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Number 3

1978

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In support of:

National Sorghum and Millet Crop Improvement
Project No: 279-11-110-030

This project initiated its activities in Yemen in early 1977. It had to build on and go forward with what was available from 1976 regarding personnel, facilities, equipment and supplies, research materials and results of past efforts.

Reports covering detailed information on project research oriented activities not previously reported elsewhere are being submitted to cover individual calendar years. These reports will be as follows:

Number One is a brief report on information on results of the 1976 calendar year which was prior to this contract. This project had to build on and go forward from this 1976 base.

Number Two will be a detailed report on project research oriented activities carried out in 1977.

Number Three is a detailed report on project research oriented activities carried out in 1978.

Number 3

1978

Section 1: Introduction to the 1978 Season

Section 2: Test Descriptions

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1978

- Section 1 -

Introduction to the 1978 Season

The 1978 cropping season represents the second full year of field research that was possible under this contract.

Part II described all activities and results from the 1977 year and field research season. The great problems of obtaining field crop research plots that would yield reliable research data were also described in Part II. It is obvious that the first requirement of doing research at this location is to develop the proper techniques, facilities and equipment. When this is accomplished then one can move on to doing reliable research. However, we found ourselves in 1978 trying to do both at once.

In Section 3 of this 1978 report a description is given of the development of these new techniques and acquisition of the necessary equipment.

Beginning early in the 1977 season field plot research data was tabulated as it became available during the season. It was rapidly put into a form that would assist in selecting those superior genotypes that should be carried forward in the breeding program. All during the fall of 1977 and early 1978 project personnel worked on data when not in the field. We tried the best we knew how to select the best genotypes in spite of extreme plot variability. A number of tests were designed for 1979 and entries selected. A description of each of these tests is given in Section 2 of this report.

- Section 2 -

Test Descriptions

A brief discussion is given as to the purpose and objectives for the research tests for 1978 is presented along with long range goals of the project.

Following are descriptions of the 19 separate field research tests conducted at Sanaa. A list of these tests is given in Table 1.

Table 1

List of Sanaa Experiment Farm
Field Experiments - 1978

Test No	Experiment Title	Number of Entries	Rows Per Plot	Reps	Total Field Rows
78097	Head-to-Row	328	1	1	328
78098	Head-to-Row	251	1	1	251
78099	Head-to-Row	352	1	1	352
78100	Head-to-Row	158	1	1	158
78101	Preliminary Yield Test	56	1	2	112
78102	Advanced Yield Test	36	2	4	288
78103	Elite Yield Test	30	2	4	240
78104	International Sorghum Disease and Insect Nursery	37	1	2	74
78105	National Cooperative Sorghum Yield Trial	5	3	3	45
78106	National Cooperative Sorghum Observation Nursery	21	3	1	63
78107	National Cooperative Maize Yield Trial	6	3	3	54
78108	National Cooperative Maize Observation Nursery	18	3	1	54
78109	National Cooperative Pearl Millet Yield Trial	3	3	3	27
78110	National Cooperative Pearl Millet Observation Nursery	10	3	1	30
78111	F_4 Generation of Populations	76	1	1	76
78112	Advanced Hybrid Generation Populations	15	1-10	1	28
78113	Nursery	158	2	1	316
78114	1978 International Food Grain Sorghym Yield Trial	30	3	3	270
78115	Early Maturity and Tall Hybrid Yield Test	18	2	3	108
		1608			2874

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— Section 2 —

Sanaa Experiment Farm Research - 1978

Background Information

It seems logical to assume that the majority of the sorghum and millet grown in Yemen in the future, will be on marginal lands. Irrigated lands with corresponding expensive production costs will be utilized for crops with higher economic value. Sorghum and millet do possess some natural characteristics making it possible for them to be a little more productive under droughty or moisture stress conditions than many other crops.

The variable moisture stresses associated with production under limited or sporadic rainfall, greatly minimizes the use of fertilizer.

The low profit or near subsistence level of sorghum and millet production, under the conditions existing, limit financial inputs by the farmer. Currently, seed of adapted genotypes are saved from year to year by farmers in all of the thousands of different environments. Improved varieties would be the first step in improvement of genotypes for farmers use.

Previous and current field plots, at the Sanaa Agricultural Research Farm, had a high degree of variability of stand, growth, and yield, indicated a probable high degree of unreliability of data.

Objectives

1. The very first objective of this project is to develop the field research techniques necessary to cope with the existing abnormal soil conditions in order to obtain reliable plot research data.

   Short term objectives, up to five years, involve:

2. Development of improved varieties.

3. Development of gene pools of adapted germ plasm from which to select recombinations of improved genotypes.

4. Attempt to work toward more moisture stress tolerance in the breeding materials.

   Longer term objectives, from five to 20 years, involve:

5. Development of hybrids from improved varieties for when seed production and farmer acceptance and use reaches an acceptable economic level.

6. Develop improved agronomic practices tailored to the particular improved variety and hybrid genotypes developed.

7. Attempt to develop a greater drought tolerance within an already drought tolerant species.

8. Eventual incorporation of miscellaneous characteristics such as insect and disease resistances, amount and quality of protein and other nutritional factors, and other factors appropriate with the state of the art of sorghum and millet improvement and for which the project has the capabilities.

TEST NO. 78097

Head-to-Row

Test Description and Purpose:

This test consists of 328 early maturity single head selections to be grown out in single unreplicated plot rows. The purpose is to visually evaluate each of these single head selections on a row basis for potential as a grain variety based on agronomic characteristics such as maturity, sufficient plant height of one meter or more, sturdy stalk, leafiness, good grain head and medium to large seed size.

Plot Size and Treatment:

Plot size is one row, six meters long and .7 meter wide. Seeding rate of three to five seeds per hill spaced at 25 cm (25 hills per plot) and thinned to two plants per hill. Three to four heads of typical plants from selected rows to be selfed at tip bloom. Seed size to be determined later. The plots to be grown under a somewhat limited (irrigation) regime in order to enhance expression of drought tolerance. Selected genotypes to be grown in a preliminary yield trial with two replications in 1979.

Seed Source:

The source of these seed were from remnant seeds of seed planted in 77082 in Field E which was lost due to unlevel land and insufficient irrigation resources. These seed came from single early maturity head selections from 76019 and 76026. Some of these selections were selfed but most were open pollinated.

TEST NO. 78098

Head-to-Row

Test Description and Purpose:

This test consists of 251 late maturity single head selections to be grown out in single unreplicated plot rows. The purpose is to visually evaluate each of these single head selections on a row basis for potential as a grain variety based on agronomic characteristics such as maturity, sufficient plant height of one meter or more, sturdy stalk, leafiness, good grain head and medium to large seed size.

Plot Size and Treatment:

Plot size is one row, six meters long and .7 meter wide. Seeding rate of three to five seeds per hill spaced at 25 cm (25 hills per plot) and thinned to two plants per hill. Three to four heads of typical plants from selected rows to be selfed at tip bloom. Seed size to be determined later. The plots to be grown under a somewhat limited (irrigation) regime in order to enhance expression of drought tolerance. Selected genotypes to be grown in a preliminary yield trial with two replications in 1979.

Seed Source:

The source of these seed were from remnant seeds of seed planted in 77083 in Field E which was lost due to unlevel and insufficient irrigation resources. These seed in turn came from single late maturity head selections from 76026. Some of these selections were selfed but most were open pollinated.

TEST NO. 78099

Head-to-Row

Test Description and Purpose:

This test consists of 352 single head selections to be grown out in single unreplicated plot rows. The purpose is to visually evaluate each of these single head selections on a row basis for potential as a grain variety based on agronomic characteristics such as maturity, sufficient plant height of one meter or more, sturdy stalk, leafiness, good grain head and medium to large seed size.

Plot Size and Treatment:

Plot size is one row six meters long and .7 meter wide. Seeding rate of three to five seeds per hill spaced at 25 cm (25 hills per plot) and thinned to two plants per hill. Three to four heads of typical plants from selected rows to be selfed at tip bloom. Seed size to be determined later. The plots to be grown under a somewhat limited moisture (irrigation) regime in order to enhance expression of drought tolerance. Selected genotypes to be grown in a preliminary yield trial with two replications in 1979.

Seed Source:

These heads were selected and selfed from 76 segregating population in the F_3 generation from test 77093. These populations were derived from a number of crosses made between a number of NES (Near East Sorghum) lines by ALAD.

TEST NO. 78100

Head-to-Row

Test Description and Purpose:

This test consists of 158 single head selections to be grown out in single unreplicated plot rows. The purpose is to visually evaluate each of these single head selections on a row basis for potential as a grain variety based on agronomic characteristics such as maturity, sufficient plant height of one meter or more, sturdy stalk, leafiness, good grain head and medium to large seed size.

Plot Size and Treatment:

Plot size is one row six meters long and .7 meter wide. Seeding rate of three to five seeds per hill spaced at 25 cm (25 hills per plot) and thinned to two plants per hill. Three to four heads of typical plants from selected rows to be selfed at tip bloom. Seed size to be determined later. The plots to be grown under a somewhat limited moisture (irrigation) regime in order to enhance expression of drought tolerance. Selected phenotypically superior genotypes to be grown in a Preliminary Yield Trial with two replications in 1979. Perhaps ten per cent will be selected for further evaluation.

Seed Source:

These heads were selected and selfed in 1977 from a bulk population of miscellaneous genotypes.

TEST NO. 78101

Preliminary Yield Test

Test Description and Purpose:

This test consists of 56 entries replicated twice in a yield test. The purpose is to evaluate each entry for yield of grain in addition to visual evaluations for other agronomic characteristics, such as maturity, height (one meter or more), plant type (sturdy stalk and leafy), head type (large), and grain characteristics (weight per 300, color, test weight, etc.).

Plot Size and Treatment:

Plot size is one row six meters long and .7 meter wide and replicated twice in a randomized complete block design. The seeding rate is three to five seeds per hill spaced at 25 cm (25 hills per plot) and thinned to two plants per hill. The following characteristics will be measured on each entry in each replication: date of 50% bloom, average plant height to top of head in cm., agronomic phenotype rating regarding head, stalk and leaves, bird damage, per cent stand, per cent lodging, grams per plot of grain yield, grain test weight, seed size as measured by weight in grams per 300 seed, and grain color. Four or five heads of each entry to be selfed to furnish seed for further testing if the genotype proves to be superior and warrants further evaluation. The test is to be grown under a somewhat limited moisture (irrigation) regime in order to enhance expression of drought tolerance. Selected superior genotypes to be grown in an Advanced Yield Trial with four replications in 1979. Perhaps twenty per cent will be selected for further evaluation.

