325-12-P1	0.0	0.0	0.0	0.0	0.0	2.5	1.1
27	SC 326-6	0.0	3.0	0.0	1.8	2.0	1.3	1.0
28	SC 330-9-P1	0.0	0.0	0.0	0.0	0.0	2.8	2.1
29	SC 333-14	2.2	6.7	7.1	12.0	3.3	2.7	1.0
30	SC 334-9-P1	0.0	0.0	2.1	1.7	4.0	1.7	1.0
31	SC 414-12E	0.0	3.0	0.0	0.0	0.0	1.5	1.0
32	SC 420-12	0.0	0.0	0.0	0.0	0.0	1.3	1.0
33	SC 423-14(2680)	0.0	0.0	0.0	4.6	6.1	1.2	1.0
34	SC 423-14(2686)	12.5	4.3	6.3	10.0	3.3	1.5	2.9
35	SC 546-14	0.0	3.4	6.7	6.0	3.4	2.5	2.5
36	SC 574-6-P1	2.2	0.0	0.0	0.0	0.0	1.2	1.1
37	SC 599-6-3(9054)	12.3	1.5	1.4	0.0	2.3	2.5	1.1
38	SC 599-6-3(9245)	23.8	11.1	2.9	0.0	0.0	1.0	1.0
39	SC 599-6-3(9247)	3.8	6.1	2.9	0.0	0.0	1.0	1.0
40	SC 599-6-10(9188)	26.7	18.0	0.0	0.0	0.0	1.0	1.0
41	SC 599-6-10(9193)	23.0	5.0	3.4	0.0	0.0	1.0	1.0
42	SC 599-11E	0.0	6.5	4.9	0.0	0.0	1.0	1.0
43	SC 680-3-2	2.2	9.8	0.0	0.0	0.0	1.4	1.0
44	SC 748-5-3	5.0	3.8	0.0	3.3	1.9	1.2	1.0
45	SC 167-14	0.0	2.5	0.0	0.0	0.0	1.2	1.0
46	NSA 440-12	6.4	11.0	4.7	21.2	4.0	1.3	1.0
47	NSA 817-3	13.9	0.0	0.0	3.9	0.0	3.7	1.0
48	NSA 837-1	22.5	42.8	3.7	17.5	14.3	1.8	1.0
49	NSA 935-6	10.7	26.7	2.4	11.0	0.0	1.0	1.0
50	QL3 (sel)	0.0	0.0	1.5	9.4	8.8	5.0	1.5

Continued

Table 1.3 Continued

Entry no	Designation	Downy mildew % systemic[a]		Head smut (%)			Anthracnose[b]	
		Berclair head smut nursery	Berclair downy mildew nursery	Victoria head smut nursery	Berclair head smut nursery	Berclair downy mildew nursery	Experiment Georgia	Meridian Miss.
51	(B 3197 x 170-6)1750	0.0	0.0	0.0	0.0	0.0	2.0	2.1
52	(B 3197 x 170-6)1753-2	0.0	0.0	1.5	0.0	0.0	2.0	1.6
53	(SC 110-9 x SC 120-6)(4130)	0.0	0.0	0.0	4.0	0.0	1.1	1.0
54	(SC 599-6 x SC 134-6)(1880)	22.5	11.7	2.7	2.2	0.0	3.0	1.0
55	(SC 120-6 x Tx 7000)	0.0	0.0	0.0	1.3	3.3	1.5	1.0
56	(IS 2930 x IS 3922)	0.0	0.0	1.8	2.0	3.7	1.2	1.0
57	(SC 56 x SC 170) 1584	4.0	11.9	13.8	2.2	0.0	4.1	2.8
58	(SC 56 x SC 170) 1922	2.9	0.0	23.4	6.3	0.0	3.3	2.3
59	(SC 56 x SC 33) 1778	13.2	5.5	2.2	0.0	0.0	2.8	1.0
60	(B 406 x Rio)-2	24.3	29.2	9.0	3.4	5.0	1.0	1.0
61	TAM 2567	8.3	8.5	5.9	18.3	4.4	1.6	2.1
62	(Tx 2536 x 170-6)-10(5252)	0.0	0.0	0.0	0.0	0.0	2.5	3.1
63	(SC 599-6 x 110-P1)-24(5396)	0.0	0.0	0.0	7.0	4.0	4.5	3.5
64	(B 3197 x SC 170-6)-7(5451)	0.0	0.0	1.4	0.0	0.0	1.6	1.9
65	Tx 2536	16.8	5.7	3.8	14.6	2.9	1.7	1.7
66	Tx 09	81.3	20.0	47.2	25.0	10.0	3.2	3.8
67	Tx 7078	5.5	13.3	15.5	51.8	36.7	5.0	1.6
68	B Tx 398	0.0	1.5	8.0	9.2	7.7	4.7	4.0
69	B Tx 378	0.0	4.3	0.0	2.9	2.9	4.8	1.5
70	Sweet Sudan	60.0	0.0	4.0	8.6	0.0	4.0	3.0

a/ Based on the incidence of infected plants from a replicated field nursery totalling approximately 100 plants.

b/ Anthracnose rating based on the combined reactions of foliar, head and peduncle infections based essentially on the scal presented in instructions on note taking for IDIN.

Table 1.4. Foliar disease ratings for zonate leaf spot (Gleocercospora sorghi) and Cercospora leaf spot (Cercospora Sorghi) in the All Disease Nursery at Victoria, Berclair, and Lubbock, Texas and in Puerto Rico.

		Zonate leaf spot[a/]				Cercospora leaf spot[a/]		Rust[a/]	
Entry no.	Designation	Victoria head smut	Berclair head smut	Berclair downy mildew	Puerto Rico	Berclair head smut	Berclair downy mildew	Lubbock	Puerto Rico
1	SC 56-14	3.8	4.5	4.0	4.0	3.0	2.0	4.4	4.0
2	SC 89-9	2.8	2.8	3.0	3.0	2.0	2.0	2.5	3.0
3	SC 97-14	3.3	3.3	3.5	3.0	2.0	2.5	2.9	3.0
4	SC 103-12	2.3	2.5	3.0	4.0	3.0	2.0	3.3	3.5
5	SC 108-14	2.5	2.5	2.5	3.0	2.8	2.0	3.3	3.0
6	SC 109-12	2.5	3.0	3.5	3.5	3.5	3.0	3.5	3.0
7	TAM 428(110-9)	2.3	2.0	2.5	3.0	2.8	2.0	2.3	3.0
8	SC 110-14	2.5	2.3	2.5	2.5	3.0	2.0	2.4	3.0
9	SC 111-9	3.3	2.8	3.0	3.0	2.0	2.0	2.9	3.0
10	SC 112-14 (no uc)	3.5	2.0	3.5	3.0	3.0	2.0	3.7	4.0
11	SC 112-14 (uc)	3.0	3.5	4.5	2.0	3.0	3.0	1.5	2.0
12	SC 115-11E-1	3.0	3.0	3.0	3.0	2.0	2.0	2.4	3.0
13	SC 120-14-1	2.5	2.8	0	3.0	1.0	0	1.0	2.5
14	SC 170-6-8-3(4244)	2.3	2.3	2.0	3.0	2.3	2.0	3.1	4.0
15	SC 170-6-8-8(4252)	3.0	2.3	2.5	3.0	3.3	2.5	3.0	3.0
16	SC 170-6-17(4267)	2.3	2.3	2.5	3.0	3.0	2.0	3.3	3.0
17	SC 170-14E-3	2.3	3.0	2.0	3.0	2.0	1.5	2.9	4.0
18	SC 173-12-6	2.5	1.3	2.0	3.0	3.0	1.5	2.2	3.0
19	TAM 2566(175-9)	3.0	3.3	3.5	3.0	3.8	3.0	1.0	3.0
20	SC 175-14	3.0	4.5	2.0	2.0	3.0	2.5	1.0	2.0
21	SC 228-14	3.3	3.5	4.0	3.0	2.0	2.0	1.9	3.0
22	SC 237-14	2.8	2.8	2.5	3.0	2.5	2.0	2.7	3.5
23	SC 239-14	3.0	2.8	4.0	3.0	1.5	1.5	2.9	3.0
24	SC 279-14	4.0	3.8	4.5	3.0	2.5	2.5	1.6	3.0
25	SC 324-12-2	3.5	4.5	4.0	3.5	2.5	2.5	3.8	4.0

Continued

Table 1.4. Continued

Entry no.	Designation	Zonate leaf spot[a/]				Cercospora leaf spot[a/]		Rust[a/]	
		Victoria head smut	Berclair head smut	Berclair downy mildew	Puerto Rico	Berclair head smut	Berclair downy mildew	Lubbock	Puerto Rico
26	SC 325-12-P1	3.0	4.0	4.0	3.0	2.0	2.0	4.1	4.0
27	SC 326-6	2.5	2.3	2.4	2.0	1.8	2.0	1.0	1.5
28	SC 330-9-P1	2.0	2.0	2.5	3.0	2.5	2.0	2.8	3.5
29	SC 333-14	3.0	3.3	3.5	3.0	2.3	2.0	3.4	3.0
30	SC 334-9-P1	1.8	2.3	2.0	2.0	2.8	1.5	3.2	3.0
31	SC 414-12E	2.0	2.8	3.0	3.0	2.3	2.0	2.9	3.0
32	SC 420-12	3.8	4.0	4.0	3.0	2.5	2.0	3.3	3.5
33	SC 423-14(2680)	2.3	3.3	2.0	3.0	2.0	2.0	2.7	3.5
34	SC 423-14(2686)	3.5	3.8	4.0	3.0	2.3	2.0	3.1	3.0
35	SC 546-14	4.3	4.8	3.5	4.0	3.0	2.0	3.9	3.0
36	SC 574-6-P1	3.0	2.8	2.5	3.0	2.3	2.0	2.4	3.0
37	SC 599-6-3(9054)	2.0	2.5	2.0	3.0	2.5	2.0	1.0	3.0
38	SC 599-6-3(9245)	2.8	2.5	2.5	3.0	1.3	2.0	1.0	2.5
39	SC 599-6-3(9247)	2.8	2.8	3.5	2.0	2.5	1.5	1.0	2.0
40	SC 599-6-10(9188)	4.0	3.5	4.5	2.5	1.8	2.5	1.0	2.0
41	SC 599-6-10(9193)	3.5	3.0	3.5	3.0	1.8	2.0	1.0	3.0
42	SC 599-11E	3.5	2.8	3.0	3.0	2.5	2.0	1.0	2.0
43	SC 680-3-2	3.5	3.0	3.5	3.0	2.5	2.0	2.9	3.0
44	SC 748-5-3	1.8	2.5	2.5	3.0	2.0	1.5	2.9	3.0
45	SC 167-14	2.3	2.5	3.5	3.5	2.5	2.5	2.4	3.5
46	NSA 440-12	3.0	3.5	3.5	4.0	2.5	2.0	2.9	3.5
47	NSA 817-3	2.5	3.3	2.5	3.0	2.0	1.0	2.8	3.5
48	NSA 837-1	2.8	2.8	3.0	3.0	2.0	2.0	2.8	3.0
49	NSA 935-6	3.0	2.3	2.5	3.0	1.3	1.5	2.2	2.5
50	QL3 (sel)	2.8	3.5	3.0	3.5	1.8	2.0	3.8	4.0

Continued

Table 1.4.—Continued

Entry no.	Designation	Zonate leaf spot[a]				Cercospora leaf spot[a]		Rust[a]	
		Victoria head smut	Berclair head smut	Berclair downy mildew	Puerto Rico	Berclair head smut	Berclair downy mildew	Lubbock	Puerto Rico
51	(B 3197 x 170-6)1750	2.3	2.3	3.0	3.0	2.8	2.0	2.7	3.0
52	(B 3197 x 170-6)1753-2	2.0	2.5	3.0	3.0	2.8	2.0	3.4	3.0
53	(SC 110-9 x SC 120-6()4130)	2.0	2.5	2.0	3.0	1.5	1.5	2.8	3.5
54	(SC 599-6 x SC 134-6)(1880)	3.3	2.5	2.5	2.5	1.0	2.0	1.0	2.5
55	(SC 120-6 x Tx 7000)	2.0	2.8	3.0	3.0	2.3	2.0	3.0	3.0
56	(IS 2930 x IS 3922)	2.8	2.8	3.0	3.0	1.0	1.0	2.5	3.0
57	(SC 56 x SC 170) 1584	2.5	3.0	3.0	3.5	1.5	2.0	4.3	4.0
58	(SC 56 x SC 170) 1922	2.8	3.0	2.5	4.0	1.8	1.5	4.1	4.5
59	(SC 56 x SC 33) 1778	3.5	2.8	4.0	3.0	1.3	2.0	2.9	4.0
60	(B 406 x Rio)-2	3.0	3.5	4.0	3.0	3.0	2.0	1.2	3.0
61	TAM 2567	2.8	3.0	3.0	3.0	2.8	2.0	3.1	3.0
62	(Tx 2536 x 170-6)-10(5252)	2.5	3.5	3.0	3.0	2.3	2.5	3.4	3.0
63	(SC 599-6 x 110-P1)-24(5396)	2.8	2.5	3.0	0	3.0	2.0	1.5	0
64	(B 3197 x SC 170-6)-7(5451)	2.3	2.5	2.5	3.0	3.3	2.5	3.0	3.0
65	Tx 2536	2.8	3.3	3.5	3.0	2.3	2.0	3.2	3.0
66	Tx 09	3.8	3.5	4.0	4.0	2.5	3.0	4.3	4.0
67	Tx 7078	3.8	4.8	4.5	4.0	3.0	3.0	4.7	4.0
68	B Tx 398	4.0	4.0	3.0	3.5	2.8	2.0	3.6	4.5
69	B Tx 378	2.3	3.0	2.5	3.0	1.8	2.0	3.1	4.0
70	Sweet Sudan	3.0	0	0	0	0	0	3.7	4.0

[a] Foliar disease reactions are based on a 1-5 scale. See pages 26 and 27.

Table 1.5 Comparisons of natural and artificial inoculated ADN entries to maize dwarf mosaic at Lubbock and College Staiton, 1974, 1975.

Entry no.	Designation	College Station Inoculated Rating	College Station Inoculated Infection %	Lubbock[a] Inoculated 7/17[c] Rating	Lubbock[a] Inoculated 7/17[c] Infection %	Lubbock[b] Inoculated 9/8[c] Rating	Lubbock[b] Inoculated 9/8[c] Infection %	Lubbock[b] Non-inoc. 9/8[c] Rating	Lubbock[b] Non-inoc. 9/8[c] Infection %	Lubbock - 1974[d] F 301 Natural rating	Lubbock - 1974[d] Natural infection Infection %	Lubbock - 1974[d] Natural infection Severity rating	Lubbock - 1974[d] Inoculated Infection %	Lubbock - 1974[d] Inoculated Severity rating
1	SC 56-14	3.5	100	2.0	100	2.0	-	2.0	-	2	-	2	-	-
2	SC 89-9	2.0	100	2.0	100	2.0	-	2.0	-	2	45.0	2		
3	SC 97-14	1.0	10	2.4	88	2.8	100	2.0	-	3.2	-	-	-	-
4	SC 103-12	2.0	100	2.0	94	2.0	-	2.0	-	2	28.3	2	-	-
5	SC 108-14	2.0	100	2.1	97	2.0	-	2.0	-	2	.8	2	-	-
6	SC 109-12	3.0	100	2.0	97	2.0	-	2.0	-	2	5.5	2	-	-
7	TAM 428(110-9)	3.0	100	2.0	100	2.0	-	2.0	-	2	7.1	2	-	-
8	SC 110-14	2.0	100	2.0	100	2.0	-	2.0	-	2	12.6	2	-	-
9	SC 111-9	4.0	100	2.0	85	2.0	-	2.0	-	2	28.8	2	-	-
10	SC 112-14(no uc)	3.0	100	2.1	100	2.5	10	2.0	-	2	32.0	2	-	-
11	SC 112-14 (uc)	3.0	100	3.5	93	4.3	95	4.0	15	4-1	12.0	2	16.0	5
12	SC 115-11E-1	3.5	100	2.0	96	2.0	-	2.0	-	2	23.9	2	-	-
13	SC 120-14-1	1.0	0	3.1	100	3.5	100	2.0	-	4-1	0.0	1	30.3	5
14	SC 170-6(4244)	2.0	100	2.0	100	2.0	-	2.0	-	2	32.9	2	-	-
15	SC 170-6(4252)	2.0	100	2.0	96	2.0	-	2.0	-	2	34.6	2	-	-
16	SC 170-7(4267)	2.0	100	2.0	100	2.0	-	2.0	-	2	13.9	2	-	-
17	SC 170-14E-3	4.0	100	2.3	100	2.0	-	2.0	-	3.3	14.7	3.5	-	-
18	SC 173-12-6	2.0	100	2.0	97	2.0	-	2.0	-	2	16.9	2	-	-
19	TAM 2566(175-9)	5.0	75	4.1	90	4.0	90	4.0	10	4-1	0.0	1	29.1	5
20	SC 175-14	4.0	29	3.8	100	4.0	100	3.0	10	4-1	0.0	1	22.4	5
21	SC 228-14	1.0	0	3.0	57	4.0	60	3.0	10	4-1	0.0	1	12.3	5
22	SC 237-14	3.5	100	2.0	90	2.0	-	2.0	-	2	2.8	2	-	-
23	SC 239-14	4.0	100	2.0	100	2.3	40	2.0	-	2	35.7	2	-	-
24	SC 279-14	2.0	100	2.6	100	3.3	80	2.0	-	3.4				
25	SC 324-12	3.0	100	2.0	88	2.0	-	2.0	-	2	-	2	-	-

Continued

Table 1.5 Continued

Entry no	Designation	College Station Inoculated Rating	College Station Inoculated Infection %	Lubbock[a] Inoculated 7/17[c] Rating	Lubbock[a] Inoculated 7/17[c] Infection %	Lubbock[b] Inoculated 9/8[c] Rating	Lubbock[b] Inoculated 9/8[c] Infection %	Lubbock[b] Non-inoc. 9/8[c] Rating	Lubbock[b] Non-inoc. 9/8[c] Infection %	F-301 Natural rating	Lubbock - 1974[d] Natural infection Infection %	Lubbock - 1974[d] Natural infection Severity rating	Lubbock - 1974[d] Inoculated Infection %	Lubbock - 1974[d] Inoculated Severity rating
26	SC 326-12	4.0	100	2.2	100	2.0	-	2.0	-	2	18.3	2	-	-
27	SC 326-6	5.0	38	3.2	70	4.0	60	3.5	10	4.3	7.4	5	17.1	5
28	SC 330-9	4.0	100	2.0	100	2.5	10	2.5	10	2	25.3	2	-	-
29	SC 333-14	4.0	100	2.5	100	3.4	60	3.0	60	4.5	67.9	5	-	-
30	SC 334-9	4.0	100	2.4	92	4.0	80	2.5	100	3.4	4.9	5	-	5
31	SC 414-12E	4.0	100	2.0	93	2.0	-	2.0	-	2	26.3	2	-	-
32	SC 420-12	4.5	100	2.0	100	2.0	-	2.0	-	2	64.4	2	-	-
33	SC 423-14(2680)	2.0	50	2.0	97	2.0	-	2.0	-	2	17.7	2	-	-
34	SC 423-14(2686)	2.0	47	2.0	95	2.3	100	2.0	-	2	5.6	2	-	-
35	SC 546-14	5.0	12	2.5	89	3.7	80	3.0	10	4.5	-	-	-	-
36	SC 574-6	2.5	100	2.0	100	2.0	-	2.0	-	2	8.9	2	-	-
37	SC 599-6(9054)	5.0	76	3.5	95	4.5	90	4.0	10	4.5	1.6	5	20.9	5
38	SC 599-6(9245)	5.0	100	3.9	100	4.5	95	4	2.5	4.5	3.4	5	37.9	5
39	SC 599-6 (9247)	5.0	49	3.6	78	4.5	60	3.5	2.5	4.5	3.1	5	30.0	5
40	SC 599-6(9188)	5.0	100	3.4	100	4.0	100	3.5	10	4.5	1.6	5	63.3	5
41	SC 599-6 (9193)	5.0	100	3.6	85	4.0	80	4.0	10	4.5	1.6	5	40.2	
42	SC 599-11E	5.0	36	3.9	86	4.8	90	3	10	4.5	2.6	5	41.7	5
43	SC 680-3	5.0	100	2.0	100	2.0	-	2.0	-	2	3.6	2	-	-
44	SC 748-5	2.0	100	2.0	93	2.0	-	2.0	-	2	6.8	2	-	-
45	SC 167-14	4.0	100	2.5	92	4.0	100	3.5	20	4.5	13.7	5	43.3	5
46	NSA 440-12	5.0	100	4.0	100	4.0	100	3.8	80	4.5	30.8	5	78.3	5
47	NSA 817-3	2.0	100	2.6	100	2.8	80	3.0	40	3.4	33.3	4	-	-
48	NSA 837-1	3.5	100	2.5	100	3.0	60	2.5	40	3.5	35.2	4.5	-	-
49	NSA 935-6	0	-	2.0	100	2.0	-	2.0	-	4.1	36.2	2	-	-
50	QL3 sel	1.0	0	1.0	0	1.0	100	1.0	100	-	-	-	-	-

Continued

Table 1.5 Continued

Entry no.	Designation	College Station Inoculated Rating	College Station Inoculated Infection %	Lubbock[a] Inoculated 7/17[c] Rating	Lubbock[a] Inoculated 7/17[c] Infection %	Lubbock[b] Inoculated 9/8[c] Rating	Lubbock[b] Inoculated 9/8[c] Infection %	Lubbock[b] Non-inoc. 9/8[c] Rating	Lubbock[b] Non-inoc. 9/8[c] Infection %	F 301 Natural rating	Lubbock - 1974[d] Natural infection Infection %	Lubbock - 1974[d] Natural infection Severity rating	Lubbock - 1974[d] Inoculated Infection %	Lubbock - 1974[d] Inoculated Severity rating
51	(B3197 x SC170)(1750)	3.0	100	2.0	100	2.0	-	2.0	-	2	40.7	2	-	-
52	(B3197 x SC170)(1753-2)	4.0	100	2.0	63	2.0	-	2.0	-	2	41.3	3.5	-	-
53	(SC110 x SC120)(4130)	3.5	100	2.0	100	2.0	-	2.0	-	2	10.6	2	-	-
54	(SC599 x SC134)(1880)	5.0	100	3.6	75	4.0	85	4.0	25	5	13.0	5	13.3	5
55	(SC120 x Tx 7000)	4.0	100	2.6	100	4.5	10	2.0	-	4-1	17.0	2	-	-
56	(IS2930 x IS3922)	3.5	100	2.0	100	2.0	-	2.0	-	2	33.3	2	-	-
57	(SC56 x SC170)(1584)	3.5	100	2.0	97	2.0	-	2.0	-	2	49.5	2	-	-
58	(SC56 x SC170)(1922)	2.5	100	2.0	100	2.0	-	2.0	-	2	-	-	-	-
59	(SC56 x SC33)(1778)	2.0	10	2.1	91	2.0	-	2.0	-	2	-	-	-	-
60	(B406 x Rio)-2	5.0	100	3.5	100	4.3	100	3.5	10	5	-	-	-	-
61	TAM 2567	5.0	100	3.0	69	3.7	90	3.3	40	3.9	-	-	-	-
62	(Tx2536 x SC170)(5252)	3.5	100	2.8	100	3.2	40	3.0	100	3.4-2	-	-	-	-
63	(SC599 x SC110)(5396)	5.0	12	3.1	81	4.0	80	2.0	-	4-1	-	-	-	-
64	(B3197 x SC170)(5451)	2.0	100	2.0	96	2.0	-	2.0	-	2	-	-	-	-
65	Tx 2536	2.0	100	2.3	97	3.7	60	3.3	80	3.9	11.3	4	-	-
66	Tx 09	3.5	100	2.1	100	2.0	-	2.0	-	2	25.6			
67	Tx 7078	2.0	100	2.0	100	2.0	-	2.0	-	2	42.5	2	-	-
68	B Tx 398	3.0	100	2.0	100	2.0	-	2.0	-	2	37.4	2	83.0	2
69	B Tx 378	5.0	100	3.5	100	3.8	80	3.5	40	4.5	44.4	5	38.6	5
70	Sweet Sudan	4.0	100	2.5	100	4.0	100	2.0	-	-	22.6	4	-	-

[a] Inoculation at Lubbock and College Station by R. W. Toler, readings at College Station by R. W. T., ratings based on 1-5 scale, see page 26.

[b] In certain entries only a few plants develop damaging symptoms. To indicate this we estimated the incidence by -- 1 = 10% or less; 2 = 20% or less.

[c] Dates given are when rating was made. These ratings made on plots where six feet of row was inoculated and ten feet remained uninoculated.

[d] Inoculated data on early planting where there was essentially no natural infection.

Table 1.6 Agronomic, lodging, root rot and seed weathering data on the All Disease Nursery, 1975.

Entry no.	Designation	Date of 50% bloom Lubbock I	Plant height(cm) Lubbock I	Head exsertion(cm) Lubbock I	Leaf and plant death rating [a]		Desirability [b] Lubbock I	Lodging(%) Lubbock I	LSDC [c]	Seed weathering [d]	
						F-105 Lubbock				College Station	Corpus Christi (LR)
1	SC 56-14	8/8	119	20	2.5	2.7	2.4	35	3	2.5	2.9
2	SC 89-9	8/9	108	19	1.9	2.4	2.8	83	1	2.0	1.9
3	SC 97-14	8/2	164	28	2.4	2.6	3.8	99.5	2	2.5	2.0
4	SC 103-12	8/6	97	9	3.2	2.9	2.6	92.5	1	1.0	2.5
5	SC 108-14	8/10	81	0	3.8	3.3	2.8	50	3	2.0	2.8
6	SC 108-14	8/10	84	9	3.3	2.8	2.6	37.5	3	2.5	2.8
7	TAM 428(110-9)	8/10	121	14	3.1	3.8	2.0	95.5	2	2.0	3.5
8	SC 110-14	8/8	93	3	4.2	4.4	2.5	76.5	2	2.5	2.3
9	SC 111-9	8/4	104	11	3.9	4.2	2.6	94.5	0	2.2	1.5
10	SC 112-14(no uc)	8/3	105	13	3.0	3.0	2.8	74.5	2	3.0	1.3
11	SC 112-14 (uc)	8/5	113	9	2.9	3.6	2.8	85	1	3.0	2.0
12	SC 115-11E-1	8/7	104	11	4.0	4.2	3.4	90	1	1.5	3.0
13	SC 120-14-1	8/12	74	38	2.5	3.0	3.1	0	5	4.5	4.0
14	SC 170-6(4242)	8/17	111	11	2.9	3.0	2.3	10	2	2.0	3.3
15	SC 170-6(4252)	8/17	114	13	2.9	3.0	2.2	17.5	0	2.0	1.9
16	SC 170-7(4267)	8/16	108	5	2.8	3.3	2.0	27.5	4	2.8	3.0
17	SC 170-14E-3	8/15	109	11	2.8	3.2	2.4	83.5	1	0	3.0
18	SC 173-12-6	8/12	94	5	3.5	3.8	2.2	15	2	3.0	4.0
19	TAM 2566(175-9)	8/7	76	8	2.5	3.0	3.1	25	2	2.0	2.8
20	SC 175-14	8/9	126	9	2.6	3.6	2.8	99.5	3	2.5	2.3
21	SC 228-14	8/4	83	6	3.0	3.1	3.3	92.5	2	2.5	2.5
22	SC 237-14	8/16	111	4	3.1	3.0	2.9	16	2	2.0	2.8
23	SC 239-14	8/11	83	6	2.2	2.8	2.6	2.5	3	4.0	3.3
24	SC 279-14	7/30	152	27	2.8	3.0	3.3	94	3	1.0	1.0
25	SC 324-12	8/12	114	10	2.2	2.6	3.0	99	3	1.5	2.0

Continued

Table 1.6 Continued

Entry no.	Designation	Date of 50% bloom Lubbock I	Plant height (cm) Lubbock I	Head exsertion (cm) Lubbock I	Leaf and plant death rating[a] Lubbock I	Leaf and plant death rating[a] F-105 Lubbock	Desirability[b] Lubbock I	Lodging (%) Lubbock I	LSDC[c]	Seed weathering[d] College Station	Seed weathering[d] Corpus Christi (LR)
26	SC 326-12	8/2	105	17	2.6	2.5	3.2	37.5	3	1.5	2.0
27	SC 326-6	8/24	90	9	2.2	3.0	2.8	8.5	2	0	3.5
28	SC 330-9	8/14	141	18	2.4	2.5	2.6	99.5	1	3.0	2.8
29	SC 333-14	8/5	131	23	2.7	2.9	2.8	99	2	2.5	2.0
30	SC 334-9	8/9	147	23	3.3	3.2	2.5	96	0	2.0	2.8
31	SC 414-12E	8/12	133	20	3.5	3.4	2.3	99.5	2	3.0	3.3
32	SC 420-12	8/4	77	10	3.3	3.4	3.2	40	1	2.0	2.0
33	SC 423-14(2680)	8/8	107	5	3.2	4.0	2.9	93.5	1	3.0	3.5
34	SC 423-14(2686)	8/6	114	8	2.8	2.9	3.0	79	3	2.5	3.5
35	SC 546-14	8/4	124	13	2.8	2.9	3.5	75	2	1.5	1.8
36	SC 574-6	8/18	98	17	2.5	3.0	2.6	1.5	3	3.5	2.5
37	SC 599-6(9054)	8/14	102	14	2.3	2.6	1.9	7.5	1	0	4.5
38	SC 599-6(9245)	8/14	102	20	1.9	2.9	2.0	12.5	2	1.5	3.8
39	SC 599-6(9247)	8/13	103	15	2.6	2.7	2.0	30	2	2.0	2.5
40	SC 599-6(9188)	8/10	118	36	1.9	2.5	2.3	55	2	2.5	2.0
41	SC 599-6(9193	8/14	116	11	2.2	3.2	2.4	12.5	1	2.0	1.8
42	SC 599-11E	8/11	118	19	2.2	2.8	2.0	15	3	1.5	1.9
43	SC 680-3	8/10	90	17	2.8	2.9	2.8	15	3	2.5	2.0
44	SC 748-5	8/10	146	20	2.9	3.4	2.8	100	3	2.3	1.8
45	SC 167-14	8/21	114	9	2.6	2.9	3.3	22.5	3	1.5	0
46	NSA 440-12	8/13	97	5	3.1	3.3	2.3	1.5	2	4.0	4.5
47	NSA 817-3	8/11	90	3	4.0	3.2	2.6	40	1	4.0	3.8
48	NSA 837-1	8/12	93	8	3.3	3.0	2.7	12.5	5	3.5	3.9
49	NSA 935-6	8/15	109	22	2.6	2.9	2.5	35	3	3.0	4.2
50	QL3 sel	8/5	147	28	2.3	2.4	3.1	98.5	5	2.0	3.3

Continued

Table 1.6 Continued

Entry no.	Designation	Date of 50% bloom Lubbock I	Plant height(cm) Lubbock I	Head exsertion(cm) Lubbock I	Leaf and plant death rating a/ Lubbock I	Leaf and plant death rating a/ F-105 Lubbock	Desirability b/ Lubbock I	Lodging(%) Lubbock I	LSDC c/	Seed weathering d/ College Station	Seed weathering d/ Corpus Christi (LR)
51	(B3197 x SC170)(1750	8/13	128	5	2.5	3.0	1.9	79	5	2.5	3.5
52	(B3197 x SC170)(1753-2)	8/9	117	10	2.5	2.8	2.3	41.5	5	3.5	3.3
53	(SC110 x SC120)(4130)	8/11	116	20	3.3	3.6	2.3	99.5	3	2.5	1.9
54	(SC599 x SC134)(1880)	8/18	118	14	2.4	2.8	2.4	45	5	3.0	3.4
55	(SC120 x Tx 7000)	8/21	114	15	2.5	3.0	2.5	32.5	5	2.5	2.4
56	(IS2930 x IS3922)	8/15	128	17	3.0	3.2	2.4	91.5	1	2.5	2.8
57	(SC56 x SC170)(1584)	8/18	98	10	2.5	2.6	2.5	0.0	5	3.0	3.0
58	(SC56 x SC170)(1922)	8/20	108	5	3.0	3.1	2.4	40	3	3.0	2.0
59	(SC56 x SC33)(1778)	8/16	117	6	2.2	2.5	2.4	30	4	2.5	3.3
60	(B406 x Rio)-2	8/16	100	20	2.0	3.0	2.4	65	1	2.5	2.5
61	TAM 2567	8/9	127	20	2.8	2.5	2.6	95.5	3	4.5	3.8
62	(Tx2536 x SC170)(5252)	8/10	116	114	2.5	2.6	2.1	91	3	3.0	4.0
63	(SC599 x SC110)(5396)	8/10	124	19	3.8	3.3	2.4	99.5	3	2.8	2.0
64	(B3197 x SC170)(5451)	8/7	149	15	2.3	2.4	2.0	100	5	2.0	2.4
65	Tx 2536	8/7	123	24	2.5	2.6	2.8	98.5	3	4.0	3.4
66	Tx 09	8/7	68	14	2.9	3.5	3.9	99	5	0	4.0
67	Tx 7078	8/11	98	16	2.8	3.0	3.0	97.5	3	4.0	2.9
68	B Tx 398	8/6	131	28	2.4	2.6	3.0	95	5	3.0	2.0
69	B Tx 378	8/15	146	15	3.0	2.8	2.6	100	5	2.5	1.5
70	Sweet Sudan	8/17	209	18	2.8	2.5	4.5	45	0	0	2.5

a/Leaf and plant death ratings based on a, 1 = no damage to 5 = plant death, Lubbock I was following stress.

b/Desirability based on a 1-5 scale (see IDIN instructions).

c/LSDC = Late summer disease complex from El Centro, California - G. Worker. A root rot disease cause unknown.

d/Seed weathering or seed mold, notes taken August 15 by R.A.F. at College Station, and July 22 by L. Reyes at Corpus Christi. Based on 1-5 scale. See IDIN instructions.

C-2. International Disease and Insect Nursery (IDIN)

SORGHUM DISEASE AND INSECT EVALUATION - NOTE TAKING INSTRUCTIONS

A variety of systems for taking disease notes are suggested. Within each nursery a selected set of susceptible controls is needed. These controls provide the researcher with a valid basis for comparing data from one cropping season to the next.

Lines used as controls vary in their disease and insect reactions. A partial listing of their disease and insect reactions is as follows:

Variety	Susceptible to:	Resistant or tolerant to:
Tx 7078	head smut, races 1, 2, 3 & 4 rust zonate leaf spot grey leaf spot downy mildew	
B Tx 398	anthracnose	MDMV (tolerant)
B Tx 378 (Redlan)	MDMV	
QL 3		MDMV (resistant)
TAM 2566		midge
TAM 2567		greenbug
Tx 2536	downy mildew	anthracnose
Sweet Sudan	Northern leaf blight Southern leaf blight downy mildew (foliar phase)	

Date of flowering of each entry is very important to record, since in many cases, disease damage is related to maturity. The date when approximately 50% of the heads have begun to flower should be recorded as the date of flowering. Accurate flowering notes are best obtained by taking them every 3 to 4 days.

Notes on diseases not listed below should be taken and added to your data sheet. Also, notes on items such as bird damage may be made along with the species involved. Differences in reaction to other characteristics such as drought, heat, cold, flooding, and soil factors such as pH, and aluminim toxicity should be recorded if the opportunity arises. When a selection appears to segregate for disease reaction, this information is very useful to the breeder and should be recorded. For example, 4, 2s means that most individuals were rated 4 and most of the rest were rated 2. The apparent segregation ration should be recorded in a comment column. The rating 1-4s means that individual

ratings 1, 2, 3, and 4 occurred with more ones and twos than threes and fours. Explain fully: let the rating format be a convenience rather than a restriction.

It should be pointed out that a "0" rating in the rating systems refers to any situation where a rating may be made on an individual plot and does not refer to a level of resistance.

DISEASE RATINGS:

1. Downy mildew. If sorghum downy mildew is present, data should be collected on the incidence of systemically infected plants as well as the severity of foliar infection (local lesion phase).

   Systemically diseased seedling and plants will develop striped or streaked leaves with alternate green and yellow or chlorotic stripes. Down (asexual sporulation) is common to abundant on the lower leaves of these plants during humid weather with moderate to cool temperatures.

   The local lesion phase develops extensively on sudangrasses under favorable conditions and could develop to a lesser extent on many of the entries. Disease evaluations can be made for this phase as for other foliar diseases.

2. Head smut. Determine the incidence of disease in each plot at or about the soft dough stage of growth.

3. Maize dwarf mosaic virus (MDMV) or sugarcane mosaic. Data may be obtained at the boot stage of growth or after flowering based on the following rating system. From flowering on, the mottling and chlorosis usually disappear; thus, one cannot determine 2 or 3 in late growth stages. Cool temperatures of 60 F or lower make symptoms much more severe, especially on susceptible lines. The red leaf symptom often does not develop in the absence of such cool temperatures. Note: Certain genotypes will show chlorotic and stunted plants without significant necrosis. These should be rated a 5. Incidence may be important and may be reported as a percentage. This is especially important when incidence is near 100% in some entries.

   0 = No evaluation possible
   1 = No apparent symptoms
   2 = Leaves with mottling only
   3 = Mottling and significant chlorosis
   3.5 = Mottling with slight leaf necrosis
   4 = Mottling with significant leaf necrosis (red leaf on most genotypes)
   4.5 = As above with stunting
   5 = The above accompanied by severe stunting or death

4. Foliar diseases. A rapid evaluation of foliar disease incidence and severity can be made for the following diseases: Grey leaf spot, sooty stripe, zonate leaf spot, rough spot, bacterial stripe,

physiological or genetic spotting, insecticide damage, leaf blight, rust, downy mildew, and others.

0 = No evaluation possible
1 = Resistant - disease inconspicuous or present on an occasional plant
2 = Disease present (over 50% prevalence with low severity; apparently causing little economic damage)
3 = Disease severe (100% prevalent, estimated leaf area destroyed up to 25%; disease appears to be of economic importance)
4 = As in 3 but over 25% of leaf area destroyed
5 = Death of leaves or plants due to disease

5. Stalk rot. Data should be collected at about physiological maturity or when the grain has completely matured. (Note: At times, following artificial inoculation, little disease develops. Nevertheless, good comparative data can usually be obtained by recording differences among entries within inoculated internodes.) Several longisections should be whittled away to reveal nodal anatomy. When rot extends into a node at 1 or 2 sites, it can be recorded as a 1.1 or 1.2. The x.5 ratings are often necessary. The following rating system can be used in evaluating the severity of anthracnose, Fusarium, and charcoal rot following artificial inoculation:

0.0 = No evaluation possible
0.1 = Minimal reaction, indistinguishable from that to a sterile toothpick
0.2 = Discoloration centered about the wound, progressing farthest in the superficial parts of the stalk, but not reaching either node
0.5 = Extensive discoloration progressing farthest in the central part of the stalk
0.8 = Discoloration reaching one or both nodes superficially or forming a cylinder
1.0 = Most or all of one internode discolored with no penetration of nodal areas
1.1 = Slight penetration of one or both nodes
1.2 = Nearly complete penetration of one or both nodes
1.5 = Penetration of one node and slight invasion of the next internode
2.0 = More than 1 but not more than 2 internodes affected; infection must have spread through at least 1 internode
2.5 = Penetration of 2 nodes and slight invasion of distal internode
3.0 = Infection has passed through 2 or more internodes
4.0 = Extensive invasion of plant but not killed
5.0 = Death of plant due to stalk rot

6. Lodging. The Ratings below based on percentage of lodged plants should be recorded. This lodging can be any one or a combination of: weak neck (breaking at base of peduncle), stalk breakage (due to stalk rots or weakened stalks due to stress, or very high wind), or root lodging (entire plant leans or falls due to wet soil and wind). The predominant type of lodging should be recorded.