Local varieties and other appropriate checks to be included as test entries, as standards against which experimental entries will be selected or discarded.

Seed Source:

Seventeen trial entries came from the Late Head-to-Row Test (77083), eight entries came from the Early Preliminary Yield Trial (77074) for retesting, eleven entries came from the Late Preliminary Yield Trial (77075) for retesting, four entries came from the Miscellaneous Preliminary Yield Trial (77084) for retesting, and sixteen entries were local checks, selected genotypes from other stations in Yemen and U. S. hybrids.

TEST NO. 78102

Advanced Yield Test

Test Description and Purpose:

This test consists of 36 entries replicated four times in a yield test. The purpose is to evaluate each entry for yield of grain in addition to visual evaluations for other agronomic characteristics. This replicated yield evaluation is normally the second one for these experimental genotypes.

Plot Size and Treatment:

Plot size is two rows six meters long with .7 meter between rows and replicated four times in a randomized complete block design. The seeding rate is three to five seeds per hill spaced at 25 cm (25 hills per row) and thinned to two plants per hill. The following characteristics will be measured on each entry in each replication: date of 50% bloom, average plant height to the top of the head in cm., agronomic phenotype rating regarding head, stalk, and leaves, bird damage, per cent stand, per cent lodging, grams per plot of grain yield, grain test weight, seed size as measured by weight in grams per 300 seed, and grain color. Ten heads of each entry to be selfed to furnish pure seed for further testing if the genotype proves to be superior and warrants further evaluation. The test is to be grown under a somewhat limited moisture (irrigation) regime in order to enhance expression of drought tolerance. Selected superior genotypes to be grown in an Elite Yield Test with four replications in 1979. Perhaps twenty per cent will be selected for further evaluation. Local varieties and other appropriate checks to be included as test entries as standards against which experimental entries will be selected or discarded.

Seed Source:

Six trial entries came from the Early Preliminary Yield Test (77074), ten entries came from the Late Preliminary Yield Test (77075), seven entries came from the Miscellaneous Preliminary Yield Test (77084), and thirteen entries were checks of local genotypes, genotypes from other stations and U. S. hybrids.

TEST NO. 78103

Elite Yield Test

Test Description and Purpose:

This test consists of 30 entries replicated four times in a yield test. The purpose is to evaluate each entry for yield of grain in addition to visual evaluations for other agronomic characteristics. This replicated yield evaluations is normally the third one for these experimental genotypes.

Plot Size and Treatment:

Plot size is two rows six meters long with .7 meter between rows and replicated four times in a randomized complete block design. The seeding rate is three to five seeds per hill spaced at 25 cm (25 hills per row) and thinned to two plants per hill. The following characteristics will be measured on each entry in each replication: date of 50% bloom, average plant height to the top of the head in cm., agronomic phenotypic rating regarding head, stalk, and leaves, bird damage, per cent stand, per cent lodging, grams per plot of grain yield, grain test weight, seed size as measured by weight in grams per 300 seed, and grain color. Ten heads of each entry to be selfed to furnish pure seed for increase if the genotype proves to be superior and is selected for release.

The test is to be grown under a somewhat limited moisture (irrigation) regime in order to enhance expression of drought tolerance. Selected superior genotypes to be increased and evaluated in on-farm test for a broader adaptation and production evaluation. Local varieties and other appropriate checks to be included as test entries as standards against which experimental entries will be selected or discarded.

Seed Source:

Five trial entries came from the Early Advanced Yield Test (77076), fourteen entries came from the Late Advanced Yield Test (77077), and eleven entries were checks of local genotypes from other stations, and U. S. hybrids.

TEST NO. 78104

International Sorghum Disease and Insect Nursery

Test Description and Purpose:

This test consists of 37 entries replicated twice in a non-yield test for evaluation of incidence of disease and insect damage to these entries. This test originated from Texas A and M University in the U. S. and is designed to evaluate the magnitude of disease and insect damage locally relative to other locations internationally at the particular time the test is growing.

Plot Size and Treatment:

Plot size is one row six meters long with .7 meter between rows and replicated twice in a randomized complete block design. The seeding rate is three to five seeds per hill spaced at 25 cm., (25 hills per row) and thinned to two plants per hill. Agronomic characteristics of date of flowering, stand, and lodging will be recorded. Incidence of some twenty to thirty diseases and insects will be observed.

Seed Source:

Thirty entries of known resistances and susceptibilities were submitted by Texas A and M in this test. Seven entries of resistant and susceptible sorghum plants for foliage blight and MDMV collected at Sanaa in 1977 were added.

TEST NO. 78105

National Cooperative Sorghum Yield Trial

Test Description and Purpose:

This test consists of 5 entries replicated three times in a yield trial. The purpose is to evaluate each entry for adaptation to the Sanaa area of about 2,300 m elevation for yield and other agronomic characteristics. This is a regional type of test in which all agricultural research organizations may enter their superior grain sorghum entries for an evaluation in various environments in Yemen. Four out of eight agricultural research organizations in Yemen are growing this test. This test is being grown in five locations in Yemen.

Plot Size and Treatment:

Plot size is three rows six meters long with .7 meter between rows and replicated three times in a randomized complete block design. The seeding rate is three to five seeds per hill spaced at 25 cm., (25 hills per row) and thinned to two plants per hill. The following characteristics will be measured on each entry in each replication: date of 50% bloom, average plant height to the top of the head in cm., agronomic phenotypic rating regarding head, stalk, and leaves, bird damage, per cent stand, per cent lodging, grams per plot of grain yield, grain test weight, seed size as measured by weight in grams per 300 seed, and grain color.

The test is to be grown under a somewhat limited moisture (irrigation) regime in order to evaluate the entries for adaptation to droughty rain-fed growing conditions. Superior genotypes produced by other organizations in other areas of Yemen that also prove to be of a superior nature here may be recommended to local farmers.

Seed Source:

Two of the entries are from the UNDP/FAO at Taiz and were developed primarily for that mid-elevation environment of around 1,300 m elevation. Two of the entries were developed for the Sanaa area by USAID and one entry is a local check.

TEST NO. 78106

National Cooperative Sorghum Observation Nursery

Test Description and Prupose:

This test consists of 21 entries replicated once in an observation nursery. The purpose is to visually evaluate and measure each entry for general adaptation of agronomic characteristics to the Sanaa area of about 2,300 m elevation. This is a regional type of test in which all agricultural research organizations may enter grain sorghum genotypes from early stages of development in their breeding programs which show promise of proving to be a superior genotype. An evaluation in this test gives an early indication to the breeder of the potential wide adaptation of his breeding material. Seven out of eight agricultural research organizations are cooperating in growing this test to give an evaluation of each entry in many different environments and elevations in Yemen. This test is being grown in eight locations in Yemen.

Plot Size and Treatment:

Plot size is three rows six meters long with .7 meter between rows and replicated once. The seeding rate is three to five seeds per hill spaced at 25 cm., (25 hills per row) and thinned to two plants per hill. The following characteristics will be observed on each entry: date of 50% bloom, average plant height to the top of the head in cm., agronomic phenotypic rating of head, stalk, and leaves, bird damage, per cent lodging, and grain color.

The test is to be grown under a somewhat limited moisture (irrigation) regime in order to evaluate the entries for adaptation to droughty rain-fed growing conditions.

Seed Source:

Entries were contributed by five different research organizations: Central Agricultural Research Station (UNDP/FAO), Alban (German), Radha (Dutch), Batina (Chinese), and USAID.

TEST NO. 78107

National Cooperative Maize Yield Trial

Test Description and Purpose:

This test consists of 6 maize entries replicated three times in a yield trial. The purpose is to evaluate each entry for adaptation to the Sanaa area of about 2,300 m elevation for yield and other agronomic characteristics. This is a regional type of test in which all agricultural research organizations may enter their superior maize entries for an evaluation in various environments in Yemen. Four out of eight agricultural research organizations in Yemen cooperate in growing this test. This test is being grown in five locations in Yemen.

Plot Size and Treatment:

Plot size is three rows six meters long with .7 meter between rows and replicated three times in a randomized complete block design. The seeding rate is three seeds per hill spaced at 25 cm., (25 hills per row) and thinned to one plant per hill. The following data will be collected on each entry: days to 50% flowering, height of plant in cm., height of ear in cm., per cent lodging, weight of dry ears and of shelled seed in kilogram, shelling per cent, and disease and insect damage.

Seed Source:

Entries were contributed by three different research organizations: Central Agricultural Research Station (UNDP/FAO), Alban (German), and Batina (Chinese), and we furnished our own local check.

TEST NO. 78108

National Cooperative Maize Observation Nursery

Test Description and Purpose:

This test consists of 18 maize entries replicated once in an observation nursery. The purpose is to visually evaluate and measure each entry for general adaptation of agronomic characteristics to the Sanaa area of about 2,300 m elevation. This is a regional type of test in which all agricultural research organizations may enter maize genotypes from early stages of development in their breeding programs which show promise of proving to be a superior genotype. An evaluation in this test gives the breeder an early indication of the potential wide adaptation of his breeding material. Seven out of eight agricultural research organizations in Yemen cooperate in growing this test to give an evaluation of each entry in many different environments and elevations in Yemen. This test is being grown in eight locations in Yemen.

Plot Size and Treatment:

Plot size is three rows six meters long with .7 meter between rows and replicated once. The seeding rate is three seeds per hill spaced at 25 cm., (25 hills per row) and thinned to one plant per hill. The following characteristics will be observed on each entry: days to 50% flowering, height of plant in cm., height of ear in cm., per cent lodging and disease and insect damage.

Seed Source:

Entries were contributed by two research organizations: Central Agricultural Research (UNDP/FAO), and Alban (German) and we furnished our own local check.

TEST NO. 78109

National Cooperative Pearl Millet Yield Trial

Test Description and Purpose:

This test consists of 3 pearl millet entries replicated three times in a yield trial. The purpose is to evaluate each entry for adaptation to the Sanaa area of about 2,300 m elevation for grain yield and other agronomic characteristics. This is a regional type of test in which all agricultural research organizations may enter their superior pearl millet genotypes for an evaluation in various environments in Yemen. Four of eight agricultural research organizations in Yemen cooperate in growing this test. This test is being grown in five locations in Yemen.

Plot Size and Treatment:

Plot size is three rows six meters long with .7 meter between rows and replicated three times in a randomized complete block design. The seeding rate is six to seven seeds per hill spaced at 25 cm., (25 hills per row) and thinned to two plants per hill. The following characteristics will be observed on each entry: days to 50% flowering, plant height in cm., per cent lodging, head weight and seed weight in kilograms, and stover weight in kilograms.