Use rating or actual %.

0 = No evaluation possible
1 = 2% or less
2 = 3-10%
3 = 11-30%
4 = 31-70%
5 = 71-100%

7. Fusarium Head Blight. Infection and death of rachis branches, rachis and often peduncle (maybe even progressing downward to the base of the stalk) should be rated as below. The panicle branches of infected heads often droop severely after maturity. Infected rachis branches and peduncles have both external and internal discoloration as contrasted to MDM induced discoloration which is limited to external discoloration only. The disease usually develops or becomes obvious at about physiologic maturity of the grain or later.

0 = No evaluation possible
1 = Resistant - no infection in rachis branches or head
2 = Infection limited to head, particularly rachis branches
3 = Whole head infected
4 = Both heads and peduncles affected
5 = Head blight resulting in death or lodging of plants

8. Anthracnose.

A. Natural infection
Each of the following are rated from 1 to 5 based on 1 = resistant to 5 = death of tissue or plant:

1. Leaves (foliage)
2. Stalk (peduncle)
3. Head

B. Artificial inoculation

1. Toothpick method, same as for stalk rot evaluation
2. Conidial injection, same as for natural infection

9. Pythium or other root rot. Ratings of root rot should normally be made at maturity, but before plant has died. Ratings are based on the following scale:

0.0 = No evaluation possible
1.0 = Roots free from disease
2.0 = No root rot near crown or on major brace roots
2.5 = At lease one dead major brace root
3.0 = More than one to 1/2 but not all brace roots dead
3.5 = More than 1/2 but not all brace roots dead
4.0 = All roots dead, but base of stalk is still alive
5.0 = All roots and base of stalk dead

10. Seed weathering. A major environment- and maturity-related problem affecting both quality and quantity of seed is weathering. Should the opportunity present itself, data on seed mold and discoloration associated with weathering should be recorded on a 1 to 5 scale as noted. Ratings can be accurately made after the sample has been threshed. Established standards for reference are recommended.

    0 = No evaluation possible
    1 = Seed bright, free from mold damage
    2 = Moderately resistant to weathering, seed slightly discolored
    3 = Moderately susceptible, considerable discoloration
    4 = Susceptible, extensive discoloration and deterioration of seed
    5 = Very susceptible, seed essentially all dead. Embryos dead and endosperm deteriorated

11. Desirability. The overall desirability, adaptation or breeding potential ratings can be made near or at maturity. Many factors influence such a rating. However, each individual's overall appraisal of the desirability of entries in conjunction with the other ratings should give valuable information regarding the most useful material or germ plasm for certain areas of the world.

    0 = No evaluation possible
    1 = Very good
    2 = Good
    3 = Average
    4 = Poor
    5 = Very poor

INSECT RATINGS:

1. Greenbugs. Data may be obtained at any plant growth stage when greenbugs are present. It is suggested that estimates of greenbug numbers be taken if possible. Also, record plant growth stage as outline by Vanderlip.

    0 = No evaluation possible
    1 = No red spotting on leaves
    2 = Red spotting on leaves
    3 = Portion of a leaf killed by greenbugs
    4 = One entire leaf killed by greenbugs
    5 = Two entire leaves killed by greenbugs
    6 = Four entire leaves killed by greenbugs
    7 = Six entire leaves killed by greenbugs
    8 = Eight entire leaves killed by greenbugs
    9 = Dead plant

2. Midge. Damage based on percent "blasted" florets. Rate no sooner than 20 days after bloom. Take care to differentiate midge damage from bird damage and sterile florets. The presence

of a cocoon at the tip of the glumes is proof that a seed was damaged by midge.

0 = No evaluation possible
1 = No damage
2 = 1-10% damage
3 = 11-20% damage
4 = 21-30% damage
5 = 31-40% damage
6 = 41-60% damage
7 = 61-80% damage
8 = 81-90% damage
9 = 91-100% damage

3. Corn leaf aphids. Ratings based on extent of damage to the infested plants. Incidence is usually variable among plants, so damage ratings should be taken on the most highly infested plants. If aphid populations differ markedly among entries, an indication of the level of infestation on each entry should be made using the following code after the rating: 1 = low incidence, 2 = average incidence, 3 = high incidence.

0 = No evaluation possible
1 = No leaf discoloration or damage
2 = Yellowing or mottling of leaves
3 = Some dead leaf margins, mottling extensive
4 = Some dead leaves
5 = Some dead plants

4. Mites. Ratings based on the extent of damage to the infested plants. Mites generally begin feeding adjacent to the mid-rib of the leaf. Feeding is accompanied by webbing in the area adjacent to the mid-rib and desiccation of the leaf tissue beginning at the tip and margins of the leaves. Mites generally cause damage to sorghum after it has bloomed; however, ratings can be made at any stage of plant growth.

0 = No evaluation possible
1 = No leaf death
2 = 1-10% of leaf area dead
3 = 11-20% of leaf area dead
4 = 21-30% of leaf area dead
5 = 31-40% of leaf area dead
6 = 41-60% of leaf area dead
7 = 61-80% of leaf area dead
8 = 81-90% of leaf area dead
9 = 91-100% of leaf area dead

Stages of Plant Growth in Sorghum

by R. Vanderlip, Kansas State University

Stage	Days after emergence (approximately)	Description
0	0	Emergence. First leaf visible at soil surface.
1	10	Three leaves with fully developed sheath, i.e., third leaf sheath elongated and collar between blade and sheath visible.
2	20	Five fully developed leaf sheaths, i.e., fifth leaf sheath elongated and collar between blade and sheath visible.
3	30	Growing point differentiation-on RS 610 eight leaf sheath elongated and collar visible but this characteristic differs in various hybrids. Culm has not started to elongate. (Plant may have to be dissected to distinguish this and separate from following stage. One or more leaves may have been lost.)
4	40	Final leaf visible in whorl. Culm undergoing rapid elongation. Lower 1-3 leaves may have been lost.
5	50	Boot stage. All leaves fully expanded. Head nearly full length and enclosed in flag sheath. Peduncle elongation occurring. Total leaf area has been attained.
6	60	Half-bloom. One half of the main heads in some stage of flowering.
7	70	Soft dough.
8	80	Hard dough.
9	90	Physiological Maturity.

A Data Management System for IDIN and Other Nurseries

The disease data should be placed on the coding sheets in the following manner (see the sample coding sheet for disease data, Exhibits 1 and 2):

I. IS number, plot number or entry number should be placed in the first 10 columns and be right justified. (The last digit of the number to be in column 10.)

II. The year, last two digits only, ie. 74, should be placed in columns 11-15 and be right justified.

III. The location code goes in columns 16-20. The following arbitrary code will be set up by the person coding the data following these guidelines.

Numbers 100-199	Texas
200-299	U.S.A.
300-399	International

This is a testing location not location of origin.

The location code is right justified.

IV. The disease data is divided into 2 types.

A. Foliage Diseases (Rust, leafspots, etc.)

1. Disease code. This code is from the exhibit entitled Disease Code for Converted Lines. Each disease has a unique code (ie., the code for head smut is 2, etc. This code is placed in columns 21-22 and is right justified.

2. The disease reaction should be placed in columns 23-25. These data are not right justified. The last column is reserved for the first decimal point. For example, if the disease rating for rust is 1.5, the 1 would be placed in column 24 and the 5 would be placed in column 25. If the rating was 1.0 or 1, the 1 would

be placed in column 24 and column 25 would be left blank. If the disease rating for downy mildew (or another stand count disease) in percent stand infected, was 70.3%, the 7 would go in column 23, the 0 (zero) in column 24 and the 3 in column 25.

3. The segregation type is an integer to tell the computer whether the numbers in columns 24 and 25 are to be separated by a decimal point, a comma, or a dash. The following code will be set up for this:

Decimal point	0 (blank)
Comma	1 (segregation)
Dash	2

The next disease code would be placed in columns 27-28, the next reaction in 29-31 and the next segregation type in 32. As many as 6 sets of disease data can be placed on one card.

B. Stand Diseases (Head smut, downy mildew, etc.)

1. Flowering date in Julian days is placed in columns 60-62.
2. The number of plants examined is placed in columns 63-65.
3. Disease code for stand diseases is placed in columns 66-67.
4. The number of plants diseased is placed in columns 68-70.

This can be repeated for up to 3 stand diseases.

In last years annual report, the initial stages of a data management system were discussed. The system was initially set up to handle only the International Disease and Insect Nursery (IDIN). Since that time the system has been expanded to include All Disease Nurseries (ADN) and data on the released converted lines.

To distinguish which set of Data, ADN, IDIN, or Converted lines, were being used a variable called ECODE was put into the program. This variable is simply a flag to tell the computer how to handle the data being used.

The second significant change is the altering of the format of the disease data. The reason for the alteration was to make coding of the data simpler. The following section explains the new disease coding scheme.

Exhibit 1

DISEASE DATA		COLUMNS
IS No.	(5)	1-10
Year	(2)	11-15
Location	(3)	16-20
Disease Data		
Foliage Diseases		
Disease Code		21-22
Reaction (rating)		23-25
Segregation type		26
Repeat last 3 steps for as many as 6 foliage diseases.		
Stand Diseases		
Flowering date		60-62
Stand count		63-65
Disease code		66-67
Diseased stand		68-70
The last two steps may be repeated for up to 3 stand diseases.		

Location Code for Disease Nurseries as of September, 1975

Location code	General
100-199	Texas
200-299	USA
300-399	International
	Specific
100	College Station (FRM)
101	College Station (KFS)
102	Victoria ADN
103	Berclair H/S
104	Berclair DM
105	College Station ADN 75
106	College Station ADN 75 MDM Nursery
200	Meridian, Mississippi
201	Experiment, Georgia
202	Manhattan, Kansas
203	Garden City, Kansas
204	Isabella, Puerto Rico
205	Mayaguez, Puerto Rico
300	Bambey, Senegal
301	Poza Rica, Mexico
302	Guarabao, Venezuela
303	Pergamino, Argentina
304	Sabaneta, Venezuela

Disease Code, Foliage Ratings

Code	Disease
1	Downy mildew (*Sclerospora sorghi*)
2	Head smut (*Sphacelotheca reiliana*)
3	Maize dwarf mosaic - stand
4	Maize dwarf mosaic - foliage
5	Anthracnose - foliage (*Colletotrichum graminicola*)
6	Red rot (*C. graminicola*)
7	Anthracnose - Head (*C. graminicola*)
8	Bacterial leaf stripe (*Pseudomonas andropogoni*)
9	Grey leaf spot (*Cercospora sorghi*)
10	Leaf blight (*Helminthosporium turcicum*)
11	Rust (*Puccinia purpurea*)
12	Rust lesion size
13	Zonate leaf spot (*Gloeocercospora sorghi*)
14	Sooty stripe (*Ramulispora sorghi*)
15	Rough spot (*Ascochyta sorghina*)
16	Leaf spot (*Ramulispora sorghicola*)
17	Leaf spot (*Phoma insidiosa*)
18	Bacterial leaf streak (*Xanthomonas holcicola*)
19	Bacterial leaf spot (*P. syringae*)
20	Loose smut (*Sphacelotheca cruenta*)
21	Covered smut (*S. sorghi*)
22	Long smut (*Tolyposporium ehrenbergii*)
23	Sugar cane mosaic
24	Corn stunt
25	Brome grass mosaic
26	Cucumber mosaic
27	Milo disease (*Periconia circinata*)
28	Pokkah - bong (*Fusarium spp.*)
29	Pink root (*Pyrenochaeta terrestris*)
30	Pythium root rot (*Pythium graminicola*)
31	Head blight (seed mold)
32	Sugary disease (*Spacelia sorghi*)
33	Nematodes (*Pratylenchus spp.*)
34	Nematodes (*Meloidogyne sp.*)
35	Witchweed (*Sriga asiatica*)
36	Witchweed (*S. hermonthica*)
37	Lodging
38	Target leaf spot (*H. sorghicola*)
39	Seed weathering (Seed mold)
40	Crazy top (*S. macrospora*)
41	Fusarium stalk rot (*Fusarium sp.*)
42	Charcoal rot (*Macrophomina phaseoli*)
43	Rhizoctonia stalk rot
44	Weak neck
45	Seedling blight
46	Downy mildew - foliar
47	Desirability
48	MDM Red-leaf
49	Anthracnose - whole plant

Disease Code, Foliage Ratings

Disease	Code
Anthracnose - foliage (*Colletotrichum graminicola*)	5
Anthracnose - head (*C. graminicola*)	7
Anthracnose - whole plant	49
Bacterial leaf spot (*P. syringae*)	19
Bacterial leaf streak (*Xanthomonas holicicola*)	18
Bacterial leaf stripe (*Pseudomonas andropogoni*)	8
Brome grass mosaic	25
Charcoal rot (*Macrophomina phaseoli*)	42
Corn stunt	24
Covered smut (*S. sorghi*)	21
Crazy top (*S. macrospora*)	40
Cucumber mosaic	26
Desirability	47
Downy mildew - foliar	46
Downy mildew (*Sclerospora sorghi*)	1
Fusarium stalk rot (*Fusarium sp.*)	41
Grey leaf spot (*Cercospora sorghi*)	9
Head blight (seed mold)	31
Head smut (*Sphacelotheca reiliana*)	2
Leaf blight (*Helminthosporium turcicum*)	10
Leaf spot (*Phoma insidiosa*)	17
Leaf spot (*Ramulispora sorghicola*)	16
Lodging	37
Long smut (*Tolyposporium ehrenbergii*)	22
Loose smut (*Sphacelotheca cruenta*)	20
Maize dwarf mosaic - foliage	4
Maize dwarf mosaic - stand	3
MDM Red leaf	48
Milo disease (*Periconia circinata*)	27
Nematodes (*Meloidogyne sp.*)	34
Nematodes (*Pratylenchus spp.*)	33
Pink root (*Pyrenochaeta terrestris*)	29
Pokkah-bong (*Fusarium spp.*)	28
Pythium root rot (*Pythium graminicola*)	30
Red rot (*Colletotrichum graminicola*)	6
Rhizoctonia stalk rot	43
Rough spot (*Ascochyta sorghina*)	15
Rust lesion size	12
Rust (*Puccinia purpurea*)	11
Seed weathering (mold)	39
Seedling blight	45
Sooty stripe (*Ramulispora sorghi*)	14
Sugar cane mosaic	23
Sugary disease (*Spacelia sorghi*)	32
Target leaf spot (*H. sorghicola*)	38
Weak neck	44
Witchweed (*S. hermonthica*)	35
Witchweed (*Striga asiatica*)	36
Zonate leaf spot (*Gloeocercospora sorghi*)	13

Results of the 1975 IDIN

The IDIN is a 30-entry test composed primarily of the best multi-disease and insect resistant sorghums along with appropriate elite sorghum control varieties and disease differentials (Table 2.1). It was mailed to 22 locations (Table 2.2). Data have been received to date from 6 locations in 5 countries: Argentina, India, Mexico, Senegal, and Venezuela (Tables 2.3-2.6).

We know that some nursery results will be late because of timing of growing seasons with seed distribution but others unfortunately are lost. Drs. N. Zummo and S. Manzo did not receive theirs which was unfortunate because they had an excellent site for disease evaluation at Samaru. A few of the IDIN entries were tested in the ISAVN at Samaru, providing extraordinarily useful data on differential reaction to anthracnose (note section ISAVN). Disease and insect reactions in Guaraboa and Sabaneta in Venezuela, were based on the 1974 IDIN. Major emphasis was placed on tropical adaptation and seed mold or weathering. When Frederiksen visited the nursery at Sabaneta the plants were healthy. Low levels of downy mildew were present but consistent with expected host reaction. In Argentina the season permitted evaluation of the IDIN for foliar diseases. The entry, TAM 2572 (SC326-6), had the following note "Muy bein granado-sin enfermedades foliares." Midge ratings were made but were not summarized this year. At Bambey, Senegal, entries differed for sooty stripe, rough spot, and

Cercospora. Resistance to sooty stripe appeared rather common whereas differences among entries for resistance to zonate leaf spot were insignificant. A few entries developed trace amounts of anthracnose. Of interest here was not the resistant reaction but that several entries, SC110-14, SC173-12, SC599-6, highly resistant in the U.S., developed the disease. These data suggest that the virulent Nigerian race, (see Table 3.1), is present in Senegal.

At Poza Rica, (Table 2.4), disease ratings were made on rust and Cercospora (grey leaf spot). The Cercospora leaf spot was very severe during early spring 1973, but according to Dr. S. Singh, not as prevalent during the summer season. The reading of the IDIN entries from various locations in the U.S. were summarized in Table 2.7. All IDIN entries appear in the ADN as well.

Table 2.1 International disease and insect nursery (IDIN), 1975

Entry no.	Designation	IS no.	Variety, kind, or group
1	SC 56-14	12568	Cau-Nig
2	SC 103-12	2403	Caudatum
3	SC 108-14	12608	Zerazera
4	TAM 428 (110-9)	12610	Zerazera
5	SC 110-14	12610	Zerazera
6	SC 112-14 (uc)	12612	Zerazera
7	SC 120-14-1	2816	Zerazera
8	SC 170-6-8-8 (4252)	12661	Zerazera
9	SC 170-6-17 (4267)	12661	Zerazera
10	SC 173-12-6	12664	Zerazera
11	TAM 2566 (175-9)	12666	Zerazera
12	SC 175-14	12666	Zerazera
13	SC 237-14	3071	Dobbs
14	SC 239-14	3574	Zerazera
15	SC 326-6	3758	Nigricans
16	SC 414-12E-P1	2508	Cau-Kaf
17	SC 423-14 (2680)	2579	Zerazera
18	SC 599-6-3 (9247)		Rio
19	SC 599-6-10 (9188)		Rio
20	SC 748-5-3	3552	Cau-Guin
21	NSA 440-12		Kafir der.
22	(B 3197 X SC 170-6)(1753)		Kafir - Zera der.
23	(SC 599-6 X SC 134-6)(1880)		Rio-Dur Doc der.
24	QL 3 selection		C. Kaf der.
25	TAM 2567		Tx 2536 der.
26	B Tx 378	413	Redlan
27	B Tx 398	412	Martin
28	Tx 7078	415	Combine 7078
29	Tx 2536	10542	Y.E. Fet. der.
30	Sweet Sudan	721	Sw. Sudangrass

Table 2.2. 1975 International Disease Nursery Locations

Location (number)	Cooperator
Argentina (2)	Elba Alessandrini Ricardo A. Parodi Manfredi
Brazil (1)	Robert E. Shaffert Sete Lagoas
India (5)	N. V. Sundaram New Delhi
	K. A. Balasubramaniyan Dharwar, India
Mexico (2)	Shree P. Singh CIMMYT Mexico 6, D.F.
Venezuela (2)	Mauricio Riccelli Maracay
Malaysia (1)	Mah Shook Ying Serdang, Selangar, Malaysia
El Salvafor (1)	Francisco R. Arias M. San Tecia
Ethiopia (1)	Brhane Gebrekidan Diredawa, Ethiopia
Virgin Islands (1)	M. R. Wanjari U. S. Virgin Islands
Uganda (1)	S. Z. Mukuru Serere
Nicaragua (1)	Arnold VanHuis Roberto Arguello Managua, Nicaragua
Columbia (3)	Jim Wilson Asgrow Seed Company Cali
Egypt (1)	S. I. Salama Giza, Egypt
Senegal (2)	J. C. Girard Bambey

Table 2.3. Disease reaction of selected IDIN sorghum entries for 1975 at Dharwar, India.[1/]

Pedigree	Stand	DM%	C	RS	Z
SC56-14-3	39	10	3.5	2.5	1.5
SC103-12-2	27	7	2.0	1.5	1.0
SC108-14-1	71	1	2.0	1.0	1.0
SC109-12-PL	52	2	4.0	1.0	1.0
SC110-9-PL	58	0	4.0	1.0	1.0
SC110-14-1	57	4	3.5	1.0	1.0
SC112-14-6	60	0	4.0	3.0	3.0
SC120-6-6-4	54	0	1.5	1.0	1.5
SC120-14-1	53	0	3.0	1.0	1.0
SC170-6-8-8	61	1	2.5	1.0	1.0
SC170-6-17	67	1	2.5	1.0	1.5
SC173-12-6	57	1	3.0	1.0	1.0
SC175-14-3	66	8	3.5	1.0	1.5
SC237-9-2	67	4	1.0	1.0	2.0
SC239-14-1	56	4	4.0	1.0	2.0
SC326-6-PL	74	0	1.5	1.0	2.0
SC334-9-PL	46	0	3.5	2.5	1.5
SC414-14-1	51	0	4.0	2.5	2.5
SC420-12-9	48	2	3.0	2.0	1.5
SC423-14-1	69	3	2.0	3.0	2.0
SC599-6-3	44	4	4.0	1.0	2.0
SC599-6-10	67	0	2.0	1.0	2.5
SC680-3-2-4	68	4	4.0	2.0	1.0
NSA440	56	5	1.5	4.0	1.0
TX09	21	14	2.5	4.0	1.0
BTx378	40	0	4.0	1.0	1.0
BTx398	32	0	3.0	2.0	3.0
Tx7078	61	18	3.5	4.0	1.0
Tx2536	57	0	2.0	1.0	2.5
Sweet Sudan	39	46	3.0	1.0	2.0

[1/] Cooperator: N. V. Sundaram

Table 2.4. Disease reaction of selected IDIN sorghum entries for 1975 at Poza Rica, Mexico. 1/ (1974 IDIN).

Pedigree	C	RS
SC56-14-3	3.5	2.5
SC103-12-2	3.5	1.5
SC108-14-1	4.0	1.0
SC109-12-PL	3.0	2.0
SC110-9-PL	4.0	2.0
SC110-14-1	4.0	1.0
SC112-14-6	3.0	1.0
SC120-6-6-4	3.5	1.0
SC120-14-1	4.0	1.0
SC170-6-8-8	2.5	2.0
SC170-6-17	2.5	1.0
SC173-12-6	3.0	2.0
SC175-14-3	4.0	1.0
SC237-9-2	2.0	3.0
SC239-14-1	4.0	1.0
SC326-6-PL	4.0	1.0
SC334-9-PL	3.0	2.5
SC414-14-1	3.5	1.5
SC420-12-9	3.5	1.5
SC423-14-1	3.0	2.0
SC599-6-3	4.0	1.0
SC599-6-10	2.0	2.0
SC680-3-2-4	3.0	2.0
NSA440	2.5	1.5
TX09	4.0	2.0
BTx378	1.5	2.0
BTx398	3.0	2.0
Tx7078	3.5	1.5
Tx2536	4.0	1.5
Sweet Sudan	3.5	2.5

1/ Cooperator: Shree P. Singh.

Table 2.5. Disease reaction of selected IDIN sorghum entries for 1975 at Bambey, Senegal.[1/] (1974 IDIN)

	Anthracnose	Cercospora	Zonate leaf spot	Sooty stripe	Rough spot	Seed mold
SC56-14-3	2	1	3	2	2	-
SC103-12-2	-	-	3.5	2	2.5	2
SC108-14-1	-	2	3.5	3	2	2
SC109-12-PL	-	3	3	1.5	2	2
SC110-9-PL	-	2	3.5	2.5	3	-
SC110-14-1	2	3.5	3.5	1.5	2.5	1
SC112-14-6	1	1	3.5	2	2.5	1
SC120-6-6-4	1	3	3	1.5	2	2.5
SC120-14-1	1	1	3	2	3	3
SC170-6-8-8	2	1	3	1.5	2	1
SC170-6-17	-	2	3	2	2.5	-
SC173-12-6	3	2	3	1	2.5	1.5
SC175-14-3	4	1.5	3	2	2.5	2
SC237-9-2	2	2.5	3	2	3	3
SC239-14-1	1	2	3	1.5	3	2
SC326-6-PL	-	2	3	1	2	-
SC334-9-PL	-	1.5	3	2	2	-
SC414-14-1	-	3	3.5	2	3	1
SC420-12-9	-	1	3	2	3.5	4
SC423-14-1	-	1	2	2	3	2
SC599-6-3	2	-	3	2	3	-
SC599-6-10	2	2.5	4	1	3	4
SC680-3-2-4	-	1	3.5	2	2	1.5
NSA440	-	2	3.5	2	2	-
Tx09	-	-	-	-	-	-
BTx378	1	3	4	1	3	2
BTx398	-	1.5	3	2	2	2
Tx7078	-	4	4	2.5	4	1
Tx2536	-	1.5	3	2.5	2.5	2.5
Sweet Sudan	-	2	2	4	3.5	-

[1/] J. C. Girard.

TABLE 2.6. Disease reaction of selected IDIN sorghum entries for 1975 at Sabaneth, Edo. Barinas, Venezuela.[1/] (1974 IDIN)

PEDIGREE	STAND	F DATE		MDMV	Z	A		
			46	4	13	5	39	47
SC 56-14-3	0	0	1.0	2.0	1.0	1.0	1.0	3.5
SC 103-12-2	0	0	1.0	1.5	1.5	1.0	1.0	2.5
SC 108-14-1	0	0	1.0	1.5	1.5	1.0	1.0	3.0
SC 109-12-PL	0	0	1.0	2.0	1.5	1.0	1.0	3.0
SC 110-9-PL	0	0	1.0	1.5	2.0	1.0	1.0	3.5
SC 110-14-1	0	0	1.0	1.5	1.0	1.0	1.0	3.5
SC 112-14-6	0	0	1.0	1.5	1.0	1.0	1.0	3.0
SC 120-6-6-4	0	0	1.0	1.5	1.0	1.0	1.0	4.0
SC 120-14-1	0	0	1.0	2.0	1.5	1.0	1.0	3.0
SC 170-6-8-8	0	0	1.0	1.0	1.5	1.0	1.0	2.5
SC 170-6-17	0	0	1.0	1.5	1.5	1.0	2.0	3.5
SC 173-12-6	0	0	1.0	1.0	1.5	1.0	1.0	3.0
SC 175-14-3	0	0	1.0	1.5	2.0	1.0	1.0	3.5
SC 237-9-2	0	0	1.0	1.5	1.5	1.0	1.0	3.5
SC 239-14-1	0	0	1.0	1.0	2.0	1.0	2.0	3.5
SC 326-6-PL	0	0	1.0	1.5	1.5	1.0	2.0	3.0
SC 334-9-PL	0	0	1.0	1.0	1.5	1.0	1.0	2.5
SC 414-14-1	0	0	1.0	1.0	1.0	1.0	1.0	2.5
SC 420-12-9	0	0	1.0	1.5	1.5	1.0	1.0	2.5
SC 423-14-1	0	0	3.0	1.5	1.0	1.0	1.0	2.5
SC 599-6-3-B	0	0	1.0	2.0	2.0	2.0	1.0	3.5
SC 599-6-10	0	0	1.0	1.0	1.0	1.0	1.0	3.0
SC 680-3-2-4	0	0	1.0	2.0	1.5	1.0	1.0	4.0
NSA 440	0	0	1.0	2.0	1.0	1.0	1.0	2.5
TX 09	0	0	1.0	2.0	2.0	1.0	1.0	2.0
B TX 378	0	0	1.0	1.0	1.5	1.0	1.0	3.0
B TX 398	0	0	1.0	1.5	1.0	1.0	1.0	2.5
TX 7078	0	0	1.0	1.0	1.0	1.5	1.0	2.0
TX 2536	0	0	1.0	1.0	1.0	1.0	1.5	2.5
Sweet Sudan	0	0	2.0	1.5	1.5	1.0	1.5	2.5

[1/] Cooperator: Mauricio Riccelli

Table 2.7 Reaction of IDIN entries at various locations in the US to major North American diseases.[a]

Entry no.	Designation	Downy mildew (%) 1973 BHS	1974 BHS	1974 BDM	1975 BHS	1975 BDM	Head smut (%) 1973 BHS	1974 BHS	1974 BDM	1974 UHS	1975 BHS	1975 BDM	Anthracnose 1971 Exp.	1972 Exp.	1973 Exp.	1974 Exp.	1974 P.R.	1975 Exp.	1975 Mer.	Maize dwarf mosaic Inoculated 9/18 Rating	F-301 Natural inf. rating[b]	Rust 1974 PR	1975 PR	1975 Lub.	Lodging Lubbock %	Charcoal rot Halfway rating[c]
1	SC 56-14	2	0	1	0	0	25	18	1	5.9	15.6	6.3	-	-	4.5	1.8	2	2.7	1.5	2.0	2	4	5	4.4	35	0.7
2	SC103-12	0	10	12	0	0	0	0	0	0	3.1	0	1.4	1.8	1.5	1.0	2	1.0	1.0	2.0	2	2.5	4	3.3	92.5	-
3	SC108-14	0	2	1	0	0	8	7	0	1.9	35	20	3.5	3.5	5.0	1.7	2.3	5.0	1.0	2.0	2	2.5	3.5	3.3	50.	-
4	TAM 428(110-9)	0	3	0	0	0	0	0	0	0	0	0	2.8	2.0	1.7	1	1	1.5	1	2	2	2.5	3.5	2.3	95.5	-
5	SC110-14	0	0	0	0	0	0	0	0	0	0	0	1.2	1.5	1.5	1	1	1.2	1.1	2	2	2.5	4.0	2.4	76.5	-
6	SC112-14(uc)	0	0	0	0	0	0	3	0	0	4.8	5.2		1.5	2.0	1.2	1.2	1.5	1.1	4.3	4-1	2.0	2.5	1.5	85.0	-
7	SC120-14-1	0	0	0	0	0	0	0	0	0	17.5	-	1.3	1.2	2.0	1	1	1.0	1	3.5	4-1	-	1.0	1.0	0.0	-
8	SC170-6-8-8(4252)	0	0	0	0	0	0	0	0	1.2	0	0	1.9	1.5	1.5	1.5	1.1	1.2	1	2	2	2.5	3.5	3.0	17.5	0.8
9	SC170-6-17(4267)	0	0	0	0	1.6	1	3	0	19.6	2.9	4.8	2.8	2.5	5.0	2	3	4	1	2	2	4.0	3.5	3.3	27.5	1.7
10	SC173-12-6.	0	5	0	0	0	0	0	0	0	.0	0	1.0	2.3	1.7	1	1	1	1	2	2	2.0	3.5	2.2	15	-
11	TAM 2566 (175-9)	1	2	1	0	3	0	2	0	0	7.9	0	1.8	2.2	4.5	2.3	3	2.8	1	4	4-1	1	2	1	25	-
12	SC 175-14	0	7	1	0	0	0	6	0	8.5	34.8	0	1.5	3.5	1.7	1.3	1	1.3	2.6	4	4-1	1	1.5	1	99.5	-
13	SC 237-14	-	-	-	0	2.5	-	-	-	3.6	0	0	-	-	1.2	-	1	1.3	1	2	2	-	-	2.7	16	-
14	SC 239-14	0	0	0	0	0	0	0	0	0	2	0	-	-	1.7	1	1	1	1	2.3	2	1.5	4	2.9	2.5	-
15	SC 326-6	0	0	4	0	3	0	0	0	0	1.8	2	2.0	1.3	1.8	1.3	1	1.3	1	4	4.3	1	1	1.0	8.5	1.7
16	SC 414-12E-P1	0	0	0	0	3	0	0	0	0	0	0	-	1.2	2.5	1.2	1.5	1.5	1	2	2	2.5	3.5	2.9	99.5	-
17	SC 423-14(2680)	0	0	0	0	0	0	0	0	0	4.6	6.1	-	2.8	3.3	1.2	3	1.2	1	2	2	3	3	2.7	93.5	-
18	SC 599-6-3(9247)	26	10	7	3.8	6.1	0	0	0	2.9	0	0	1.0	1.2	1.3	1	1	1	1	4.5	4.5	1	1.5	1.0	30	0.8
19	SC 599-6-10(9188)	9	5	10	26.7	35.6	0	0	0	0	0	0	1.0	1.3	1.3	1	1	1	1	4.0	4.5	1	2	1.0	55	1.8
20	SC 748-5-3	-	0	3	5	3.8		0	0	0	3	1.9	-	-	-	1.3	1	1.2	1	2.0	2	2.5	3.5	2.9	100	-
21	NSA 440-12	10	16	6	6.4	11	12	4	0	4.7	21.2	4	2.3	2.3	5	1.7	3	1.3	1	4.0	4.5	3.5	4.5	2.9	1.5	1.3
22	(B3197 x SC170-6)		0	0	0	0		0	0	1.5	0	0				1.3	2.3	2.0	1.6	2.0	2.0	3	3.5	3.4	79	-
23	(SC 599-6 x SC134-6)	-	17	14	22.5	11.7		0	0	2.7	2.2	0	-	-	-	1.8	2.8	3.0	1.0	4.0	5.0	1	2	1.0	45	-
24	QL 3 selection	-	-	-	0	0	-	-	-	1.5	9.4	8.8		-	-	-	-	5	1.5	1.0	1.0	-	-	3.8	98.5	-
25	TAM 2567	-	-	-	8.3	8.5	-	-	-	5.9	18.3	4.4	-	-	-	-	-	1.6	2.1	3.7	3.9	-	-	3.1	95.5	-
26	B Tx 378	2	0	1	0	4.3	4	6	2	0	2.9	2.9	4.0	4.5	5	2.7	4.0	4.8	1.5	3.8	4.5	3.5	5.0	3.1	100	3.9
27	B Tx 398	17	8	5	0	1.5	0	5	2	8	9.2	7.7	5	5	5	5	4.5	4.7	4.0	2.0	2.0	4.0	5.0	3.6	95	-
28	Tx 7078	17	4	10	5.5	13.3	60	31	2	15.5	51.8	36.7	5	5	5	4.8	5	5	1.6	2.0	2.0	4.0	4.9	4.7	97.5	-
29	Tx 2536	10	53	10	16.8	5.7	5	5	1	3.8	14.6	2.9	1	1.7	1	2.9	1.7	1.7	1.0	3.7	3.9	3.0	3.0	3.2	98.5	-
30	Sweet Sudan	33	37	50	60	-	13	3	5	4	8.6	-	-	5.0	5.0	3.7	3.0	4.0	3.0	4.0	-	3.5	4.0	3.7	45	-

[a] Nursery code: BHS, Berclair head smut; BDM, Berclair Downy mildew; UHS, Victoria head smut, Exp, Experiment, GA; P.R., Isabela, Puerto Rico; Mer, Meridian, Miss.

[b] All notes based on IDIN note taking instructions except on MDMV incidence rating is given as a dash number for a few lines, i.e., 1 indicates that less than 10% of the plants had the rating indicated.

[c] Most of the lines not rated are susceptible to charcoal rot.

C-3. International Sorghum Anthracnose Virulence Nursery, S. B. King, and R. A. Frederiksen[a/]

An International Sorghum Anthracnose Virulence Nursery (ISAVN) was initiated in 1975 to obtain information on the virulence of Colletotrichum graminicola (Ces.) Wils. on sorghum. To date, interest has been expressed for growing the nursery at 19 locations, 15 of which lie in the western hemisphere.

As of February 15, results had been reported from 9 locations, and these data are summarized in Table 3.1. The data show evidence for physiologic specialization of C. graminicola on sorghum. This is especially evident in reaction differences between Nigeria and locations in the western hemisphere, and it is evident to a lesser degree in a reaction difference between Venezuela and other locations. In Nigeria, MN 960 and TAM 428 were highly susceptible but they showed little or no infection in the western hemisphere. In addition, Martin, and PB 846, showed no infection in Nigeria, but they were highly susceptible at locations showing a high C. graminicola challenge in the western hemisphere.

The results from Venezuela give evidence for possible physiologic specialization within the western hemisphere. The data indicate that the variety Wiley was moderate to highly susceptible in Venezuela, in contrast to it being highly resistant in other areas

---

[a/] We are cooperating with Dr. S. B. King, Research Plant Pathologist, USDA-ARS, Plant Science Lab, Mississippi State, MS 39762, who is responsible for conducting these trials

of the western hemisphere and Nigeria. The Venezuela test is the only one reported to date from South America.

It is intended that the ISAVN be continued. The objective, procedures, and numbers of entries will remain the same as in 1976, although 5 new entries will likely replace 5 of the entries used in 1975.

Table 3.1. Reaction of entries in the International Sorghum Anthracnose Virulence Nursery to anthracnose and red rot at 9 locations in 1975.

Variety or Designation	Foliar symptoms[a]									stalk/peduncle/head symptoms[a]		
	Poza Rica, Mexico	Mayaguez, Puerto Rico	Isabela, Puerto Rico	Gainesville, Florida	Experiment, Georgia	Meridian, Mississippi	College Station, Texas	Los Guayos, Venezuela	Samaru, Nigeria	Experiment, Georgia	Meridian, Mississippi	College Station, Texas
Honey	no anthracnose infection	1.7	1.0	no anthracnose infection	4.0	5.0	2.0	2.0	5.0	3.0	3.0	1.0
Brandes		1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Wiley		1.0	1.0		1.0	1.0	1.0	3.3	1.0	1.0	1.0	1.0
MN 960		1.0	1.0		1.0	1.0	1.0	1.0	4.0	1.0	1.0	1.0
Martin (Tx 398)		3.0	1.7		5.0	5.0	1.0	4.0	1.0	5.0	5.0	4.0
N 9040		1.0	1.0		2.0	1.3	1.0	3.0	2.0	1.7	1.3	1.7
C-42y		3.0	2.0		3.0	2.5	1.0	3.0	1.0	3.0	3.0	2.0
NK 233[b]		1.3	1.0		1&5	1&2	1.0	4.0	1&5	1&3	1.3	1.0
PB 846		3.0	1.0		5.0	4.9	1.0	4.0	1.0	5.0	4.3	4.0
Wheatland x Tx 2536		3.0	1.3		3.5	3.0	1.0	3.0	5.0	3.0	3.5	2.3
Tx 2536		1.3	1.0		2.5	2.0	1.0	3.0	5.0	2.5	1.3	1.7
Combine Sagrain		1.7	1.3		4.0	4.0	1.0	4.0	5.0	4.7	4.0	2.2
SC 599-6(9247)		1.0	1.0		1.0	1.0	1.0	1.3	2.0	1.0	1.0	1.0
TAM 428		1.0	1.0		1.1H	1.0	1.0	2.0	5.0	1.0	1.0	1.0

[a] 1-5 severity scale: 1 = no infection; 5 = very severe symptoms.

[b] Plants heterogeneous for reaction to anthracnose at 4 locations.

C-4. Head Smut Nurseries

The Uniform Head Smut Nursery (UHSN)

Because of the high degree of physiological race specificity of the head smut pathogen (Sphacelotheca reiliana), standard differentials and key sources of resistance are grown annually in head smut problem areas. This group of 20 entries (Table 4.1) provides us with data on frequence of races, new races and usefulness of the sources of resistance to an ever shifting pathogen. In 1975, the UHSN was grown in 7 locations in Texas and Kansas. The significant findings from these nurseries are summarized in Table 4.2.

Locations where UHSN was grown in 1975

Beeville, Texas (artificially inoculated)

Berclair, Texas (head smut nursery)

Corpus Christi, Texas

Robstown, Texas (PAG)

Etter, Texas

Edmonson, Texas (McNair)

Hereford, Texas (Warner)

Plains, Kansas (PAG)

Plainview, Texas (ACCO) and (Asgrow)

Victoria, Texas

Race 4 was found in Plains, Kansas, as in trace amounts at Berclair and Robstown, Texas. The SC170-14 entry smutted

at Corpus Christi but not at Victoria. Unfortunately, the smut incidence was lower than anticipated at Victoria. A number of susceptible lines failed to smut. In 1976, we have located our race 4 screening on the Edwin Cook farm near Edna. Mr. Cook had a major smut epidemic in 1975 in a commercial hybrid with excellent resistances to races 1 and 3.

Entries were artificially inoculated with race 4 at Beeville. Smut developed in most of the newer converted entries, such as in all of the SC170 entries, and in TAM 618.

Table 4-1. Uniform head smut nursery (UHSN), 1975

Entry no.	Designation	IS no.	Variety, kind or group
1	SA 281	107	Early Hegari
2	PI 48770	197	White Kafir
3	B Tx 3197	169	Combine Kafir-60
4	B TAM 618		Sm. Res. Kafir
5	Lahoma Sudan		Sudangrass
6	Calif #38	349	Res. D.D.Y. Milo
7	Tx 7078	415	Combine 7078
8	Tx 414	10550	7078 deriv.
9	RS 626		(A Tx 3197 X Tx 414)
10	IS 12664C (SC 173)	12664	Zerazera
11	IS 2403C (SC 103)	2403	Caudatum
12	SC 170-6-17 (Sel 4267)	12661	Zerazera
13	SC 170-14	12661	Zerazera
14	SC 170-6-8 (Sel 4252)	12661	Zerazera
15	IS 12666C (SC 175)	12666	Zerazera
16	TAM 428 (SC 110-9)	12610	Zerazera
17	Tx 2536	10542	Y.E. Fet. deriv.
18	B Tx 399	835	Wheatland
19	NK 233		Commercial hybrid
20	B Tx 3048	10600	Redbine sel.

Table 4.2. Average incidence of head smut among entries of the uniform head smut nursery at 7 locations in 1975.

Designation	Variety of Kind	Berclair % smutted	Corpus Christi % smutted	Victoria % smutted	Plains, Ks. % smutted	Edmundson % smutted	Robstown % smutted	Beeville Artificial % smutted	Beeville Natural % smutted
SA 281	Early Hegari	0	0	0	0	-	0	0	0
PI 48770	White Kafir	0	0	0	0	0	0	0	0
B Tx 3197	Combine Kafir-60	4.0	5.7	5.6	6.0	5.0	3.0	90.0	5.0
B TAM 618	Sm. Res. Kafir	0	0	0	2.0	2.0	1.0	40.0	0
Lahora Sudan		0	0	0	0	0	0	0	0
Calif #28	Res. D.D.Y. Milo	0	0	0.7	0	3.0	0	0	0
Tx 7078	Combine 7078	80	20.0	8.6	23.0	6.0	11.0	0	20.0
Tx 414	7078 deriv.	42.9	20.0	2.0	11.0	3.0	7.0	40.0	26.0
RS 626	(A Tx 3197 x Tx 414)	12.9	5.8	4.4	6.0	7.0	3.0	0	7.0
IS 12664C (SC 173)	Zerazera	0	0	0	0	0	0	0	0
IS 2403C (SC 103)	Caudatum	0	5.6	0	0	0	0	10.0	0
SC 170-6-17 (sel 4267)	Zerazera	1.0	0	17.8	1.0	0	0	40.0	0
SC 170-14	Zerazera	0	0.8	0	0	0	1.0	40.0	0
SC 170-6-8 (sel 4252)	Zerazera	0	0	0.4	3.0	0	3.0	50.0	0
IS 12666C (SC 175)	Zerazera	17.3	1.2	0.5	3.0	0	1.0	10.0	2.0
TAM 428 (SC 110-9)	Zerazera	0	0	0	0	0	0	0	0
Tx 2536		10.1	3.1	1.9	3.0	0	6.0	50.0	8.0
B Tx 399	Wheatland	11.0	2.2	0.2	0	0	2.0	10.0	3.0
NK 233		0	0	6.4	15.0	3.0	1.0	0	0
B Tx 3048	Redbine sel.	2.0	0	0	2.0	0	1.0	0	0

Old Line Head Smut Test

In 1975, 90 old open pedigree varieties which were resistant to Race 3 in previous years were grown at Berclair and Victoria in a replicated trial to determine levels of resistance to Race 4 (Table 4.3). Low levels of infection developed at Victoria, but at Berclair excellent disease developed. The tests will be regrown in 1976.

In these tests 30 lines remained resistant to Race 4. Resistance was found basically in 5 groups of sorghum: Kafir (9), Hegari (6), Feterita (4), Milo (4), Redbine (1), and miscellaneous types (6). It is not possible to say that all items in any group will remain resistant to Race 4 under a more severe environment. The fact that Kafir, Milo and (Feterita - Hegari) are widely different in origin suggests that there may be more than one source of resistance operating among these materials.

Disease Reaction of A and B lines of Sorghum

Seventeen A and B pairs of Sorghum bicolor lines were grown at Berclair and Victoria to test their reaction to downy mildew and head smut (Table 4.4). Additional notes were taken on several other diseases at Victoria.

There appeared to be no difference in disease reaction between A and B lines for any of the foliar diseases, i.e., bacterial stripe, Cercospora leaf spot, zonate leaf spot, bacterial leaf spot or Fusarium stalk rot. However, at Berclair, B Tx 3197 had significantly

more head smut than A Tx 3197. The incidence was not as high at Victoria but there B Tx 3197 had more than the A-line also. Downy mildew was greater on A Tx 407 than on B Tx 407 at Berclair. All other A- and B-lines did not differ in incidence of head smut although there appeared to be a slightly lower level of downy mildew on B-lines than on A-lines at both locations.

Table 4.3 Old-line head smut test (race 4), Victoria and Berclair, Texas 1975.

Entry no	Designation	Variety, type, or kind	Incidence of head smut			
			Berclair		Victoria	
			Stand	% Smut	Stand	% Smut
1	CI 827	Black Spanish	170	1.2	210	0
2		Acme	105	2.9	172	0
3		Rennell's #11	55	1.8	110	0
4		Japanese Dwarf	175	0	225	0.4
5	CI 946	Dwf White Durra	135	36.3	188	5.9
6	SA 1754	Dwf Bonar Durra	41	2.4	170	0
7	CI 182	Feterita	155	0	195	0
8	CI 693	Red Feterita	70	2.9	130	0
9	FC 6601	Spur Feterita	100	2.0	105	0
10	Tx 09	Combine Wh.Feterita	95	7.4	62	1.6
11	Tx 2532	Feterita deriv.	1	0	4	0
12	Tx 2535	Feterita deriv.	5	20	1	0
13	Tx 2536	Feterita deriv.	33	33.3	7	0
14	PI 34911	Hegari	130	0	135	0
15	SA 79	Bonita	95	2.1	135	0
16	SA 391	Combine Bonita	150	.7	158	0
17	SA 392	Combine Hegare	125	0	165	0
18	Tx 404	Hegari deriv.	41	0	100	0
19	Tx 2526	Hegari deriv.	60	1.7	87	6.5
20	Tx 2529	Hegari deriv.	22	18.2	11	0
21	B Tx 378	Redlan	55	0	90	0
22	A Tx 378	Redlan	57	5.3	175	2.9
23	B Tx 385	Comb. Kafir-60	105	6.7	140	5.0
24	A Tx 385	Comb. Kafir-60	120	11.7	110	4.5
25	B Tx 3197	Comb. Kafir-60	100	10	167	9.0
26	A Tx 3197	Comb. Kafir-60	60	6.7	133	7.5
27	B TAM 618	SR C. Kaf. deriv.	55	0	132	0
28	A TAM 618	SR C. Kaf. deriv.	65	0	181	0
29	B Tx 413	Dwf. Redlan	90	6.7	115	0
30	A Tx 413	Dwf. Redlan	100	4.0	125	1.6
31	B Tx 399	Wheatland	100	1.0	172	1.7
32	A Tx 399	Wheatland	100	2.0	127	.8
33	B Tx 398	Martin	155	2.6	145	3.4
34	A Tx 398	Martin	100	6.0	140	5.7
35	FC 8987	Red Kafir Meade	155	0	170	0
36	FC 13641	White Kafir	130	0	95	0
37	PI 48770	White Kafir	145	0	173	0
38	SA 310	Highland Kafir	150	0	172	0
39	SA 360	Imperial Kafir	175	1.1	125	0

Table 4.3 Continued

Entry no	Designation	Variety, type, or kind	Incidence of head smut: Berclair Stand	Berclair % Smut	Victoria Stand	Victoria % Smut
41	Tx 408	Golden Kafir	130	6.9	125	0
42	CI 171	Manchu Br Kaoliang	85	0	93	1.1
43	PI 38205	White Kaoliang	85	0	190	0
44	TS 23240	Wetland Dwf Kaoliang	100	0	120	0
45	CI 293	Shantung Br Kaoliang	70	5.7	135	3.0
46	Calif. #38	Res. DDY Milo	68	0	95	0
47	CI 332	DY Milo	50	0	53	0
48	CI 352	Std Wh Milo	65	0	105	0
49	FC 8927	Dwf Wh Milo	44	0	50	0
50	FC 8963	DDY Milo	50	2.0	14	0
51	FC 16208	Club	130	7.7	99	1.0
52	FC 16219	Finney	40	2.5	55	0
53	SA 368	Texas Milo	145	0	140	3.4
54	SA 7088	Chinch Bug Res Milo	28	0	178	.6
55	TS 13352	DD Wh Milo	40	0	36	2.8
56	Tx 414	Combine 7078 SR	40	45	67	10.4
57	Tx 7078	Combine 7078	75	46.6	125	4.8
58	Tx 7000	Caprock	105	0	100	0
59	SA 394	Combine Shallu	135	20	197	12.7
60	Tx 410	Golden Shallu	95	2.1	202	1.5
61	FC 6605	Honey	115	0	270	0
62	FC 9112	Atlas	180	3.9	170	0
63	FC 16184	Collier	150	.7	180	1.1
64	Rio		180	.6	270	1.9
65	Sumac 6550		170	27.1	192	14.6
66	Common Sudan		85	1.2	165	0
67	Lahoma Sudan		160	0	300	0
68	Greenleaf Sudan		225	3.6	300	3.0
69	Piper Sudan		140	15	165	1.8
70	Sweet Sudan		125	7.2	300	1.0
71	B Tx 387	Redbine-66	105	1.0	115	0
72	DA 3494	Day x Atlas	130	.8	177	0
73	FC 8989	Desert Bishop	44	0	52	0
74	FC 8990	Algeria	80	0	67	0
75	KS 3		137	0	160	0
76	ROKY 10		40	0	97	0
77	Tx 7005	Plainsman	145	2.8	140	0
78	Tx 7078	Combine 7078	92	53.2	120	28.3
79	SA 218	Early Hegari	135	0	130	0
80	Tx 414	Combine 7078 der.	95	35.7	143	32.9

Continued

Table 4.3 Continued

Entry no.	Designation	Variety, type, or kind	Incidence of head smut			
			Berclair		Victoria	
			Stand	% Smut	Stand	% Smut
81	FC 6601	Spur Feterita	80	0	141	0
82	A Tx 3048	Redbine sel.	65	0	130	5.4
83	B Tx 3048	Redbine sel.	100	0	101	0
84	SC 170-6-17(4267)	Zerazera	55	3.6	85	9.4
85	B 3047	Redbine sel.	55	0	111	0
86	B 3029	Redbine sel.	95	12.6	88	3.4
87	B 3035	Redbine sel.	65	3.1	68	0
88	B 3053	Redbine sel.	39	5.1	110	4.5
89	B Tx 608	Combine Kafir	120	0	128	0
90	B Tx 407	Combine Kafir	95	1.1	140	0

Table 4.4 Comparison of A and B lines of sorghum for reaction to several common diseases.

Entry no.	Designation	Source	Berclair Stand	Berclair Downy mildew	Berclair Head smut	Victoria Stand	Victoria Downy mildew	Victoria Head smut	Victoria Bacterial stripe	Victoria Cercospora	Victoria Zonate leaf spot	Victoria Stalk rot[a/]	Victoria Bacterial leaf spot[b/]
1	A Tx 378 Redlan	74 Material	189	4	6	125	2	5	1	1	2	1	1
2	B Tx 378 Redlan		100	8	1	65	1	0	1	1.5	2.5	1	1
3	A Tx 3197 Combine Kafir-60		166	5	9	65	2	2	1	1.5	2	1	1
4	B Tx 3197 Combine Kafir-60		267	3	22	150	3	5	1	1.25	1.75	1	2
5	A TAM 618 SR-Combine Kafir-60		204	19	0	130	6	0	1	1	2.25	1	3
6	B TAM 618 SR-Combine Kafir-60		182	18	0	95	1	1	1	1.75	3	1	1
7	A Tx 399 Wheatland		165	6	9	135	12	0	1.5	1.5	3	2	3
8	B Tx 399 Wheatland		238	9	6	125	1	4	1	2	3	2.5	3.0
9	A SC0151-6 (Durra) 74CS 1329-1	74 CS Nursery	252	24	4	180	32	31	1	2.5	3.5	1	1
10	B SC0151-6 (Durra) 74CS 1329-1		177	3	2	200	41	34	1	3	4	1	1
11	A SC0430-6 74CS 1371-[illegible]		117	3	0	65	0	0	1	1.5	2.25	1	2
12	B SC0430-6 74CS 1371-[illegible]		124	2	0	85	0	0	1	1.5	2	2	1
13	A SC0128-3 74CS 1452 [illegible]		182	4	3	130	0	4	1	1.5	2.5	2.5	2
14	B SC0128-3 74CS 1452 [illegible]		243	3	15	195	0	6	1	1.75	3	1	4.0
15	A SC0027-6 74CS 1654		170	0	0	130	0	0	2.5	2.75	3	1	2
16	B SC0027-6 74CS 1654		169	1	0	115	0	0	3.5	2	3.5	1	3.0
17	A (B3197 x SC0170) 74CS 4366-1		157	1	0	118	0	0	1	1.5	2	1	1
18	B (B3197 x SC0170) 74CS 4366-1		195	1	0	135	0	3	1	2	2	1	1
19	A (B3197 x SC0170) 74CS 4379-2		186	1	0	150	0	0	1	2.5	2	1	1
20	B (B3197 x SC0170) 74CS 4379-2		192	0	0	150	0	0	1	2	2	1	1
21	A (B3197 x SC0170) 74CS 4462-1		139	1	0	135	0	0	1.5	2.25	2	1	1
22	B (B3197 x SC0170) 74CS 4462-1		165	3	1	165	0	1	1	2.5	2	1	1
23	A (B378 x SC0110-6) 74CS 4496-2		187	10	30	140	1	12	1	1.5	2	2	2
24	B (B378 x SC0110-6) 74CS 4496-2		236	6	30	145	1	16	2	1.5	2	1	2
25	A (B617 x SC0170-9) 74CS 4580-1		239	0	0	155	0	0	1	1	2	1	2.5

Continued

Table 4.4 Continued

Entry no.	Designation	Source	Berclair Stand	Berclair Downy mildew	Berclair Head smut	Victoria Stand	Victoria Downy mildew	Victoria Head smut	Victoria Bacterial stripe	Victoria Cercospora	Victoria Zonate leaf spot	Stalk rot[a/]	Bacterial leaf spot[b/]
26	B (B617 x SC0170-9) 74CS 4580-1		191	0	0	135	0	1	1	1	2	1	2
27	A (B617 x SC0170-9) 74CS 5554-1		171	0	0	155	0	0	1	2	2	1	2
28	B (B617 x SC0170-9) 74CS 555401		130	1	0	70	0	0	1	1.5	1.75	1	2.5
29	A Tx 3048 Redbine Sel.	70L 135	167	18	0	85	10	0	1	2	3.5	2	2
30	B Tx 3048 Redbine Sel.	70L 136	202	16	1	65	7	0	1	2	3	2	2.5
31	A Tx 398 Martin	FS 74	202	17	10	140	11	25	1	1	2.5	2	2
32	B Tx 398 Martin	FS 74	142	16	4	110	2	4	1	1	2.25	3	3
33	SC 170-6-1-7 (4267)	74PR1793,4,5 bk	157	0	6	95	0	11	1	1	1.5	1	1
34	TAM 428	FS 74	167	1	0	140	0	0	1.25	2	1.5	1	1
35	A 407 C.K.	70L 55	213	30	4	23	2	0	1	2	2	1	1
36	B 407 C.K.	70L 56	256	4	3	80	2	0	1	2	1.5	1	2

[a/] Fusarium stalk rot.

[b/] Bacterial leaf spot, *Pseudomonas syringae*.

Other Head Smut Evaluations

F_1 testing

We compared a few experimental F_1 hybrids developed from head smut resistant males for reaction to head smut following artificial inoculation. Artificial inoculation of sorghum with head smut has not been as useful as the development of naturally infested fields for screening of sorghum lines; however, if the proper resistance and virulence genes are introduced at the precise stage of growth, artificial inoculation is a useful technique. Hybrids with resistance from Calif. #38 are relatively resistant to natural infection but become severely diseased when inoculated. Virulent race 4 inoculum would have infected the SC170-6 hybrids (note race 4 inoculation in UHSN at Beeville, Table 4.5.) but did not in this test. It is quite evident that an improved inoculation method accurately reflecting host resistance would complement the field testing program

Many of the 1974 ADN entries, resistant to head smut, were evaluated as resistant male parents in experimental hybrids. Most hybrids were made with the common sterile A Tx 378. Inheritance of smut reaction from seven smut resistant 1974 ADN entries was incomplete (Table 4.6.) whereas for 17 the resistance was completely dominant.

Unfortunately, a number of these smut resistant male entries with dominant resistance developed a low incidence of smut at Victoria and at other locations. These data suggest that resistance in the SC170 sels which smut at Victoria and elsewhere at low levels are highly race specific.

Table 4.5. Reaction of selected hybrids to head smut following artificial inoculation at Beeville, Texas.

	Average incidence of head smut		Anticipated Reaction	
	Natural (%)	Artificial (%)[a]	Natural	Inoculated
A 3197 x PI 48770	1	2	R	R
A 618 x PI 48770	1	0	R	R
B 3197 x Calif #38	4	80	R	R
A 618 x Calif #38	0	60	R	R
A 618 x B 3197	0	55	R	S
A 3197 x B 618	3	55	MS	S
A 3197 x Tx 7078	10	80	S	S
A 618 x Tx 7078	5	30	R	S
A 3197 x Tx 414	76	30	S	S
A 618 x Tx 414	2	20	R	S
A 3197 x 175-14	10	55	MS	S
A618 x 175-14	3	20	R	S
B 3197 x 170-6-17	0	0	R	R
A 618 x 170-6-17	0	0	R	R
3197 x B 399	8	30	S	S
618 x B 399	4	20	S	S
A 3197 x NSA 818	5	15	R	?
A 618 x NSA 818	0	20	R	?

a/ Both races 3 and 4 were attempted but only race 3 was virulent. Data represent averages from about 20 inoculated plants and 110 plants grown in 3 rows left uninoculated. Inoculation was by hypodermic method using inoculation from mixed whole teliospore colonies.

Table 4.6. Reaction of F_1 hybrids from smut resistant 1974 ADN entries at Berclair, 1975.

74 ADN no.	Males producing susceptible hybrids	Smut[a/] %	74 ADN no.	Males producing resistant hybrids	Smut %
3	SC103-12	6	14	SC170-6-8-3(4244)	0
13	SC120-14	10	17	SC170-12	0
25	SC334-9	6	18	SC170-14	0
31	SC414-12	10	19	SC173-12	0
36	SC574-6	9	25	SC324-12	0
52	SC935-6	5	26	SC325-12	0
59	(SC120 x Tx7000)	13	28	SC330-9	0
			33	SC420-12	0
			34	SC423-14	0
			37	SC599-6-3(9054)	0
			45	SC680-3	0
			46	SC748-5	0
			47	SC167-14	0
			53	(BTx3197xSC170)(1750)	0
			54	(BTx3197xSC170)(1753)	0
			58	(BTx3197xSC170)(FRM)	0
			57	(SC599xSC 34)(1880)	0

[a/] Based on incidence of smut at Berclair head smut nursery 1975. Most entries were evaluated on A Tx 398.

Effect of head smut on yield of grain sorghum

Populations of hybrid grain sorghum plants were inoculated at various frequencies at Victoria and College Station, Texas. The experiments were designed to establish various levels of head smut in a constant plant density. The plant densities were established at about 150,000 plants per hectare. In all three tests, the effect of incidence of smut on grain yield was linear and significantly negatively correlative with yield (Table 4.7, Fig. 4.1,4.2,4.3.)

From a combined analysis from all three tests it is estimated that an increase of 1 percent head smut decreases yield by 44.5 ± 2.7 kilograms per hectare. These effects on yield are much more striking than those caused by downy mildew.

Table 4.7 Relations between incidence of head smut and grain sorghum yields at Victoria and College Station, Texas, 1975.

Victoria		College Station Early planting		College Station Late planting	
Ave. inc. of smut	Yield kg/ha	Ave. inc. of smut	Yield kg/ha	Ave. inc. of smut	Yield kg/ha
66.7	1259	25.8	4176	34.5	2470
37.1	3937	29.8	3815	31.3	2294
26.3	3102	12.7	4338	15.9	3327
0.7	4648	0	4838	0	3310

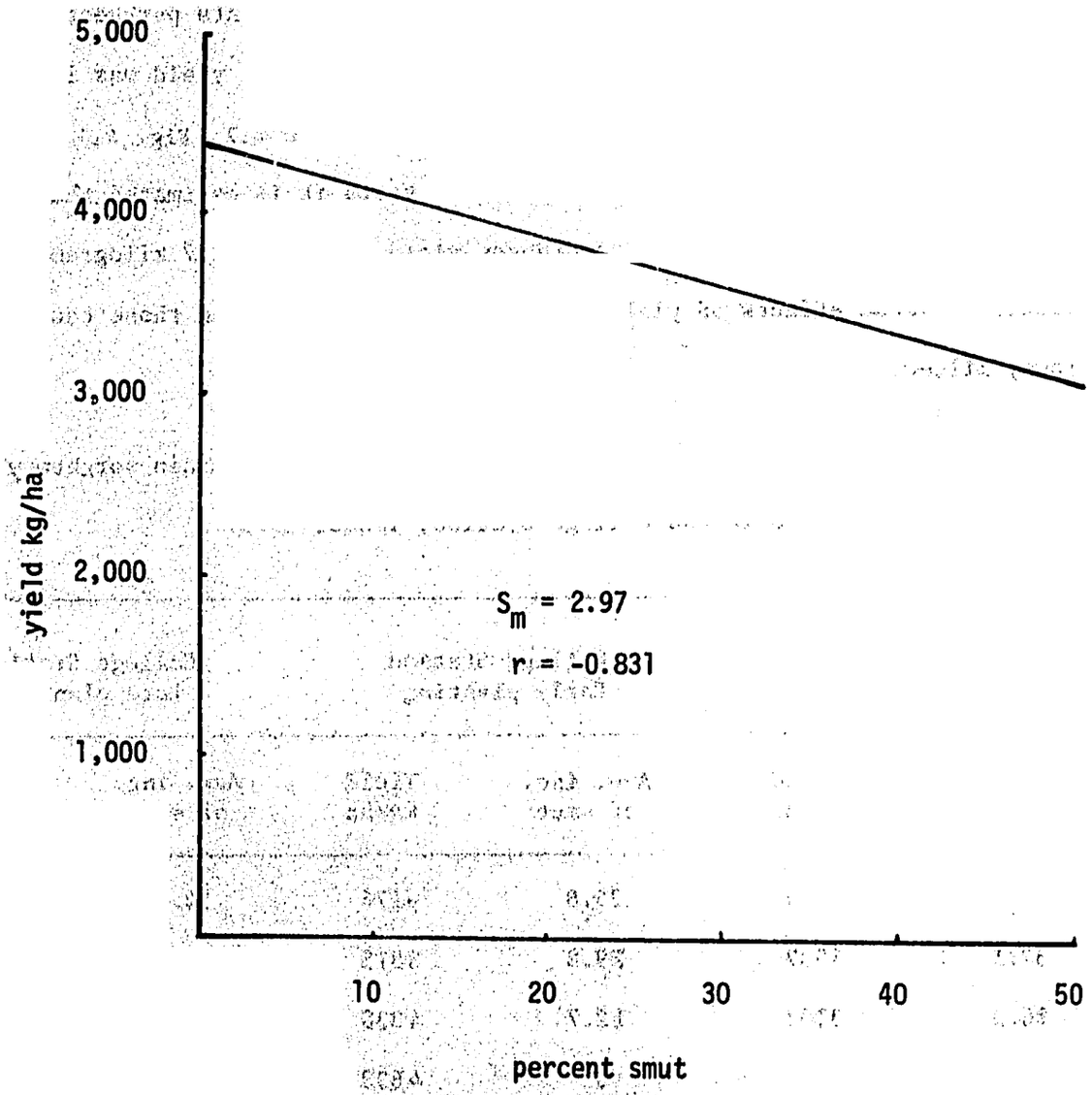


Figure 4.1 Effect of head smut on yield of grain sorghum, College Station; early planting, 1975.

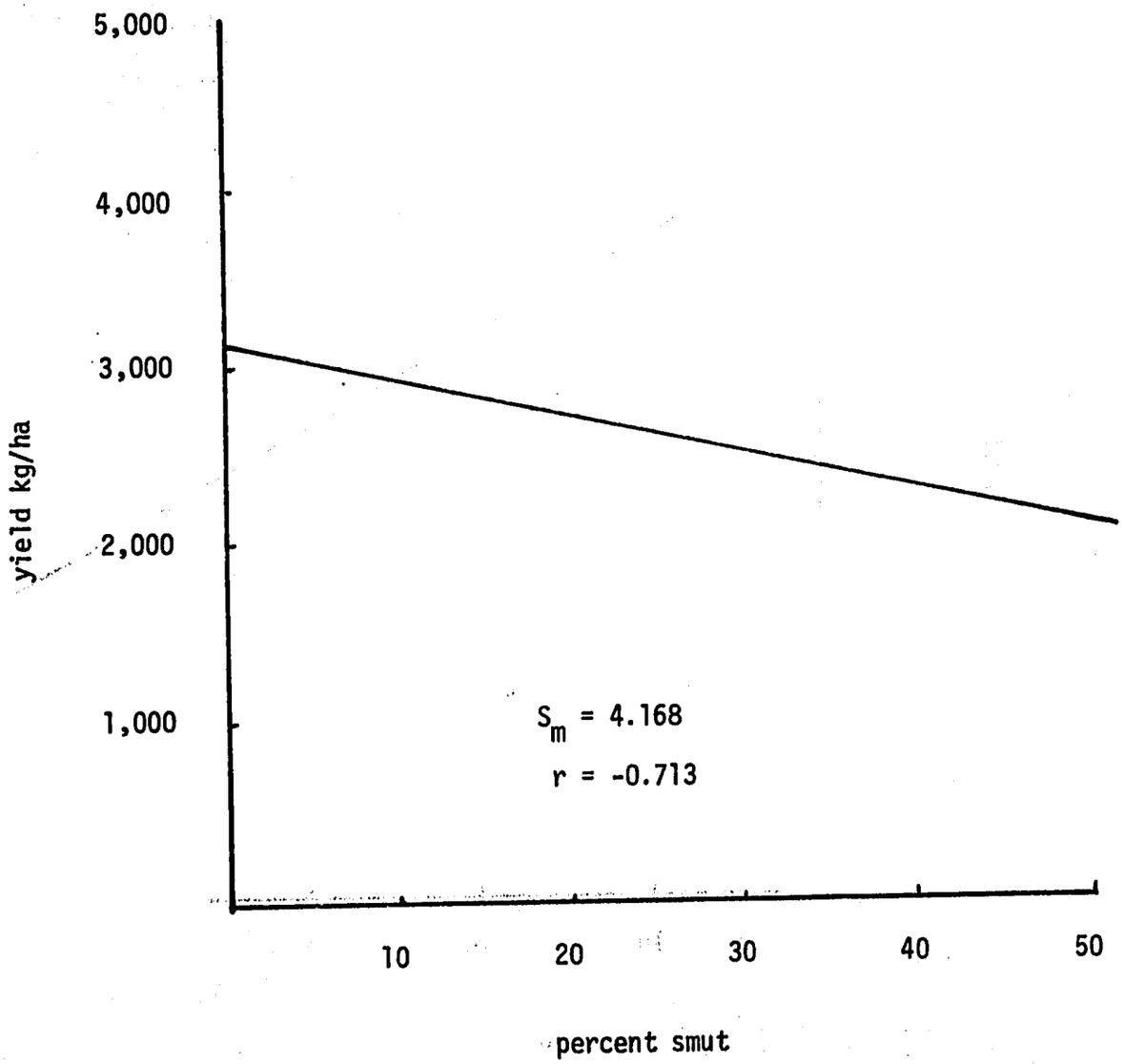


Figure 4.2 Effect of head smut on yield of grain sorghum, College Station; late planting, 1975.

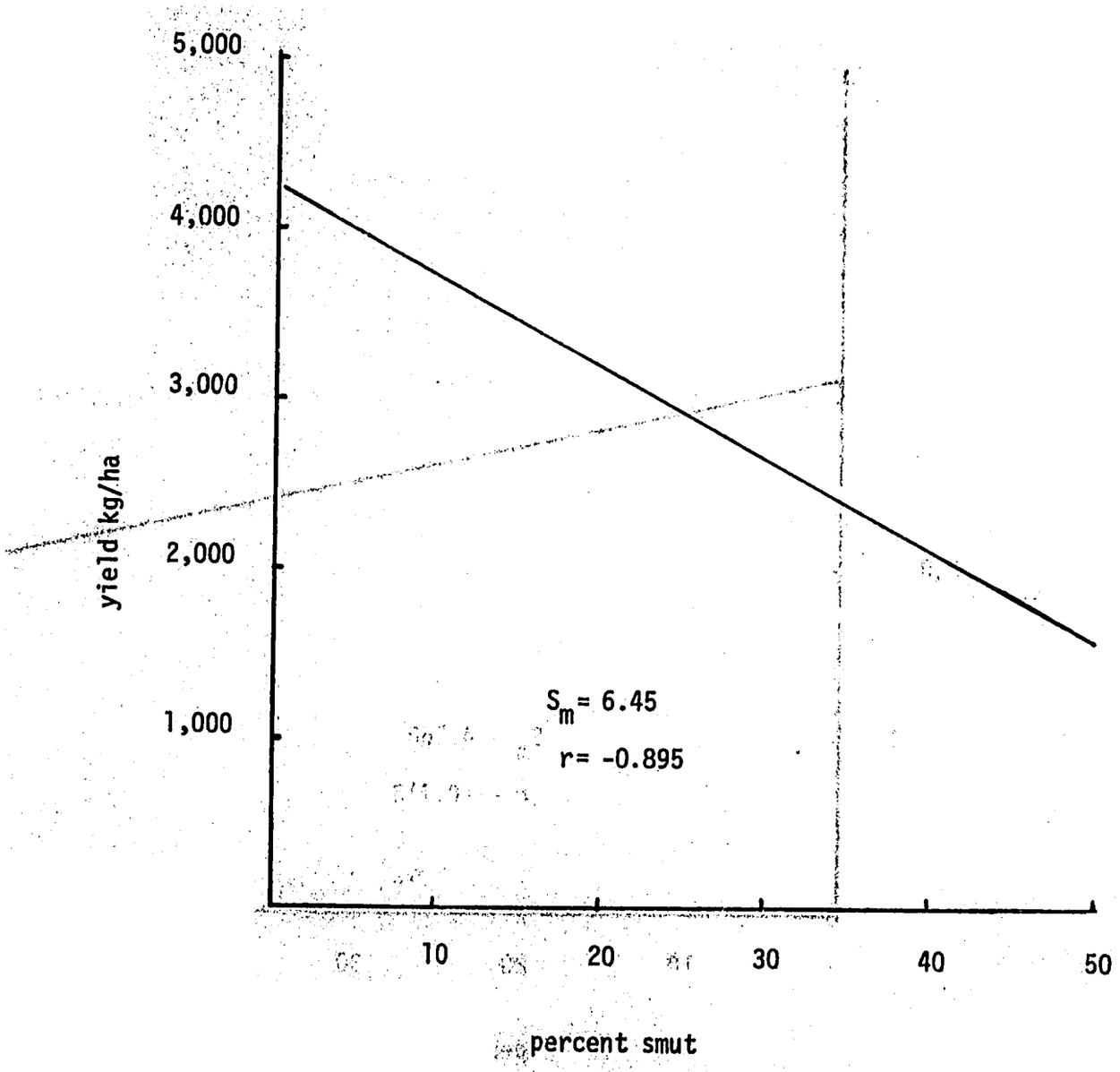


Figure 4.3. Effect of head smut on yield, Victoria, Texas, 1975.

C-5. Leaf blight

Greenhouse grown plants at 6 stages of plant growth (Table 5.1) were artificially inoculated with Exerohilum turcicum. Best differentiation among lines for reaction occurred at the seedling stages prior to growing point differentiation. By the time plants reached the boot stage, (stage 5) the probability of disease development was slight.

Most conidia used to inoculate sorghum plants fail to develop infection. When used on young seedlings, they induce a characteristic fleck reaction. Rates of flecking decrease as plants mature, as does their susceptibility to disease development. The ability to induce the fleck response was not correlated with resistance in the seedling stage but was somewhat associated with resistance at the time of floral differentiation. (Table 5.2).

To evaluate the influence of potential pathotoxins from E. turcicum, potometers were developed to measure rate of transpiration from sorghum leaves treated with toxin and controls. A significant relationship between transpiration and resistance to E. turcicum was noted (Table 5.3). These data suggest that a host specific pathotoxin is in part responsible for some of the damage daused by E. turcicum infection.

Table 5.1 Leaf blight reactions on host differentials at six maturity stages 14 days after inoculation.[a]

	disease reactions[b] for maturity stages:					
Host differential	1	2	3	4	5	6
TAM2572	MR[c]	MR[c]	R	R	R	R
TAM2566	MS	MS	R	R	R	R
Tx3197	S	MS	R	R	R	R
Tx7078	S	S	S	MS	MS	-[d]
IS2403C	S	S	S	S	R	R

[a]Plant maturity stages used as defined by Vanderlip. 1: collar of 3rd leaf visible. 2: collar of 5th leaf visible. 3: growing point differentiation. 4: final leaf visable in whorl. 5: boot. 6: half bloom.

[b]Qualitative disease reactions represent means for three replications of two to four plants for each maturity stage; each replication was inoculated and incubated separately at 22C for 48 hours. R=resistant; MR=moderately resistant; MS=moderately susceptible; S=susceptible.

[c]Only one lesion observed on one of eight plants.

[d]Missing sample is indicated by "-".

Table 5.2 Frequency of hypersensitive flecking with Exserohilum turcicum appressoria on host differentials at six maturity stages 72 hours after inoculation.[a]

Host differential	% appressoria surrounded by flecks for maturity stages: 1	2	3	4	5	6
TAM2572	100	50	50	50	50	0[b]
TAM2566	100	25	25	33	0	0
Tx3197	100	40	0	10	-[c]	0
Tx7078	90	50	10	0	0	-
IS2403C	100	50	0	0	0	0

[a]Flecks associated with 20 appressoria on 2 cm^2 leaf tissue were counted from a plant of each of the maturity stages defined by Vanderlip (note table).

[b]No spores were found to adhere to leaf surfaces in Stage 6.

[c]Missing sample indicated by "-".

Table 5.3 Comparative reactions of five differential cultivars to *Exserohilum turcicum* in field and laboratory tests.

Host differential	Field react. (adult plants) Naturally occurring[a]	Conidial injection[b]	Greenhouse reactions (seedlings)	Toxin response[c] Toxin: Control
TAM2572	1.0	Resistant	Resistant	102
TAM2566	1.2	Mod. susceptible	Intermediate	79
Tx3197	1.5	Susceptible	Intermediate	50
Tx7078	2.3	Susceptible	Susceptible	46
IS2403C	2.2	Susceptible	Susceptible	44

[a]Reaction at Tampico, Tex., recorded 3/7/75, was rated on a 1 to 5 scale of increasing disease severity (average of all replications).

[b]Reaction at College Station, Tx., was recorded 6/7/74.

[c]Ratio of mean volume (toxin): volume (control) transpired in 30 minutes. Means not followed by the same letter within a column differ significantly, P=0.05, as determined by Duncan's multiple range test.

Inheritance of Resistance to *Exerohilum turcicum*

F_2 plants of *E. turcicum* resistant SC326-6 x Tx7078 and SC103-12 were grown in the Berclair downy mildew nursery. Plants in parental and F_2 rows were inoculated on May 19 and May 25 or approximately 2 weeks too late. Nevertheless, nearly adequate levels of infection developed in the SC326-6 x SC103-12 crosses.

	Plants with Lesions	Plants without Lesions	
SC103-12	52	17	69
SC326-6	0	43	43
SC326-6 x SC103-12	145	296	441

Evidence by Tuleen suggested that 2 major genes may be conditioning resistance to leaf blight. These data also suggest that 2 complementary genes are necessary for resistance in the field.

Assuming 75% resolution of susceptible plants, this adjusts our population as follows:

	Actual Observed	Adjusted	Expected (9:7 ratio)
Susceptible	145	248	248.1
Resistant	296	193	193.9

These data fit, essentially a perfect 9:7 ratio. We plan to repeat these inoculations in 1976.

C-6. Chemical Control

Chemical Control - Sorghum Downy Mildew

The use of chemicals to control plant diseases is one of the oldest control methods used by man. While many plant diseases have been controlled by this method, some have not. Recently, reports have indicated that selected chemicals could control sorghum downy mildew but they tend to be phytotoxic to sorghum plants. Since the ideal chemicals for controlling downy mildew have not been found, continued testing is required. The following tests were conducted to determine if KN_3, NaN_3 and Pyroxychlor were effective in controlling downy mildew of sorghum.

Materials and Methods

Tests using KN_3 and NaN_3

Downy mildew infested soil was collected from the Perry Foundation Farm west of Robstown. Eight percent granular formulation of KN_3 and NaN_3 were incorporated with this soil at 2, 5 and 10 ppm. Soil untreated with any fungicides served as the control. Treated and untreated soil was placed in nonperforated stainless steel trays at 26 C in a controlled temperature water tank. Approximately 30 seeds of the sorghum variety Tx2536 were sown in each tray. All treatments were replicated twice. The incidence of downy mildew for each treatment was determined 17 days after seeding.

Test the effect of Pyroxychlor

These trials were also conducted in stainless steel trays in a controlled temperature water tank in the greenhouse. Sorghum downy mildew infested soil collected from Tynan served as the source of inoculum. Thirty sorghum seeds of the variety Tx412 were used with three replications. Three methods of applying Pyroxychlor were used: foliar application, seed treatment and soil incorporation. In foliar application, thirty untreated seeds

were sown in each tray. The plants were first sprayed at emergence and at three 5-day intervals with Pyroxychlor solution at 0.1, 10 and 100 ppm. In the seed treatment, seeds were put in plastic bags with Pyroxychlor at rates 0.25, 0.5 and 1 gm per kg of seed. A small amount of water was added and shaken to coat each seed with the fungicide. The next day after the seeds were dry, they were sown. In soil incorporation, Pyroxychlor was suspended in 250 ml sterile distilled water and poured over the surface of the soil. The proportion of Pyroxychlor to soil were 0.0005, 0.0025, and 0.005 gm per kg of soil. The control was untreated soil. The incidence of sorghum downy mildew was observed 17 days after seedling.

Results and Discussion

Effect of KN_3 and NaN_3

At all three rates, both KN_3 and NaN_3 significantly reduced the incidence of downy mildew (Table 6.1). The application of KN_3 at a rate of 5 ppm completely controlled infection. The higher rate, 10 ppm, of both products resulted in none percentage of downy mildew. At this rate, however, KN_3 caused a marked reduction in stand and plant growth. These results were similar to those of Matocha, et al. They successfully used KN_3 to control sorghum downy mildew, and they reported that the incorporation of KN_3 in oospore infested soil significantly reduced the disease incidence in both greenhouse and field trials.