Seed Source:

Two entries were furnished by the Central Agriculture Research Station (UNDP/FAO) and we furnished our own local check.

TEST NO. 78110

National Cooperative Pearl Millet Observation Nursery

Test Description and Purpose:

This test consists of 10 pearl millet entries replicated once in an observation nursery. The purpose is to visually evaluate and measure each entry for general adptation of agronomic characteristics to the Sanaa area of about 2,300 m elevation. This is a regional type of test in which all agricultural research organizations may enter pearl millet genotypes from early stages of development in their breeding programs which show promise of being a superior genotype. An evaluation in this test gives the breeder an early indication of the potential wide adaptation of his breeding materials. Seven out of eight agricultural research organizations in Yemen cooperate in growing this test to give an evaluation of each entry in many different environments and elevations in Yemen. This test is being grown in eight locations in Yemen.

Plot Size and Treatment:

Plot size is three rows six meters long with .7 meter between rows and replicated once. The seeding rate is six to seven seeds per hill spaced at 25 cm., (25 hills per row) and thinned to two plants per hill. The following characteristics will be observed on each entry: days to 50% flowering, plant height in cm., per cent lodging and a visual general agronomic appearance rating.

Seed Source:

Five entries were furnished by the Central Agricultural Research Station (UNDP/FAO) and we, (USAID) furnished one entry and a local check.

TEST NO. 78111

F_4 Generation of Populations

Test Description and Purpose:

This test consists of 76 populations from specific crosses which are in the F_4 generation. The purpose is to select segregating single heads with a visual locally adapted phenotype of head and plant. These single plant selections will be grown in Head-to-Row Test in 1979 for possible inclusion in a Preliminary Yield Test in 1980.

Plot Size and Treatment:

The plot size allotted each population was only one row six meters long with .7 meter between rows. The seeding rate was five seeds per hill spaced at 25 cm., (25 hills per row) and thinned to two plants per hill. These populations to be grown under somewhat limited moisture (irrigation) regime in order to enhance expression of drought tolerance.

Seed Source:

Seed for this test was harvested in bulk from visually superior open pollinated heads in the F_3 generation from test 77093 in 1977.

TEST NO. 78112

Advanced Hybrid Generation Populations

Test Description and Purpose:

This test consists of 15 populations in various stages of segregation. The purpose is to select segregating single heads with a visually locally adapted phenotype of head and plant. These single plant selections will be grown in Head-to-Row Tests in 1979 for evaluation and a row basis for possible inclusion in a Preliminary Yield Test in 1980.

Plot Size and Treatment:

The plot size allotted each population was from one to 10 rows, six meters long with .7 meters between rows. The seeding rate was five seeds per hill spaced at 25 cm., (25 hills per row) and thinned to two plants per hill. These populations to be grown under somewhat limited moisture (irrigation) regime in order to enhance expression of drought tolerance.

Seed Source:

Seed for this test was harvested in bulk from visually superior open pollinated heads from test 77088 in 1977.

TEST NO. 78113

Nursery

Test Description and Purpose:

This test consists of approximately 158 lines or varieties of sorghum and millet. The purpose is to observe and select, self, and/or cross for various breeding purposes.

Plot Size and Treatment:

The plot size is two rows six meters long with .7 meter between rows. The seeding rate was five to seven seeds per hill spaced at 25 cm., (25 hills per row) and thinned to two plants per hill.

Seed Source:

Seed for the various entries came from previous seed lots within the project and from various imports into the country.

TEST NO. 78114

1978 International Food Grain Sorghum Yield Trial

Test Description and Purpose:

This test consists of 30 genotypes of sorghum grouped into three height sets, each of which is made up of 10 entries. There are 23 selected Purdue varieties, three commercial hybrids, and four local checks. The purpose of this test designed and distributed by the Department of Agronomy at Purdue University is identify broadly adapted genotypes, study the bais for wide environmental adaptation and distribute adapted germplasm to cooperators.

Plot Size and Treatment:

The plot size is three rows six meters long with .7 meter between rows and replicated three times. The design is a split plot with main plots laid out in randomized complete blocks. Main plots are the height groups and entries in each set are treated as subplots.

The seeding rate was five seeds per hill spaced at 25 cm., (25 hills per row) and thinned to two plants per hill.

Data will be obtained for the following characteristics: acceptability of grain for food based on visual appeal, grain yield, maturity, height, lodging, disease incidence, insect damage, bird damage, and mold damage.

Seed Source:

Seed was furnished by Purdue University and from local sources.

TEST NO. 78115

Early Maturity and Tall Hybrid Yield Test

Test Description and Purpose:

This test consists of 18 entries of which 16 are hybrid grain sorghums and two are local checks. The 16 hybrids were selected for tall height and early maturity. It was observed in 1977 that U. S. genotypes attained about half the height and were double in days to 50% bloom at this location compared to in Arizona. This test is to evaluate selected U. S. hybrids for performance in this environment.

Plot Size and Treatment:

The plot size is two rows six meters long with .7 meter between rows and replicated three times in a randomized complete block design. The plots to be grown under a somewhat limited moisture (irrigation) regime in order to enhance expression of drought tolerance. The seeding rate was five seeds per hill spaced at 35 cm., (25 hills per row) and thinned to two plants per hill. Data will be obtained for the following characteristics: maturity, height, lodging, yield, agronomic adaptability for forage, and general disease and insect damage.

Seed Source:

Seed obtained from the University of Arizona.

- Section 3 -

Field Plans of Tests

Following is a description of the planned revision of preparation of field research plots at the Sana'a Research Farm.

Mr. Dale Bucks, an irrigation engineer, with expertise in desert irrigation spent a month TDY in Yemen in late 1977 developing land management techniques for optimum plant growth. His trip report is a matter of record.

The procedures of land preparation for field plots for 1978 were drastically revised over what had been used in 1977 and previous years. A basic procedure of furrowing out, pre-irrigating with a sufficient amount of water to put moisture down to a depth of 20 to 24 inches, and planting in hills on the side of the furrow ridge above the pre-irrigation water line was devised. The land also needed to be leveled so that irrigation water could be applied at a uniform depth. The soil also needed to be chiseled to break up the plow sole and loosen the sub soil to improve water penetration. (The local top soil is used to make bricks for local houses).

The field plots were to be oriented in a north-south direction in order to give sun on both sides of the plot instead of having an east-west orientation as previously A number of temperature measurements of both east and west sides of the furrow for several days before planting showed that the east side of the furrow ridge warmed up faster by 2 to 3 hours and retained its heat nearly as long as the west side of the furrow ridge. All plantings were made on the east side of the furrow ridge.

Another important aspect of rearrangement of the field plots was that our new system theoretically allowed powered machinery to be driven the complete length of the field rows. I felt it was highly desirable to work toward mechanization. We did not yet have the proper field equipment to

mechanize but we took the first step to set up the field plot procedures for mechanized equipment.

The former system had a mini-irrigation ditch in every alley which had prevented the use of any machinery at all. Everything had to be accomplished by hand labor.

Actual development of these procedures for the 1978 season went as follows:

1. Mr. Fred French from the USDA came to Yemen on TDY for April and May to help us institute the revised field plot land preparation procedure. Mr. French was an expert irrigation and soil management technician.

2. Planting should be done in late April or early May in this environment in order to fully utilize the growing season. It is true that a farmer under rainfed conditions has to wait for rain. Many do have to plant at times as late as mid-June but this late date is undesirable. Yields decline steadily from the first of May onwards. By having a breeding and development program based primarily on the optimum then adjustments and predictions can be made from that point.

3. A land plane was not available to level the fields due to shipping delays running into not just months but years. Several fields were completely unusable without leveling.

4. A land chisel did arrive at the last minute (late March). It could only go to about 20 inches depth. We found that it shattered this particular kind of soil only about 6 to 12 inches to each side of the chisel instead of 18 to 24 inches as the manufacturer had suggested it would. We chiseled about every 20 inches instead of 40 inches as planned.

5. The sorghum project did not own any furrow openers. We had ordered some from the U.S. by air freight in November 1977 as soon as this equipment was definitely identified as being needed. We had very slim hopes of the furrow openers arriving in time to be used. I was able to borrow a light

weight furrow opener from the UNDP-FAO at Taiz in late April. It took a week to set the tractor and repair the furrow opener before starting. The soil at Sana'a is much heavier than at Taiz. The furrow openers would bend and need repair every few rows. It took almost 4 weeks (most of May) to complete the furrowing out.

6. Pre-irrigation should have started somewhat prior to mid April so that planting could have started after mid-April. We were not able to start until mid-May because neither of the irrigation wells were functional until mid-May. The USAID Mission had the responsibility of getting these wells functional but could not get it done until mid-May. Our first furrows were ready for pre-irrigation in the first week in May.

7. During pre-irrigation the unplaned (unlevel) land caused the irrigation water level in the furrows to vary from the top to the bottom of the furrow ridge from area to area of the field. The soil in the ridge where the water had covered it became quite hard. When planting in moist soil started in a couple of days a planting "pick", used to make a hole for the hill, would break out large pieces of soil. These large pieces of soil, although moist, had to be chopped up to make loose soil in the hill and to cover the seed. High sections of the field or ridges received too little water and the ridge was actually still dry in the center. If we couldn't get water to this area during pre-irrigation it was even more difficult after planting without destroying nearby plantings originally in better condition.

8. It was important to select a time to plant after pre-irrigation when the soil was at the "correct" degree of dryness (or wetness). Depending on wind and temperature this was from 5 to 7 or 8 days on the average. At this time there was only a 2 to 3 day spread in time of satisfactory soil moisture conditions before they started becoming too dry in spots. Unlevel land gave us unequal soil moisture conditions.

This particular type of soil is more critical for proper irrigation or pre-irrigation than any I have seen in 30 years of field research across half of the U.S. Neither have I, in 3 years in Yemen, seen any other soil in Yemen that causes the problems this soil does.

9. Time of day of planting combined with the variable daily weather effect turned out to be of greater importance than was originally thought. The greatest successes were attained by starting field plantings as soon as it was light or slightly before sun up at 0600. This meant getting to the field at 0530 to lay out the tests and get set up to plant. This was not easy to do within an organization (USAID) that is geared to starting work at 0800 or later and everyone depends upon Government transportation. This early planting time assured higher humidity and slower drying of the air and soil surfaces. Soil surfaces would be powder (dusty dry) by 1000 or so yet be moist again early the next morning. The time to stop planting could vary from 0830 to 1000 or 1100 depending on sun, temperature, and wind. When to stop planting for the day became a judgment learned from experience and constant observation and not possible to easily explain to someone.