Effect of Pyroxychlor

Foliar application of 2-chloro-6-methoxy-4-(trichloromethyl) was ineffective in controlling downy mildew at rates of 0.1, 10 and 100 ppm (Table 6.2). Seed treatment at rate of 1 gm per kg of seed completely controlled downy mildew (Table 6.2). The incidence of sorghum downy mildew was gradually

decreased at rates lower than 1 gm per kg of seed. Soil incorporation rates as low as 0.0005 gm per kg of soil also controlled downy mildew (Table 6.2) and there was no indication of reduced seed germination and phytotoxicity to seedlings. Since these results were obtained in the greenhouse, the question of whether or not the promising fungicide Pyroxychlor will be effective in the field trials awaits further study. Additional trials using Pyroxychlor were conducted in the field.

Table 6-1. The effect of potassium azide (KN_3) and sodium azide (NaN_3) on sorghum downy mildew incidence in the grain sorghum variety Tx2536.

Treatment		Stand[1/]	Percent downy mildew[1/]
KN_3	2 ppm	23	8.7[a]
	5 ppm	23	0 [a]
	10 ppm	14	0 [a]
NaN_3	2 ppm	25	5.8[a]
	5 ppm	22	4.6[a]
	10 ppm	20	0 [a]
Control		22	25.9[b]

1/ Means significantly different at the 5% level, the least significant difference.

Table 6.2. Relative control of sorghum downy mildew in grain sorghum variety Tx412 by foliar applications with Pyroxychlor.

Treatment	Stand[1/]	Percent downy mildew[1/]
0.1 ppm	22	22.9
10 ppm	21	32.8
100 ppm	21	35.8
Control	22	33.5
By seed treatment with Pyroxychlor.		
0.25	25	19.9[a]
0.5	20	6.8[b]
1.0	21	0 [b]
Control	22	33.5[a]
By Pyroxychlor when incorporated in oospore infested soil in the greenhouse.		
0.005	21	0 [a]
0.0025	22	0 [a]
0.0005	21	0 [a]
Control	22	33.5[b]

1/ Means of three replications. Means not followed by the same letter differ significantly at the 5% level of probability, the least significant difference.

In field trials, Pyroxychlor and potassium azide were compared at kg/ha incorporated in the bed with a mechanical tiller and seeded directly. Neither treatment significantly reduced downy mildew (Tables 6.3 & 6.4).

Table 6.3. Effect of selected seed treatment fungicide on incidence of downy mildew in the grain sorghum cultivar Dorado M at Berclair, Texas, 1975.

Chemical	Rate g/kg, a.	Systemic downy mildew[1/]
M 4116 (Pyroxychlor formulation)	.25	11.4
M 4116 " "	.5	21.4
Control		28.2
Captan (75W)		17.3
UNI 1130 (Vitavax formulation)	.25	15.5
UNI 1130 " "	.5	18.2

1/ Difference between treatments are not statistically different.

Table 6.4. Effect of incorporated fungicides on stand and incidence of downy mildew in grain sorghum cultivar, Dorado M.

Chemical	Rate kg/ha, a.	Stand[1/]	Systemic downy mildew
M 4116	2	41.8a	4.5
KN_3	2	8.8b	5.5
Control	0	21.8c	9.5

1/ Difference between treatment means are significant at the 1% level.

Chemical Control - Head smut

Selected seed treatment fungicides were tested for control of head smut at Berclair. None significantly reduced the incidence of head smut (Table 6.5).

Table 6.5. Seed treatments for control of head smut in grain sorghum, RS 625, at Berclair, Texas, 1975.

Fungicide	Rate g/kg, a.	Stand	% Smut
Kocide	.25	56.0	16.5
	.375	43.8	21.3
Vitavax 200	1.0	43.3	18.8
	2.0	50.3	17.7
UNI 1130	.125	48.3	21.5
	.25	51.8	19.4
	1.0	46.3	21.3
Nontreated Control	-	39.8	22.3
Captan 50 W	.25	45.0	16.6

a= Data represent an average from 4 replications of 100 treated seed per plot. Difference among treatments are not statistically different.

Chemical Control - Zonate Leafspot and Seed Mold

Two chemicals were tested for the control of seed mold and zonate leafspot (Gleocercospora sorghi) during the 197[illegible] growing season at Robstown, Texas. Chemicals were applied with a Solo-Pac sprayer when the plants were a) flowering and b) soft dough stages of growth.

Treatments were evaluated on 5 hybrid sorghum cultivars replicated 3 times. Zonate leafspot and seed mold were rated at crop maturity using a 1 to 5 scale, with no disease to 5, complete defoliation or mold coverage of seed. Benlate 50 W controlled zonate leafspot with a single application whereas 2 applications of Benlate 50W and Dithane M-45 reduced seed mold slightly (significant at the 10% level).

Yields in these trials were not affected by treatment nor was there evidence of control of rust (Puccinia purpurea) and gray leafspot (Cercospora sorghi).

Treatment and rate a.i. per hectare	Time of application	Zonate Leafspot	Seed mold
Benlate 50W 1 kg	Flowering	1.0	2.0
Benlate 50W 1 kg	Flowering and soft dough	1.0	1.8
Dithane M-45 80W 2 kg	Flowering	2.6	2.2
Dithane M-45 80W 2 kg	Flowering and soft dough	2.2	1.9
Control		2.4	2.3

C-7. Grain Weathering (Seed Mold)

Based primarily on 1974 Lubbock grain weathering notes, a 25-entry replicated test containing lines with the least weathering was assembled for 1975 (Table 7.1.). Nine tests were planted at seven locations in Texas during 1975. Moderate weathering occurred at Corpus Christi, with severe weathering at College Station. Little weathering occurred on the High Plains at Lubbock and Halfway, as rainfall was very low.

Data in 1975 indicates that the 1974 ratings were very reliable, and that ratings under conditions of severe weathering are a reliable indicator of resistance to seed mold (Table 7.2.). The College Station, September ratings should be the best ratings since they had an extensive period of rain following maturity with very severe weathering. Several entries, however, had good ratings of less than 2 whereas the standard checks ranged from 2.45 to 5. The most promising lines based on overall ratings, appear to be SC 748-5, SC 279-14, SC 566-14, and the red-seeded kafir line 74PR 759. Other promising entries are SC 97-14, SC 546-14, SC 283-14, and SC 269-14. The brown seeded line SC 103-12 had a low rating, as well as the weathering resistant commercial hybrid, NK 233.

Since seed color and the presence of an undercoat influenced weathering, these characteristics are given in Table 7.3.

A detailed study of grain quality as related to weathering resistance is underway by graduate student, James Glueck, under

the direction of Dr. L. W. Rooney. Some preliminary data on test weight and germination are presented in Table 7.4. They correspond rather well with the weathering ratings, with a few exceptions. Additional studies on seed density, hardness, pericarp anatomy, and lechate analysis are planned.

A large number of fertile plants were selected for weathering resistance in several random mated populations at Lubbock in 1974. These S_1's were grown at Beeville, College Station, and Lubbock in 1975. Several appeared to possess good weathering resistance. Selections were made at each location and will be consolidated into one nursery and again planted at the three locations in 1976.

In the All Disease Nursery at College Station and Corpus Christi, a good set of grain weathering resistance notes were obtained (Table 1.6). The results obtained for weathering in the ADN agreed with data observed for identical entries in the GWT.

Table 7.1. Grain weathering test (GWT), 1975

Entry no.	Designation	IS no.	Variety, kind, group or pedigree
1	SC 748-5	3552	Cau-Guin
2	TAM 428	12610	Zerazera
3	SC 111-9	12611	Zerazera
4	SC 112-14 (nouc)	12612	Zerazera
5	SC 170-6-8 (4252)	12661	Zerazera
6	SC 170-6-17 (4267)	12661	Zerazera
7	SC 97-14 (IS 12602C)	12602	Conspicuum
8	SC 566-14	7254	Caudatum
9	SC 279-14	7419	Conspicuum
10	SC 546-14 (IS 7550)	7550	Conspicuum
11	SC 599-6-3 (9054)	-	Rio derivative
12	SC 283-14 (IS 7173C)	7173	Conspicuum
13	SC 269-14 (IS 7267)	7267	Conspicuum
14	SC 414-12E	2508	Cau-Kafir
15	SC 103-12	2403	Caudatum
16	NK 233	-	-
17	B Tx 3197	169	C. Kafir-60
18	Tx 2536	10542	Y.E. Fet. deriv.
19	B Tx 378	413	Redlan
20	B Tx 398	412	Martin
21	74PR 759	-	Kafir (tan, red seed)
22	(SC108-6 X Tx7078)-8(74CS1893)	-	(SC108 X Tx7078)
23	(Tx414 X SC108-6)-4(74B1298)	-	(Tx 414 X SC108)
24	Tx414 X SC170-6)-25(74CS2325)	-	(Tx 414 X SC170)
25	(Tx7000 X SC170-6)-22(74CS2598)	-	(Tx 7000 X SC170)

Table 7.2. Grain weathering ratings on the Grain Weathering Test (GWT), 1975.

Entry No.	Designation	Days to 50% bloom			Grain Weathering Ratings 1/									
		Corpus Christi	College Station	Lubbock	Corpus Christi 2/		College Station 3/				Half-way	Lubbock 4/		Avg. all ratings
					J.G.	F.R.M.	J.G. 8/15	F.R.M. 8/12	J.G. 9/12	F.R.M. 9/9		F-105	Date I	
1	SC748-5	69.0	73.5	67.0	2.25	2.25	1.50	1.75	1.55	2.15	1.50	1.40	1.45	1.76
2	TAM428	76.0	77.0	67.5	4.00	2.45	1.80	1.70	3.80	2.20	2.15	2.00	2.10	2.47
3	SC111-9	64.0	72.0	62.0	2.75	1.70	1.85	2.30	2.95	2.35	2.45	1.90	2.00	2.25
4	SC112-14 (no uc)	64.0	68.5	66.0	1.75	1.70	1.75	1.85	2.65	2.45	2.05	1.80	1.80	1.98
5	SC170-6(4252)	69.5	82.5	71.0	2.50	2.30	1.75	1.90	3.10	3.50	1.95	1.75	1.90	2.29
6	SC170-6(4267)	81.0	81.5	75.5	4.00	3.10	1.80	1.60	3.60	2.20	1.85	1.70	1.85	2.41
7	SC97-14	69.0	68.0	62.0	2.00	1.90	1.70	1.40	2.50	2.25	1.40	1.45	1.50	1.79
8	SC566-14	58.5	64.0	64.0	1.50	1.70	1.50	1.20	2.20	2.20	1.40	1.30	1.40	1.43
9	SC279-14	65.5	63.0	63.5	1.00	1.45	1.10	1.15	1.25	1.45	1.20	1.25	1.25	1.23
10	SC546-14	60.5	65.5	62.5	1.25	2.40	1.35	1.60	2.20	1.95	1.50	1.55	1.70	1.72
11	SC599-6(9054)	72.5	83.0	73.0	3.25	3.50	1.65	1.90	3.00	2.50	2.25	1.75	1.90	2.41
12	SC283-14	67.5	72.0	69.0	2.00	1.90	1.80	1.30	2.50	1.70	1.60	1.60	1.50	1.77
13	SC269-14	56.0	60.5	65.5	1.25	2.10	1.95	1.75	3.40	1.75	1.60	1.70	1.60	1.90
14	SC414-12	66.0	74.5	68.0	4.00	3.25	1.90	1.90	4.05	2.75	3.35	2.40	2.60	2.91
15	SC103-12	70.5	69.0	68.0	2.00	2.65	1.05	1.35	0.35	1.70	1.35	1.30	1.20	1.55
16	NK233	65.5	66.5	58.0	1.75	1.80	1.40	1.35	2.20	2.20	1.85	1.65	1.55	1.56
17	BTx3197	66.0	68.5	63.5	2.75	2.35	1.75	1.65	2.60	2.40	2.25	2.25	2.30	2.26
18	Tx2536	68.9	78.5	66.5	4.75	4.25	2.85	2.50	5.00	5.00	3.00	2.80	2.60	3.64
19	BTx 378	63.5	74.5	72.0	2.50	1.95	1.65	1.80	2.45	1.85	2.45	1.95	2.25	2.09
20	BTx398	62.0	67.5	62.0	2.25	2.15	1.85	1.65	2.65	2.80	2.20	2.00	2.20	2.19
21	74PR759	72.5	71.5	62.0	2.00	1.55	1.45	1.75	1.70	1.90	1.90	1.70	1.70	1.74
22	(SC108 x Tx7078)	67.0	69.5	65.0	2.75	2.50	1.65	1.35	2.30	1.90	2.05	1.90	2.00	2.04
23	(Tx414 x SC108)	69.5	71.5	66.0	2.75	2.35	1.35	1.55	2.15	1.75	2.30	1.75	1.95	1.99
24	(Tx414 x SC170)	65.0	74.5	65.0	2.75	2.00	1.80	1.55	2.85	2.55	2.15	1.85	2.00	2.17
25	(Tx7000 x SC170)	63.0	74.0	71.5	2.25	1.75	1.65	1.65	3.50	1.80	2.30	1.95	2.15	2.11

1/ Ratings based on 1-5 scale where 1=no weathering or mold and 5=very susceptible with seed essentially all dead. There was extensive weathering on the College Station test at the late readings, only moderate weathering at Corpus Christi, and very little weathering at Halfway and Lubbock

2/ Rated on 7/22 by James Glueck (J.G.) and Fred R. Miller (F.R.M.)

3/ Rated by James Glueck (J.G.) and Fred Miller (F.R.M.) in August and again in September. Test planted April 17. 70 days to 50% bloom was June 26.

4/ Rated by Darrell Rosenow at Halfway 11/4; Lubbock Field 105 11/17; Lubbock Date I 2/11/76.

Table 7.3. Descriptive information on entries in the Grain Weathering Test (GWT), 1975.

Entry No.	Designation	Grain color, overall appearance	Mesocarp thickness 1/	undercoat 2/	Resistance classification in 1974
1	SC748-5	lemon yellow, translucent	0	A	resistant
2	TAM428	white translucent	0	A	moderately resistant
3	SC111-9	red translucent	0	A	resistant
4	SC112-14 (no uc)	red translucent	0	A	resistant
5	SC170-6 (4244)	white, semi-translucent	0	A	resistant
6	SC170-6 (4267)	while, semi-translucent	0	A	moderately resistant
7	SC97-14	lite red translucent	0	A	resistant
8	SC566-14	bright red translucent	0	A	resistant
9	SC279-14	bright red translucent	0	A	resistant
10	SC546-14	dark brownish red	+	A	resistant
11	SC599-6(9054)	red	+	A	moderately resistant
12	SC283-14	white translucent	0	A	resistant
13	SC269-14	lite red translucent	0	A	resistant
14	SC414-12	white	+	A	susceptible (check)
15	SC103-12	dark reddish brown	+	P	resistant
16	NK233	light red translucent	0	A	resistant (check)
17	BTx3197	white	+	A	intermediate (check)
18	Tx2536	yellow trans. (yel. end)	0	A	susceptible (check)
19	BTx378	red	+	A	intermediate (check)
20	BTx398	red	+	A	intermediate (check)
21	74PR759	red	+	A	resistant
22	(SC108 x Tx7078)	red translucent	0	A	resistant
23	(Tx414 x SC108)	red translucent	0	A	resistant
24	(Tx414 x SC170)	red	0	A	resistant
25	(Tx7000 x SC170)	red	+	A	resistant

1/ 0=thin mesocarp (gives pearly or translucent appearance); +=thick mesocarp (gives chalky appearance).
2/ A=undercoat absent; P=undercoat present.

Table 7.4. Weathering rating, test weight, and germination on the Grain Weathering Test (GWT) at College Station, Texas, 1975.

Entry No.	Designation	Days to 50% Bloom 1/	Weathering rating 2/		Test weight kg/hl		Germination %	
			JG 9/12	FRM 9/9	First harvest 3/	Second harvest 4/	First harvest	Second harvest
1	SC748-5	73.5	1.55	2.15	76.3	72.3	80.5	32.3
2	TAM428	77.0	3.80	2.20	76.7	71.1	56.5	13.5
3	SC111-9	72.0	2.95	2.35	73.0	71.7	85.3	48.8
4	SC112-14 (no uc)	68.5	2.65	2.45	78.9	73.1	86.3	18.0
5	SC170-6(4252)	82.5	3.10	3.50	73.3	71.1	75.8	41.5
6	SC170-6(4267)	81.5	3.60	2.20	77.2	73.0	66.3	24.3
7	SC97-14	68.0	2.50	2.25	77.2	72.4	79.0	16.8
8	SC566-14	64.0	2.20	2.20	76.9	71.5	77.8	32.3
9	SC279-14	63.0	1.25	1.45	77.0	73.2	93.0	30.0
10	SC546-14	65.5	2.20	1.95	72.5	67.2	76.5	18.3
11	SC599-6(9054)	83.0	3.00	2.50	75.7	71.8	82.5	38.5
12	SC283-14	72.0	2.50	1.70	80.0	74.7	87.5	36.0
13	SC269-14	60.5	3.40	1.75	76.0	72.0	81.0	35.0
14	SC414-12	74.5	4.05	2.75	75.7	69.1	82.5	10.3
15	SC103-12	69.0	1.35	1.70	74.0	69.0	88.8	75.3
16	NK233	66.5	2.20	2.20	78.8	75.2	91.5	33.0
17	BTx3197	68.5	2.60	2.40	75.7	72.5	88.3	44.0
18	Tx2536	78.5	5.00	5.00	66.8	61.0	33.0	2.3
19	BTx378	74.5	2.45	1.85	73.0	70.1	76.5	44.8
20	BTx398	67.5	2.65	2.80	77.0	73.1	86.0	60.3
21	74PR759	71.5	1.70	1.90	74.2	72.0	80.5	38.5
22	(SC108 x Tx7078)	69.5	2.30	1.90	74.0	71.0	75.5	29.3
23	(Tx414 x SC108)	71.5	2.15	1.75	75.1	72.4	79.5	24.0
24	(Tx414 x SC170)	74.5	2.85	2.45	76.1	73.0	65.5	26.8
25	(Tx7000 x SC170)	74.0	3.50	1.80	76.7	72.4	79.8	26.0

1/ Test planted April 17. 70 days to 50% bloom was June 26.
2/ Rating on 1-5 scale. See IDIN note taking instructions. Notes by James Glueck (JG) and Fred Miller (FRM) on 9/12 and 9/9 respectively.
3/ First harvest was made on each entry at 35 days following 50% bloom (approximately at physiologic maturity). Second harvest for all entries was on September 12 which was about 55 to 65 days following physiologic maturity.

C-8. Lodging Resistance

The lodging resistance program involves several replicated tests grown throughout Texas. Three replicated tests include lines, with one test for hybrids. The best sources of lodging resistance are placed in the Statewide Lodging Test (SLT), a 25-entry test (Table 8.1). Fifteen tests were planted at thirteen locations over Texas in 1975 (Table 8.2). The large number of locations are used to increase the probability of obtaining the various types of lodging; root lodging, weak neck, charcoal rot-moisture stress lodging, and after freeze stalk breakage. The 36-entry Advanced Lodging (ALT) and Preliminary Lodging Tests (PLT), and the 97-entry Hybrid Lodging Test (HLT) were planted at fewer sites (Table 8.2).

Excellent lodging notes were obtained from all Lubbock tests (Tables 8.3-8.9). These tests remained in the field much of the winter, being exposed to repeated strong winds up to 65 MPH (105 km/hr). Lubbock Date I remained in the field until March 1, 1975 and experienced severe lodging pressure. Charcoal rot ratings from toothpick inoculated plants were excellent at Halfway and good at Lubbock, with good moisture stress during the late stages of grain development.

Less charcoal rot developed in the lines, (SLT and ALT), than in hybrids (HLT) (Tables 8.3, 8.5, 8.8). In the SLT, charcoal rot was sufficiently severe to differentiate lodging resistant lines, entries 10-20, which had an average rating at

Halfway of 1.31 compared to the five standard lines which had an average rating of 3.25 (Table 8.3). New Mexico 31, a released line with established charcoal resistance, had a 2.65 rating, while eight of our breeding lines had an average of less than 1.0. The average lodging from the three Lubbock tests for the resistant 20 entries was 9.3% while that for the five checks was 64.6%. Obviously much progress has been made in selection for both lodging resistance and charcoal rot.

Several promising lines were identified in the ALT and PLT and will be entered in the SLT and PLT, respectively, in 1976 (Tables 8.5, 8.7). Relevant agronomic, lodging, and disease data for the SLT, ALT, and PLT are represented in Tables 8.3 through 8.7.

Data from the Hybrid Lodging Test at Lubbock and Halfway indicated that both lodging resistance and charcoal rot resistance are much more difficult to obtain in high yielding hybrids than in lines (Tables 8.8 and 8.9). Charcoal rot was severe in essentially all hybrids at Halfway, with very few showing resistance. However, there were marked differences among hybrids in leaf and plant death and early season lodging due to moisture stress (Table 8.8) at Halfway and Lubbock (see lodging on 11/4 and 10/31). Hybrids which senesced during the period of moisture stress also lodged early in the season before frost.

Some significant differences were evident in late season lodging in the Lubbock tests with a few hybrids being resistant. The reaction of hybrids where only one parent is resistant indicates that lodging resistance is essentially recessive in inheritance. However, a few lines, such as (SC56xSC33) selections 1778 and 1790 exhibited good resistance in F_1 hybrids with susceptible females.

A few hybrids made with an experimental lodging resistant female crossed with a lodging resistant male had good lodging resistance, such as Entries 1, 8, 9, 10, 12, and 15. It appears that for a high yielding hybrid to have a good level of lodging resistance, both the male and female must be resistant. Another observation from the 1975 data is that charcoal rot ratings on hybrids under severe moisture stress may be too severe a test. Several hybrids did not senesce and had good lodging resistance in spite of high charcoal rot ratings. Yields of the HLT entries show that yield level of various lodging resistant males and females is very good compared to some of the best standard commercial hybrids, entries 81-90 (Table 8.8).

Table 8.1. Statewide lodging test (SLT), 1975

Entry no.	Designation	IS no.	Variety, kind or derivation
1	SC 33-6	12553	Durra
2	SC 35-6	12555	Durra
3	SC 56-14	12568	Cau-Nig
4	SC 170-6-8 (4252)	12661	Zerazera
5	SC 170-6-17 (4267)	12661	Zerazera
6	SC 326-6	3758	Nigricans
7	NSA 440-12	-	Kaf. deriv.
8	NSA 681-4-3-2	-	Y.E. deriv.
9	(B 406 x Rio)-2	-	(B 406 x Rio)
10	SC 599-6-10(9188)	-	Rio deriv.
11	SC 599-6-3(9247)	-	Rio deriv.
12	(SC 56-6 x SC110-6)F_7 (1565)	-	(SC 56-6 x SC110-6)
13	(SC 56-6 x SC170-6)F_7 (1584)	-	(SC 56-6 x SC170-6)
14	(SC 56-6 x SC170-6)F_7(1588)	-	(" x ")
15	(SC 56-6 x SC170-6)F_7(1589)	-	(" x ")
16	(SC173-9 x SC56-6)F_7 (1600)	-	(SC173-9 x SC56-6)
17	(SC56-6 x SC33-6)F_7 (1778)	-	(SC56-6 x SC33-6)
18	(SC56-6 x SC33-6)F_7 (1790)		(SC56-6 x SC33-6)
19	(SC56-6 x SC33-6)F_7 (1790)	-	(SC56-6 x SC33-6)
20	(SC56-6 x SC170-6)F_7 (1922)	-	(SC56-6 x SC170-6)
21	Tx 7000	410	Caprock
22	B Tx 399	896	Wheatland
23	B Tx 378	413	Redlan
24	New Mexico-31	-	Redbine-Kaf. deriv.
25	SA 392	119	Comb. Hegari

Table 8.2. Location of lodging tests in Texas in 1975

A. Statewide Lodging Test (SLT)

1. Corpus Christi
2. Robstown (Perry Foundation)
3. Berclair (head smut nursery)
4. Beeville
5. Uvalde
6. College Station
7. Hillsboro
8. Dallas
9. San Angelo
10. Pecos (mite nursery)
11. Chillicothe
12. Lubbock (charcoal rot nursery - date I)
13. Lubbock (charcoal rot nursery - date II)
14. Lubbock (dryland)
15. Halfway

B. Advanced Lodging Test (ALT)

1. Robstown (Perry Foundation)
2. Berclair (head smut nursery)
3. Beeville
4. Chillicothe
5. Lubbock (charcoal rot nursery - date I)
6. Lubbock (charcoal rot nursery - date II)
7. Lubbock (dryland)
8. Halfway

C. Preliminary Lodging Test (PLT)

1. Lubbock (charcoal rot nursery - date I)
2. Lubbock (charcoal rot nursery - date II)
3. Lubbock (dryland)

D. Hybrid Lodging Test (HLT)

1. Chillicothe
2. Lubbock (charcoal rot nursery - date I)
3. Lubbock (charcoal rot nursery - date II)
4. Lubbock (dryland)
5. Lubbock (grub area)
6. Halfway

Table 8.3. Lodging and charcoal rot data from the Statewide Lodging Test (SLT), 1975, with some 1973 and 1974 data.

Entry No.	Designation	Date of 50% Bloom		Lodging % 1/						Charcoal Rot 5/				Charcoal Rot 1973 6/	
										Halfway		Lubbock I			
		Halfway	Lub. I	Lub. I	Lub. II	Lub. D	Avg. 2/	1974 3/	1973 4/	Rating	Range	Rating	Range	Rating	Range
1	SC33-6	8/14	8/16	11.7	0.0	0.0	3.9	0.8	6.7	0.75	.5-1	1.10	.5-3.5	0.75	.2-2
2	SC35-6	8/11	8/12	25.0	3.3	3.3	10.5	3.4	2.0	2.65	1.5-4	1.10	.5-3	0.78	.2-1
3	SC56-14	8/14	8/13	30.0	0.3	4.0	11.4	0.0	0.9	0.70	.5-2	0.60	.1-1	0.36	.2-.8
4	SC170-6-8 (4242)	8/13	8/16	63.3	2.0	6.7	24.0	12.5	63.0	0.75	.5-1.5	0.53	.2-1	0.77	.2-1.8
5	SC170-6-17 (4267)	8/15	8/17	60.0	17.7	13.3	30.3	6.7	68.8	1.70	.5-4	0.73	.2-1	0.57	.2-1
6	SC326-6	8/18	8/22	5.3	0.0	0.7	2.0	0.0	0.5	1.70	.5-3	0.50	.2-1.5	0.42	.2-1.5
7	NSA440	8/15	8/15	2.7	0.0	0.0	0.9	1.7	9.9	1.30	.5-2	1.40	.5-2.5	0.92	.2-4
8	NSA681	8/14	8/14	5.0	0.0	0.0	1.7	5.9	24.3	1.20	.5-3.5	0.86	.2-1	0.74	.2-5
9	(B406 x Rio)	8/14	8/14	8.3	1.0	0.7	3.3	4.2	11.0	1.90	.5-5	0.47	.2-1	0.50	.2-1
10	SC599-6 (9188)	8/13	8/10	6.0	3.3	11.7	25.0	12.5	35.8	1.80	1-3	0.60	.2-1	0.78	.2-2.5
11	SC599-6 (9247)	8/15	8/11	61.7	1.7	1.0	21.5	6.7	15.0	0.75	.5-1	0.70	.2-2.5	0.61	.2-1
12	(SC56 x SC110)(1565)	8/14	8/16	18.3	6.3	7.3	10.6	2.5	14.3	1.75	.5-5	0.93	.5-2	0.85	.2-1
13	(SC56 x SC170)(1584)	8/13	8/17	8.3	0.0	1.3	3.2	1.7	4.2	0.80	.5-2.2	0.76	.2-1	0.60	.2-1
14	(SC56 x SC170)(1588)	8/14	8/16	1.7	0.0	0.0	0.6	1.7	4.2	0.85	.2-2.5	0.80	.2-1	1.55	1-3
15	(SC56 x SC170)(1589)	8/14	8/12	1.7	0.0	0.7	0.8	0.9	3.2	1.15	.3-3	0.50	.2-1	0.95	.2-2
16	(SC173 x SC56)(1600)	8/16	8/16	8.3	0.0	3.3	3.9	1.7	5.5	1.45	.5-3	1.03	.2-2.5	1.00	.2-3
17	(SC56 x SC33)(1778)	8/16	8/17	8.3	0.0	3.3	3.9	5.0	16.0	0.55	.5-1	0.43	.2-1	0.90	.2-2.2
18	(SC56 x SC33)(1790E)	8/4	8/4	35.0	5.7	5.3	15.3	-	-	2.40	1-4.5	0.90	.2-1	-	-
19	(SC56 x SC33)(1790L)	8/14	8/16	11.0	2.0	0.0	4.3	3.3	8.0	0.83	.5-1	0.76	.2-1	0.95	.5-1
20	(SC56 x SC170)(1922)	8/14	8/15	23.3	3.5	2.5	9.8	4.2	2.0	1.25	1-2	0.90	.2-1	1.00	.5-1.2
21	Tx7000 (Caprock)	8/13	8/13	100.0	83.3	85.0	89.4	83.4	-	3.28	1-5	2.46	1-4.5	-	-
22	BTx399 (Wheatland)	8/14	8/13	90.0	11.7	11.7	37.8	36.7	69.8	2.50	1.5-5	1.06	.2-3	1.58	.2-5
23	BTx 378 (Redlan)	8/14	8/16	100.0	90.0	86.7	92.2	65.0	93.4	3.90	1.5-5	1.26	.8-2.5	2.35	.5-5
24	N. Mex.-31	8/13	8/11	77.7	3.0	30.0	36.9	-	38.4	2.65	.5-5	0.93	.5-1.5	1.70	.2-5
25	C. Hegari	8/13	8/17	99.7	43.3	56.7	66.6	62.5	66.7	3.90	1.5-5	1.30	1.2-4.5	1.53	2-5

1/ Lodging primarily weak neck and after freeze stalk breakage. Moisture stress significantly weakened stalks of some entries in 1973 and 1975. Lubbock I notes taken 3/1/76, Lubbock-II and Lubbock-D (dryland) taken 12/5/75.
2/ The average of 1975 tests, Lubbock Date I, Lubbock Date II, and Lubbock Dryland.
3/ Average from 1974 Lubbock, Date I and Date II tests (taken 1/28/75).
4/ Average from 1973 Lubbock, Date I and Dryland tests (taken 3/11/74).
5/ Rated on 1-5 scale. See IDIN note taking instructions. Average of five inoculated plants per replication. Moisture stress was most severe at Halfway.
6/ Average from Lubbock Date I, Date II, and Dryland, 1973.

Table 8.4. Disease and agronomic data from the Statewide Lodging Test (SLT), 1975.

Entry No.	Designation	Plant height cm. 1/	Head exsertion cm. 1/	Leaf and plant death 2/ Half.	Leaf and plant death 2/ Lub.	Stem juiciness 3/	Desirability 4/ Half.	Desirability 4/ Lub. I	Desirability 4/ Lub.-D	Desirability 4/ BHS	Downy mildew % 5/	Head smut % 5/	1974 6/ Downy mildew %	1974 6/ Head smut %
1	SC33-6	96	11	2.9	2.9	1.5	2.8	2.4	2.9	2.5	1.7	0.0	0.5	0.0
2	SC35-6	111	27	2.7	2.4	5.0	2.3	2.7	3.0	2.5	8.9	0.0	0.0	0.0
3	SC56-14	107	12	2.5	2.6	5.0	3.0	2.9	2.9	2.6	1.4	22.3	0.0	20.0
4	SC170-6-8(4252)	107	10	3.0	3.6	2.5	2.3	2.8	2.7	2.2	0.0	0.0	0.0	0.7
5	SC170-6-17(4267)	98	4	2.9	3.2	3.0	2.3	2.6	2.8	1.8	0.0	4.9	0.0	1.3
6	SC326-6	85	6	2.7	3.0	5.0	3.2	3.1	3.5	2.5	0.0	3.4	0.8	0.8
7	NSA440	85	5	3.3	3.9	2.5	2.9	2.6	2.9	2.9	1.1	17.3	0.5	1.9
8	NSA681	87	3	2.6	3.1	2.5	2.9	2.6	3.1	3.3	2.6	2.6	1.7	1.7
9	(B406 x Rio)	91	16	2.7	2.8	1.0	2.7	2.8	2.9	2.7	19.5	6.0	11.4	0.0
10	SC599-6(9188)	120	18	2.8	3.1	1.0	2.0	3.2	3.0	3.7	10.8	0.4	2.6	0.0
11	SC599-6(9247)	99	15	2.9	2.9	1.0	2.2	3.0	2.9	2.1	3.9	0.5	2.9	0.0
12	(SC56 x SC110)(1565)	111	3	2.9	2.7	5.0	2.6	2.4	2.7	2.6	8.0	6.0	-	-
13	(SC56 x SC170)(1584)	91	10	2.8	2.9	2.0	2.8	2.6	2.7	3.0	0.0	8.9	1.8	1.8
14	(SC56-6 x SC170)(1588)	89	3	2.6	2.7	5.0	3.0	2.9	3.0	3.0	0.0	29.3	0.0	18.2
15	(SC56-6 x SC170)(1589)	86	3	2.8	2.5	5.0	3.2	3.0	3.3	3.1	15.6	31.2	1.6	14.4
16	(SC173 x SC56)(1600)	107	3	3.0	3.4	5.0	2.8	2.1	2.8	2.7	2.8	30.8	-	-
17	(SC56 x SC33)(1778)	107	1	2.2	2.4	2.5	2.6	2.2	2.6	2.8	8.6	0.0	12.1	0.0
18	(SC56 x SC33)(1790E)	107	16	2.9	2.5	5.0	2.7	2.4	3.0	2.6	2.2	0.0	-	-
19	(SC56 x SC33)(1790L)	106	11	2.6	2.8	5.0	2.8	2.2	2.7	2.7	2.7	0.0	4.6	0.6
20	(SC56 x SC170)(1922)	99	3	2.9	2.8	2.5	2.8	2.6	3.0	2.3	1.6	1.6	0.0	1.3
21	Tx7000 (Caprock)	116	10	4.4	4.3	2.0	3.2	3.5	3.1	2.4	11.6	2.9	3.8	0.6
22	BTx399 (Wheatland)	96	5	2.7	2.8	3.5	2.6	3.1	2.9	2.9	16.9	2.4	1.5	3.4
23	BTx378 (Redlan)	120	4	3.0	3.0	1.5	2.6	3.3	3.3	2.5	21.1	2.6	0.4	7.1
24	N. Mex.-31	110	12	3.4	2.5	1.5	3.0	3.6	4.1	3.1	8.3	5.6	1.2	6.2
25	Comb. Hegari	115	5.	3.3	3.7	2.5	2.8	3.2	3.5	3.1	4.6	0.0	0.0	1.5

1/ Lubbock, Date I, 1975
2/ Ratings made at Halfway and Lubbock - Date I on October 6, 1975 on the extent of leaf and plant death due primarily to moisture stress. 1=no leaf or plant death; 5=plants completely dead.
3/ Rating: 1=midrib completely juicy; 2=semi-juicy; 3=intermediate; 4=semi-dry; 5=completely dry.
4/ Rating on 1-5 scale. See IDIN instructions. Lubbock -I and -D ratings taken in winter after plants had lodged. Lodged entries received low ratings.
5/ Berclair Head Smut Nursery, 1975.
6/ Berclair Head Smut Nursery, 1974.

Table 8.5. Lodging and charcoal rot data from the Advanced Lodging Test (ALT), 1975 (some data from 1973 and 1974 included).

Entry No.	Designation	Date of 50% bloom		Lodging % 1/				Charcoal Rot 5/				Charcoal Rot 1973 6/	
		Halfway	Lub. I	Lub. I	Avg. 2/	1974 3/	1973 4/	Halfway Rating	Halfway Range	Lubbock I Rating	Lubbock I Range	Rating	Range
1	SC56-6	8/6	8/5	5.0	4.0	3.3	14.2	2.15	1-4	0.70	.2-1	0.58	.2-1
2	NSA323-4 (Way)	8/18	8/12	6.7	2.2	5.9	1.4	1.00	.5-2	0.20	.2	0.65	.2-1.5
3	NSA637-6	8/17	8/14	30.0	12.0	5.0	23.4	2.00	1-3	0.80	.2-1	0.70	.2-2.5
4	NSA704-1	8/9	8/7	58.3	23.3	-	13.0	1.50	.5-1	0.55	.2-1	1.25	.2-5
5	NSA443-7	8/16	8/11	13.3	5.6	1.7	8.7	1.20	.5-4	1.00	.2-2	0.68	.2-1
6	NSA817-3	8/18	8/12	96.0	40.8	10.0	20.0	1.20	.5-2	3.30	.5-5	0.60	.2-2.5
7	NSA837-1-2	8/14	8/11	30.0	15.3	5.9	52.5	0.50	.5	0.55	.2-1	1.00	.2-5
8	SC237(-9,-6)	8/10	8/11	4.0	1.3	1.7	10.5	3.85	1.5-5	0.95	.2-1.5	1.04	.2-4
9	(SC56 x SC170)(1577)	8/7	8/5	10.0	4.7	1.7	3.7	2.80	1-5	2.15	1-3.8	0.95	.5-2
10	(SC56 x SC170)(1578)	8/16	8/8	50.0	23.3	4.2	6.7	1.45	.5-4	0.75	.2-1	0.90	.2-2.2
11	(SC56 x SC170)(1587)	8/13	8/12	1.7	0.6	0.9	6.4	1.75	.5-4	0.95	.5-2	0.75	.5-1.2
12	(SC56 x SC33)(1786)	8/14	8/11	2.7	1.2	0.9	3.4	1.40	1-2	1.05	1-1.5	0.65	.2-1
13	(SC56 x SC33)(1792)	8/17	8/12	4.0	2.7	3.3	6.2	1.60	1-3	1.0	.2-1.5	0.85	.2-1
14	(SC56 x SC33)(1793)	8/16	8/19	7.3	4.6	5.0	24.2	1.40	1-2	0.6	.2-.8	1.05	1-1.5
15	(SC56 x SC170)(1922)	8/15	8/17	16.7	15.6	4.2	2.0	2.95	1-5	0.6	.2-1	1.00	.4-1.2
16	(SC56 x SC170)(1924)	8/13	8/17	6.7	2.9	2.5	-	2.95	1.5-5	1.0	.2-3.5	-	-
17	(SC56 x SC170)(1927)	8/13	8/14	0.7	1.2	2.5	-	1.70	1-3.5	0.95	.8-1	-	-
18	SC599-6-3(9054)	8/14	8/17	3.3	1.1	0.9	9.2	1.05	.5-2	0.35	.2-.8	0.64	.2-2.5
19	SC599-6-10(9193)	8/15	8/14	50.0	1.7	4.2	19.2	1.50	.5-4.5	0.85	.2-2.5	0.70	.2-1
20	(P407 x ?)-14(73CS58)	8/13	8/14	15.0	5.3	2.5	-	1.15	.5-1.8	1.05	.5-3	-	-
21	(P407 x ?)-47-3-4(670)	8/15	8/20	45.0	16.2	12.5	17.5	2.35	1.2-5	0.65	.2-1	0.65	.2-1
22	(P407 x ?)-33-3-1(637)	8/15	8/13	40.0	17.0	2.5	32.5	2.10	.5-5	0.70	.2-1	0.9	.2-3
23	(P407 x ?)-63-3-3(722)	8/1	8/13	0.3	6.1	7.5	11.0	1.20	1-2	0.70	.5-1	0.75	.5-2
24	(P407 x ?)-47-3-4(668)	8/14	8/17	75.0	29.8	11.7	55.9	3.45	1-4.5	0.95	.2-2.5	0.65	.2-1.2
25	(SC599 x SC134)(1887)	8/15	8/12	10.0	5.3	5.0	-	1.95	.5-5	0.90	.5-1	0.85	.5-1

Table 8.5. Continued

Entry No.	Designation	Date of 50% bloom		Lodging % 1/				Charcoal Rot 5/				Charcoal Rot 1973 6/	
		Halfway	Lub. I	Lub. I	Avg. 2/	1974 3/	1973 4/	Halfway Rating	Halfway Range	Lubbock I Rating	Lubbock I Range	Rating	Range
26	SC599-6-3(9245)	8/14	8/15	6.7	2.6	0.9	-	1.70	.5-4	0.55	.2-1	0.45	.2-1.2
27	SC599-6(9247) no uc	8/16	8/11	25.0	9.0	6.7	15.0	2.00	.5-1	0.70	.2-1	0.61	.2-1
28	(P407 x ?)-62-1-2(709)	3/8	8/8	35.0	17.2	4.2	-	2.40	1-4.5	0.85	.5-1	0.80	.2-1.8
29	TAM428 (SC110-9)	8/11	8/10	97.3	85.2	57.5	97.2	3.50	.5-5	3.00	1-5	1.75	.2-5
30	(SC56 x SC170)(3534)	8/9	8/11	58.3	31.9	-	-	3.00	1-5	1.00	.2-2	-	-
31	Comb. Hegari	8/14	8/18	98.7	72.4	62.5	66.2	2.35	1-4	1.55	1-3.5	1.53	.2-5
32	(SC56 x SC170)(3555)	8/10	8/10	46.7	20.8	-	—	3.65	1.2-5	1.55	.5-5	-	-
33	Tx7000 (Caprock)	8/15	8/13	98.3	89.4	80.0	-	3.65	1.5-4.5	1.25	.5-3.2	-	-
34	BTx399(Wheatland)	8/11	8/10	91.0	50.1	36.7	69.8	3.45	1-5	1.05	.2-2	1.58	.2-5
35	BTx378(Redlan)	8/14	8/13	100.0	67.2	65.0	93.4	3.05	1.2-5	2.35	1-5	2.35	.5-5
36	New Mexico-31	8/13	8/9	88.3	34.9	-	38.4	2.15	.5-5	2.50	1-4.5	1.70	.2-5

1/ Lodging primarily weak neck and after freeze stalk breakage. Moisture stress significantly weakened stalks of some entries in 1973 and 1975. Lubbock I notes taken 3/1/76, Lubbock-II and Lubbock-D (dryland) taken 12/5/75.
2/ The average of 1975 tests, Lubbock Date I, Lubbock Date II, and Lubbock Dryland.
3/ Average from 1974 Lubbock, Date I and Date II tests (taken 1/28/75).
4/ Average from 1973 Lubbock, Date I and Dryland tests (taken 3/11/74).
5/ Rated on 1-5 scale. See IDIN note taking instructions. Average of five inoculated plants per replication. Moisture stress was most severe at Halfway.
6/ Average from Lubbock Date I, Date II, and Dryland, 1973.