10. Plots and alleys were marked with lime (gypsum) in the usual field research manner. A string was laid out on top of the bed that had plastic tape markers stapled at 25 cm intervals to mark hills. The beds ran north and south. Soil temperature observations showed the obvious thing that the east side of the ridge increased in temperature at planting dept 3 or 4 hours earlier than the west side of the ridge and maintained nearly an equal temperature throughout the rest of the day. The east side of the ridge thus gave about 20 to 25 percent more heat units toward growth.

11. The planting holes for the hills were dug with a pick with the opening about half way up the side of the bed or ridge. In most other areas of Yemen a simple stick is used to punch a hole into which the seed can be

dropped. As previously pointed out most other soils in Yemen are more friable and make better seed beds. The soil on this farm packs hard as soon as it gets wet which then makes necessary the use of a pick. The exact location for this hole is again a learned judgment situation due to variable soil and moisture conditions. The hole should be dug straight down. An angle into the bed with an overhang from the "high" side of the hole resulted in the germinating seed coleoptile unable to go around this overhang and emerge. The soil in the bottom of the hole must be pulverized down further a couple of inches with the pick to give a loose seed bed below the seed. The seed should be dropped immediately by a second man. The 5 seed should be kept in an area of ½ to 1 inch across at the bottom of the hole so that they may assist each other in emerging. The exact depth of the hole for planting the hill depends on the type of seed, seed size, and even the state of the moisture. Millet seed, because of its small size, needs to be shallower than sorghum. Corn can be planted deeper than sorghum. The U.S. type sorghum seed are small compared to the usual large size Yemen seed and must be planted shallower than Yemen types. The usual and best depth for Yemen type sorghum seed is about 3 inches or more. If the soil moisture is tending towards drying then the seed should be slightly deeper. It is obvious that millet seed have difficulty under even the best of conditions in this soil. If deep enough for moisture then it may be too deep to emerge. The location of the seed from one side of the bottom of the hole to the other can vary the depth because of the angle top.

A third man should cover the seed right after it is dropped to prevent drying of the soil around the seed. Pulverized moist soil that was dug out to form the hole should be put back in on the seed and packed gently. A pulverized loose dirt cover should be added to prevent crusting and retain moisture.. Care needs to be taken that only moist soil is used to

the seed and not dry clods or rocks. Moist soil may have to be dug from another hole made in the bottom of the furrow in order to have sufficient amount to cover the seed. The depth of planting can be regulated somewhat by the amount of soil that is put in the hole to cover the seed. The soil can be easily packed into the hole too hard which dries into an impervious plug preventing emergence or too loosely allowing the hole to dry out before germination and emergence.

12. The three man planting crew should work right along together to prevent the moist soil in the holes from drying out. The clear weather, lots of sun, wind, and low humidity dries out any moist soil very rapidly. I assigned a project technician to drop the seed as a member of each three man planting crew. He was familiar with the test, the seed, the procedures, and the reason for all activities and procedures. These project technicians could speak Arabic and guide the other two members of the planting crew.

13. After emergence, when the seedlings were about 10 to 15 cm high, the hills were thinned. We planned to plant 5 seed per hill and expected 3 or 4 to emerge. We thinned the hills to 3 plants. If a hill was missing we tried to leave a 4th plant in each adjacent hill.

This type of planting procedure of planting deep in hills is used successfully throughout Yemen. It is much like planting Indian Corn in southwest U.S.

I tried two kinds of "jab" planters but they would not work at all in this type of soil. I actually planted a small field of a random mating population with a jab planter. Less than 1% of the population emerged. The seed had excellent viability.

It became obvious to me after two seasons in Yemen that the usual U.S. type planting equipment or procedures would not work under the conditions existing on the Sana'a Experiment Farm.

Following are field maps of all of the 1978 test plantings showing their location in the fields.

Figure 1

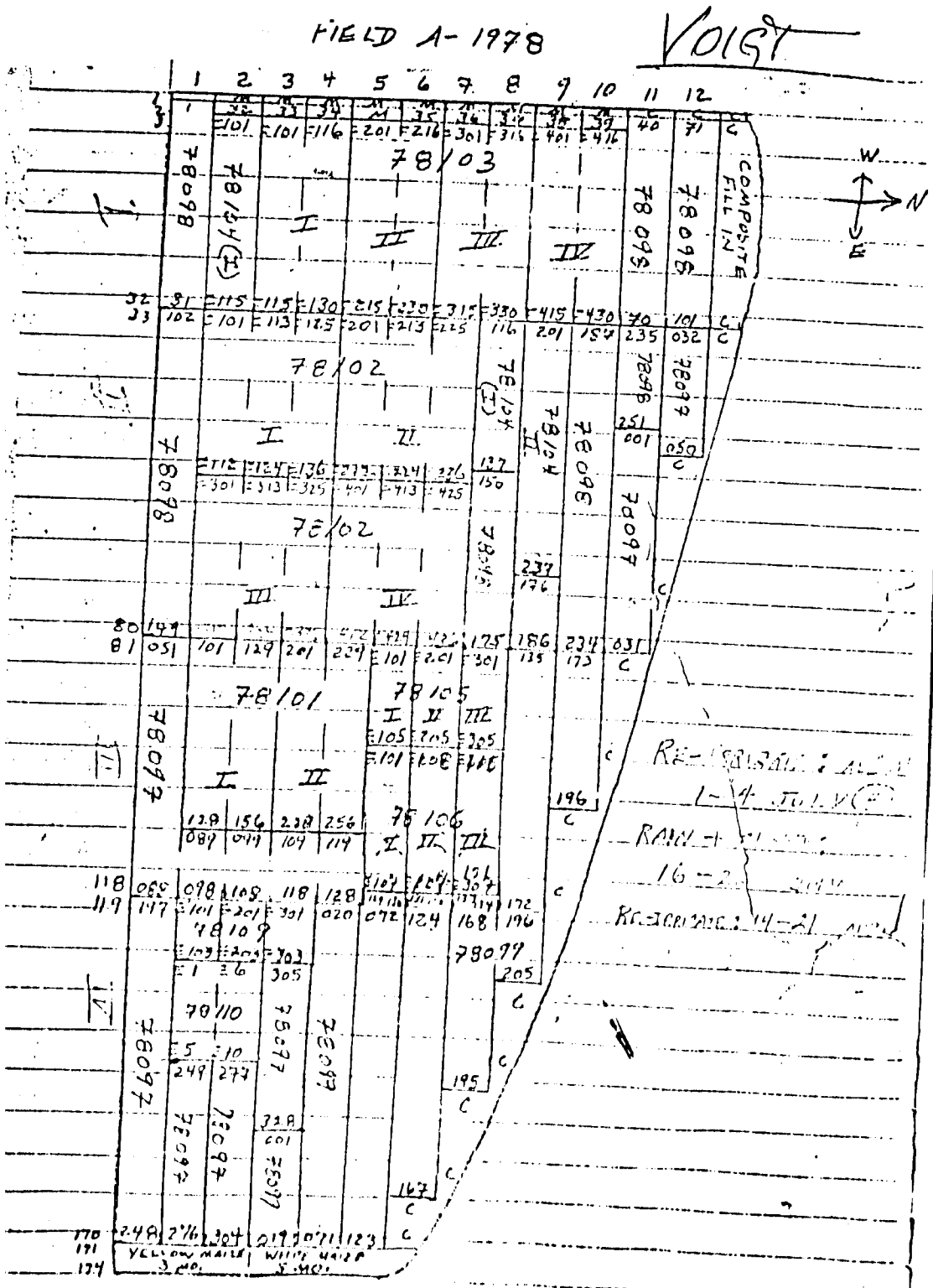

FIELD A-1978
VOIGT
1 2 3 4 5 6 7 8 9 10 11 12
78/03
78/02
78/01
78/05
78/06
78/09
78/10
78/07
78/04
78/08
COMPOSITE FILL IN
W
N
E
YELLOW MAIZE
WHITE MAIZE

Figure 2

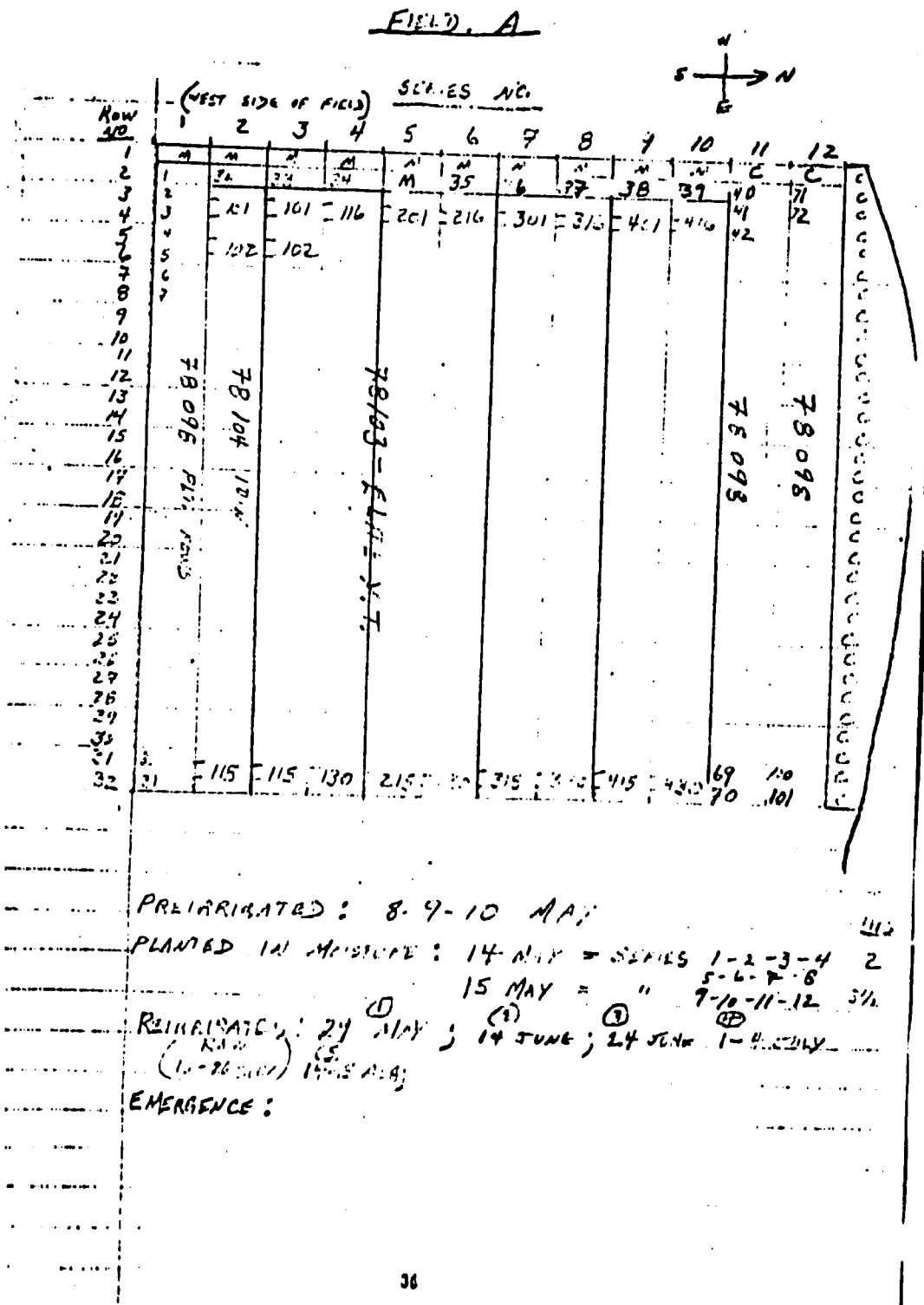
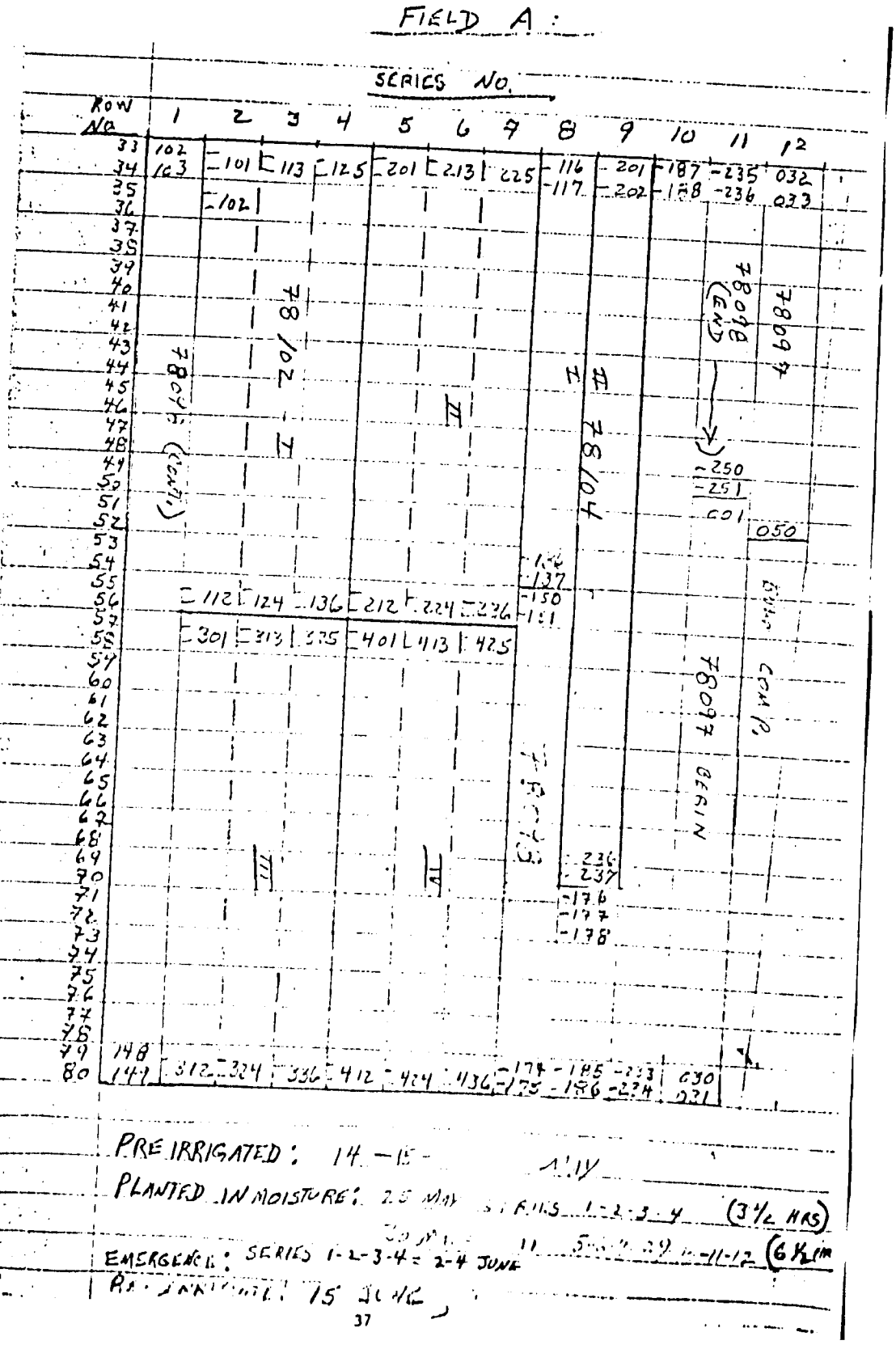

FIELD A
(WEST SIDE OF FIELD)
SERIES NO.
Row No.
1 2 3 4 5 6 7 8 9 10 11 12
S N
78096
78104
78163 - FULL N.T.
75098
78095
PRELIRRIGATED: 8-9-10 MAY
PLANTED IN MOISTURE: 14 MAY = SERIES 1-2-3-4
15 MAY = " 5-6-7-8 9-10-11-12
RELIRRIGATED: 24 MAY; 14 JUNE; 24 JUNE
EMERGENCE:

Figure 3


FIELD A:
SERIES No.
ROW No.
PRE IRRIGATED: 14 -15-
PLANTED IN MOISTURE:
EMERGENCE: SERIES 1-2-3-4 = 2-4 JUNE
(3½ HRS)
(6½ HRS)

FIELD A

SERIES NO.

ROW NO.	1	2	3	4	5	6	7	8	9	10
81	051	101	127	201	229				135	173
82	052	102	130	202	230	101	201	301	136	174
83										
84										
85						102	202	302		
86										
87										
88										
89						103	203	303		
90										
91										
92						104	204	304		
93										
94						105	205	305		
95										
96										
97										
98										
99										
100										
101						102		116		
102										
103										
104										195
105										196
106										
107		127	155	227	255					
108		128	156	228	256					
109										
110										
111										
112										
113										
114										
115										
116										
117	087									
118	088									

PREIRRIGATED:

PLANTED IN MOISTURE: 29 MAY - (ALL)

EMERGENCE: 4 JUNE = VERY FIRST

REIRRIGATE: 16 JUNE

Figure 5

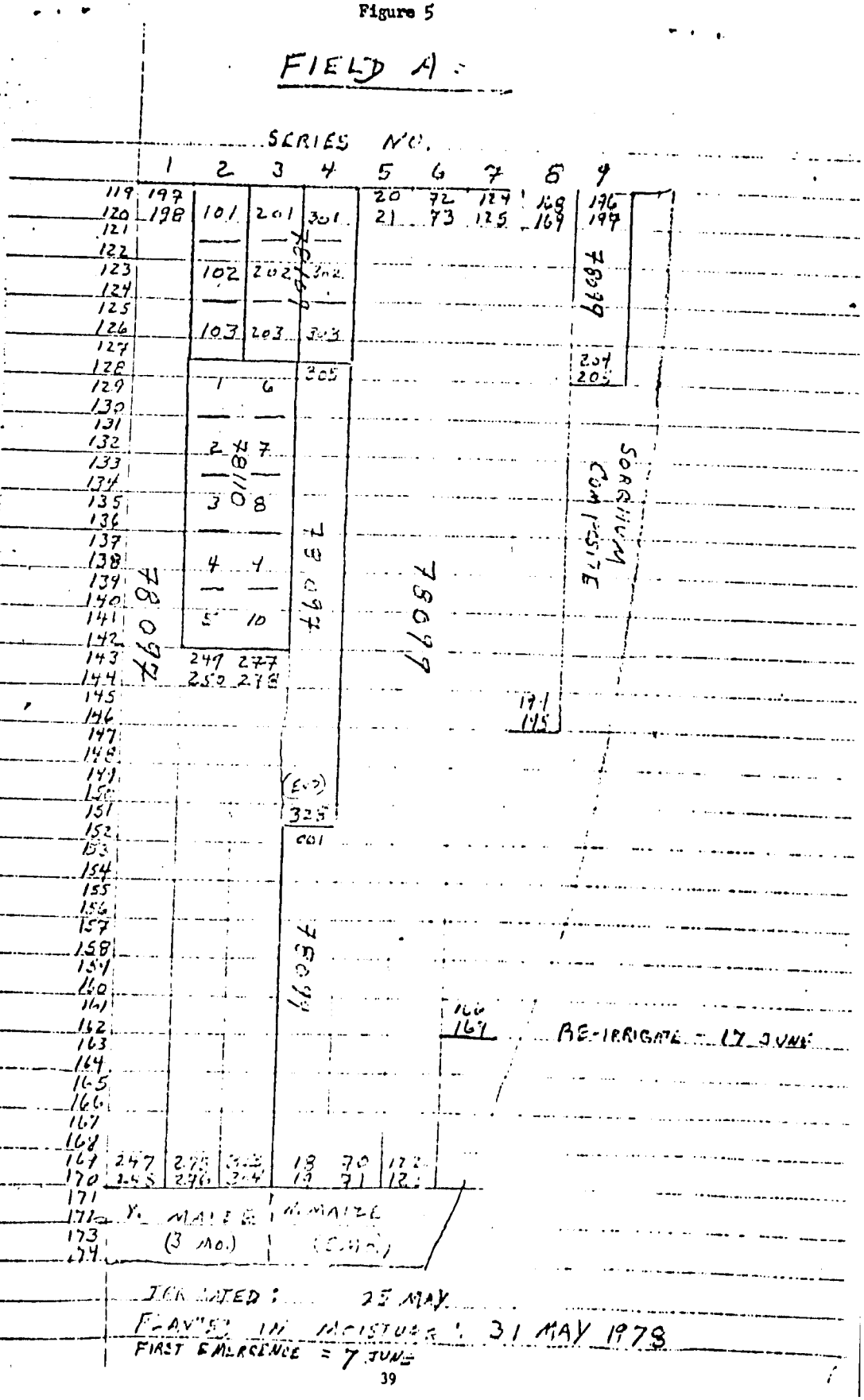

FIELD A :
SERIES NO.
1 2 3 4 5 6 7 8 9
SORGHUM
COMPOSITE
RE-IRRIGATE - 17 JUNE
% MAIZE
(3 MO.)
% MAIZE
(5 MO.)
INCULATED : 25 MAY
PLANTED IN MOISTURE : 31 MAY 1978
FIRST EMERGENCE = 7 JUNE