Table 8.6. Disease and agronomic data from the Advanced Lodging Test (ALT), 1975

Entry No.	Designation	Plant[1/] height cm.	Head[1/] exsertion cm.	Leaf and plant death[2/] Halfway	Leaf and plant death[2/] Lubbock	Stem[3/] juiciness	Desirability[4/] Half.	Desirability[4/] Lub.-I	Desirability[4/] Lub.-II	Desirability[4/] BHS	Downy[5/] mildew %	Head[5/] smut %
1	SC56-6	89	1.8	3.5	3.2	5	3.0	2.8	3.1	3.4	2.6	34.4
2	NSA323-4(wxy)	86	5.8	2.4	2.4	2	4.1	3.4	4.0	3.4	6.5	0.0
3	NSA637-6	89	7.6	3.3	3.9	2-4	3.5	3.0	3.5	3.7	14.3	16.1
4	NSA704-1	97	27.2	2.8	3.7	1.5	2.4	2.7	2.9	3.0	11.2	16.4
5	NSA443-7	97	5.1	3.1	3.9	5	3.1	2.6	2.9	3.4	12.9	38.8
6	NSA817-3	86	2.5	3.0	4.9	1.5	2.9	3.3	2.9	2.6	12.1	3.7
7	NSA837-1-2	90	5.1	3.2	4.5	5	2.8	2.7	2.9	3.0	12.3	11.5
8	SC237(-94-6)	76	5.1	3.8	3.3	5	3.3	2.8	3.2	3.0	0.6	0.0
9	(SC56 x SC170)(1577)	99	5.6	3.2	2.6	2.5	2.8	2.7	3.2	2.8	0.0	29.6
10	(SC56 x SC170)(1578)	95	2.5	2.6	2.5	5	3.1	2.1	3.2	3.6	0.0	6.8
11	(SC56 x SC170)(1587)	93	0.8	2.8	3.2	5	2.8	2.3	2.9	2.6	3.8	2.4
12	(SC56 x SC33)(1786)	91	5.1	2.7	2.9	3	3.0	2.5	3.0	3.0	5.3	0.0
13	(SC56 x SC33)(1792)	101	5.8	2.5	2.9	5	2.9	2.2	2.9	2.8	9.5	1.0
14	(SC56 x SC33)(1793)	98	5.8	2.7	2.7	5	3.1	2.4	3.0	3.1	16.9	2.1
15	(SC56 x SC170)(1922)	107	5.8	3.3	3.7	5	2.3	2.8	3.2	2.2	1.6	1.6
16	(SC56 x SC170)(1924)	102	7.6	3.3	3.1	3.5	3.0	2.8	3.4	3.1	0.9	6.3
17	(SC56 x SC170)(1927)	86	0.0	2.9	2.5	5	3.1	2.9	3.2	2.9	8.3	3.3
18	SC599-6-3(9054)	96	8.0	2.5	2.7	1	2.5	2.3	2.9	1.8	14.8	0.0
19	SC599-6-10(9193)	111	12.0	2.7	3.2	1	2.6	3.0	3.1	2.7	14.4	0.0
20	(P407 x ?)-14(73CS58)	112	9.4	2.3	2.8	2	3.0	2.8	3.0	2.8	0.0	0.0
21	(P407 x ?)-47-3-4(670)	123	14.5	2.8	2.9	4.5	2.4	2.9	2.9	2.5	1.4	2.1
22	(P407 x ?)-33-3-1(637)	107	17.8	2.8	2.9	3	3.1	3.1	3.0	3.4	4.8	0.0
23	(P407 x ?)-63-3-3(722)	81	1.8	2.8	3.4	5	3.1	3.1	3.0	3.3	2.6	0.0
24	(P407 x ?)-47-3-4(668)	117	13.5	2.7	3.1	4	2.5	2.8	3.0	2.6	2.1	0.7
25	(SC599 x SC134)(1887)	103	16.0	2.7	2.8	3.5	2.8	2.8	2.1	2.7	11.3	2.5

Continued

Table 8.6. -(Continued)

Entry No.	Designation	Plant height[1/] cm.	Head exsertion[1/] cm.	Leaf and plant death[2/] Halfway	Leaf and plant death[2/] Lubbock	Stem juiciness[3/]	Desirability[4/] Half.	Desirability[4/] Lub-I	Desirability[4/] Lub-II	Desirability[4/] BHS	Downy mildew[4/] %	Head smut[5/] %
26	SC599-6-3(9245)	99	14.5	2.4	2.5	1	2.4	2.9	2.3	2.1	10.6	0.0
27	SC599-6(9247) no uc	98	19.6	2.7	3.2	1	2.6	3.0	2.7	2.2	3.3	0.0
28	(P407 x ?)-62-1-2(709)	112	17.0	3.3	3.0	5	2.8	3.3	3.1	2.9	12.0	0.6
29	TAM428 (SC110-9)	117	11.9	3.9	4.1	3	2.3	2.9	3.0	1.8	0.0	0.0
30	(SC56 x SC170)(3534)	101	3.3	3.4	3.5	2	2.6	3.3	2.9	2.3	1.4	3.3
31	Comb. Hegari	122	1.8	3.2	3.4	3	2.9	3.2	3.5	3.5	8.0	0.0
32	(SC56 x SC170)(3555)	89	5.1	3.8	3.1	2.5	3.2	3.1	3.2	2.5	11.6	17.3
33	Tx7000 (Caprock)	112	9.4	4.9	3.5	1.5	3.2	3.4	3.1	2.6	4.5	0.6
34	BTx399 (Wheatland)	101	9.4	3.2	3.0	3.5	2.5	3.1	3.1	2.9	3.4	6.3
35	BTx378 (Redlan)	125	9.4	3.4	3.6	1.5	2.8	3.3	3.0	1.4	0.5	6.5
36	New Mexico-31	106	16.0	3.0	2.9	2.0	3.7	3.6	4.2	2.7	4.1	8.9

1/ Lubbock, Date I.
2/ Ratings at Halfway and Lubbock Date I on October 6, 1975 on the extent of leaf and plant death due primarily to moisture stress. 1=no leaf or plant death; 5=plants completely dead.
3/ Rating: 1=midrib completely juicy; 2=semi-juicy; 3=intermediate; 4=semi-dry; 5=completely dry.
4/ Rated on 1-5 scale. See IDIN note taking instructions. Lubbock-I and -D ratings taken in winter after lodging occurred.
5/ Berclair Head Smut Nursery, 1975.

Table 8.7. Lodging, charcoal rot, and agronomic data from the Preliminary Lodging Test, 1975.[1/]

Entry No.	Designation	Date of 50% bloom	Plant height, cm	Head exsertion, cm	Leaf and[2/] plant death	Desirability[3/]	Lodging (%) [4/] Date I	Lodging (%) [4/] Avg.[5/]	Charcoal rot [6/] 1975 Rating	Charcoal rot [6/] 1975 Range	Charcoal rot [6/] 1973[7/] Rating	Charcoal rot [6/] 1973[7/] Range
1	NSA356-2	8/14	101	7	2.6	3.0	80.0	37.7	0.85	.2-2	0.80	.2-5
2	NSA548-9	8/11	111	14	2.8	2.6	31.7	11.9	1.10	1-2	1.28	.2-4
3	NSA8772-14	8/15	61	1	2.8	3.0	3.3	1.7	0.60	.2-1	0.75	.5-1
4	SC599-6(9189)	8/16	114	14	2.7	2.7	15.0	6.1	0.55	.2-1	0.65	.2-1
5	SC599-6(9249)	8/12	101	7	2.4	2.2	11.7	5.2	0.40	.2-.8	0.75	.2-1
6	(SC56 x SC170)(1579)	8/10	107	7	3.2	2.4	16.7	6.0	1.10	.8-2	1.05	.8-2
7	(SC56 x SC33(1784)	8/13	119	6	2.8	2.1	10.0	3.3	0.95	.5-1	1.30	.8-3
8	(SC56 x SC33)(1794)	8/12	107	9	3.0	2.2	25.0	8.3	1.05	.8-2	0.85	.2-2
9	NSA1603-10	8/16	141	19	2.8	3.2	97.7	44.8	1.35	1-2.2	0.95	.5-1.2
10	NSA926-5	8/20	81	0	2.7	3.0	1.7	1.9	0.35	.2-.5	0.58	.2-1
11	(SC599 x SC110)(1663)	8/11	110	11	3.5	3.2	86.7	33.1	2.10	.2-4.5	0.85	.2-2
12	(SC599 x SC134)(1886)	8/16	95	11	2.9	2.8	14.3	6.2	0.95	.2-1	0.75	.2-1
13	(SC599 x SC134)(1888)	8/15	103	5	2.7	2.4	9.0	3.4	0.70	.2-1	0.90	.5-1
14	SC448-6	8/10	84	1	3.3	3.0	2.3	1.0	0.95	.8-1	1.10	.8-2
15	NSA344-1	8/14	97	6	3.1	2.9	13.3	11.7	0.50	.2-.8	0.95	.5-2
16	NSA837-1-2-2	8/18	87	2	2.9	3.0	16.7	7.2	0.65	.2-.5	1.05	.2-2.5
17	TAM2561(NSA323)	8/14	93	2	2.6	2.9	25.0	17.2	0.45	.2-1	0.55	.2-1
18	SC599-6(9052)	8/8	103.	20	2.5	2.8	36.7	13.4	0.60	.2-1	0.80	.2-1.8
19	SC173-12	8/11	96	3	4.1	2.8	58.3	37.5	1.50	.2-5	1.36	.2-5
20	NSA440-4	8/15	77	1	3.0	2.7	0.0	0.1	0.90	.5-1	1.33	.2-3
21	NSA923-4	8/14	79	0	3.0	3.1	3.3	1.1	0.55	.2-1	1.10	.2-2
22	NSA818-12	8/19	96	0	2.9	3.0	20.0	18.0	0.25	.2-.5	1.53	.2-5
23	NSA951-9	8/9	107	10	2.8	3.0	36.7	17.0	0.75	.2-1	2.00	.2-4
24	(B406 x Rio)(6098,9)	8/18	89	11	2.4	3.0	16.7	10.1	0.25	.2-.5	0.50	.2-1
25	599-6(9242)	8/11	97	13	2.6	2.4	18.3	10.1	0.75	.2-1	0.85	.2-1

Continued

Table 8.7. Continued

Entry No.	Designation	Date of 50% bloom	Plant height, cm	Head exser-tion, cm	Leaf and plant death [2]	Desir-ability [3]	Lodging (%) [4] Date I	Lodging (%) [4] Avg. [5]	Charcoal rot [6] 1975 Rating	Charcoal rot [6] 1975 Range	Charcoal rot [6] 1973 [7] Rating	Charcoal rot [6] 1973 [7] Range
26	(SC56 x SC170)(1579)	8/3	109	15	2.8	3.0	53.3	24.8	0.65	.2-1	1.05	.8-2
27	SC423-9	8/11	108	9	3.7	3.5	96.7	80.6	2.10	1-5	2.48	.5-5
28	SC599-6(9188)(55)	8/15	114	14	2.4	3.2	65.0	33.3	0.40	.2-.8	0.75	.2-2.5
29	SC599-6(9188)(56)	8/13	108	12	2.4	3.2	50.0	38.3	0.35	.2-.8	0.75	.2-2.5
30	SC599-6(9247)(36)	8/11	102	14	2.8	2.7	41.7	14.8	0.80	.2-2.5	0.61	.2-1
31	SC599-6(9247)(37)	8/11	101	13	2.9	2.7	35.0	13.2	0.60	.2-1	0.61	.2-1
32	BTx378(Redlan)	8/16	116	5	2.7	3.4	83.3	82.5	1.40	.5-3	1.87	1-5
33	Tx7000(Caprock)	8/13	114	15	3.4	3.5	66.7	70.4	1.25	.5-2.5	-	-
34	Tx7078	8/2	101	10	3.5	3.8	100.0	98.2	1.60	1-5	1.75	1-4.5
35	New Mexico-31	8/9	108	13	2.8	3.7	90.0	33.9	1.00	.8-1	1.70	.2-5
36	BTx399(Wheatland)	8/10	100	6	3.3	3.0	83.3	52.0	1.50	.8-3.5	1.58	.2-5

1/ Data from Lubbock Date I unless specified otherwise.

2/ Rated on 1-5 scale. 1 = no leaf or plant death; 5 = dead.

3/ Rated on 1-5 scale. See IDIN note taking instructions. Data taken 3/2/76, after lodging occurred.

4/ Primarily weak neck and after freeze stalk breakage. Some moisture stress. Lubbock Date I notes taken 3/1/76.

5/ Average of 1975 tests, Lubbock Date I, Date II, and Dryland.

6/ Rated on 1-5 scale. See IDIN note taking instructions. Five inocculated plants per replication.

7/ Average from Lubbock Date I and Lubbock Dryland, 1973.

Table 8.8. Lodging and charcoal rot data from the Hybrid Lodging Test (HLT), Lubbock, Date I, and Halfway, 1975.

Entry no.	Designation	Date of 50% bloom		Leaf and plant death[1]		Lodging % [2]				Charcoal rot[4]		Grain yield[5], kg/ha
		Halfway	Lubbock I	Halfway	Lubbock I	Halfway 11/4	Lubbock I 10/31	Lubbock I 12/2	Avg.[3]	Halfway	Lubbock I	
1	A599 x SC170-6-17	7/30	8/10	3.3	3.6	0	1	63	33	4.0	1.6	6590
2	A599 x Tx7000	8/4	8/4	4.5	3.0	15	10	100	95	4.3	2.3	6120
3	A599 x Tx2536	8/2	8/3	4.7	3.2	63	15	93	89	4.0	2.6	6800
4	A(406 x Rio) x Tx2536	8/2	8/4	0	3.5	0	4	96	89	0.0	2.0	6120
5	A(56 x 110) x Tx2536	7/30	7/31	4.8	4.8	90	85	100	99	4.6	2.3	5340
6	A599 x TAM428	8/2	8/7	4.9	4.0	32	35	100	98	3.9	3.6	7850
7	A(56 x 33) x TAM428	8/2	8/7	4.2	3.4	13	3	100	95	3.4	3.2	8160
8	A599 x SC56-14	8/7	8/7	3.4	2.8	0	0	94	67	2.8	1.1	7120
9	A599 x NSA440	8/10	8/11	3.3	3.3	0	2	76	61	3.8	1.5	6690
10	A(406 x Rio) x NSA440	8/9	8/4	3.4	3.1	0	1	95	57	3.8	2.1	6690
11	A(56 x 110) x NSA440	8/10	8/11	4.4	4.0	0	0	90	46	4.1	3.1	6750
12	A(599 x 134) x NSA440	8/10	8/11	3.1	3.0	3	2	50	26	3.3	1.7	6590
13	A618 x NSA935	7/31	8/3	4.5	3.1	70	2	100	100	3.8	2.1	7060
14	A(599 x 134) x Tx2536	8/2	8/4	3.0	3.0	10	0	97	91	3.4	1.5	7530
15	A(56 x 33) x NSA440	8/14	8/15	3.0	2.8	0	0	18	9	3.5	1.9	6440
16	A399 x (599 x 134)(1880)	8/3	8/3	4.5	3.1	5	1	97	98	4.4	1.5	6590
17	A378 x NSA356	8/7	8/7	2.5	2.2	0	0	92	43	1.7	1.4	5022
18	A618 x SC56-6	7/30	8/7	3.0	2.5	0	0	92	60	2.1	1.9	5650
19	A618 x SC599-6(9054)	7/31	8/3	3.8	2.8	30	7	99	96	4.6	3.1	6591
20	A618 x SC599-6(9189)	8/2	8/5	3.2	2.6	4	0	98	86	1.9	1.0	6280
21	A378 x SC599-6(9242)	8/3	8/4	4.3	3.0	35	1	96	87	2.9	2.3	7530
22	A618 x SC599-6(9245)	7/30	8/4	4.0	2.5	35	2	100	98	4.4	1.9	7850
23	A618 x SC599-6(9249)	7/30	8/4	4.5	3.3	70	15	100	96	3.7	2.0	6590
24	A618 x (P407x)-14(558)	8/5	8/9	3.4	2.9	5	2	90	73	4.4	2.9	7630
25	A618 x (P407x)-33(637)	8/1	8/4	3.2	2.9	9	2	95	92	3.5	1.9	6180

continued

Table 8.8. Continued

Entry no.	Designation	Date of 50% bloom		Leaf and plant death[1]		Lodging % [2]				Charcoal rot[4]		Grain yield[5], kg/ha
		Halfway	Lubbock I	Halfway	Lubbock I	Halfway 11/4	Lubbock I 10/31	Lubbock I 12/2	Avg.[3]	Halfway	Lubbock I	
26	A618 x (P407x)-62(709)	8/1	8/4	3.7	2.9	2	1	94	86	3.6	1.9	7530
27	A618 x (56x170)(1578)	8/2	8/5	4.5	3.0	43	2	97	86	3.3	1.9	6910
28	A618 x (56x170)(1579)	7/28	7/31	3.8	2.9	20	7	100	95	3.7	1.2	7220
29	A618 x (56x170)(1584)	8/7	8/11	4.0	3.3	0	7	95	83	3.8	2.4	7320
30	A618 x (56x170)(1587)	8/2	8/9	4.9	2.8	8	0	75	67	4.1	1.9	6750
31	A618 x (56x170)(1588)	8/3	8/9	3.3	2.8	5	0	96	76	2.9	1.9	7850
32	A618 x (56x170)(1589)	8/7	8/9	4.3	3.3	0	1	94	68	3.5	1.9	6690
33	A618 x (56x170)(1922)	8/2	8/7	3.9	3.1	12	2	93	94	3.9	3.2	7010
34	A618 x (56x33)(1778)	8/7	8/10	3.4	2.7	0	0	91	49	3.9	1.8	8790
35	A378 x (56x33)(1778)	8/15	8/17	2.5	2.8	0	0	80	31	1.8	1.3	7380
36	A618 x (56x33)(1786)	8/6	8/10	4.0	3.4	0	0	58	33	4.2	1.7	6180
37	A618 x (56x33)(1792)	8/5	8/7	3.0	2.7	0	0	88	65	2.6	1.0	7120
38	A618 x (56x33)(1793)	8/7	8/7	3.7	2.7	0	0	95	92	3.6	1.0	8060
39	A618 x (56x33)(1794)	8/5	8/10	3.2	3.0	0	1	75	41	2.3	2.4	7530
40	A618 x (599x134)(1887)	8/5	8/4	3.2	3.5	0	1	98	97	4.0	1.2	6120
41	A618 x NSA1603	8/4	8/8	3.3	3.1	1	-	95	91	4.1	1.6	6120
42	A618 x NSA926	8/5	8/5	4.0	4.2	13	2	93	53	3.8	4.2	6435
43	A378 x (P407x)-48(668)	8/16	8/18	2.9	3.2	3	3	94	50	3.3	2.7	7690
44	A618 x (P407x)-63(722)	8/4	8/5	3.5	2.8	10	0	100	85	1.6	1.3	5960
45	A378 x (56x170)(1577)	8/3	8/3	4.5	2.7	25	0	98	98	4.2	1.6	4710
46	A618 x (173x56)(1600)	8/7	8/9	4.0	3.1	0	1	96	80	4.9	1.5	8480
47	A618 x (599x134)(1886)	8/2	8/6	3.5	2.5	5	2	94	74	2.3	1.7	5960
48	A618 x (599x134)(1888)	8/1	8/7	2.8	2.7	0	0	94	53	2.8	1.5	5180
49	A618 x SC599-6(9052)	7/29	7/31	2.8	3.0	3	5	100	98	1.0	2.0	6910
50	A618 x SC33-6	8/5	8/6	3.2	3.3	0	0	95	57	3.8	2.2	5340
51	A618 x SC35-6	8/1	8/5	2.9	2.6	0	3	97	91	3.5	1.0	7120
52	A399 x SC35-6	8/9	8/8	3.3	2.7	0	0	73	40	4.5	1.6	6280
53	A618 x SC56-14	7/30	8/4	3.0	2.5	3	0	93	92	1.9	1.1	7430
54	A618 x SC170-6(4252)	8/3	8/3	3.2	3.2	5	0	100	99	4.4	1.8	8320
55	A399 x SC170-6(4252)	7/30	8/4	4.8	3.5	30	5	97	92	3.6	1.5	8000

continued

Table 8.8. Continued

Entry no.	Designation	Date of 50% bloom		Leaf and plant death[1/]		Lodging %[2/]				Charcoal rot[4/]		Grain[5/] yield, kg/ha
		Halfway	Lubbock I	Halfway	Lubbock I	Halfway 11/4	Lubbock I 10/31	Lubbock I 12/2	Avg.[3/]	Halfway	Lubbock I	
56	A618 x SC170-6-17(4267)	8/1	8/2	4.2	3.4	45	23	100	99	3.2	2.4	7120
57	A399 x SC170-6-17(4267)	8/5	8/6	4.3	3.2	8	2	95	96	4.5	1.1	4710
58	A618 x SC237(-9,-6)	7/30	8/4	3.6	2.8	3	0	99	78	2.8	1.3	7690
59	A378 x SC237(-9,-6)	8/8	8/9	3.3	4.3	0	1	96	61	3.9	3.6	6380
60	A618 x SC326-6	8/3	8/6	3.8	3.1	10	3	96	89	4.7	2.9	6800
61	A378 x SC326-6	8/10	8/11	4.8	4.2	3	4	93	85	3.7	3.4	6440
62	A618 x SC599-6(9188)	7/31	8/3	4.2	2.9	60	12	100	94	4.8	1.6	6590
63	A378 x SC599-6(9188)	8/9	8/8	4.7	3.8	48	15	100	97	4.3	3.7	7096
64	A399 x SC599-6(9188)	8/4	8/5	3.5	2.8	0	2	100	94	2.5	3.3	6750
65	A618 x SC599-6(9247)	7/30	8/1	3.5	2.8	6	37	100	100	3.6	2.6	6070
66	A378 x SC599-6(9247)	8/4	8/4	4.4	3.6	50	23	100	98	3.9	3.5	6590
67	A399 x SC599-6(9247)	7/31	8/6	5.0	3.9	45	5	98	95	4.9	1.5	6280
68	A618 x NSA440	8/2	8/6	3.4	3.8	0	0	94	79	4.6	4.2	7430
69	A378 x NSA 440	8/8	8/13	4.4	3.9	1.5	-	99	87	4.8	2.7	4870
70	A618 x NSA443	8/1	8/4	4.3	3.1	8	3	99	95	4.2	3.9	6490
71	A618 x NSA 637	7/31	8/3	4.0	3.4	3	6	100	97	4.2	3.1	5750
72	A618 x NSA681	8/2	8/5	4.7	3.9	15	7	77	68	4.4	4.4	5860
73	A618 x NSA817	7/30	8/2	4.7	4.0	50	17	99	98	4.5	2.9	7630
74	A618 x NSA817	7/29	8/2	3.8	3.2	10	2	90	94	3.3	1.4	6490
75	A618 x (406xRio)	8/1	8/5	3.4	2.3	0	0	93	78	2.4	1.1	5750
76	A378 x (406 x Rio)	8/8	8/8	3.8	4.4	1	4	100	68	3.9	3.2	5180
77	A618 x (P407x)-47(670)	8/5	8/11	4.3	3.1	9	0	88	73	4.1	2.1	8260
78	A618 x (56x33)(1790)	8/7	8/6	3.0	2.8	0	0	87	47	2.3	0.9	6910
79	A399 x (56x33)(1790)	8/14	8/9	2.8	2.6	0	0	40	17	2.5	0.9	5650
80	A620 x SC423-9	7/31	8/3	4.8	3.5	92	45	100	100	2.2	3.8	3920
81	TAM 670	7/30	8/1	4.7	3.7	73	51	100	100	4.4	3.8	5340
82	TAM 680	8/1	8/3	4.3	3.3	80	3	100	100	3.1	2.8	7320
83	HT 124	8/7	8/3	4.3	4.1	28	28	99	98	4.3	4.4	5964
84	WAC 694	8/1	8/4	3.5	4.6	20	92	99	100	4.4	3.0	6180
85	RS 671	7/31	8/3	4.1	2.6	49	6	100	99	4.0	2.5	7010

Continued

Table 8.8. Continued

Entry no.	Designation	Date of 50% bloom		Leaf and plant death[1]		Lodging % [2]				Charcoal rot[4]		Grain yield, kg/ha[5]
		Halfway	Lubbock I	Halfway	Lubbock I	Halfway 11/4	Lubbock I 10/31	Lubbock I 12/2	Avg.[3]	Halfway	Lubbock I	
86	NK 266	7/29	8/1	4.4	3.8	80	18	98	90	4.4	1.7	5340
87	RS 610A	7/29	7/31	3.9	3.4	23	21	100	99	3.1	2.8	5960
88	A399 x TAM 2567	8/9	8/5	4.3	3.4	10	2	92	90	4.7	2.9	6591
89	A399 x TAM 2568	8/2	8/1	4.8	3.5	13	30	100	99	4.0	4.2	6800
90	A399 x TAM 428	8/2	8/3	4.8	3.7	33	1	100	94	4.9	2.9	7006

1/ Rated on 1-5 scale: 1 = no leaf or plant death, 5 = dead. Death due primarily to moisture stress.

2/ Primarily weak neck and stalk breakage. Lodging at Halfway on 11/4 and Lubbock Date I on 10/31 was prior to a freeze and was moisture stress induced lodging. The difference between Lubbock Date I, 10/31 and 12/2 was after-freeze stalk breakage due to strong winds.

3/ Average from Lubbock I on 12/2, Lubbock Date II, and Lubbock Dryland.

4/ Rated on 1-5 scale: See IDIN note taking instructions. Average of five inoculated plants per replication.

5/ Lubbock Date I.

Table 8.9. Agronomic data from the Hybrid Lodging Test, 1975.

Entry no.	Designation	Plant height, cm [1/]	Head exsertion, cm [1/]	Leaf and plant death [2/]			Desirability [3/]					Lodging % [4/]		
				Lubbock II	Lubbock Dry	Lubbock Grub	Halfway	Lubbock I	Lubbock II	Lubbock Dry	Lubbock Grub	Lubbock II	Lubbock Dry	Lubbock Grub
1	A599 x SC170-6-17	130	23	3.5	3.4	0	1.9	1.8	2.3	2.7	0	20	18	-
2	A599 x Tx7000	130	33	3.4	3.5	0	0	2.4	2.8	0	0	90	95	-
3	A599 x Tx2536	130	30	3.1	3.2	3.1	2.9	3.0	0	0	0	93	82	95
4	A(406 x Rio) x Tx2536	114	30	4.0	2.7	0	2.2	3.0	0	0	0	80	93	-
5	A(56 x 110) x Tx2536	124	13	4.0	0	0	3.5	4.0	0	0	0	98	-	-
6	A599 x TAM428	135	23	3.3	3.5	0	3.0	2.4	2.1	0	0	97	97	-
7	A(56 x 33) x TAM428	132	24	3.3	3.8	0	2.5	2.7	0	0	0	88	98	-
8	A599 x SC56-14	140	30	3.1	2.5	3.3	2.1	2.8	3.0	2.8	0	45	62	93
9	A599 x NSA440	125	25	3.0	2.9	3.7	2.3	2.0	2.6	2.7	2.8	38	69	75
10	A(406 x Rio) x NSA440	119	27	3.2	2.4	3.5	2.8	2.0	2.8	3.0	2.3	16	37	40
11	A(56 x 110) x NSA440	119	24	3.5	3.2	0	2.4	2.7	2.8	2.8	0	17	31	
12	A(599 x 134) x NSA440	112	30	0	2.5	0	2.9	2.0	0	2.0	0	-	20	-
13	A618 x NSA935	130	36	2.8	2.9	0	3.5	2.8	0	0	0	100	100	-
14	A(599 x 134) x Tx2536	124	27	3.0	2.5	0	2.5	2.2	0	0	0	85	92	-
15	A(56 x 33) x NSA440	124	17	2.5	2.8	0	2.2	1.9	2.4	2.0	0	0	2	-
16	A399 x (599 x 134)(1880)	124	29	0	3.0	0	2.7	2.6	0	0	0	-	98	-
17	A378 x NSA356	115	11	2.9	2.4	3.1	3.1	3.2	0	3.2	3.2	3.7	33	85
18	A618 x SC56-6	131	23	3.0	2.7	0	3.4	3	2.9	3.1	0	48	40	-
19	A618 x SC599-6(9054)	131	28	2.9	3.1	0	2.7	2.6	0	0	0	92	97	-
20	A618 x SC599-6(9189)	135	26	2.8	3.4	3.0	2.8	2.8	3.0	0	0	68	92	94
21	A378 x SC599-6(9242)	124	25	3.0	2.3	0	3.2	2.9	0	0	0	70	95	-
22	A618 x SC599-6(9245)	128	33	2.8	3.0	0	3.0	2.8	0	0	0	99	97	-
23	A618 x SC599-6(9249)	126	30	3.0	2.7	0	3.4	2.8	0	0	00	93	97	-
24	A618 x (P407x)-14(558)	131	23	2.6	2.4	0	2.7	2.9	2.7	2.9	0	55	75	-
25	A618 x (P407x)-33(637)	135	31	2.9	2.5	2.9	2.6	3	0	0	0	86	97	97

Continued

Table 8.9. Continued

Entry no.	Designation	Plant height, cm 1/	Head exsertion, cm 1/	Leaf and plant death 2/			Desirability 3/					Lodging % 4/		
				Lubbock II	Lubbock Dry	Lubbock Grub	Halfway	Lubbock I	Lubbock II	Lubbock Dry	Lubbock Grub	Lubbock II	Lubbock Dry	Lubbock Grub
26	A618 x (P407x)-62(709)	140	28	2.8	2.7	3.5	2.5	2.8	0	2.7	0	77	88	93
27	A618 x (56x170)(1578)	136	25	3.0	2.5	0	3.3	3	0	0	0	90	70	-
28	A618 x (56x170)(1579)	146	31	3.2	2.9	3.3	3.1	3	0	0	0	87	100	95
29	A618 x (56x170)(1584)	133	19	3.4	2.7	3.1	2.5	2.4	2.6	0	2.6	68	87	65
30	A618 x (56x170)(1587)	116	17	3.0	2.7	0	2.9	2.9	2.6	2.9	0	73	53	-
31	A618 x (56x170)(1588)	135	25	2.8	2.8	3.0	2.4	2.5	2.7	2.8	2.9	63	68	85
32	A618 x (56x170)(1589)	125	20	2.9	2.5	3.4	2.6	2.9	2.8	2.8	2.7	62	48	73
33	A618 x (56x170)(1922)	136	23	2.9	3.8	0	2.5	2.8	0	0	0	93	98	-
34	A618 x (56x33)(1778)	136	21	2.9	2.7	3.6	2.9	2.3	2.6	2.4	2.8	30	27	80
35	A378 x (56x33)(1778)	132	5	2.7	2.4	0	2.6	2	3	3.3	0	4	8	-
36	A618 x (56x33)(1786)	119	19	3.3	2.7	3.3	3.1	2.8	2.7	2.9	2.7	18	21	43
37	A618 x (56x33)(1792)	138	21	3.1	2.4	3.2	2.4	2.5	2.6	3.0	2.7	43	63	83
38	A618 x (56x33)(1793)	140	17	2.8	2.9	3.4	2.9	2.4	0	2.9	2.4	90	90	92
39	A618 x (56x33)(1794)	137	25	3.0	2.5	0	2.7	2.8	2.5	2.9	0	25	23	-
40	A618 x (599x134)(1887)	144	21	2.8	2.4	0	2.4	2.7	0	0	0	96	98	-
41	A618 x NSA1603	142	19	3.0	2.9	0	3.1	3	0	0	0	90	88	-
42	A618 x NSA926	112	19	3.1	2.6	0	2.7	2.8	0	3.0	0	30	35	-
43	A378 x (P407x)-48(668)	149	19	2.8	2.2	0	2.8	1.7	0	2.8	0	15	43	-
44	A618 x (P407x)-63(722)	142	28	2.8	2.5	0	2.6	2.9	0	0	0	95	60	-
45	A378 x (56x170)(1577)	126	14	3.0	3.8	0	3	2.8	0	0	0	100	95	-
46	A618 x (173x56)(1600)	156	25	3.0	2.9	0	3	2.8	0	2.8	0	70	74	-
47	A618 x (599x134)(1886)	132	25	3.2	2.8	0	2.7	2.7	2.7	0	0	40	89	-
48	A618 x (599x134)(1888)	122	18	2.5	2.8	0	2.8	2.3	2.7	2.5	0	45	20	-
49	A618 x SC599-6(9052)	149	28	3.3	2.3	0	0	3.2	0	0	0	95	100	-
50	A618 x SC33-6	124	30	3.1	2.9	3.0	2.7	2.4	2.6	2.8	2.8	44	33	50
51	A618 x SC35-6	149	36	2.8	2.5	0	2.7	2.4	0	0	0	88	89	-
52	A399 x SC35-6	124	24	3.3	2.7	0	2.2	2.1	2.5	2.9	0	25	21	-
53	A618 x SC56-14	151	32	2.8	2.6	2.5	2.9	2.8	0	0	0	87	95	100
54	A618 x SC170-6(4252)	157	30	2.5	2.9	0	2.3	2.8	0	0	0	98	100	-
55	A399 x SC170-6(4252)	131	28	3.5	1.8	0	2	2	0	2*	0	85	95	

Continued

Table 8.9. Continued

Entry no.	Designation	Plant height, cm [1/]	Head exsertion, cm [1/]	Leaf and plant death [2/]			Desirability [3/]					Lodging % [4/]		
				Lubbock II	Lubbock Dry	Lubbock Grub	Halfway	Lubbock I	Lubbock II	Lubbock Dry	Lubbock Grub	Lubbock II	Lubbock Dry	Lubbock Grub
56	A618 x SC170-6-17(4267)	138	30	3.1	3.4	3.2	3.1	3	0	0	0	98	100	100
57	A399 x SC170-6-17(4267)	121	27	3.3	0	0	2.3	2.5	0	0	0	96	-	-
58	A618 x SC237(09,-6)	135	24	2.9	2.6	2.9	3	2.8	0	0	0	50	86	95
59	A378 x SC237(-9,-6)	114	21	3.7	2.5	0	2.7	2.7	0	0	0	40	48	-
60	A618 x SC326-6	126	31	3.2	3.3	3.5	3	2.8	0	0	0	89	83	96
61	A378 x SC326-6	117	25	3.8	3.5	0	3.1	2.7	0	0	0	67	94	-
62	A618 x SC599-6(9188)	137	30	2.7	3.1	2.9	3.2	3	0	0	0	83	98	100
63	A378 x SC599-6(9188)	136	25	3.1	2.8	3.2	3.0	3.0	0	0	0	94	97	97
64	A399 x SC599-6(9188)	135	30	3.3	2.6	0	2.3	2.8	0	0	0	90	93	-
65	A618 x SC599-6(9247)	133	31	3.0	3.5	2.9	2.9	3	0	0	0	100	99	100
66	A378 x SC599-6(9247)	132	26	3.8	3.4	3.0	2.9	3	0	0	0	95	99	98
67	A399 x SC599-6(9247)	116	27	0	3.6	0	3.5	2.9	0	0	0	0	93	-
68	A618 x NSA440	126	34	3.3	3.3	3.4	2.5	2.7	2.6	2.6	2.8	62	92	85
69	A378 x NSA440	126	20	3.4	2.8	0	2.4	2.2	0	3	0	85	78	-
70	A618 x NSA443	127	25	3.7	3.4	2.9	2.9	3.1	0	0	2.9	92	95	85
71	A618 x NSA637	121	25	3.1	3.1	3.5	3.6	4.5	0	0	0	94	98	99
72	A618 x NSA681	115	22	3.5	3.2	3.4	3.1	1	0	3.1	2.8	73	55	60
73	A618 x NSA817	119	30	3.7	3.4	3.7	3.4	3.5	0	0	0	91	97	90
74	A618 x NSA837	119	29	3.9	3.4	3.2	3.2	3	0	0	0	98	95	90
75	A618 x (406xRio)	116	26	3.3	2.5	3.2	3.2	2.4	0	0	2.5	70	70	88
76	A378 x (406xRio)	112	22	3.1	3.1	0	2.6	2.9	3	2.9	0	30	75	-
77	A618 x (P407x)-47(670)	153	37	2.8	2.7	3.4	2.9	2.4	2.7	3.0	2.7	73	57	90
78	A618 x (56x33)(1790)	138	25	3.2	2.4	2.5	2.2	2.5	2.5	2.1	2.3	85	18	33
79	A399 x (56x33)(1790)	124	15	2.8	2.4	0	2.7	2.2	2.8	2.3	0	4	8	-
80	A620 x SC423-9	168	25	2.9	3.0	0	3.9	4	0	0	0	100	100	0
81	TAM 670	140	26	3.3	3.1	3.4	3.8	3.3	0	0	0	99	100	100
82	TAM 680	152	25	3.5	3.8	3.9	3.1	3.0	0	0	0	99	100	100
83	HT 124	115	28	4.3	3.6	3.9	2.9	3.5	0	0	0	96	99	99
84	WAC 694	130	20	3.4	3.2	3.8	2.1	4.0	0	0	2.5	100	100	90
85	RS 671	128	20	3.5	2.9	3.5	3.4	3.5	0	0	0	99	99	100

Continued

Table 8.9. Continued

Entry no.	Designation	Plant height[1/], cm	Head exser-tion[1/], cm	Leaf and plant death[2/]			Desirability[3/]					Lodging % [4/]		
				Lubbock II	Lubbock Dry	Lubbock Grub	Halfway	Lubbock I	Lubbock II	Lubbock Dry	Lubbock Grub	Lubbock II	Lubbock Dry	Lubbock Grub
86	NK 266	130	27	3.8	2.8	3.4	3.5	3.1	0	0	0	79	92	98
87	RS 610A	130	25	3.8	2.9	2.7	3.3	3.7	0	0	0	98	99	99
88	A399 x TAM2567	109	17	3.2	2.8	3.0	2.9	3.0	0	0	0	88	91	88
89	A399 x TAM2568	120	30	3.8	3.5	3.8	3.5	3.5	0	0	0	99	99	100
90	A399 x TAM428	130	25	3.8	3.6	3.7	2.8	3.0	0	0	0	83	99	99
91	A618 x NSA818	122	28	3.5	2.8	0	0	3.0	0	0	0	90	90	-
92	A618 x NSA951	132	28	3.8	3.0	0	0	2.9	0	0	0	95	80	-
93	A618 x SA9101	119	30	4.0	3.5	0	0	4.0	0	0	0	99	98	-
94	A618 x NSA 548	126	17	2.9	2.3	0	0	3.0	2.9	3	0	17	25	-
95	A378 x SC599-6(9054)	131	30	3.3	3.4	3.5	0	2.8	0	0	0	92	94	98
96	A378 x SC170-6(4267)	125	26	3.7	2.8	3.8	0	3.1	0	0	0	81	98	100
97	A378 x (56x33)(1790)	137	21	2.8	2.4	2.9	0	3.7	2.9	2.8	2.3	35	12	83

1/ Lubbock Date I.