Figure 6

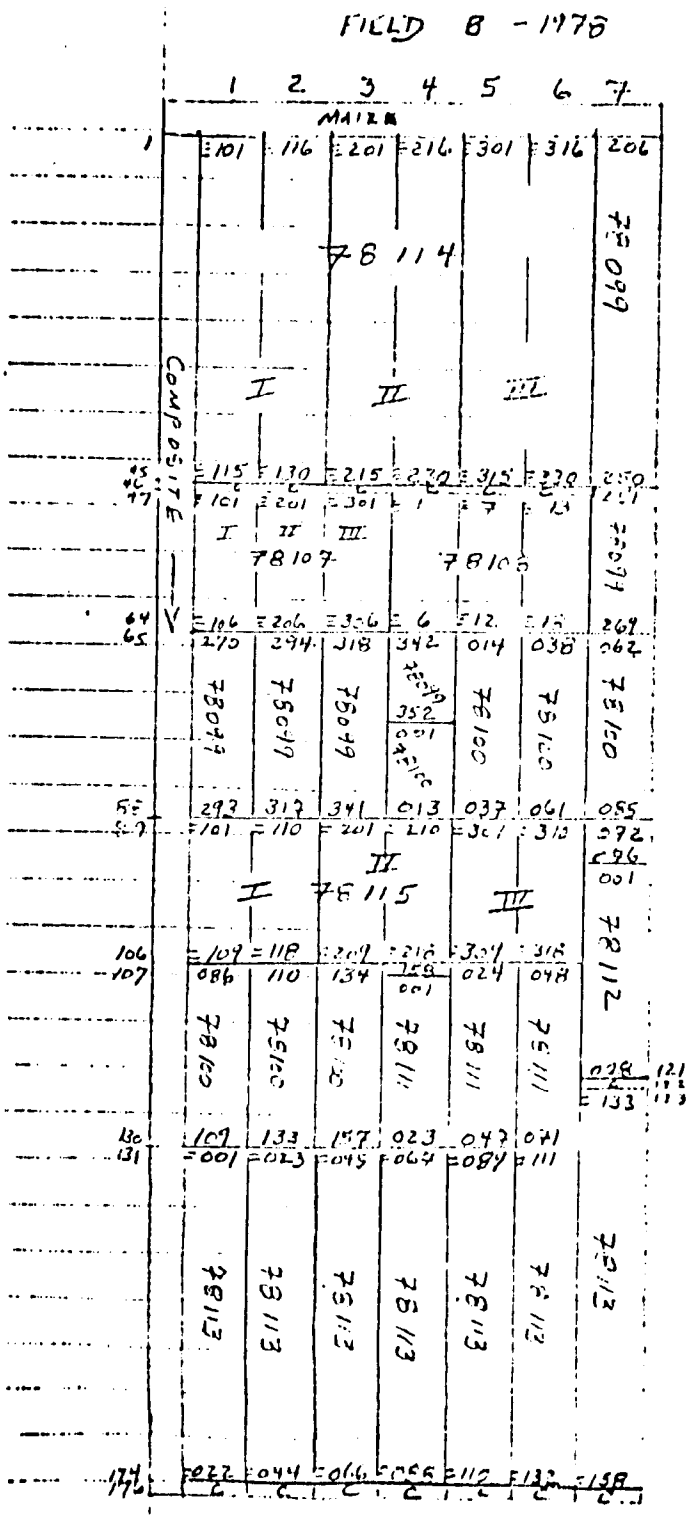

FIELD B - 1978
1 2 3 4 5 6 7
MAIZE
78114
78107
78105
78115
78112
78113
COMPOSITE
I
II
III
RAIN = LAST HALF JULY
ZIPMAIZE = AVG. 3-8

Figure 7

FIELD B

SERIES

	1	2	3	4	5	6	7
		MAIZE		3 MO.			
1							
2	101	116	201	216	301	316	206 207
3							
4							
5	102	117	202				
6							
7							
8	103	118	203				
9							
10							
11	104	119					
12							
13							
14	105	120					
15							
16							
17	106	121					
18							
19							
20	107	122					
21							
22							
23	108	123					
24							
25							
26	109	124					
27							
28							
29	110	125					
30							
31							
32	111	126					
33							
34							
35	112	127					
36							
37	113						
38	112	125					
39							
40							
41	114	129	214				
42							
43							
44	115	130	215	230	315	330	
45							250