2/ Rated on 1-5 scale. 1 = no leaf or plant death, 5 = dead.

3/ Rated on 1-5 scale. See IDIN note taking instructions. Lubbock I, II, Dry, and Grub data taken late, after lodging occurred.

4/ Primarily weak neck and after freeze stalk breakage. Lodging notes taken Lubbock II 12/3, Lubbock Dry 12/5 and Lubbock Grub 12/4.

C-9. Population Breeding

Several random mating populations containing elite sources of disease resistance, insect resistance, and elite United States germplasm have been developed. The populations use $\underline{ms}_3$ as a source of genetic male sterility.

Each population is grown in isolation from other sorghum in a block with from 3,000 to 5,000 plants. Male sterile plants are identified at flowering time and a colored tag placed in the tip of each sterile head. At harvest, each tagged plant is harvested and threshed individually. Equal quantities of seed are then massed to produce seed for the next cycle of random mating.

The populations and their primary objectives are listed in Table 9.1. The insect resistant populations, TP1R and TP8R are discussed in detail in sections D-1 and D-2, respectively.

Listed below is the status of each population:

TP1R - released and distributed in 1975 after four random matings.

$TP1R1_2$ - this revised version of TP1R received second random mating in 1975--will be random mated again in 1976.

$TP2RO_3$ - received third random mating in 1975--plan to release and distribute.

$TP3RO_4$ - plan to release and distribute.

$TP4RO_4$ - grown and mass selected at three locations under four environments--each recombined and now being random mated in Puerto Rico.

$TP5RB1_0$ - this revised version of TP5RB0 was random mated for first time in 1975--will be random mated again in 1976.

$TP6B0_4$ - plan to release and distribute.

$TP7B0_3$ - received third random mating at Chillicothe in 1975--plan to release and distribute.

TP8R - released and distributed in 1975.

$TP9R0_3$ - grown in 1975 and lodging resistant S_1 and 1/2 sib plants selected for screening with Pythium and under natural lodging in 1976.

$TP10R0_2$ - grown in 1975 for MDM inoculation, but failed to get it inoculated--will be inoculated and resistant plants allowed to random mate in 1976.

$TP11R0_3$ - random mated in 1975--released and distributed in late 1975.

$TP12R0_1$ - random mated in 1975--will be random mated again in 1976.

$TP13B0_1$ - random mated in 1975 at Chillicothe--being random mated in Puerto Rico--will receive third random mating in 1976.

$TP14R0_1$ - random mated in 1975--being random mated in Puerto Rico--will receive third random mating in 1976.

In 1975, 200 randomly selected plants each from TP3, TP6 and TP7 were evaluated for level of head smut and downy mildew resistance in the Berclair Downy Mildew Nursery (Table 9.2). These data indicate that TP7 has a higher level of resistance to both smut and mildew than TP6, as anticipated by the makeup of the population. Also, TP3 had a surprisingly high level of downy mildew resistance.

Also grown in 1975 were S_1 rows which had been selected under disease conditions the previous year (Table 9.2). Although not directly comparable since they were grown in different nurseries, it appears that it is easier to shift resistance to downy mildew than for head smut. A very high proportion of S_1 rows from the selected S_1's had mildew resistance, while there was little difference in smut between the random selections and those selected under disease pressure.

Selections from various populations are outstanding for lodging resistance, insect and disease resistance, grain weathering resistance, and yield. We plan to continue to use populations as a breeding tool to handle large quantities of germplasm. We will continue to attempt to improve various populations by either mass selection, S_1 or 1/2 sib testing, or inoculation and then selectively removing susceptible plants before random mating.

Table 9.1. Texas sorghum populations in various stages of development

Designation	Male sterile gene	Number component lines	Description
TP1R	ms_3	26(5 gb res)	Greenbug resistant (disease resistant x greenbug resistant)
TP1R1	ms_3	-	Greenbug-disease resistant (TP1R x disease resistant)
TP2R	ms_3	33	Multiple disease resistant
TP3R	ms_3	38(21 dm res)	Downy mildew resistant
TP4R	ms_3	37	General source
TP5RB1	ms_3	-	Broad base (converted lines)
TP6B	ms_3	25	Standard B line (some part. conv. B x Doggett B)
TP7B	ms_3	-	Disease resistant B (TP6 x zerazera deriv. B)
TP8R	ms_3	67	Midge resistant
TP9R	ms_3	64	Lodging resistant
TP10R	ms_3	-	MDM resistant (QL source) (QL1,2xTP1,2,3,4,5,9)
TP11R	ms_3	-	Twin seeded (TP4 x twin seed)
TP12R	ms_3	-	High lysine (SC 1030 source)
TP13B	ms_3	-	Waxy endosperm B line
TP14R	ms_3	-	Waxy endosperm R line

Table 9.2 Frequency of random and selected S_1 progeny from various random mating populations with resistance to head smut and downy mildew.

Population selected from	Type of S_1 selection	Location of 1975 test	Number of S_1's selected	Number of S_1 rows: Susceptible to smut and downy mildew	Susceptible to smut, resistant to downy mildew	Resistant to smut, susceptible to downy mildew	Resistant to both smut and downy mildew	Percentage of S_1 rows resistant to: Downy mildew	Head smut	Both
TP_3RO_3	Random at Lubbock	Berclair downy mildew nursery	200	37	29	68	66	47	67	33
TP_7RO_2	"	"	231	57	54	34	86	61	52	37
TP_6RO_3	"	"	199	88	32	41	38	35	40	19
TP_2RO_2	Plants resistant to both smut and mildew--Berc.H.S.-1974	Beeville head smut nursery	44	4	21	2	17	86	43	39
TP_3RO_2	"	"	21	2	6	0	13	90	62	62
TP_4RO_2	"	"	64	6	22	5	31	83	56	48
TP_7RO_1	"	"	152	37	69	4	42	73	30	28

Pythium Root Rot

During 1975, 120 S_1 selections from $TP9RO_3$ were evaluated for reaction to *Pythium graminicola*. Seedlings were grown in sand culture for 20 days, and inoculated with mycelial mats of *P. graminicola*. Each line was evaluated for plant growth, root rot, root growth and crown rot. Combinations of low root rot, good root and plant growth were used primarily in basing selection for use in developing Pythium root rot resistant TP9 population.

Table 9.3 Selected S_1 heads with low disease index.

Selection	Disease Index	Selection	Disease Index	Selection	Disease Index	Selection	Disease Index
$TP9RO_3$-6	2.6	$TP9RO_3$-51	2.6	$TP9RO_3$-86	2.0	$TP9RO_3$-114	2.3
$TP9RO_3$-13	2.1	$TP9RO_3$-58	2.3	$TP9RO_3$-87	2.0	$TP9RO_3$-115	2.1
$TP9RO_3$-14	2.5	$TP9RO_3$-59	2.6	$TP9RO_3$-88	1.7	$TP9RO_3$-120	1.5
$TP9RO_3$-15	1.9	$TP9RO_3$-62	2.0	$TP9RO_3$-89	1.7	B Tx3197	3.8
$TP9RO_3$-18	2.1	$TP9RO_3$-65	2.5	$TP9RO_3$-92	2.2	B Tx398	2.8
$TP9RO_3$-22	2.1	$TP9RO_3$-67	2.5	$TP9RO_3$-95	2.5	SC326-6	3.0
$TP9RO_3$-32	2.5	$TP9RO_3$-70	2.6	$TP9RO_3$-99	2.4	Tx2536	2.2
$TP9RO_3$-42	2.5	$TP9RO_3$-71	2.6	$TP9RO_3$-100	2.4		
$TP9RO_3$-44	2.4	$TP9RO_3$-75	2.6	$TP9RO_3$-101	2.1		
$TP9RO_3$-45	2.6	$TP9RO_3$-76	1.8	$TP9RO_3$-103	2.6		
$TP9RO_3$-47	1.4	$TP9RO_3$-77	1.4	$TP9RO_3$-104	1.7		
$TP9RO_3$-50	2.6	$TP9RO_3$-78	2.1	$TP9RO_3$-105	2.0		

The procedure of S_1 testing permits forming a new population without producing seed on diseased plants in the greenhouse. During 1976, the selected S_1's in Table 9.3 will be recombined and random mated to develop a new sub-population of TP9. This new population will then be compared with the original population to determine progress made in root rot resistance.

Tropical Adaptation

Several females were testcrossed to standard males and grown in 1975 to determine yield potential of the tropical adaptation characteristic. The females developed from the B Tx 3197 x SC 0170 cross show the greatest tropical adaptation. At Weslaco in Southern Texas the tropically adapted female by a standard male produced significantly greater yield than any commercial hybrid tested. At College Station, yields were generally better and similarly at Lubbock. Number of days to flower was greater at Weslaco and College Station for the tropical type hybrids when compared to standards but not at Lubbock (Table 9.4). More extensive tests will be carried out in 1976 to test for both tropical adaptation and combining ability.

Table 9.4 Yield of tropically adapted females grown at Weslaco, College Station and Lubbock in 1975.

Designation	Pedigree	Grain yield, kg/ha		
		Weslaco	College Station	Lubbock
	A Tx 378 x Tx 2536	2990	7010	7340
	A Tx 399 x Tx 2536	2340	5470	6940
RS 626	A Tx 3197 x Tx 414	1390	4580	5890
	74CS4417 x Tx 2536	4010	7290	-
	74CS5455 x Tx 2536	-	7510	-
	74CS5550 x Tx 2536	-	6310	7940

E. Seed Releases

Listed below are the sorghum lines or germplasm sources which have been released by the Texas Agricultural Experiment Station during the AID contract period, February 15, 1975 - February 14, 1976. Below them are listed sorghum materials which have been proposed for release, but have not yet been officially approved for release, or items which are now in the process of being prepared for release and should be submitted and approved before the 1976 spring planting time.

The releases are products of the overall Texas Agricultural Experiment Station sorghum improvement program. Much of the breeding was done prior to AID funding and some were developed primarily without AID funding. All are listed here, however, because they have relavence to the objectives of the AID contract.

Releases

TP1R - greenbug resistant population

TP8R - midge resistant population

TP11R - twin seed population

TAM 2574-TAM 2713 - 140 Gaines releases from Karper yellow endosperm breeding nursery

Tx 430 - downy mildew and head smut resistant zerazera - yellow endosperm male

Proposed or being prepared for release

Tx 2714 - Tx 2733 - disease resistant zerazera derivative restorer lines

Tx 2734 - Tx 2748 - greenbug resistant restorer lines

Tx 2749 - Tx 2752 - greenbug resistant A and B lines

Tx 2567 - Tx 2573 - lodging and charcoal rot resistant, mite resistant, disease resistant restorer lines

Tx 2753 - Tx 2757 - grain weathering resistant, Cercospora resistant, lodging resistant, high yield, disease resistant restorer lines

TAM Bk's - six downy mildew resistant sudan type bulks

TAM Bk's - eight downy mildew resistant forage type bulks

TP2R - multiple disease resistant population

TP6B - standard B-line population

TP7B - disease resistant B-line population

D. Insect and Mite Studies

D-1. Greenbug Resistance

PROGRESS IN BREEDING FOR GREENBUG RESISTANCE

The greenbug, [*Schizaphis graminum* (Rondani)], continues to be a major pest of sorghum. The continued spread of greenbugs that are resistant to commonly used insecticides has created an increasing need for host plant resistance in sorghum to greenbugs. Insecticide applications for greenbug control were very high throughout the Great Plains in 1975. Considerable concern was created in Brazil in 1975 (Carlos Rossetto, personal communication)

Germplasm Releases

The genetic male sterility gene, ms_3, from 'Coes' was backcrossed with Tx 411, Tx 412 and OKRY8. Genetic sterile plants from these three lines were used as females in crosses with disease resistant lines to provide the female parents in developing TP1R.

Equal quantities of seed from F_1 plants from each of the female parents were bulked and planted in an isolation block in alternate rows with a bulk of the greenbug resistant male parents. Male fertile plants in the female rows were cut from the row as soon as they could be identified, allowing crosses to occur only between the greenbug resistant male rows and the sterile plants in the female rows.

Male sterile plants were harvested from the female rows and equal quantities of seed were bulked from 1000 heads to produce TP1R. Equal quantities of seed from approximately 1000 heads were bulked after each random mating to produce the seed for

the next cycle of random mating. TP1R was random mated for the fourth time in 1974.

Greenhouse evaluation of 320 plants from TP1R indicate that approximately 38% of the plants are as resistant to the greenbug as TAM 2567. Since many of the lines composited to produce the original female parents of the population are disease resistant, TP1R should provide sorghum breeders with a single population containing greenbug resistance and disease resistance from several sources.

Most plants in TP1R are 3-dwarf but some 2-dwarf plants are present. Seed color ranges from white to brown. Maturity ranges from early to late. Approximately 50% of the plants are male sterile.

TP1R has been released and distributed to 42 breeders and entomologists in nine countries. This population provides breeders with greenbug resistance from six sources combined with elite disease resistant material. With the proper population breeding approach, sorghums combining high yield potential, greenbug resistance and disease resistance, can be developed from this population.

Greenbug resistance derived from SA 7536-1, IS 809 and KS 30 have been crossed into five standard sorghum varieties. Nineteen lines developed from this breeding program, designated Tx 2734 - Tx 2752, have been proposed for release and will boraden the germplasm base of available greenbug resistant lines while incorporating greenbug resistance into lines with improved

yield potential and disease resistance. The pedigree, description and agronomic data of these lines are presented in Table 1.

Effect of Greenbugs on Grain Yield of Resistant and Susceptible Hybrids:

Three commonly used susceptible hybrids, A Tx 399 x Tx 2536, A Tx 378 x Tx 2536 and TAM 680; and three greenbug resistant hybrids that will be grown by producers in 1976, A Tx 399 x TAM 2567, A Tx 399 x TAM 2568, and A Tx 378 x TAM 2567 were grown in replicated yield trials at several locations in 1975. Nine experimental hybrids were also included in the test.

Data from two of these tests are presented in Tables 2 and 3. Data from the Deaf Smith County test (Table 2) shows the yielding superiority of resistant hybrids produced with TAM 2567 and TAM 2568 when compared to these susceptible counterparts produced with Tx 2536 when greenbug populations are large and are not controlled.

In the Hale County test (Table 3) data are presented from a test receiving four applications of insecticide to control greenbugs. Grain yields and other agronomic data from this test illustrates that greenbug resistance has no adverse effect on grain yield or any of the other agronomic characters measured.

Population Breeding:

TP1R was grown under natural greenbug populations in the fields. One hundred thirty six greenbug resistant, 3-dwarf plants with good yield potential were selected. These selections

will be used to determine their disease resistance and to combine for additional cycles of random mating and selection.

Pedigree Breeding:

Replicated yield tests of hybrids made with advanced lines derived from crosses between greenbug resistant lines and TAM 2554, Tx 7000 and TAM 428 were conducted.

Grain yields and other agronomic data of the TAM 2554 derived lines compare favorably with the susceptible checks, TAM 680 and A 399 x Tx 2536 (Table 4). Most have the advantage of being shorter than the susceptible checks. Several have yields in excess of the resistant Tx 2536 derived checks, A 399 x 75PR 580, and A 399 x 75PR 601. The most promising of the lines used as pollinators have been selected for use in the breeding program.

Grain yield of hybrids produced with Tx 7000 derived greenbug resistant lines were much greater than their susceptible counterpart, A 378 x Tx 7000 (Table 5). The latter hybrid is very susceptible to maize dwarf mosaic (MDM) and its yield was reduced by both greenbugs and MDM. In developing the lines used in this test, greenbug resistance and MDM tolerance have been combined resulting in lines that will be valuable in future breeding programs.

TAM 428 is a downy mildew, smut resistant line with tolerance to MDM. Thus, crosses involving this line and greenbug resistant lines should produce material resistant or tolerant to all four pests. Grain yield data from the TAM 428 derived test (Table 6)

indicate that yield potential of the experimentals has been maintained or increased above both the susceptible and resistant check hybrids in the test. Additional testing will be done to determine the disease reaction of the experimental lines used as pollinators in this test.

Thirty eight F_2 populations from crosses among greenbug resistant sources and lines containing desirable characteristics such as mite resistance, lodging resistance, disease resistance, midge resistance and waxy endosperm were grown. Over 1000 selections were made from these populations that included both B and R line material. Several of the F_2 populations appeared to have outstanding yield potential. Selections from the populations will be entered in disease and insect nurseries in 1976 to determine their use in future breeding efforts.

Backcrosses to elite grain types containing $\underline{ms}_3$ were made from greenbug resistant plants selected from F_2 populations containing resistance from PI 15264, PI 220248, PI 302178, PI 302231, PI 226096 and Capbam. Backcrossing will continue with these sources until the resistance of each has been transferred into agronomically acceptable grain types. These materials will form the basic material for inheritance studies to determine if resistance is controlled by the same gene(s) in the sources presently available.

Table 1. Designation, pedigree and agronomic data for 23 greenbug resistant sorghums proposed for release

Designation	Source	Pedigree
Tx 2734	75L 2814,16,17,20,21,23	[TAM 2554 X [Tx 2536 X (Tx 7000 X SA 7536-1)F_3]-1-3-5-Bk
Tx 2735	75L 2825,27,29,31,33	["]-3-2-1-Bk
Tx 2736	75L 2839,41	["]-3-2-4-Bk
Tx 2737	75L 2843,45,47	["]-3-2-5-Bk
Tx 2738	75L 2859,61,63	[4 dw Tx 7000 X [Tx 7000 X (TAM 428 X IS 809)F_2]-7-6-2-Bk
Tx 2739	75L 2865,67	["]-7-10-Bk-Bk
Tx 2740	75L 2885,88	[TAM 428 X [Tx 2536 X (4 dw Tx 7000 X SA 7536-1)F_2]-26-1-Bk
Tx 2741	75L 2915,16	["]-2-1-2-Bk
Tx 2742	75L 2950	]-2-4-3-3
Tx 2743	75L 2975,76	]-2-4-8-4
Tx 2744	75L 2987,88	]-2-4-10-Bk
Tx 2745	75L 3001,04,06	]-16-1-Bk
Tx 2746	75L 3008,09,12	]-23-1-2-Bk
Tx 2747	75L 3013,14,17	]-30-5-Bk
Tx 2748	75L 3036,38	]-1-7-Bk
B Tx 2749	75L 1182,84	[B 4 dw 378 X [B Tx 378 X (4 dw 378 X KS 30)F_2]-7-7-2-3-Bk
A Tx 2749	A Tx 378 X	["]5
B Tx 2750	75L 1204,06,10,12,14	[B 4 dw 378 X [B Tx 378 X (4 dw 378 X KS 30)F_2]-7-7-3-3-Bk
A Tx 2750	A Tx 378 X	["]5
B Tx 2751	75L 1485,87,89	[B Tx 399 X [B Tx 378 X (4 dw 378 X KS 30)F_2]-23-3-3-Bk
A Tx 2751	A Tx 399	["]2
B Tx 2752	75L 1505,07	[B Tx 399 X [B Tx 378 X (4 dw 378 X KS 30)F_2]-23-5-3-Bk
A Tx 2752	A Tx 399	["]3

Continued

Table 1. Continued

Designation	Days to 50% bloom*	Plant height, cm	Head Exsertion, cm
Tx 2734	64 - 68	79 - 99	0.0 - 2.5
Tx 2735	62 - 67	102 - 112	4.8 - 7.6
Tx 2736	62 - 65	114 - 119	2.5 - 7.6
Tx 2737	64 - 66	107 - 112	4.8 - 7.6
Tx 2738	65 - 67	89 - 104	0.0
Tx 2739	67 - 68	107	2.5
Tx 2740	68 - 71	114 - 122	0.0 - 7.6
Tx 2741	64 - 66	81	0.0
Tx 2742	66	79	0.0
Tx 2743	67	81	0.0
Tx 2744	67 - 68	74	0.0
Tx 2745	67 - 68	81 - 89	0.0
Tx 2746	69 -	102 - 114	2.5 - 7.6
Tx 2747	68 - 72	81 - 99	0.0
Tx 2748	68 - 70	112	0.0
B Tx 2749	68 - 72	81	2.5
B Tx 2750	69 - 73	84 - 97	2.5
B Tx 2751	65 - 70	89 - 112	4.8
B Tx 2752	71	102 - 114	4.8

*Represents range in bloom dates of rows bulked.

Continued

Table 1. Continued

Designation	Epi-carp[1]	Meso-carp[2]	Endo-sperm[3]	Plant color[4]	Mid-rib[5]	Awns[6]	MDM[7]	Downy mildew[8]	Head smut[9]	Green-bug[10]	B or R reaction[11]
Tx 2734	wt	0	Y	P	2	A	4-5	-	-	2-3	R
Tx 2735	wt	0	Y	P	2	A	2-4	-	-	3	R
Tx 2736	wt	0	Y	P	2	A	2	-	-	3-4	R
Tx 2737	wt	0	Y	P	2	A	2-4	-	-	3-4	R
Tx 2738	R	++	N	P	2	A	2	-	-	3	R
Tx 2739	R	++	N	P	2	A	2	-	-	3	R
Tx 2740	wt	0	N	P	4	A	2	3	0	3	R
Tx 2741	wt	0	N	P	4	A	2-4	0	0	3-4	R
Tx 2742	wt	0	N	P	4	A	-	3	0	3	R
Tx 2743	wt	S	N	P	4	A	5	0	0	3-4	R
Tx 2744	wt	+	N	P	4	A	5	0	0	3	R
Tx 2745	wt	0	Y	P	4	A	5	1	1	3-4	R
Tx 2746	wt	0	Y	P	-	A	2-5	0	0	3-4	R
Tx 2747	wt	0	N	P	-	A	5	0	0	3-4	R
Tx 2748	wt	0	N		4	S	5	0	0	3	R
B Tx 2749	R	+	N	P	1-2	A	5	-	-	3-4	B
A Tx 2749	R	+	N	P	-	-	-	-	-	-	-
B Tx 2750	R	+	N	P	2-3	A	5	-	-	3-4	B
A Tx 2750	R	+	N	P	-	-	-	-	-	-	-
B Tx 2751	R	+	N	P	1-3	A	2	-	-	3-4	B
A Tx 2751	R	+	N	P	-	-	-	-	-	-	-
B Tx 2752	R	+	N	P	3	A	2	-	-	2-4	B
A Tx 2752	R	+	N	P	-	-	-	-	-	-	-

Continued

Table 1. Footnotes

[1]T = lack of color in epicarp; W = white, R = red.

[2]Mesocarp thickness ++ = thick, + = intermediate, 0 = thin, S = segregating.

[3]Y = yellow, N = normal.

[4]P = purple.

[5]Rating of 1-5: 1 = cloudy (juicy), 5 - white (dry).

[6]A = awns absent, S = segregating.

[7]Rating of MDMV reaction -- rated on 2-5 scale: 2 = leaves with mottling only, 3 = mottling and significant chlorosis, 4 = mottling and significant necrosis, 5 = necrosis accompanied by severe stunting or death.

[8]Number of systemically infected plants in one observation row at Berclair, Texas.

[9]Number of plants with head smut in one observation row at Berclair.

[10]Seedling greenbug damage rated on a 1 - 10 scale: 1 = no damage, 10 = dead plants. Ratings taken when susceptible checks were 10. TAM 2567 rows were rated 3-4 at this time.

[11]R = fertility restorer, B = non-restorer.

Table 2. Agronomic data of greenbug resistant and susceptible hybrids, Deaf Smith County, Texas, 1975*

Designation	Days to 50% bloom	Plant ht. cm	Head exs., cm	% Lodging	Total head smut	Test wt., kg/hl	Threshing %	Grain yield, kg/ha	Greenbug** damage rating
A Tx 399 X Tx 2536	86	94	0.0	11	1	-	43	672	8.5
A Tx 378 X Tx 2536	85	107	0.0	1	0	-	58	784	8.6
TAM 680	81	117	2.5	97	0	68.6	50	1344	8.0
A Tx 399 X TAM 2567	85	107	5.0	1	2	64.5	62	5040	5.6
A Tx 399 X TAM 2568	87	107	5.0	10	1	64.1	56	4032	5.6
A Tx 378 X TAM 2567	86	124	5.0	27	3	67.1	56	3136	6.8
A Tx 399 X 74L1829-31	84	114	5.0	0	3	74.6	69	5376	5.5
A Tx 399 X 74L1852-61	80	102	5.0	1	0	68.2	60	4816	6.0
A Tx 399 X 74L1889-1901	82	112	10.0	1	0	73.0	58	4928	5.0
A Tx 399 X 75PR580	85	107	2.5	7	1	65.6	61	4032	5.3
A Tx 399 X 74L1952-60	85	109	10.0	10	0	71.7	55	2912	7.5
A Tx 378 X 74L1989-92	85	140	5.0	12	0	74.5	61	5152	6.3
A Tx 378 X 74L1997-2016	84	109	0.0	43	1	-	-	-	7.8
A Tx 378 X 74L1785,6	85	124	10.0	4	1	70.5	57	4704	6.0
A Tx 399 X 75PR601	87	104	2.5	41	1	65.4	57	3920	5.5

*No insecticide applied.

**See IDIN note taking instructions.

Table 3. Agronomic data of greenbug resistant and susceptible hybrids, Hale County, Texas, 1975*

Designation	Days to 50% bloom	Plant ht., cm	Head exs., cm	Total head smut	Test wt., kg/hl	Threshing %	Grain yield, kg/ha
A Tx 399 X Tx 2536 (S)	70	104	5.0	0	70.1	69	7392
A Tx 378 X Tx 2536 (S)	71	127	2.5	2	73.9	66	8736
TAM 680 (S)	70	127	2.5	0	77.6	70	6944
A Tx 399 X TAM 2567 (R)	69	102	5.0	1	72.2	68	7504
A Tx 399 X TAM 2568 (R)	70	102	5.0	1	71.2	66	7168
A Tx 378 X TAM 2567 (R)	70	122	2.5	2	70.9	70	8288
A Tx 399 X 74L1829-31	74	114	5.0	2	77.0	73	6944
A Tx 399 X 74L1852-61	70	102	5.0	0	75.4	64	7056
A Tx 399 X 74L1889-1901	69	102	5.0	0	75.5	67	7392
A Tx 399 X 75PR580	70	104	2.5	1	69.1	67	7168
A Tx 399 X 74L1952-60	68	109	8.0	0	74.0	71	6944
A Tx 378 X 74L1989-92	72	127	0.0	0	73.4	68	8064
A Tx 378 X 74L1997-2016	74	124	0.0	0	77.1	74	9296
A Tx 378 X 74L1785,6	71	127	8.0	0	74.3	71	9968
A Tx 399 X 75PR601	70	102	2.5	1	69.1	65	7056

*Test had four applications of insecticide for greenbug control.

Table 4. Agronomic data of TAM 2554 derived greenbug resistant hybrids, Texas Agricultural Experiment Station, Lubbock, 1975

Designation	Days to 50% bloom	Plant ht., cm	Head exs., cm	Greenbug damage rating	Total head smut	Test wt. kg/hl	Threshing %	Grain yield, kg/ha
TAM 680 (S)	67.0	131	1.8	5.5	0	77.6	64.1	6170
A 399 X 75PR580 (R)	65.3	111	4.3	2.7	0	75.0	60.2	5768
A 399 X 75PR601 (R)	66.3	107	1.7	2.7	0	73.2	57.4	5376
A 378 X Tx 2536 (S)	69.7	102	2.5	4.3	0	75.0	53.6	5171
A 399 X 75PR627	69.7	94	2.5	2.7	0	73.0	55.3	5716
A 399 X 75PR628	70.7	97	1.8	2.3	0	72.6	57.5	6052
A 399 X 75PR629	68.0	97	2.5	3.5	0	74.4	56.1	6048
A 399 X 75PR630	69.7	100	2.5	2.3	0	73.5	50.1	5046
A 399 X 75PR631	68.7	99	5.8	2.7	0	73.7	54.3	5565
A 378 X 74L1788	67.7	133	11.0	2.7	0	77.5	66.3	7086
A 399 X 75PR634	66.7	109	3.3	2.3	0	75.5	58.0	6459
A 399 X 75PR635	68.3	112	2.5	2.0	0	75.9	61.1	5880
A 399 X 75PR636	67.0	108	1.8	2.7	0	76.4	54.5	5958
A 399 X 75PR637	68.7	97	2.5	3.0	0	76.2	58.4	5557
A 399 X 75PR640	68.0	106	3.3	2.3	0	77.2	62.5	6384
A 399 X 75PR641	67.7	108	3.3	2.7	0	76.3	61.2	7204
A 399 X 75PR642	67.0	102	3.3	2.3	0	76.8	61.3	6278
A 378 X 74L1789	69.0	135	6.9	3.3	0	77.2	67.8	8453
A 399 X 74L1789,90	66.7	111	4.3	2.0	1	75.9	59.8	6638
A 399 X 75PR601	67.7	105	3.3	3.0	0	73.5	58.1	5398
A 399 X 75PR580 (R)	65.0	106	5.1	3.0	0	74.5	58.5	5837
A 378 X Tx 2536 (S)	68.0	130	5.8	5.8	0	75.9	63.8	5880

S = Susceptible check
R = Resistant check

Table 5. Agronomic data of Tx 7000 derived greenbug resistant hybrids, Texas Agricultural Experiment Station, Lubbock, 1975*

Designation	Days to 50% bloom	Plant ht., cm	Head exs., cm	% Lodging	Greenbug damage rating	Total head smut	Test wt., kg/hl	Threshing %	Grain yield kg/ha
TAM 680 (S)	66	132	3.3	0.0	5.8	0	78.5	77	6241
A 399 X 75PR580 (R)	65	102	1.8	0.0	3.5	1	74.1	75	6686
A 399 X Tx 2536 (S)	66	99	2.5	0.0	5.5	0	75.2	75	6080
A 378 X Tx 2536 (S)	69	124	6.4	0.7	5.5	2	76.3	78	6617
A 378 X Tx 7000 (S)	74	109	1.8	0.0	5.8	0	73.5	77	3388
RS 671 (S)	67	109	1.8	0.0	5.0	0	75.3	78	4816
A 378 X 75PR648	66	119	5.8	0.3	3.5	0	76.4	80	5001
A 378 X 75PR649	70	124	7.6	0.0	3.5	0	75.8	78	5634
A 399 X 75PR649	68	104	0.0	0.0	2.0	0	76.3	71	5852
A 378 X 74L1803	70	109	3.3	0.0	3.5	0	75.4	76	5727
A 399 X 74L1803,4	66	109	5.1	0.0	2.5	0	74.4	76	6311
A 378 X 74L1805	69	112	5.1	0.0	4.0	0	74.4	77	6003
A 618 X 74L1805	65	97	3.3	0.0	4.0	0	69.4	70	3220
A 399 X 74L1805,6	65	112	4.3	0.0	2.5	0	75.4	74	6759
A 378 X 74L1807	70	109	3.3	0.0	4.0	0	75.5	77	5880
A 399 X 74L1807,8	65	114	5.1	0.0	3.0	0	75.0	72	6737
A 618 X 74L1808	64	112	6.9	0.0	3.5	0	74.3	72	4956
A 399 X 74L1809,10	65	104	2.5	0.0	3.0	0	70.5	66	6645
A 378 X 74L1810	70	102	0.0	0.0	4.5	0	71.6	66	5292
A 378 X 75PR650	69	104	2.5	0.0	3.0	0	72.3	68	6429
A 378 X 74L1811	70	97	0.8	0.0	4.0	0	72.3	66	5040
A 399 X 74L1811,12	65	102	1.8	0.0	3.0	0	67.3	61	5160
A 378 X 75PR651	68	102	1.8	0.0	4.0	0	70.1	63	4808
A 621 X 75PR651	67	97	3.3	0.0	3.5	0	68.7	63	4810
A 399 X 74L1813,14	65	97	5.8	0.0	3.5	0	70.8	66	4825

Continued

Table 5. Continued

Designation	Days to 50% bloom	Plant ht., cm	Head exs., cm	% Lodging	Greenbug damage rating	Total head smut	Test wt., kg/hl	Threshing %	Grain yield, kg/ha
A 378 X 74L1814	67	102	3.3	0.0	3.5	0	72.0	72	6227
A 378 X 75PR652	67	99	1.8	0.0	4.0	0	70.9	66	5447
A 399 X 74L1815,16	67	107	3.3	0.0	2.5	0	69.2	66	5939
A 378 X 74L1816	69	112	2.5	0.0	3.5	0	71.2	67	6793
A 378 X 75PR653	70	112	3.3	0.0	3.0	0	70.0	69	6569
A 378 X 74L1817	70	107	3.3	0.0	3.5	0	73.1	72	4648
A 399 X 74L1817,18	67	104	1.8	0.0	3.5	0	70.1	64	4861
A 399 X 74L1819	67	117	1.8	0.0	3.5	0	70.4	68	5410
A 378 X 75PR654	69	107	4.3	0.0	3.0	0	70.0	60	6608
A 378 X Tx 7000 (S)	73	102	3.3	0.0	5.5	0	74.3	73	3192

*No insecticide applied

S = Susceptible check
R = Resistant check

Table 6. Agronomic data from TAM 428 derived greenbug resistant hybrids, Texas Agricultural Experiment Station, Lubbock, 1975*

Designation	Days to 50% bloom	Plant ht., cm	Head exs., cm	% Lodging	Greenbug damage rating	Total head smut	Grain yield, kg/ha
TAM 680 (S)	70.3	147	7.6	0.3	6	0	7328
TAM 670 (S)	67.3	129	8.4		6	0	5908
A 399 X TAM 428 (S)	69.7	129	7.6		5	0	6130
A 399 X TAM 2568(R)	67.0	125	12.0		3	1	7280
A 399 X 74PR580 (R)	67.0	124	7.6		3	0	7485
A 399 X 4534-1	66.7	122	8.4		4	0	7022
A 378 X 4665-1	70.7	138	7.6		4	0	7711
A 407 X 4667-2	70.3	147	10.0		3	0	8560
A 378 X 4669-1	71.0	142	10.0		3	1	6757
TA 680	70.0	140	8.4	0.7	6	1	6788
A 399 X TAM 428 (S)	68.0	124	6.9		5	0	6869
A 399 X TAM 2567 (R)	72.3	111	3.3		3	0	7515
A 378 X 4690-1	70.3	147	12.0		3	3	8822
A 378 X 4690-2	71.7	140	3.3		4	3	6847
A 399 X 1864,5	66.3	107	4.3		2	0	6778
A 618 X 1873 Bk	66.5	107	2.5		2	0	6670
A 399 X 1885,6	68.0	117	8.4		2	0	7209
A 399 X 1889,91 Bk	67.0	119	7.6		2	0	7420
A 399 X 1904	67.3	114	6.9		2	0	6880
A 618 X 1904	68.7	118	5.8		3	0	5149
A 399 X 1911 Bk	67.0	109	9.4		3	0	6936
A 399 X 1918,19	67.0	111	6.9		2	0	6410
A 399 X 1946,7 Bk	67.7	107	4.3		3	0	6048
A 399 X 1955,6	71.0	110	3.3		3	0	6362
A 399 X 3643-1	68.3	123	7.6		5	0	6835

Continued

Table 6. Continued

Designation	Days to 50% bloom	Plant ht., cm	Head exs., cm	% Lodging	Greenbug damage rating	Total head smut	Grain yield, kg/ha
TAM 680 (S)	70.0	144	6.9		6	0	7538
A 399 X TAM 428 (S)	69.0	124	7.6		5	0	6994
A 399 X TAM 2568 (R)	67.0	120	10.0	0.3	2	0	7355
A 399 X 3934-1	71.0	120	6.9		3	0	8512
A 399 X 3934-2	72.5	122	5.1		4	0	8663
A 378 X 3935-2	73.7	149	10.0	0.3	3	0	8773
A 399 X 1978,9 Bk	68.0	119	6.9		3	0	7848
A 399 X 3942-3	71.5	114	5.1		2	0	6944
A 378 X 1987 Bk	71.0	143	8.4		2		9221
A 399 X 1987 Bk	70.0	119	5.8		2	0	6967
A 618 X 1987 Bk	67.3	129	7.6		2		7134
A 399 X 1988 Bk	73.3	116	5.8		2	0	7000
A 378 X 1991 Bk	73.0	155	8.4		3	0	9408
A 399 X 3993-3	74.0	135	2.5		2	0	8831
A 399 X 3994-1	69.5	113	3.0		4	0	7392
A 378 X 1995,6 Bk	75.0	140	5.8		3	0	8047
A 378 X 4016-1	74.7	135	7.6		3	0	8271
A 378 X 4016-2	75.0	130	5.1		3	0	8504
A 378 X 4016-3	74.0	138	8.4		3	0	8493
A 378 X 4082-1	74.3	127	3.3		3	0	7781
A 378 X 4082-2	73.2	149	8.4		3	0	8773
A 399 X 2027,8	68.3	129	7.6		2	0	9061
A 399 X 2028,9	70.4	112	3.6		2	0	7034
A 399 X 2029,30 Bk	68.4	123	5.1		2	0	8086
A 399 X 4122-2	71.4	117	6.9		2	0	7015

Continued

Table 6. Continued

Designation	Days to 50% bloom	Plant ht., cm	Head exs., cm	% Lodging	Greenbug damage rating	Total head smut	Grain yield, kg/ha
A 399 X 4123-2	68.4	136	6.1	0.3	2	0	8179
A 399 X 4132-1	68.4	122	6.1		5	0	6278
A 378 X 4134-1	70.0	140	5.1		4	0	8680
A 399 X 2039,40	67.4	133	14.0		3	0	7877
A 399 X 2041,2	70.3	119	9.4		2	0	7395
A 399 X 2043,4	71.0	122	6.1		2	0	8541
A 378 X 41371	73.0	137	6.4		2	0	9705
A 378 X 4137-2	71.5	133	5.1		2	0	8822
A 378 X 4137-3	73.0	140	6.8		2	0	8646
A 378 X 4349-2	71.0	143	7.6		4	0	7930
A 378 X 4349-3	69.3	144	8.4		4	0	7314
A 378 X 4488-3	73.7	146	6.8		4	0	8654
A 378 X 4493-3	74.7	134	5.8		3	0	8232
A 399 X TAM 2567 (R)	71.3	101	3.3		4	0	6695
A 378 X 2081,2	68.3	136	11.0		4	0	7467
TAM 680 (S)	69.0	151	12.0		6	0	5656
A 399 X TAM 428 (S)	68.7	123	10.0		6	0	6824
A 399 X TAM 2567(R)	70.3	118	4.3		5	1	6306
A 399 X TAM 2568(R)	68.7	123	7.6		4	2	6899
A 399 X 74L1649,50	67.7	118	5.8		4	0	7691
A 399 X 75PR601 (R)	69.7	113	5.1		5	1	7258

S = Susceptible check
R = Resistant check

GREENBUG RESISTANT SORGHUMS

SUMMARY

It took greater numbers of greenbugs feeding for a longer period of time on resistant sorghums than susceptible sorghums to cause an equal amount of yield loss. However, the same amount of damage, that is, the same amount of leaf loss to resistant sorghums resulted in similar amounts of yield loss when compared to susceptible sorghums. Under natural conditions, resistant sorghums were not severely damaged and only under artificially produced conditions such as caging, which excluded predators and parasites, did significant damage occur.

When resistant and susceptible sorghums were isolated in a cotton field, greenbug numbers on resistant sorghum were about one-third that found on susceptible sorghums. Predator numbers in general were lower in resistance than susceptible sorghum. The ratio of predators to greenbugs was about equal in either sorghum type

INTRODUCTION

As a result of both public and private breeding programs, greenbug resistant sorghum hybrids of good agronomic quality have been developed. Acceptance by producers of these resistant hybrids will probably be good; however, there will be concern expressed because of the levels at which these hybrids are infested.

Research data collected from both laboratory and field experiments have identified the resistance mechanisms of these sorghums with resistance from sources such as SA 7536-1, KS 30, IS 809, and PI 264453. Moderate levels of non-preference exists as well as some antibiosis. The primary resistance mechanism has been shown to be tolerance.

Because of the need for assessing the damage to resistant sorghums by greenbugs, and the need to acquire research information on the response of the greenbug when large acreages of resistant sorghums are planted, two independent experiments were conducted. One involved the determination of greenbug numbers and damage under natural and artificial infestations. The other involved planting plots of resistant and susceptible sorghums within a field of cotton to mimic a large field planting.

METHODS AND MATERIALS

Damage Assessment.--Four row plots with 1.01m spacing 15.2 m long, were arranged in a randomized complete block design with 4 replications. Plots were planted May 1. One preplant and 1 postplant irrigations were made April 7 and July 15, respectively.

Sorghum entries included one greenbug-resistant hybrid (Wheatland X TAM 2568) and a commonly grown heteroyellow endosperm greenbug-susceptible hybrid. Treatments imposed upon the 2 center rows of 4-row plots of each entry included an insecticide application of phorate at 1.1 kg AI/ha at 4 population densities on the susceptible and resistant sorghum. Similar insecticide treatments were applied at various population densities of the greenbug on resistant sorghum caged by 1.8x1.8x1.8m Lumite^{R} cages to exclude parasites and predators. The cages were established when plants were infested with 1 greenbug per plant and allowed greenbug populations to reach unnaturally high levels. Tests were conducted at the Texas Agricultural Experiment Station at Lubbock.

Weekly greenbug counts were made on 10 randomly selected plants from June 13-August 27. Damage ratings were made Aug. 7 by use of the following scale: 1 = no red spotting on leaves; 2 = red spotting on leaves; 3 = portion

of a leaf killed by greenbugs; 4 = 1 leaf killed; 5 = 2 leaves killed; 6 = 4 leaves killed; 7 = 6 leaves killed; 8 = 8 leaves killed; and 9 = dead plant. Grain yields were obtained Oct. 1 by plant harvesting heads in 4.4m of each of the 2 center rows of each plot. Samples were threshed, cleaned, weighed and yields per acre calculated. Seeds per gram were determined as an indication of seed size differences.

Isolation Test.--In an attempt to mimic a large acreage of greenbug resistant sorghum, and the subsequent effect on greenbug numbers, damage, and predator population levels, plots of greenbug resistant and susceptible sorghums were planted in a field of cotton. Plots were 2 rows 15.2m long arranged randomly and replicated 3 times with approximately 130 rows separating each entry across rows and approximately 100 ft down the rows. Sorghums were planted May 10 at the same time the cotton was planted. The plots were not irrigated.

Greenbug counts were made in the manner described above. Predators were counted in a similar manner. Bird damage to grain prevented the acquisition of yield data

RESULTS AND DISCUSSION

Damage Assessment.--Greenbug numbers prior to insecticide treatment, leaf damage and yield per acre are shown in Table 1. Greenbug numbers (4767/plant), and damaged leaves (4.7) were greater and kg/ha (3649) less on the susceptible sorghum under natural infestation than the resistant sorghums either naturally infested or caged. Natural greenbug infestation on resistant sorghum reached only 700/plant and caused no significant leaf or yield loss. Under cages, the greenbug population on resistant sorghum reached ca. 2500/plant and caused significant leaf and yield loss. Greenbug numbers below this

level did not reduce yields. Yield and seed size was decreased at the 2500 greenbug/plant level because at this density 3.3 leaves/plant had been killed. Based on these and prior data, leaf loss of 3.3 per plant on susceptible sorghum resulted in yield loss. It would appear that the damage tolerance level for resistant or susceptible sorghums is approximately the same. However, greenbug numbers have not occurred naturally on resistant sorghums at a level sufficient to cause significant damage to result in yield loss.

No benefit was shown in treating the naturally infested resistant sorghums. Data would indicate that the economic threshold, based on damage only and not greenbug numbers would be the same for resistant and susceptible sorghums.

Isolation Test.--Initial infestations and rates of population increase of greenbugs on resistant and susceptible sorghums were similar (Fig. 1). Peak population levels of greenbugs occurred between July 23 and 31 on both resistant (825/plant) and susceptible (2324/plant). However, greenbug numbers declined at a greater rate on the resistant than susceptible sorghum.

Aphid predator population levels were in general lower on the resistant sorghums, although differences were not significant (Fig. 2). However, the ratio of predators to greenbugs was significantly higher in resistant sorghums (.004) on July 23 than on susceptible (.002). This probably was a result of the fact that the greenbug multiplies faster on susceptible than on resistant sorghums and since predators are relatively slow in reproducing, this slower rate of natural increase resulted in fewer predators/greenbug.

Table 1. Greenbug populations and damage to resistant and susceptible sorghum hybrids. Lubbock. Texas. 1975.

Hybrid	Greenbug/plant prior to treatment	Leaves/plant killed	Kg/ha	Seeds/ gm
Susceptible	640a	0.8a	6234a	27a
(A Tx 399 X TX 2536)	1510a	3.7ab	5170a	33a
	2983b	4.3b	5574a	34a
	4767c	4.7b	3649b	36a
Resistant	19a	.0a	6784a	26ab
(A Tx 399 X TAM 2568)	88a	.0a	6435a	26ab
	300b	.3a	6636a	24b
	700b	.6a	6490a	27a
Resistant (caged)	5a	.0a	6453a	26a
(A Tx 399 X TAM 2568)	543ab	.6ab	5775a	29a
	937b	1.0ab	5885a	30ab
	2487c	3.3b	5243b	33b

Fig. 1.--Seasonal greenbug populations on resistant and susceptible sorghum hybrids.

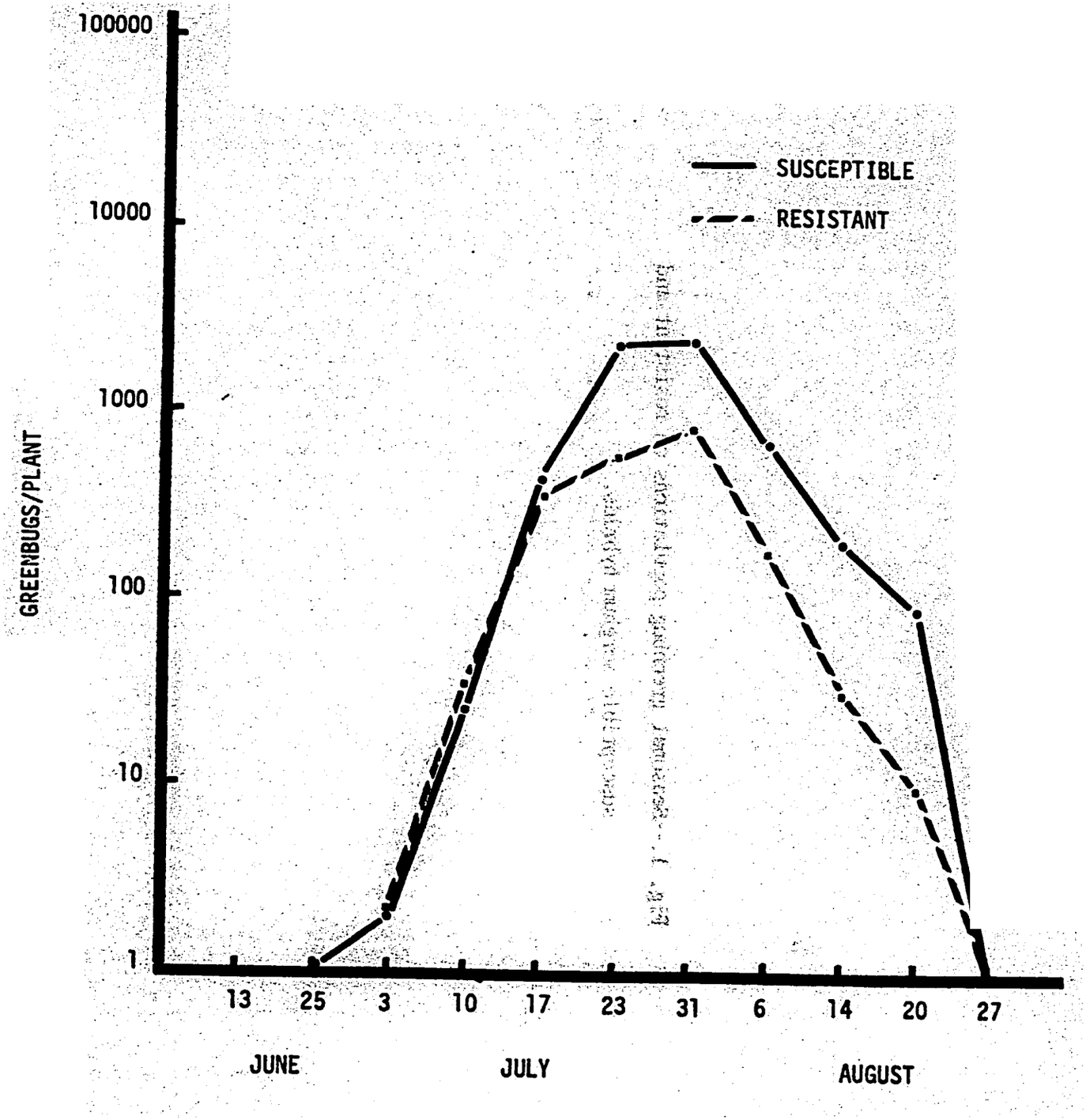

SUSCEPTIBLE
RESISTANT
GREENBUGS/PLANT
100000
10000
1000
100
10
1
13
25
3
10
17
23
31
6
14
20
27
JUNE
JULY
AUGUST

Fig. 2.--Seasonal predator populations on greenbug resistant and susceptible sorghum hybrids.

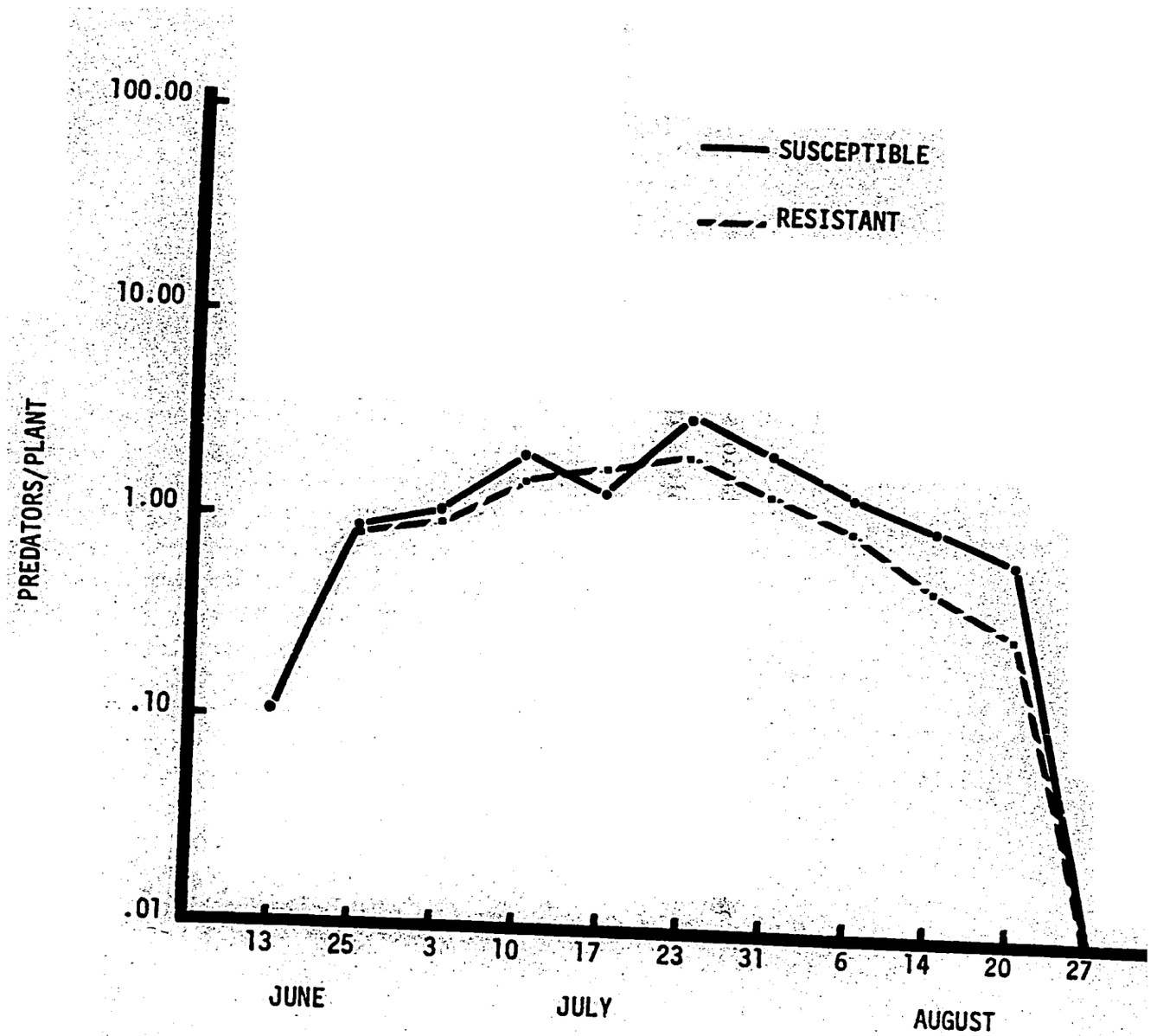
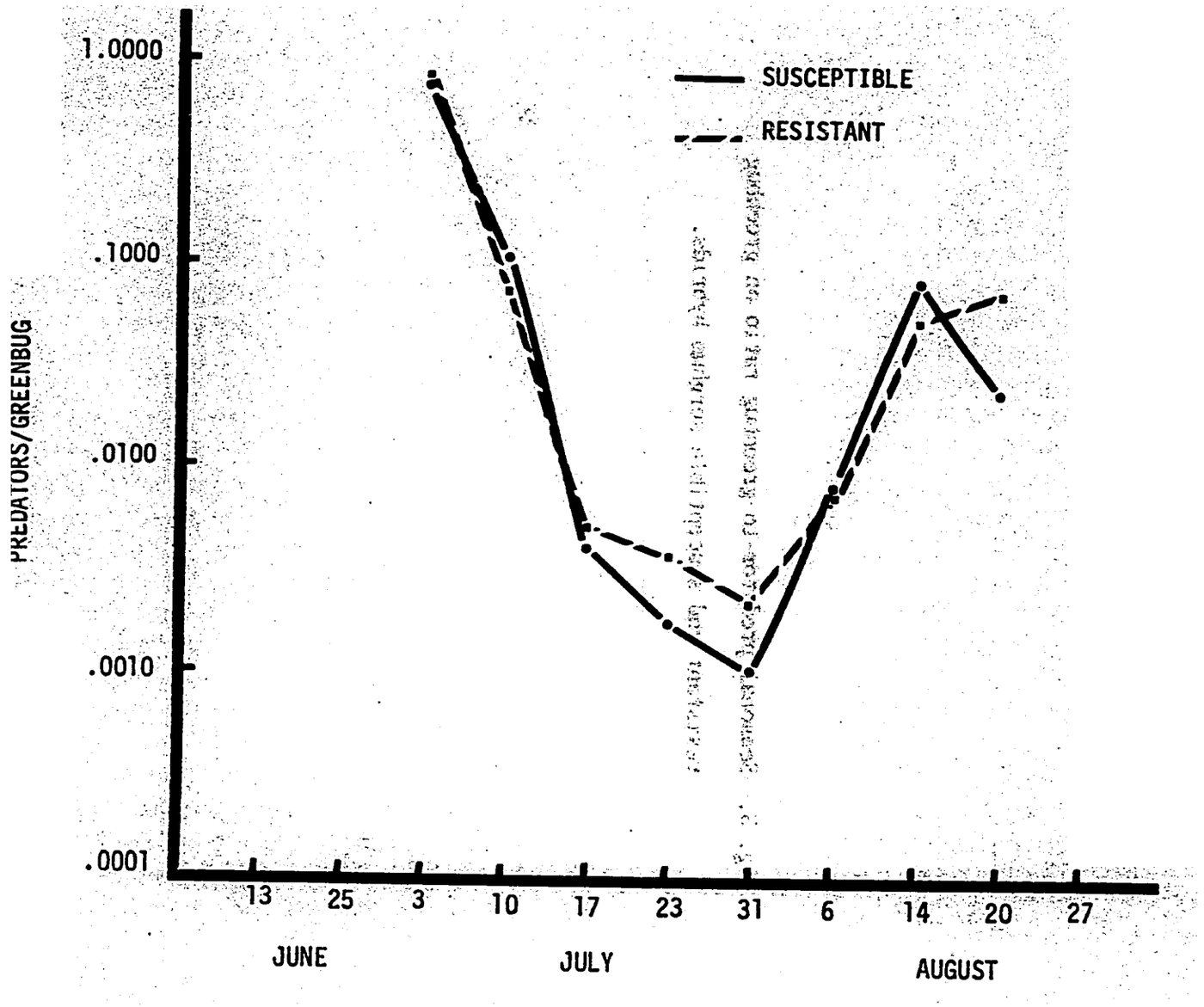

SUSCEPTIBLE
RESISTANT
PREDATORS/PLANT
100.00
10.00
1.00
.10
.01
13
25
3
10
17
23
31
6
14
20
27
JUNE
JULY
AUGUST

Fig. 3.--Seasonal predator-to-greenbug ratio on greenbug resistant and susceptible sorghum hybrids.


SUSCEPTIBLE
RESISTANT
PREDATORS/GREENBUG
1.0000
.1000
.0100
.0010
.0001
13
25
3
10
17
23
31
6
14
20
27
JUNE
JULY
AUGUST

D-2. Midge Resistance

PROGRESS IN BREEDING FOR MIDGE RESISTANCE

Several sorghum breeding lines have been identified in the past four years as resistant to the sorghum midge. Unfortunately, none of this possesses the yield potential that will be necessary for producer acceptance. A breeding program to transfer resistance to disease resistant types with high yield potential is underway.

Breeding for resistance to the midge will be much slower than breeding for greenbug resistance for primarily two reasons: (1) mature plants are required to identify resistant plants, (2) midge population densities may be variable over time resulting in the selection of plants that are not resistant to the midge but have good seed set because they were blooming when the number of midge was low.

Germplasm Releases:

Seed from ninety-one F_1 rows of crosses between breeding material containing the genetic male sterile gene, ms_3, derived from 'Coes', and midge resistant lines were composited to develop a midge resistant population, TP8R. The population contains crosses with all temperate adapted lines identified as midge resistant at the time it was started in June 1973.

A composite of this seed was planted in isolation at Lubbock in 1973. Male sterile plants were tagged at bloom and harvested at maturity. Equal quantities of seed from each of 1200 plants were composited for the second cycle of random mating during the

winter of 1973-74 at Isabela, Puerto Rico. Equal quantities of seed from 900 male sterile heads were composited for planting at Lubbock in 1974. Equal quantities of seed form 1000 male sterile heads were composited from the third cycle of random mating. The seed from this last composite was designated TP8R.

One hundred forty five male fertile agronomically desirable plants were selected from the composite planted at Lubbock in 1974 (TP8RO) and thirty agronomically desirable plants were selected from the TP8R planting ($TP8RO_1$) in Puerto Rico in the winter of 1973-74. These 175 selections were planted in single row observation nurseries at Lubbock and Beeville in 1974. Under extremely large midge populations at Beeville, 33 percent of the TP8 RO and 60 percent of the S_1 selections from $TP8RO_1$ were identified as resistant or segregating for resistance.

These observations indicate that TP8R should provide sorghum breeders in both tropical and temperate regions with good midge resistant lines for their respective locations.

Most plants in TP8R are 3-dwarf but some 2-dwarf plants are present. Seed color ranges from white to brown. Maturity ranges from early to late. Approximately 50% of the plants are male sterile.

TP8R has been released and distributed to 42 researchers in eight countries. TP8R can be used in recurrent selection schemes to develop improved sorghum types with high levels of resistance to the sorghum midge.

Midge Test:

In 1975, midge tests were grown at Lubbock, Beeville, and Corpus Christi, Texas, Experiment, Georgia, and in Argentina and Brazil. The tests at Lubbock, Beeville, Corpus Christi and Experiment contained susceptible checks, converted IS lines known to be resistant, and selected breeding lines from the midge nursery that offered promise as agronomically improved resistant lines. Tests in Argentina and Brazil were sent to these countries in 1974 before the breeding selections were made and could be entered into the test but the data was not returned until 1975.

In the Lubbock and Corpus Christi tests, midge populations were too low to inflict sufficient damage for ratings to be made. In the test at Experiment, webworms caused extensive damage requiring that an overall rating for both webworm and midge damage be made. The test in Argentina had severe damage by the sugarcane borer. The borer enters and feeds in the stalk of sorghum and can cause a large reduction in seed size. The method used in determining midge damage in this test (Table 1.) may have resulted in more seed loss attributed to midge damage than was actually caused by the midge.

The problems encountered in the tests discussed above illustrate the need for multiple locations in the evaluation of lines for midge resistance. The data obtained from Beeville and Brazil appear to be the most reliable data obtained in 1975.

Midge damage ratings from Beeville (Table 1.) confirm the resistance of previously identified lines, TAM 428 through SC 574-6. All of these lines, with the exception of TAM 428, can be classified as highly resistant when compared to the susceptible checks, Tx 7000 through B 378. The breeding lines, TP6B(D)-54-3-Bk through [Tx 411 x SC 110-9) SC 175-9]-2-2-Bk, represent lines obtained by selection from random mating populations or from pedigree breeding. Midge damage ratings from these lines illustrate that resistance can be transferred to improved types. None of the breeding lines have brown seed and one has improved disease resistance over its resistant donor parent, i.e., SC 414-14.

Data from Brazil confirms the ratings from Beeville on the lines tested there. The damage ratings were obtained from a test in which susceptible checks were damaged 100 percent (personal communication, C. J. Rossetto). The line with the lowest midge damage rating, AF 28, is a tall, photoperiod sensitive variety with a white pericarp and undercoat. Crosses have been made to incorporate the resistance of AF 28 into improved agronomic types.

In addition to the data presented in Table 1. information has been received from India (personal communication, Mr. Pralhad Karkikar, Maharashtua State) that the material we had sent to him was resistant to midge in that country. A list of the material he evaluated follows:

IS 2501C (SC 52)	IS 2579C (SC 423)
IS 12608C (SC 108)	IS 8100C (SC 424)
IS 2816C (SC 120)	IS 12612C (SC 112)
TAM 2566 (SC 175-9)	IS 2508C (SC 414)
IS 12666C (SC 175)	IS 12664C (SC 173)
IS 2549C (SC 228)	

Population Breeding:

TP8R has been developed and released. This population was planted at Corpus Christi, Beeville and Lubbock in 1975. Selections were to be made of midge resistant plants to use for S_1 testing in an effort to improve the midge resistance of the population. Unfortunately no selections could be made because of low midge populations at Corpus Christi and Lubbock and the lack of proper plant growth at Beeville. The Beeville planting was severely infected by iron chlorosis. This population will again be planted in 1976 and selections made.

Pedigree Breeding:

Nurseries were planted at Lubbock, Corpus Christi, Beeville and Weslaco. The nursery at Weslaco was planted in August from material identified as resistant in the Beeville Nursery.

Over 2800 rows of F_2 populations and F_3 through F_5 rows were planted at Beeville. From this nursery 1202 selections were made from 449 F_3 through F_5 rows and 391 selections were made

from F_2 populations. All selections were planted in head rows at Weslaco in August from which 705 selections were made from 245 rows.

Pedigrees of material planted in the nurseries discussed above include numerous good agronomic midge susceptible types and midge resistance from the following: TAM 2566, IS 2508C (SC 414), IS 3574C (SC 239), IS 2579C (SC 423), IS 12666C (SC 175), IS 1309C (SC 322), IS 3071C (SC 237), IS 3758C (SC 326). Also included were selections from TP2, TP3, TP4, TP5, TP6 B(D), TP7 and TP8.

As shown in Table 1, midge resistance in F_1 hybrids made with susceptible females and TAM 2566 do not produce hybrids that are resistant as TAM 2566. Thus our breeding program in 1975 contained a large number of F_2 populations and F_3 rows derived from crosses with B lines and TAM 2566. F_1's of crosses between A lines and midge resistant plants selected from F_3 rows derived from crosses between B lines and TAM 2566, indicate that several of the selections are B lines. Observations in 1975 indicate that a modified backcross method will be needed to combine high levels of midge resistance into good agronomic types.

Evaluation Method for Midge Resistance:

Presently there are several methods being used to evaluate sorghums for midge resistance. In an effort to evaluate the relationship of our present system of rating rows for percent seed loss due to midge with a method of comparing threshing

percent of damaged and undamaged heads, a test was planted in 1975. The test contained six sorghum varieties (3 resistant and 3 susceptible) planted in a three-replicate test at three dates of planting. Midge populations were small in date 1, moderate in date 2 and large in date 3.

In general, as the numerical ratings became larger, the threshing percent for that entry and date was smaller (Table 2) The data from this test indicate that with the type of resistance presently available, the rating system presently in use compares favorably with the method of comparing threshing percents and is, of course, much easier.

Table 1. Midge damage ratings and agronomic data of selected sorghums

Designation	Days to 50% bloom		Midge damage[1]						Plant ht., cm	Head[2] exs., cm	Downy mildew	Total[3] Head smut	MDM[4]
	Bee-ville	Exp. Ga.	Bee-ville	Exp. Ga.	Argen-tina	Bra-zil	1974	1973					
Tx 7000	69.7	56	9.6	9.2	99	-	10.0	8.7	104	7.6	3	0	4.7
B 399	68.0	54	7.9	6.4	97	-	9.5	-	88	1.3	0	3	2.5
Tx 2536	71.7	59	9.1	8.5	97	-	9.7	8.2	102	3.3	9	1	3.5
B 398	67.0	52	8.0	6.6	-	-	-	6.7	108	11.0	4	7	1.8
B 3042	64.3	48	7.6	6.0	100	-	9.6	6.2	111	16.0	1	11	2.5
B 3197	70.7	54	8.7	3.4	87	-	9.6	7.6	124	7.6	0	3	3.5
Tx 415	70.5	66	7.3	-	-	-	9.5	8.6	74	2.5	1	1	2.3
B 378	72.7	61	8.7	8.3	87	-	9.1	7.8	115	5.8	0	0	4.5
TAM 428	69.0	61	6.0	2.3	84	-	7.6	-	100	0.8	0	0	1.5
SGIRL-MR-1	66.5	64	3.6	3.6	75	-	6.7	4.5	94	0.0	1	1	3.5
IS 2501C (SC 52)	61.7	48	1.3	5.0	29	-	2.6	1.8	90	7.1	2	0	1.3
TAM 2566 (SC175-9)	67.0	62	1.8	4.2	57	-	3.6	1.8	72	0.0	0	0	1.0
IS 2249C(SC228-14)	66.0	53	2.2	5.9	73	5.0	3.1	3.2	88	0.0	12	1	1.0
IS 3071C(SC237-14)	-	76	2.0	2.3	-	3.5	-	-	86	0.0	0	0	2.0
IS 3574C(SC239-14)	67.3	58	1.9	8.1	80	4.5	-	3.5	69	0.0	3	4	2.5
IS 2508C(SC414-14)	65.5	54	2.9	4.8	47	2.5	5.8	4.3	100	8.4	13	13	4.0
IS 2579C(SC423-14)	-	56	1.5	8.8	69	4.5	4.6	2.1	93	0.8	1	0	1.0
IS 8100C(SC424-14)	64.7	55	3.4	8.7	45	3.4	6.2	3.4	101	17.0	0	3	3.0
SC 574-6	70.0	67	2.9	7.1	54	3.5	4.6	3.8	83	3.3	1	2	3.0
TP6B(D) 54-3-Bk	71.3	65	S[5]	4.0	-	-	-	-	79	2.5	0	4	1.5
TP6B(D) 45-Bk	70.0	61	4.4	5.1	-	-	-	-	97	2.5	8	6	2.7
[(Tx411XSC110-9)SC110]SC414)-1-Bk	68.3	58	3.2	6.0	-	-	-	-	85	0.0	0	1	2.5
[(Tx412XSC599)SC326]114-2-Bk	70.3	65	1.9	3.6	-	-	-	-	71		0	0	1.3
[(Tx414XSC110-9)SC175-14] 50237-1-Bk	67.3	58	1.9	9.7	-	-	-	-	83	0.0	0	3	1.3
[(Tx411XSC110-9)SC175-9] -3-1-Bk	67.3	56	3.5	7.2	-	-	-	-	77	0.0	0	0	3.3

Continued

Table 1. Continued

Designation	Days to 50% bloom		Midge damage[1]						Plant ht., cm	Head[2] exs., cm	Downy mildew	Total[3] head smut	MDM[4]
	Bee-ville	Exp. Ga.	Bee-ville	Exp. Ga.	Argen-tina	Bra-zil	1974	1973					
[(Tx411XSC110-9)SC175-9]-2-2-Bk	76.0	62	3.7	3.6	-	-	-	-	77	0.0	0	5	1.7
A 398 X TAM 2566	63.7	52	4.3	3.2	-	-	-	-	110	6.4	0	3	1.6
A 378 X TAM 2566	66.7	53	4.4	5.1	-	-	-	-	114	4.6	0	5	2.0
A 399 X TAM 2566	67.0	-	3.6	-	-	-	-	-	90	1.3	0	3	1.5
TAM 680	66.0	52	7.4	3.9	-	-	-	-	137	7.6	0	2	
A 378 X Tx 2536	69.0	53	9.3	5.7	-	-	-	-			-	-	-
RS 671	68.0	-	8.3	-	-	-	-	-	126	8.9	0	13	2.6
SC 108	-	-	-	-	85	-	4.8	3.8	-	-	-	-	-
SC 112	-	-	-	-	61	-	6.3	3.4	-	-	-	-	-
SC 265	-	-	-	-	81	-	-	-	-	-	-	-	-
SC 322	-	-	-	-	83	-	4.7	3.2	-	-	-	-	-
IS 2043C Sel. (SC 103)	-	-	-	-	69	-	-	4.8	-	-	-	-	-
A 3197 X IS 2043C Sel.	-	-	-	-	91	-	-	-	-	-	-	-	-
AF-28	-	-	-	-	-	1.1	-	-	-	-	-	-	-
SC 175-14	-	-	-	-	-	2.6	4.2	1.2	-	-	-	-	-
SC 268	-	-	-	-	-	3.7	8.4	4.0	-	-	-	-	-

Table 1. Continued

[1]Beeville: For rating system see IDIN note-taking instructions.

Experiment Georgia: Test grown and evaluated by Billy R. Wiseman. Because of extensive damage by webworms and the difficulty in separating midge and webworm damage, the rating includes both webworm and midge damage.

Argentina: Test grown and evaluated by Horacio Pacagnini. Midge damage was calculated as follows:

(1) First panicles were bagged before anthesis, without removing flag leaves, and removed just after anthesis.

(2) Threshing percent was calculated from the bagged panicles.

(3) Three meters were harvested from each plot. Head weight and grain weight were recorded.

(4) Percent loss was calculated by comparing the threshing percent of the bagged panicles.

Mr. Pacagnini reported that data was variable due to large infestations of *Diatraea saccharalis*.

Brazil: Entries grown and evaluated by Carlos Rossetto.

1974 and 1973: Data is mean of six and three tests, respectively.

[2]Plant height and head exsertion recorded at Lubbock.

[3]Downy mildew and head smut recorded at Beeville and represent the total number of plants systemically infected with downy mildew or with head smut in the 4-replication test.

[4]Ratings taken at Lubbock, see IDIN note taking instructions for rating system.

[5]Entry segregating with a rating range of 1.8-7.3.

Table 2. Midge damage ratings and threshing percent of selected sorghum lines under three midge population levels

	Planting DATE 1		Planting DATE 2		Planting DATE 3	
	Damage* Ratings	Threshing %	Damage Ratings	Threshing %	Damage Ratings	Threshing %
TAM 2566 (R)	1.3	68.5	2.0	66.1	2.3	64.8
SC 423 (R)	2.5	70.2	2.0	65.9	3.8	62.8
SGIRL-MR-1 (R)	1.8	62.2	3.2	59.9	4.3	58.2
TX 414 (S)	3.0	66.7	3.3	66.3	6.0	48.0
TX 2536 (S)	4.3	61.9	5.0	57.9	8.0	30.3
TX 7000 (S)	3.3	67.5	6.0	53.6	8.7	17.6

*See IDIN note-taking instructions

D-3. Corn Leaf Aphid Resistance

SCREENING FOR CORN LEAF APHID RESISTANCE IN GRAIN SORGHUM

SUMMARY

In 1975 sorghum nurseries containing sources of diverse germ plasm were screened for resistance to the corn leaf aphid, Rhopalosiphum maidis Fitch. Based on damage ratings on these sorghums, it was apparent that some of the commonly used sorghum parental lines were highly susceptible to corn leaf aphid damage. For example, B "Redlan" was recorded to be extremely susceptible.

Also, in these screening trials several Zera Zera sorghums, especially TAM 428 were found to highly resist corn leaf aphid damage. The resistance of TAM 428 is effected by the other parental line used in hybrid combination. Sources for resistance to the corn leaf aphid do exist, even in some agronomically improved lines.

INTRODUCTION

The corn leaf aphid, Rhopalosiphum maidis Fitch, commonly infests sorghum and since 1968 its presence has attracted greater attention probably as a result of the greenbug. The species is generally not considered a serious pest of sorghum, but since producers choose to apply insecticides to control it, it does become an important consideration in sorghum pest management. As a consequence, screening trials were initiated at the Texas Agricultural Experiment Station at Lubbock in a search for sorghums resistant to the corn leaf aphid.

MATERIALS AND METHODS

Three nurseries were planted during the first week of May, 1975 for the purpose of evaluation for corn leaf aphid resistance. The nurseries were located at the Texas Agricultural Experiment Station at Lubbock.

A corn leaf aphid test nursery consisted of seven lines or hybrids selected from past observations for either their apparent resistance to the corn leaf aphid or because of their extreme susceptibility. Test plots were three rows 6.6m long arranged in a randomized complete block design with four replications. Damage ratings were made of each plot prior to the boot stage on July 3 and 10, 1975 based on the following system: 1 = no leaf discoloration or damage, 2 = yellowing or mottling of leaves, 3 = some plants with deaf leaf margins, 4 = some dead leaves, 5 = some dead plants.

A corn leaf aphid observation nursery consisted of 54 entries of diverse germ plasm. Replications of each entry varied from 1-9 and plots were one row 6.6m long. Damage ratings were taken at the same time and by the same system as described above.

Damage ratings of sorghums planted in an "All-Disease Nursery" were also evaluated as described above for their response to corn leaf aphid infestations. This nursery contained material which had shown promising resistance to several sorghum diseases. The test consisted of 70 entries with two replications.

RESULTS AND DISCUSSION

Response of seven sorghum lines or hybrids to corn leaf aphid infestations is shown in Table 1. BTX 378 (Redlan) was the most severely damaged sorghum entry. Based on damage ratings of this sorghum, leaf mottling was extensive and dead leaf margins were common. This common parental line is apparently highly susceptible to corn leaf aphid feeding. A majority of the sorghums evaluated showed leaf yellowing and mottling but damage was not extremely severe. TAM 428, a Zera Zera sorghum, was the least damaged of all the entries. In general, little or no leaf discoloration as a result of corn leaf aphid feeding

occurred. These plants were corn leaf aphid infested, but appeared to be tolerant to damage.

Corn leaf aphid damage ratings of 54 sorghum entries in a corn leaf aphid observation nursery are shown in Table 2. Approximately one half of the entries evaluated received damage ratings of between 2 and 3 which would indicate varying levels of leaf yellowing or mottling. Eleven of the entries were recorded to have damage ratings of two or less. These entries are listed in Table 3. Sixteen entries received damage ratings of three or more which would indicate extensive leaf mottling and some dead leaves resulting from corn leaf aphid feeding. These entries are listed in Table 4

Corn leaf aphid damage ratings for sorghums in the All-Disease Nursery are shown in Table 5. Of these 70 entries, a majority received damage ratings of between 2-3, which indicated leaf yellowing and mottling. Nine of the entries were considered susceptible to corn leaf aphid feed and received damage ratings of three or more (Table 6). Eleven entries received damage ratings of two or less (Table 7). Of the sorghums which showed low levels of corn leaf aphid damage, a majority were Zera Zera types.

Table 1. Response of seven sorghum entries to infestations of the corn leaf aphid. Lubbock, 1975.

Entry	Damage rating[1/] on date indicated		
	7/3	7/10	Mean
BTX 378	3.6	3.6	3.6
ATx 378 Hyb	2.6	2.8	2.7
TX 414	2.5	-	-
TX 2536	2.5	2.6	2.6
RS 671	2.4	2.6	2.5
TAM 680	2.1	2.2	2.2
TAM 428	1.3	1.6	1.5

1/ 1 = no leaf discoloration or damage, 2 = yellowing or mottling of leaves, 3 = some dead leaf margins, mottling extensive, 4 = some dead leaves, 5 = some dead plants.