SEGMENT COMPOSITE

76094

76114

IRRIGATED: 27-28 - 29 MAY

PLANTED: 3 JUNE — ROWS 1-35, 9 JUNE

REIRRIGATED: 19 JUNE - ROWS 1-46

FIRST EMERGENCE

Figure 8

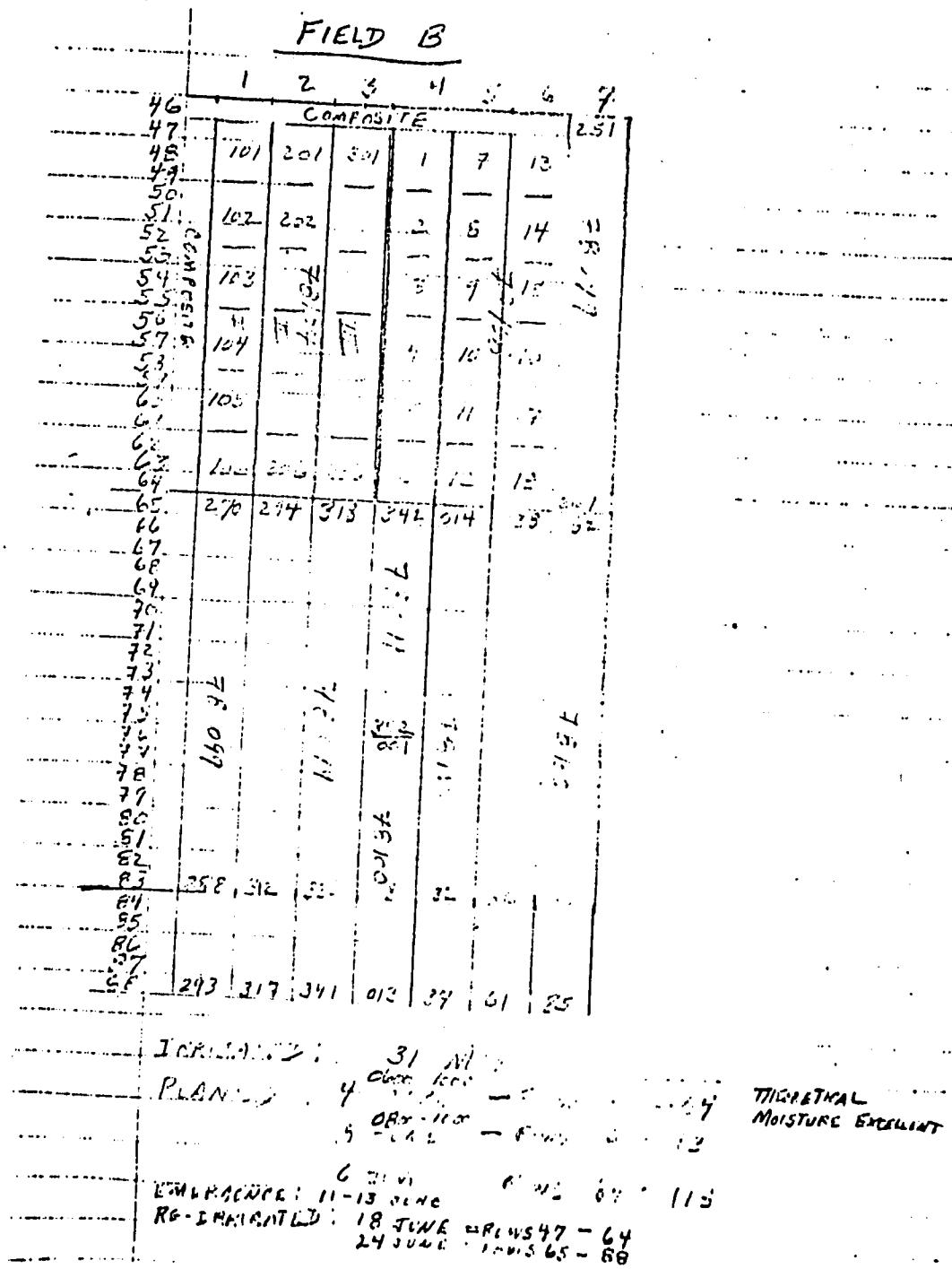


Figure 9

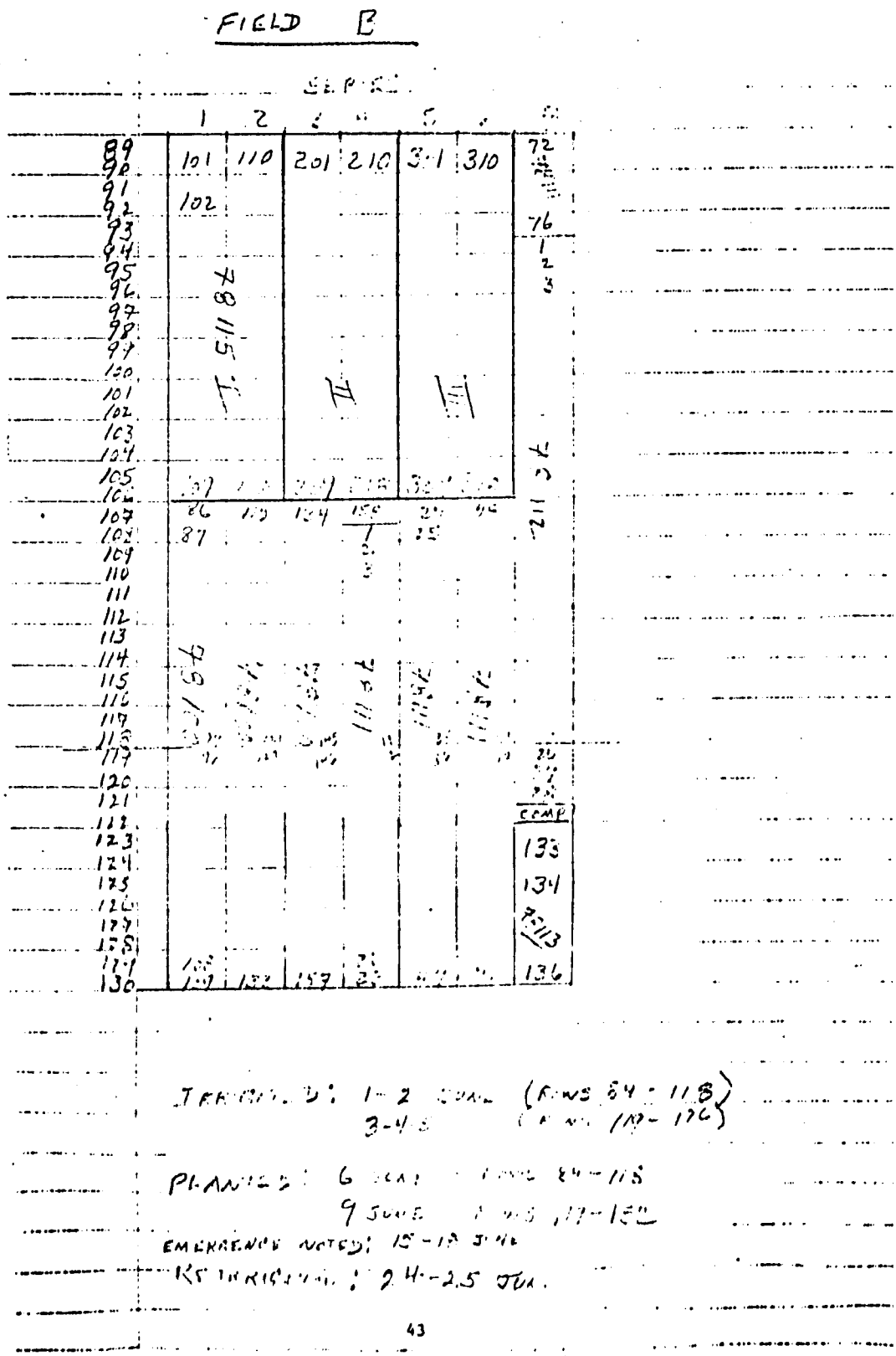

FIELD B
1
2
101
110
201
210
310
102
87
COMP
133
134
136
PLANTED:
EMERGENCE NOTED:

Figure 10

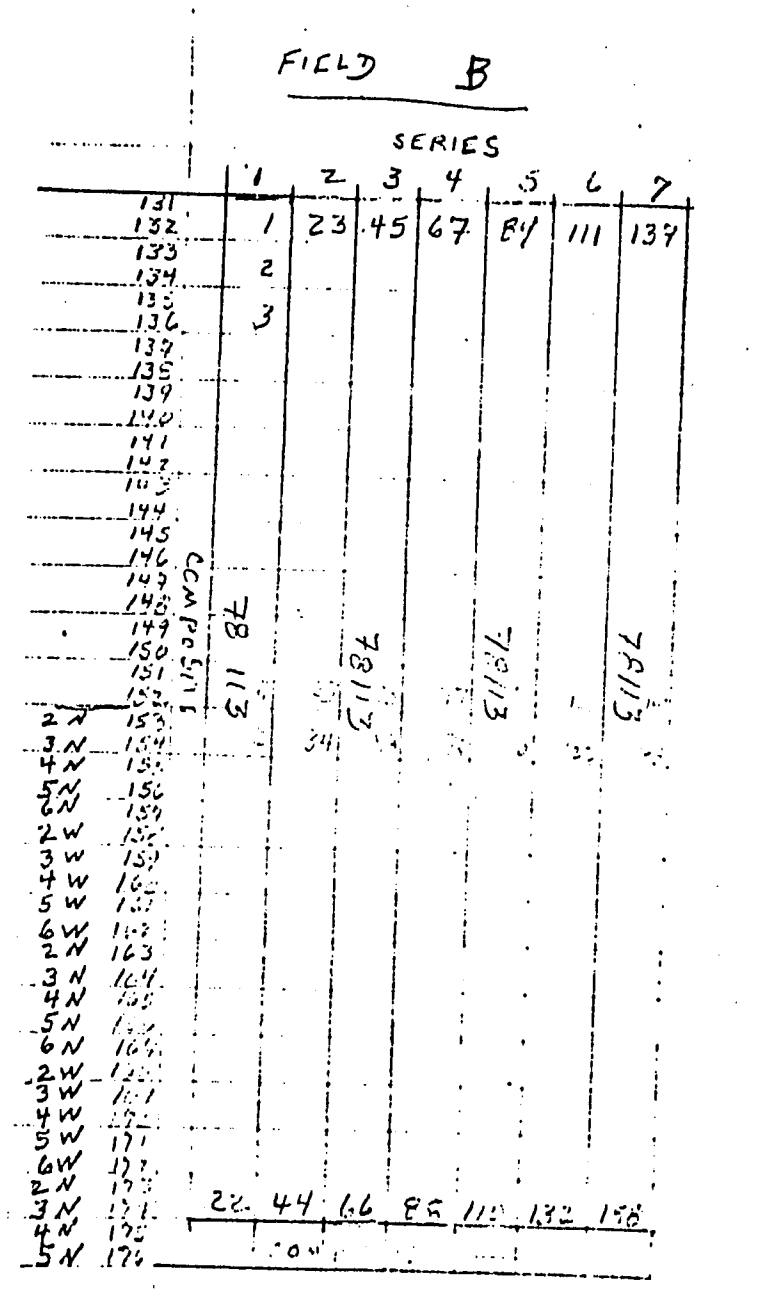
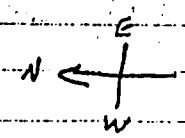
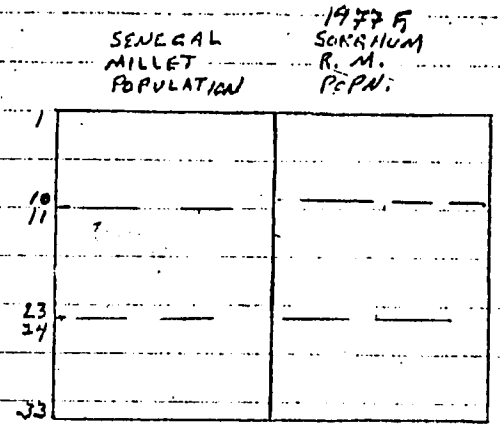

FIELD B
SERIES
1 2 3 4 5 6 7
1 23 45 67 89 111 137
2
3
COMPOSITE
87 113
78 113
78 113
78 113
22 44 66 88 110 132 158
PRE-IRRIGATION — 121 - 176 = 3-4-5 JUNE
153-176 = LAST ON 5 JUNE
PLANTING: 9 — 119-152
10 JUNE — 153-176
FIRST IRRIGATION: 153-176 · 11 JUNE
RE-IRRIGATION — 26 JUNE

Figure 11

VOIGT

FIELD D





PRE-IRRIGATION = (# 1 = 8 JUNE)(# 2 = 10 JUNE)

RE-IRRIGATE : CENTER = 17 JUNE

" = 21 JUNE

- Section 4 -

Explanation of Items of Data

Following is a listing of various data that were collected from among the research materials being tested with a description of the data and how they were collected and calculated.

1. Pedigree: This is a plant breeding term generally referring to the cross or test and plot from which a single plant or genotype was selected to thereafter have its own identity. It may also be a number from a germplasm collection.

2. Source: refers to the project test and plot from which actual seed was obtained for this particular planting or the name of the outside source.

3. Stand Count: the actual number of hills that grew in a plot expressed as a percent of the total number of hills that were planted in the plot. A hill with only one surviving plant was counted. These counts were made after thinning.

4. Days to 50% bloom: When the heads had emerged from the boot and were starting to bloom the date was recorded when all heads had bloomed half way down (half of the florets in the row had bloomed). This simple situation never really existed because of a range of beginning and ending of blooming among plants in the plot. An educated guess had to be made as to when the entire plot was about half way through blooming.

Considerable experience with sorghum is necessary to correctly estimate this character under these conditions.

The days to this bloom date are calculated from the date of planting in moisture or the date of first irrigation if planted dry.

5. Height: For general evaluation and comparison purposes in sorghum this is simply the average distance from the ground level to the top of

the head of typical plants in the plot. Considerable judgment may be needed to estimate this character under these conditions of considerable variation among plants within plots.

The value of this character is usually expressed in centimeters.

6. Agronomic Rating of the Plant and of the Head: The average or typical plant in a plot was usually rated on a scale of 1 to 3 with a score of 1 being equal to "good", 2 equal to "average" and 3 being "poor". These evaluations are professional and experienced comparisons to the typical plant desired and needed by the Yemeni farmer. The heads on an average or typical plant in a plot was visually rated in a similar manner on a similar scale but independent of the evaluation rating given to the plant.

These evaluations by experienced personnel are necessary to initially select experimental materials with potential for further testing. There is no other way to initially sort out promising genotypes for actual testing. There is a high degree of correlation of these visual ratings with actual grain and forage production values with experienced personnel.

7. Lodging: Just prior to their harvest for grain all plots were evaluated for lodging. These evaluations were expressed in a percent value composed of a combination of a value for number of lodged plants combined with degree of lodging. It is necessary that the same person be experienced and do all of the evaluations since estimates would differ by individuals.

8. Grain Production: The grain was allowed to mature and dry down on the plant in the field plot in a normal mann r. However, due to continual bird problems we did not delay harvest much beyond hard dough stage of development. There was variation in maturity among plants within plots so some heads were high in moisture. The harvested plots were hung up to dry under an open sided roofed area.

Bird watch personnel during daylight hours were very successful in keeping down bird damage of the plots. Most plots had little or no bird damage at all. Plot yields were adjusted for these estimated bird damages. Estimating bird damage correctly takes years of experience. The new or inexperienced researcher will always over-estimate bird damage by several times the real amount. This results in plots with the greatest bird damage always coming up with the greatest yields. Many years of experience are necessary to calibrate one's self on this. It is necessary for uniformity of data that the same individual do all estimating, at least within tests.

The harvesting of the heads from each plot was done by hand. Each test was harvested separately. The total time taken to hand harvest the grain of all of the tests for 1978 was only about 3 days. The actual harvesting was spread out over a greater period of time because of differences in planting dates and general maturities among tests. By hand harvesting carefully every head was harvested. Nothing was lost. This sort of accuracy is not possible with machine harvesting.