Table 2. Damage response from corn leaf aphid feeding, of 54 entries in a corn leaf aphid observation nursery. Lubbock, 1975.

Entry	No. of Reps	Damage rating on date indicated 7/3	7/10	Mean
ATX 398 X TAM 428	1	2.5	0	2.5
NK 266	1	2.0	2.3	2.5
TAM 680	9	2.1	2.4	2.3
A 378 X Tx 2536	9	2.8	3.1	3.0
A 399 X TAM 428	1	1.5	1.7	1.6
HT 124	2	2.3	2.3	2.3
AKS4 X TAM 428	1	2.7	0	2.7
A 413 X Tx 2536	2	2.9	2.9	2.9
A 115 X TAM 428	1	2.0	2.0	2.0
AKS 614	1	1.5	2.5	2.0
A 407 X TAM 428	1	2.7	2.7	2.7
A 399 X TAM 2568	1	2.7	3.0	2.9
Milos	5	2.8	3.3	3.1
A 606 X TAM 428	1	1.3	0	1.3
TAM 670	1	1.3	0	1.3
A 378 X 1993-96	1	2.7	3.0	2.8
A 378 X 1852	1	3.5	3.5	3.5
A 378 X 4097-1	1	2.0	2.0	2.0
TX 7000	2	1.9	2.5	2.2
TX 414	1	2.7	0	2.7
BTX 378	3	3.5	3.7	3.6
BTX 399	2	2.2	2.9	2.6

Cont'd.

Entry	No. of Reps	Damage rating on date indicated 7/3	7/10	Mean
TX 2536	2	2.8	3.2	3.0
TAM 2551	1	1.3	1.3	1.3
TX 412	1	1.5	1.5	1.5
TAM 2554	2	1.4	1.8	1.6
TAM 428	4	1.3	1.6	1.5
TAM 2552	1	1.3	1.3	1.3
TAM 2566	2	2.5	2.5	2.5
SC 170	1	2.3	3.0	2.7
SC 599	1	2.3	3.3	2.8
TAM 2555	1	2.0	2.0	2.0
SC 103	1	2.5	3.0	2.8
TAM 2557	1	3.0	3.3	3.2
SC 109	1	2.0	2.5	2.3
SC 414	1	3.3	3.3	3.3
NSA 440	1	3.0	3.3	3.2
SC 334	1	2.0	2.0	2.0
TAM 2558	1	2.0	3.3	2.7
SC 423	1	2.0	2.5	2.3
TAM 2559	1	2.5	3.3	2.9
SC 108	1	2.3	2.5	2.4
TAM 2560	1	3.0	3.0	3.0
SC 120	1	1.2	1.2	1.2
BTX 398	1	3.2	0	3.2
74 PR 190-5	1	2.0	0	2.0

Cont'd.

Entry	No. of Reps	Damage rating on date indicated 7/3	7/10	Mean
BTX 3197	1	3.0	0	3.0
BTX 618	1	3.7	0	3.7
BTX 4d 398	1	3.7	0	3.7
A 413	1	4.2	4.2	4.2
BTX 4d 378	1	3.9	3.9	3.9
BTX 3048	1	2.0	2.5	2.3
BTX 3042	1	2.7	0	2.7
SC 110 X LB 16	1	2.5	0	2.7

Table 3. Sorghum entries from the corn leaf aphid observation nursery with damage ratings of two or less. Lubbock, 1975.

Entry	Damage rating[1/]
AKS 614	2.0
A 378 X 4097-1	2.0
TAM 2554	1.6
A 399 X TAM 428	1.6
TX 412	1.5
TAM 428	1.5
TAM 670	1.3
TAM 2551	1.3
TAM 2552	1.3
A 606 X TAM 428	1.3
SC 120	1.2

1/ Mean of ratings on 7/3 and 7/10, 1975.

Table 4. Sorghum entries from corn leaf aphid observation nursery with damage ratings of three or more. Lubbock, 1975.

Entry	Damage rating[1/]
A 413	4.2
BTX 4d 378	3.9
BTX 4d 398	3.7
BTX 618	3.7
BTX 378	3.6
A 378 X 1852	3.5
SC 414	3.3
BTX 398	3.2
NSA 440	3.2
TAM 2567	3.2
Milos	3.1
BTX 3197	3.0
TAM 2560	3.0
TAM 2566	3.0
TX 2536	3.0
A 378 X Tx 2536	3.0

1/ Mean of ratings on 7/3 and 7/10, 1975.

Table 5. Corn leaf aphid and Banks grass mite damage ratings of sorghums in the All-Disease Nursery at Lubbock and Pecos, Texas, respectively, 1975.

Entry	Damage Rating	
	Corn Leaf Aphid	Banks Grass Mite
SC 56-14	3.0	3.3
SC 89-9	3.3	4.0
97-14	3.3	3.1
103-12	2.8	5.3
108-14	2.4	3.9
109-12	3.5	3.4
TAM 428(110-9)	1.6	4.0
SC 110-14	1.9	4.0
111-9	2.3	4.6
112-14 (no uc)	2.5	5.8
112-14 (uc)	2.9	3.9
115-11E-1	1.7	3.4
120-14-1	2.2	3.9
170-6-8-3 (4244)	2.6	3.3
170-6-8-8 (4252)	3.2	3.5
170-6-17 (4267)	2.1	3.6
170-14E-3	1.9	3.3
170-12-6	1.9	3.8
TAM 2566(175-9)	2.4	3.0
SC 175-14	2.0	4.3
228-14	2.0	3.6
237-14	2.7	2.3

Cont'd.

Entry	Damage Rating	
	Corn Leaf Aphid	Banks Grass Mite
239-14	2.3	3.6
279-14	2.8	4.1
324-12-2	2.5	3.8
325-12-P1	2.9	3.8
326-6	2.2	2.9
330-9-P1	2.2	2.9
333-14	2.6	6.5
334-9-P1	2.0	3.9
414-12E-P1	2.0	3.5
420-12	3.0	6.0
423-14 (2680)	2.2	3.9
423-14 (2686)	2.0	3.8
546-14	2.2	3.8
574-6-P1	2.5	3.0
599-6-3 (9054)	2.7	2.9
599-6-3 (9245)	2.1	3.3
599-6-3 (9247)	2.0	3.3
599-6-10 (9188)	2.0	3.1
599-6-10 (9193)	2.5	3.3
599-11E	2.5	3.1
680-3-2	2.5	3.4
748-5-3	2.5	3.6
SC 167-14	2.4	3.8
NSA 440-12	2.6	3.3

Cont'd.

Entry	Damage Rating	
	Corn Leaf Aphid	Banks Grass Mite
817-3	1.7	3.4
837-1	2.2	4.4
935-6	2.0	3.8
QL 3	3.5	4.8
(B3197 X 170-6)^{1750}(14195-1)	2.4	3.8
(B3197 X 170-6)$^{1753-2}$(14195-4)	2.5	3.6
(SC110-9 X SC120-6)$^{(4130)}$	2.2	4.4
(SC599-6 X SC134)	1.9	3.0
(SC120-6 X TX7000)	2.1	4.0
(IS2930 X IS3922)	2.1	4.3
(SC56 X SC170)^{1584}	2.9	3.3
(SC56 X SC170)^{1922}	2.1	3.6
(SC56 X SC33)^{1778}	2.6	4.3
(B406 X Rio)-2	2.2	3.3
TAM 2567	2.7	3.3
(TX2536 X 170-6-5-1-E_2)-10-4-4-1-4	2.4	3.5
(SC599-6 X 110-P1-1-1)-24-4-1-3-3-1	2.2	4.5
(B3197 X SC170)-7-2-1-2-1-1	2.4	4.8
TX 2536	2.8	4.5
TX 09	2.0	4.4
TX 7078	2.4	5.4
BTX 398	3.0	5.6
BTX 378	3.6	4.8
Sweet Sudan	1.8	2.0

Table 6. Sorghum entries from the All Disease Nursery with damage ratings of three or more. Lubbock, 1975.

Entry	Damage rating[1]
SC 56-4	3.0
SC 89-9	3.3
SC 97-14	3.3
SC 109-12	3.5
SC 170-6-8-8 (4252)	3.2
SC 420-12	3.0
QL 3	3.5
BTX 398	3.0
BTX 378	3.6

1/ Mean of ratings on 7/3 and 7/10, 1975.

Table 7. Sorghum entries from the All-Disease Nursery with damage ratings of two or less. Lubbock, 1975.

Entry	Damage rating[1/]
TAM 428(110-9)	1.6
SC 110-14	1.9
SC 115-11E-1	1.7
SC 170-14E-3	1.9
SC 173-12-6	1.9
SC 175-14	2.0
SC 228-14	2.0
SC 334-9-P1	2.0
SC 414-12E-P1	2.0
SC 423-14(2686)	2.0
SC 599-6-3(9247)	2.0
NSA 817-3	1.7
NSA 935-6	2.0
(SC 599-6 X SC 134)	1.9
TX 09	2.0
Sweet Sudan	1.8

1/ Mean of ratings on 7/3 and 7/10, 1975.

D-4. Mite Resistance

PROGRESS IN BREEDING FOR MITE RESISTANCE

Mite Test:

A 22-entry, single-row, six-replication test containing sorghum lines and hybrids were planted near Pecos, Texas. Sweet Sudan was included in the test and had good mite resistance but data is not included in the table because it is not a grain type. Adequate mite populations were present to provide good evaluations.

Of the lines tested, SC 599 (9188) and SC 599 (9247), TAM 2568 and B Tx 618 were the most resistant to damage by mites (Table 1.). These lines had the lowest leaf and stalk death ratings coupled with small decreases in seed size. Hybrids containing these lines exhibited the highest level of mite resistance among the hybrids tested with the exception of A Tx 378 x SC 599 (9188) and A Tx 378 x SC 599 (9247). Hybrids from the two SC 599 selections crossed to A Tx 618 had much lower stalk death ratings and less loss in seed size than hybrids made with the same pollinators crossed to A Tx 378. These data indicate that the resistance of SC 599 is influenced by the genetic background of the female used in crosses.

The hybrid A Tx 399 x TAM 2568 had lower leaf and stalk death ratings than in counterpart greenbug susceptible hybrid, A Tx 399 x Tx 2536. Similar differences were evident between these pollinator lines, TAM 2568 and Tx 2536. These data

indicate that a relationship may exist between greenbug resistance and mite resistance.

Pedigree Breeding Program:

The mite breeding nursery planted near Pecos, Texas contained 383 F_3 rows selected from the 1974 mite nursery and single observation rows of 50 experimental hybrids. One hundred twenty four selections were made from 47 rows that appeared to combine mite resistance with improved agronomic types. Mite resistant lines used in the crosses with standard varieties from which the F_4 selections were made were SC 599-6 (a partially converted Rio) IS 12568 (SC 56-14) and SC 326-6 (a partially converted IS 3758).

Most selections were made from SC 599-6 and SC 56-14 crosses indicating that these two lines offer the best germplasm for breeding purposes presently available for mite resistance.

Table 1. Mite damage ratings and agronomic data for selected sorghums, Pecos, 1975

Designation	Days to 50% bloom	Plant height cm	Head Exsertion cm	Desirability[1] rating	% Lodging
A Tx 618 X SC 599 (9188)	71	107	18	1.5	0.0
A Tx 618 X SC 599 (9247)	71	97	15	2.0	1.6
A Tx 378 X SC 599 (9188)	78	104	15	3.2	29.2
A Tx 378 X SC 599 (9247)	77	102	10	2.9	18.3
B Tx 618	71	91	8	2.9	0.0
B Tx 378	85	89	3	4.0	5.8
SC 599 (9188)	81	99	13	2.3	0.0
SC 599 (9247)	76	89	8	2.5	0.0
A 618 X SC 56-14	71	109	20	2.5	0.0
SC 56-14	92	76	3	4.0	0.0
Tx 2536	78	91	13	4.3	32.5
A Tx 399 X Tx 2536	77	86	8	3.1	11.6
A Tx 378 X Tx 2536	78	104	10	3.5	42.0
B Tx 399	79	79	5	3.2	0.0
A Tx 618 X TAM 428	71	107	13	2.4	0.0
TAM 428	78	94	5	2.5	0.0
A Tx 378 X Tx 415	74	94	8	3.3	28.0
Tx 415	71	64	3	4.1	0.0
A Tx 399 X TAM 2568	76	91	10	2.5	9.2
TAM 2568	75	89	10	2.6	0.0
SC 56-6	75	76	3	3.2	0.0

[1]Based on a 1-5 scale. See IDIN note taking instructions.

Continued

Table 1. Continued

Designation	Leaf[2] damage rating	Stalk[3] damage rating	Pecos 1000 kernel wt., g	Lubbock 1000 kernel wt., g	% Loss in seed size from mites	Thresh-ing %	Grain yield kg/ha
A Tx 618 X SC 599 (9188)	4.8	1.0	19.36	27.53	29.66	77	5395
A Tx 618 X SC 599 (9247)	7.1	1.7	17.83	25.66	30.50	76	5354
A Tx 378 X SC 599 (9188)	8.1	7.2	12.53	28.16	55.52	61	3808
A Tx 378 X SC 599 (9247)	8.8	6.8	13.37	25.33	47.21	62	3360
B Tx 618	6.3	3.2	19.38	25.46	23.88	70	3717
B Tx 378	8.8	5.9	15.00	30.03	50.05	63	2464
SC 599 (9188)	4.6	1.0	16.68	23.46	28.90	68	2688
SC 599 (9247)	6.8	1.5	18.35	21.23	13.55	74	4032
A 618 X SC 56-14	5.8	3.2	18.85	28.86	34.70	78	3584
SC 56-14	7.0	5.0	22.80	28.93	21.19	56	672
Tx 2536	8.7	8.3	12.95	26.43	51.02	68	2576
A Tx 399 X Tx 2536	8.0	8.0	15.35	32.96	53.42	68	4032
A Tx 378 X Tx 2536	8.5	8.0	17.61	30.50	42.25	61	2688
B Tx 399	7.5	8.0	20.73	32.46	36.13	74	4256
A Tx 618 X TAM 428	6.5	3.0	23.06	27.60	16.45	62	4415
TAM 428	7.5	6.8	16.57	24.56	32.55	77	3584
A Tx 378 X Tx 415	8.2	8.5	14.88	27.63	46.15	61	2912
Tx 415	8.8	8.8	15.65	26.56	41.10	61	2576
A Tx 399 X TAM 2568	5.3	3.6	22.11	33.50	34.01	76	5152
TAM 2568	5.2	2.2	22.81	26.76	14.78	70	3808
SC 56-6	7.8	6.8	21.15	27.27	22.43	69	3360

[2]Based on a 1-9 scale. See IDIN note taking instructions.

[3]Based on a 1-9 scale. 1 = no stalk death, 2 = 1-10%, 9 = 91-100%.

SPIDER MITE RESISTANT SORGHUMS

SUMMARY

In the laboratory studies, there were no extreme preference response of Banks grass mite to selected sorghum lines. However, total length of the life span of the Banks grass mite was significantly shorter when reared on SC 599-6 than when reared on SC 56-6, TX 7000, B TX 378, KS 30, Sweet Sudan, or Honey sorghums. This may imply that there is some antibiotic effect of SC 599-6 sorghum on the Banks grass mite. The effect of plant growth stages on the biology of the Banks grass mite indicated that at plant growth stages 1-6 there is a longer life span and ovipositional period with fewer eggs deposited per female mite per day, while at plant growth stages 6-8 there is a shorter life span and ovipositional period with higher numbers of eggs deposited per female mite per day.

In field tests, mite populations began to increase between July 30 and August 6 at plant growth stages 5 and 6, which continues to verify the existence of some physiological change in the sorghum plant at these growth stages which results in mite population increase. Factors which resulted in lower mite numbers in the field were: a) differences in maturity of the plants, for example late maturity of SC 56-14, b) differences in plant types such as nongrain types (Sweet Sudan), c) differences in sugar content, (SC 599(9188), A TX 618 x SC 599(9188), and SC 599(9247)). Population density ratings were found to be 43% (Small Mite Test) and 85% (Large Scale Mite Test) correlated to actual mite populations. A numerical system of 0-9 should be adopted in the future in order to increase the efficiency of the mite density rating. Factors which influenced damage were: a) sugar content--the lower the sugar

content the more damage observed (B TX 378, and TX 2536), b) senescence--the greater the senescening the more damage observed (B TX 378). Those entries which showed low death stalk ratings were those which also showed the lower percent loss in seed size and good qualities for resistance (A TX 618 x SC 599(9188), B TX 618, SC 599(9188), SC 599(9247), TAM 670, and TAM 2568).

Data obtained from a Large Scale Mite Test indicated that the Small Scale Mite Test was a valid test in that evaluation of mite numbers was just as accurate on small plots as it was on the larger plots.

In summary, laboratory and field data indicate that the most promising sources of resistance to the Banks grass mite occur in converted Rio sorghums which are high in sugar content and are non-senescening.

INTRODUCTION

Damaging infestations of the Banks grass mite[1/], Oligonychus pratensis (Banks), were first reported on grain sorghum in 1953 (Griffith and Wene 1953) in the Lower Rio Grande Valley of Texas, and the following year on corn (Walter and Wene 1956). Pate and Neeb (1971) reported that the Banks grass mite reached pest status during 1967 in the Trans-Pecos area, and heavy infestations have occurred in that area on grain sorghum since that time. Huddleston et al. (1968) first reported that the Banks grass mite infested grain sorghum in 1967 in several counties of the Texas High Plains. The Banks grass mite has continued to infest grain sorghum and increase in severity on the Texas High Plains since 1967 (Cate and Bottrell 1971), but not to the extent as in the Trans-Pecos region.

The Banks grass mite is apparently a secondary pest which reaches damaging infestation levels after early insecticide treatments for the greenbug;

[1]Acarina: Tetranychidae

Schizaphis graminum (Rondani). The Banks grass mite can increase in numbers without prior treatment because weather is the major factor which influences Banks grass mite populations. Concern over the Banks grass mite stems from the severe damage it causes to grain sorghum and the recent evidence that indicates that the Banks grass mite may be becoming resistant to most insecticides.

The significance of host plant resistance in a pest management system is that it allows the host plants to support subeconomic levels at the pest species while supporting the pest's natural enemies. With the constant use of insecticides, the constant danger of heavy Banks grass mite infestations, and the vast acreage of grain sorghum on the Texas High Plains, it is evident that it would be greatly advantageous to develop resistant hybrids to help suppress the Banks grass mite and incorporate it into a pest management system. Such an approach is being undertaken by J. C. Rodriguez, J. T. Dabrowski, and others at the University of Kentucky to control Tetranychus urticae (Koch) on strawberries. The objectives of this study were: 1) To determine resistance mechanisms of certain sorghum lines to the Banks grass mite under laboratory and field condition. 2) To evaluate certain sorghum lines for Banks grass mite resistance in the field under naturally occurring conditions of infestation.

RESULTS AND DISCUSSION

Non-Preference

Non-preference reactions of the Banks grass mite when given a choice of SC 599-6, TX 7000, KS 30, and High Sugar Honey (HSH) at 24, 48, and 72 hours are shown in (Table 1). Numbers of female mites on each entry based on the mean of all plant growth stages did not differ significantly at either 24, 48,

or 72 hours. Differences in the number of mites among plant growth stages of each entry were in some cases indicated, but no valid trends could be established. Data based on the means of the number of mites on each entry at the various growth stages indicated that mite numbers were higher at growth stages 2-6, especially at the 48 and 72 hour inspection. Mite numbers tended to be lower at plant growth stages 1, 7 and 8 at the 48 and 72 hour inspection. The female mites not accounted for after initial infestation were those individuals which died or became entrapped in the Tanglefoot[R] which lined the inside of the petri dish to prevent escape.

The number of eggs laid by female mites on each sorghum entry at the three inspection periods followed a similar pattern to that described in the previous test. Based on the mean number of eggs laid at each growth stage, no significant differences among entries were shown. Even though some differences in egg numbers were indicated among entries, as well as among growth stages, no valid conclusions could be drawn. Greatest oviposition generally occurred during plant growth stages 3-6.

Antibiosis

An isolated leaflet technique involved observations of the life cycle of the mite (Table 2) on four sorghum lines at plant growth stages 1-6. There were no significant differences in the duration of the developmental stages of the mite on any of the lines, except for the protonymph stages on SC 599-6 which tended to be shorter than on the other three entries. Mean developmental time in days of the various life stages of the mite for this test was as follows: egg (4.26), larvae (2.36), protonymph (1.85), duetonymph (2.06), and adult (15.20). This resulted in a total life duration of approximately 26 days, with the period from egg to egg being about 12.5 days.

Ovipositional data of mites on plants at growth stages 1-6 indicated no significant differences among entries in the ovipositional period or the number of eggs produced per day per female mite (Table 3). However, the total number of eggs laid on TX 7000 (67.25) was significantly higher than the number laid on KS 30 (43.98) or HSH (35.93). Based on the ovipositional data expressed as a mean of all entries, the ovipositional period was 11.60 days, the total number of eggs laid was 50.10 and the number of eggs laid per day per female mite was 4.17.

Banks grass mite life cycle data were also collected using the leaf disc technique involving seven sorghum lines at plant growth stages 6-8 (Table 4). The duration of the egg stage was significantly shorter on SC 599-6 and SC 56-6 than all other entries except Sweet Sudan when means of the three plant growth stages were compared. Some differences in egg stage duration was indicated among the different sorghum entries, but no patterns could be detected. No significant effect of plant growth stage on egg development was detected when means for all entries were compared. With respect to larval development, duration of this stage was longer on SC 599-6 sorghum than SC 56-6, KS 30, or Sweet Sudan sorghums based on a mean for the plant growth stages. Some differences in larvae development times were detected among growth stages of each sorghum entry, but based on the mean of all entries, no significant differences occurred. The duration of the protonymph stage was longest on KS 30 sorghum. No influence of plant growth stage was shown. Duetonymph development was not affected by the sorghum on which they were grown or at any plant growth stage. The duration of the adult stage was shortest when they were reared on SC 599-6 sorghum. No influence on adult development of any plant growth stage was detected. The total life span of individual mites (sum of the duration of the

previous life stages) was less on SC 599-6 sorghum than all other sorghums. Plant growth stage did not appear to affect the mites life span.

Mean developmental time in days of the various life stages of the mite was as follows: egg (2.2), larvae (1.52), protonymph (1.05), deutonymph (1.02), and adult (13.45). This would indicate a total life span duration of approximately 2.5 weeks with the period from egg to egg being about 8.79 days. These data, when compared to life developmental data of the mite on plant growth stages 1-6, indicates that the immature stages required a shorter developmental period and the adults required a longer developmental period on sorghum at plant growth stages 6-8.

Tolerance

As a means of measuring tolerance of four sorghum lines to mite damage, mite numbers were compared to a damage rating. Results showed (Table 5) that the number of mites on each entry based on the mean of plant growth stages 1-6 did not differ significantly at any time period. Data based on the mean of damage ratings on each entry at various time periods indicated that damage was significantly different among entries. Generally, HSH showed greatest damage while KS 30 showed the least damage followed by SC 599-6. Greater significant differences among entries occurred during the first two weeks than occurred in the second two weeks.

Small Scale Mite Test (Field Evaluation)

Field evaluation of resistance to the Banks grass mite was made of 12 sorghum lines or hybrids (Table 6). Based on four measures of mite population levels, SC 56-14 and Sweet Sudan were generally the least infested sorghums.

SC 56-14 is a late maturing sorghum and Sweet Sudan is a grassy type. Among grain types, significant differences in infestation levels were not detected. Mite population levels, however, were not always reflected in damage ratings. This was particularly true for SC 599(9188) sorghum and its F_1 hybrid with A TX 618. These two entries were about equally infested with mites as the other grain type sorghums, but their damage ratings and stalk death ratings were significantly lower. Both of these entries were about average in maturity, but higher in sugar, especially SC 599(9188). Based on seed weight comparisons from mite infested and mite free sorghum, the percent decrease in seed weight was lowest for SC 56-14, SC 599(9188), B TX 618, and A TX 618 x SC 599(9188).

It would appear from these field data that SC 599(9188) sorghum possess some level of resistance to Banks grass mites. This sorghum is high in sugar and is a "non-senescening" type. These factors appear to be involved in the resistance mechanisms. It is also interesting to note the resistance of SC 599 (9188) in an F_1 hybrid was influenced by the female parent. A TX 378 x SC 599 (9188) was damaged much more by mites than A TX 618 x SC 599(9188).

Also included in this evaluation was Pearl Millet Population RMPI (S) (C1), a grain type line. Millet showed very low mite population levels as did Sweet Sudan. Although low mite populations occurred, there was a considerable amount of damage associated with mite populations on the lower leaves.

State Lodging Test

Sorghums in the State Lodging Test were evaluated for resistance to Banks grass mite. Based on a mean of the damage ratings taken on two dates, a majority of the sorghum entries received ratings of 3.0-4.0. SC 326-16, NSA 440-12, $(SC\ 56\text{-}6 \times SC\ 110\text{-}6)_{F7}^{(1584)}$, $(SC\ 56\text{-}6 \times SC\ 33)_{F7}^{(1790)}$, $(SC\ 56\text{-}6 \times SC\ 33)_{F7}^{(1740)}$,

and B TX 399 received damage ratings of 3.0 or less. SC 170-6-8$^{(4252)}$, (SC 56-6 x SC 110-6)$_{F7}^{(1565)}$, (SC 173-9 x SC 56-6)$_{F7}^{(1606)}$, (SC 56-6 x SC 170)$_{F7}^{(1922)}$ TX 7000, B TX 378, New Mexico-31, and (SA 392) were the most severely damaged entries.

All Disease Nursery

The All Disease Nursery (a uniform nursery of diverse germplasm) was rated for resistance to Banks grass mites (see data in section on corn leaf aphid). Those entries which received a damage rating (mean of two dates) of 3.0 or less were TAM 2566(175-9), SC 237-14, SC 326-6, SC 330-9-PI, SC 574-6-PI, SC 599-6-3$^{(9054)}$, (SC 120-6 x TX 7000), and Sweet Sudan. The majority of the entries received ratings greater than 3.0. Those entries with damage ratings above 4.0 were considered highly susceptible and these included, SC 103-2, SC 111-9, SC 112-14$^{(no\ uc)}$, SC 175-14, SC 279-14, SC 333-14, SC 420-12, SC 837-1, QL3 (Sel), SC 110-9 x SC 120-6$^{(4130)}$, (IS 2930 x IS 3922), SC 56 x SC 33)^{1778}, (SC 599-6 x SC 110-PI-1-1)-24-4-1-3-3-1, (B 3197 x SC 170)-7-2-1-2-1-1, TX 2536, TX 09, TX 7078, B TX 398, and B TX 378.

In summary, both laboratory and field data indicated that SC 599, a Rio type sorghum, showed greatest resistance to the Banks grass mite. Laboratory data indicated that SC 599-6 possessed some degree of antibiosis to the Banks grass mite showing a reduced duration of the adult stage of the mite. No significant differences among lines were determined in either the non-preference or tolerance tests. However, generally speaking, SC 599-6 possessed fewer adult mites and had fewer eggs laid on it after 24, 48, and 72 hours in the non-preference tests. In tolerance tests, SC 599-6 maintained higher mite populations but less damage resulted than on TX 7000 or HSH.

Field data also indicated that mite resistant qualities were shown in SC 599. Although there were no significant differences in infestation levels, there were significant differences in damage ratings. This was true for SC 599(9188), A TX 618 x SC 599(9188), SC 599(9247), and A TX 618 x SC 599(9247). Other entries which showed good resistance were SC 56-14, B TX 618, TAM 2568 and A TX 618 x TAM 428.

Both laboratory and field data suggested that those sorghums showing resistance to the Banks grass mite are those sorghums processing high sugar content and are of a non-senescening nature.

TABLE 1. Laboratory evaluation of non-preference of Banks grass mite for four sorghum lines at eight stages of plant growth, based on number of adult female mites after 24, 48, and 72 hour periods. Lubbock, 1975.a/b/c/

Plant stage	Average number of female mites on four sorghum lines								Mean number of mites/stage
	SC 599-6		TX 7000		KS 30		HSH		
	24 Hours After Infestation								
1	0.80bc	x	0.50bc	x	1.20bc	x	0.70c	x	0.80a
2	0.60bc	y	2.00a	x	1.30b	xy	0.80bc	xy	1.20a
3	1.20ab	y	1.10b	y	2.80a	x	0.80bc	y	1.50a
4	0.90bc	y	1.00b	y	0.70c	y	2.80a	x	1.40a
5	0.60bc	x	1.20b	x	1.70b	x	1.00bc	x	1.10a
6	1.30ab	x	1.10b	x	0.50c	x	1.50b	x	1.10a
7	0.50c	x	0.30c	x	0.50c	x	0.80c	x	0.50a
8	1.80a	x	0.60bc	xy	0.40c	y	0.60c	xy	0.90a
Entry mean	1.00a		1.00a		1.10a		1.10a		1.05
	48 Hours After Infestation								
1	0.90bc	x	0.50de	x	1.30b	x	0.80c	x	0.88abc
2	1.00bc	y	2.40a	x	1.40b	xy	1.10bc	y	1.48a
3	1.10bc	y	1.10cd	y	2.60a	x	0.80c	y	1.40a
4	1.30b	y	1.00cde	y	0.90bc	y	2.90a	x	1.53a
5	0.60cd	x	1.20c	x	1.50b	x	1.00bc	x	1.08ab
6	2.10a	x	1.80b	x	0.40c	y	1.60b	x	1.48a
7	0.50cd	x	0.40e	x	0.60c	x	0.80c	x	0.58bc
8	1.10d	x	0.60cde	x	0.40c	x	0.60c	x	0.43c
Entry mean	0.95a		1.13a		1.14a		1.20a		1.10

TABLE 1. Continued

Plant stage	Average number of female mites on four sorghum lines								Mean number of mites/stage
	SC 599-6		TX 7000		KS 30		HSH		
	72 Hours After Infestation								
1	1.30a	x	0.60bc	x	1.20b	x	0.60cd	x	0.93bc
2	1.70a	xy	2.50a	x	1.10bc	y	0.90cd	y	1.55a
3	1.20a	y	1.10b	y	2.80a	x	1.20c	y	1.58a
4	1.20a	y	1.00bc	y	1.00bc	y	2.60a	x	1.45ab
5	0.60b	x	0.90bc	x	1.30b	x	1.00cd	x	0.95bc
6	1.70a	x	1.20b	xy	0.30d	y	1.80b	x	1.25ab
7	0.60b	x	0.40c	x	0.60cd	x	1.90cd	x	0.63c
8	0.10b	x	0.70bc	x	0.30d	x	0.50d	x	0.40c
Entry mean	1.05a		1.05a		1.08a		1.19a		1.09

a/ Means in a column or row followed by the same letter are not significantly different at 5% level of probability, Duncan's Multiple Range Test.

b/ Means a, b, and c appear in a column, and means x and y appear in a row.

c/ Initial infestation of ten female mites in each petri dish containing leaf discs from four Lines, 1.7 cm in diameter, ten replications/plant stage.

TABLE 3. Laboratory evaluation of antibiosis to Banks grass mite for four sorghum lines at plant growth stages 1-6, ovipositional records. Lubbock, 1975.[a/][b/]

Sorghum line	Ovipositional Period in days	Total number eggs laid/female	Eggs laid/ day/female
SC 599-6	10.44a	53.22ab	4.58a
KS 30	11.67a	43.98b	4.09a
TX 7000	14.56a	67.25a	4.90a
HSH	9.75a	35.93b	3.11a
Mean	11.60	50.10	4.17

[a/] Means in a column followed by the same letter are not significantly different at 5% level of probability, Duncan's Multiple Range Test.

[b/] Initial infestation of a single female mite on a leaf disc 1.7 cm in diameter on four lines, eight replications/plant stage.

TABLE 2. Laboratory evaluation of antibiosis to Banks grass mite for four sorghum lines at plant growth stages 1-6. Lubbock, 1975.a/b/

Sorghum line	Mean number of days spent in each life stage					
	Eggs	Larvae	Proto-nymphs	Dueto-nymphs	Adults	Life Span in days
SC 599-6	4.19a	2.54a	1.56b	1.98a	15.46a	25.92a
KS 30	4.04a	2.09a	1.91ab	2.01a	16.77a	26.89a
TX 7000	3.90a	2.20a	1.77ab	1.94a	13.32a	22.85a
HSH	4.92a	2.60a	2.07a	2.31a	15.26a	27.18a
Mean	4.26	2.36	1.85	2.06	15.20	25.71

a/ Means in a column followed by the same letter are not significantly different at 5% level of probability, Duncan's Multiple Range Test.

b/ Initial infestation of a single female mite enclosed in a 1.25^2 cm area on four lines, eight replications/plant stage.

TABLE 4. Laboratory evaluation of antibiosis to Banks grass mite reared on seven sorghum lines at plant growth stages 6-8. Lubbock, 1975.[a/b/c/]

Plant stage	SC 599-6	SC 56-6	TX 7000	B TX 378	KS 30	Sweet Sudan	HSH	Mean number of days/stage
				Average number of days spent in each life stage				
				Eggs				
6	2.00a y	2.00a y	2.00b y	2.00b y	3.00a x	2.00b y	3.00a x	2.29a
7	2.00a y	2.00a y	2.00b y	3.00a x	2.50b y	2.00b y	2.00b y	2.21a
8	2.00a y	2.00a y	3.00a x	2.00b y	2.00c y	2.50a y	2.00b y	2.21a
Entry mean	2.00c	2.00c	2.30ab	2.30ab	2.50a	2.20bc	2.30ab	2.20
				Larvae				
6	2.00a x	1.00b y	1.00b y	2.00a x	1.50a xy	1.00b y	1.00c y	1.36a
7	2.00a x	2.00a x	2.00a x	1.00c y	1.00b y	1.00b y	2.00a x	1.57a
8	2.00a x	1.00b y	2.00a x	1.50b xy	1.50a xy	2.00a x	1.50b xy	1.64a
Entry mean	2.00a	1.30b	1.70ab	1.50ab	1.30b	1.30b	1.50ab	1.52
				Protonymphs				
6	1.00a x	1.00a x	1.00a x	1.00a x	1.50a x	1.00a x	1.00a x	1.07a
7	1.00a x	1.00a x	1.00a x	1.00a x	1.50a x	1.00a x	1.00a x	1.07a
8	1.00a x	1.00a x	1.00a x	1.00a x	1.00a x	1.00a x	1.00a x	1.07a
Entry mean	1.00b	1.00b	1.00b	1.00b	1.30a	1.00b	1.00b	1.05

TABLE 4. Continued

Plant stage	SC 599-6	SC 56-6	TX 7000	B TX 378	KS 30	Sweet Sudan	HSH	Mean number of days/stage
				Average number of days spent in each life stage				
				Duetonymphs				
6	1.00a x	1.00a x	1.00a x	1.00a x	1.00a x	1.00a x	1.00a x	1.00a
7	1.00a x	1.00a x	1.00a x	1.00a x	1.50a x	1.00a x	1.00a x	1.07a
8	1.00a x	1.00a x	1.00a x	1.00a x	1.00a x	1.00a x	1.00a x	1.00a
Entry mean	1.00a	1.00a	1.00a	1.00a	1.17a	1.00a	1.00a	1.02
				Adults				
6	9.00a x	13.50a x	11.50a x	12.00a x	13.50a x	20.50a x	14.50a x	13.50a
7	8.00a x	11.50a x	12.50a x	16.00a x	17.50a x	13.50a x	16.00a x	13.57a
8	5.00a x	14.50a x	9.50a x	14.00a x	21.00a x	18.00a x	11.00a x	13.29a
Entry mean	7.33c	13.17ab	11.17bc	14.00ab	17.33a	17.33a	13.83ab	13.45

TABLE 4. Continued

Plant stage	SC 599-6	SC 56-6	TX 7000	B TX 378	KS 30	Sweet Sudan	HSH	Mean number of days/stage
				Average number of days spent in each life stage				
				Total Life Span				
6	14.20a x	18.50a x	15.90a x	16.10a x	15.25a x	23.40a x	19.00a x	17.48a
7	11.95a x	14.50a x	18.30a x	19.15a x	23.80a x	17.45a x	19.65a x	17.83a
8	10.35a x	18.30a x	14.95a x	16.25a x	24.25a x	22.00a x	15.95a x	17.44a
Entry mean	12.17c	17.10ab	16.38b	17.17ab	21.10a	20.95a	18.50ab	17.58

a/ Means in a column or in a row followed by the same letter are not significantly different at the 5% level of probability, Duncan's Multiple Range Test.

b/ Means a, b, and c appear in a column, and means x and y appear in a row.

c/ Initial infestation of a single female mite on a leaf disc 1.7 cm in diameter on seven lines, twenty replications/plant stage.

TABLE 5. Laboratory evaluation of tolerance to Banks grass mite of four sorghum lines on plant growth stages 1-6, Lubbock, 1975.[a][b][c]

Time	SC 599-6		KS 30		TX 7000		HSH	
	No. mites[b]	Damage[c]	No. mites	Damage	No. mites	Damage	No. mites	Damage
Week 1	13.67a	8.08c	10.50a	5.67c	17.58a	16.42b	17.75a	26.33a
Week 2	126.58a	28.75bc	79.17a	14.92c	133.92a	42.08ab	110.33a	54.67a
Week 3	224.33a	41.25ab	124.42a	27.83b	213.75a	51.75ab	136.25a	63.83a
Week 4	255.00a	49.58ab	140.42a	29.92b	230.00a	59.58a	154.58a	65.50a

[a] Means in a row followed by the same letter are not significantly different at 5% level of probability, Duncan's Multiple Range Test.

[b] Initial infestation of a single female enclosed in a 1.25^2 cm area on four lines, two replications/plant stage.

[c] Based on percent leaf area damaged by mites in a 1.25^2 cm area.

TABLE 6. Field evaluation of resistance to Banks grass mite for 13 lines and hybrids. Pecos, September, 1975.a/

Sorghum lines and hybrids	Sugar Content (%)b/	50% Bloom (in days)	Average female mite population per plantc/	Average population density rating per plantc/	Damage Ratingd/
A TX 618 x SC 599(9188)	8.66ab	71.33i	24.18ab	2.07abc	4.49d
A TX 378 x SC 599(9188)	5.24bc	78.33e	24.68ab	1.72abc	5.99b
B TX 618	6.36bc	71.00i	33.39a	2.66a	5.65bc
B TX 378	6.30bc	85.00c	33.42a	2.07abc	6.17ab
SC 599(9188)	10.82a	80.66d	15.16ab	1.77abc	3.45e
A TX 618 x SC 56-14	7.48bc	71.00i	20.78ab	1.63abc	4.91cd
SC 56-14	7.30bc	92.00a	3.87b	0.68c	3.58e
TX 2536	7.12bc	78.00efg	24.75ab	2.07abc	6.75a
A TX 378 x TX 2536	5.24c	78.00efg	25.20ab	1.54abc	6.83a
A TX 378 x TX 415	6.24bc	73.66h	29.00a	2.04abc	6.66a
A TX 399 x TAM 2568	6.88bc	75.66gh	34.86a	1.87abc	4.58d
Sweet Sudan	7.00bc	87.33b	3.14b	.76b	2.00f
Millet (West)			27.34ab	3.29a	
Millet (East)			15.75ab	2.58b	

a/ Means in a column followed by the same letter are not significantly different at 5% level of probability, Duncan's Multiple Range Test.

b/ Mean of five plant growth stages, (stages 5, 6, 7, 8, and 9).

c/ Average female mite population and average population density rating per plant on six replications over an eight week period.

d/ Based on a numerical rating system of 0-9, six replications, mean of two rating.