As reported earlier the sacks of heads were allowed to dry down to an air dry condition suitable for threshing. No suitable mechanized threshing equipment was available on the project for threshing these yield heads. The equipment available cracked or broke much of the local type seed which is much larger than U.S. type sorghum grain for which all of the threshers had been developed. The greatest problem was the loss of grain during threshing by throwing it out of the machine and not fully threshing out of the glumes. Threshing of the grain from the glumes by pounding by sticks on the closed sacks of dry heads was very quick and efficient with absolutely no grain loss, or cracked or broken grain. The chaff was gently fanned from the grain and then the grain was weighed for plot yield of grain.

These plot grain yields were then corrected for any percent bird damage followed by correction for percent stand count less than 100%. The resulting plot grain yield then reflected the theoretical performance of a full plot undamaged by birds.

These plot yields of grain were then converted to yields per hectare. Other grain yield values for individual genotypes were then calculated relative to height and days to maturity.

The current market values of grain by the kilo was checked in several locations and monetary values of production per hectare for each genotype were calculated.

9. Forage Production: The sorghum plant itself is of equal if not greater value than the grain in the Yemen economy. Consequently it is necessary to evaluate the experimental genotypes in the advanced or elite tests for actual forage production as well as grain production. Traditionally much of the sorghum was harvested as follows: first the leaves except for the top 2 or 3 were stripped from the stalk near soft dough and sold for feed. Second the heads were harvested by hand at maturity. Third the stalks were cut off at or near ground level, bundled and sold for feed or fuel. Fourth and last the stubble was sometimes plowed up and used for fuel. Currently the great on-farm labor shortage has eliminated the labor intensive leaf stripping on many farms. Most of the bundles of sorghum stalks sold in the suks have all dried leaves attached. Because of the great labor requirement to strip leaves this project also eliminated this step.

Immediately after grain harvest the plants in each plot of the advanced yield test were cut and weighed green in the field. A forage sample of 4 or 5 typical complete plants were immediately taken from the harvested plot material, cut up, put in a sack and reweighed green as a sample. This

representative sample was hung up to completely air dry under roof and then reweighed dry. This drop in moisture for the sample (less the sack) gave us a percent dry matter which was applied to the original total plot yield of green material to give a forage dry matter production figure. This initial plot dry matter production figure was corrected for percent stand less than 100% to bring it up to a theoretical full plot.

These plot yields of forage per hectare were then converted to yields per hectare. Other forage yield values for individual genotypes were then calculated relative to height and days to maturity.

The current market values of bundles of sorghum stalks (including leaves) by the kilo of dry matter was checked by having Yemeni employees buy several bundles at different locations. The bundles were air dried like the plots and monetary values of production of dry matter per hectare for each genotype were calculated.

Bundles of sorghum leaves and of alfalfa were also purchased air dried and monetary values calculated per ton of dry matter for comparison with sorghum stalks and leaves.

10. Grain Test Weight: A measure of the quality of the grain produced by each genotype was obtained by measuring their test weights in kilos per hectoliter.

- Section 5 -

End-of-Season Results

Following are summarized tabular data for all sorghum and millet research plots. The tables for each test contain the particular data that was collected for that particular test. In the case of replicated data the averages are given for all of the replications involved. No statistical analyses were made on any of these data. The resources (equipment, personnel and time) were not available to do this in Yemen. It is not possible to do this here in the United States since much of the replicated data had to be left in Yemen, nor is personnel, time, and money available to do all of this.

Interpretations and conclusions are presented.

Test Number 78097

Head-to-Row

End of Season Results:

This test contained a total of 328 entries, including a local check variety entered at periodic intervals. These check plots were phenotypic standards against which the agronomic performance of the surrounding entries could be compared for selection purposes. A description of this test, its purpose, seed sources, plot size and treatment during the season is given on page 9.

A total of 114 of these head rows were selected for further testing in 1979. The agronomic data collected on these selected genotypes are given in this table. The pedigree is given for each genotype making it possible to trace the source of the selection. These pedigrees are shown only within the field books of this project.

The percent stand that is given is the ratio of the actual number of hills that produced plants during the season divided by the number 25 that was planted. This value of percent stand can be regarded as some measure of the ability of the particular genotype to germinate, emerge and survive during the season in this environment.

The days to 50% bloom of the row is a measure of the maturity of the genotype.

Height of sorghum is rather important as an indication of forage production. Taller plants will likely produce greater yields of forage dry matter.

Each head row that was selected was evaluated as to its greatest future potential in the program. Those rows that were of a uniform and very desirable agronomic phenotype were selected for inclusion in the preliminary yield test (PYT) in 1979. The rows that were apparently segregating for phenotypic characters were reselected for one or more agronomically desirable individual plants and entered in Head-to-Row (HD-R) tests in 1979. If these head-to-row plots in 1979 will be of a desirable uniform agronomic phenotype then they will be selected for future evaluation for yield. Certain head rows were shorter than generally desired for forage production but possessed extremely large heads of grain. These were selected as short grains (S-GR). These genotypes were selected to be saved as a possible production genotype for use in those areas of Yemen where fields are large enough, smooth enough, and the total acreage is great enough to justify a combine for mechanized harvest.

The local check plots had agronomic data of: stands of 50 to 75%, about 92 days to 50% bloom, and about 125 cm in height.

Research data on the other 214 entries which were discarded and were not carried forward in the breeding program are not shown here. These genotypes and their data have no further value.

Table 1. Agronomic Data From Head-To-Row Grown in Test 78097 in 1978 and Selected for Further Testing in 1979.

Table No.	Test Entry No.	*1 Pedigree	% Stand	*2 Days To 50% Bloom	Ht. in Cm.	*3 Type of Selection
1	4	76026-002-2	44	90	115	PYT
2	6	76026-002-4	80	88	125	PYT
3	10	76026-002-8	24	96	130	PYT
4	13	76026-002-11	68	94	95	PYT
5	14	76026-003-1	84	95	120	PYT
6	15	76026-003-2	24	96	125	HD-R
7	19	76026-003-7	32	92	125	HD-R
8	21	76026-004-1	28	94	80	HD-R
9	24	76026-004-4	44	89	70	S-GR
10	30	76026-015-1	60	90	110	PYT
11	33	76026-015-4	72	86	95	PYT
12	34	76026-015-5	68	93	95	HD-R
13	35	76026-015-7	72	90	90	HD-R
14	41	76026-015-13	84	89	90	HD-R
15	44	76026-022-3	40	95	100	HD-R

*1 Plot size = 1 row (.7 m) X 6 m long, unreplicated.

*2 Planted in moisture on May 30, 1978.

*3 Purpose of selections: PYT = for Preliminary Yield Trial, HD-R = for Head-To-Row, S-GR = for Short Grain Collection.

Table 1. (continued)

Table No.	Test Entry No.	*1 Pedigree	% Stand	*2 Days To 50% Bloom	Ht. in Cm.	*3 Type of Selection
16	46	76026-022-5	84	88	75	HD-R
17	47	76026-022-6	36	99	90	HD-R
18	48	76026-022-7	64	99	110	HD-R
19	49	76026-022-8	56	95	90	HD-R
20	51	76026-022-10	60	93	110	HD-R
21	53	76026-024-2	76	96	140	PYT
22	54	76026-024-3	16	99	130	PYT
23	55	76026-024-4	80	95	130	PYT
24	59	76026-024-8	40	89	115	PYT
25	60	76026-024-9	56	97	115	PYT
26	66	76026-026-4	20	101	170	HD-R
27	67	76026-026-5	60	94	145	PYT
28	70	76026-026-8	36	105	140	PYT
29	72	76026-026-10	44	98	140	PYT
30	78	76026-027-2	16	98	125	HD-R
31	79	76026-027-3	52	90	125	PYT
32	94	76026-029-10	76	93	130	PYT
33	96	76026-030-1	96	90	120	PYT
34	99	76026-032-2	44	103	90	S-GR
35	102	76026-032-5	80	107	120	PYT

Table 1. (continued)

Table No.	Test Entry No.	*1 Pedigree	% Stand	*2 Days To 50% Bloom	Ht. in Cm.	*3 Type of Selection
36	110	76026-037-1	76	92	145	PYT
37	111	76026-037-2	16	97	140	HD-R
38	113	76026-037-4	48	95	130	PYT
39	114	76026-037-5	48	101	130	HD-R
40	115	76026-037-6	72	101	130	PYT
41	116	76026-037-7	80	99	135	PYT
42	119	76026-037-10	44	100	120	PYT
43	120	76026-037-11	28	101	120	PYT
44	129	76026-039-3	28	101	90	S-GR
45	132	76026-039-6	44	91	110	PYT
46	141	76026-041-1	92	96	125	PYT
47	142	76026-041-2	44	97	115	PYT
48	145	76026-041-5	92	97	145	PYT
49	146	76026-041-6	60	98	115	PYT
50	147	76026-041-7	76	98	120	PYT
51	149	76026-044-2	60	97	155	PYT
52	150	76026-044-3	24	96	120	HD-R
53	151	76026-044-4	92	96	145	PYT
54	154	76026-046-3	76	106	145	PYT
55	155	76026-046-4	20	107	140	HD-R

Table 1. (continued)

Table No.	Test Entry No.	*1 Pedigree	% Stand	*2 Days To 50% Bloom	Ht. in Cm.	*3 Type of Selection
56	160	76026-047-4	72	99	135	HD-R
57	163	76026-047-7	56	105	140	PYT
58	164	76026-048-2	44	102	120	PYT
59	174	76026-050-2	60	99	135	PYT
60	175	76026-050-3	32	99	135	PYT
61	176	76026-050-4	8	100	130	HD-R
62	177	76026-050-5	16	101	135	HD-R
63	178	76026-050-6	76	103	135	PYT
64	180	76026-052-1	56	96	130	PYT
65	182	76026-052-4	96	95	130	PYT
66	183	76026-052-5	76	104	145	PYT
67	184	76026-052-6	64	96	150	PYT
68	197	76026-063-2	40	92	115	PYT
69	198	76026-063-3	12	94	110	PYT
70	202	76026-063-6	36	92	95	PYT
71	203	76026-063-7	56	98	115	PYT
72	205	76026-063-9	60	105	115	PYT
73	207	76026-063-11	36	95	105	HD-R
74	212	76026-064-3	36	95	125	HD-R
75	213	76026-064-4	28	94	110	PYT

Table 1. (continued)

Table No.	Test Entry No.	*1 Pedigree	% Stand	*2 Days To 50% Bloom	Ht. in Cm.	*3 Type of Selection
76	225	76026-065-5	64	95	105	PYT-White
77	229	76026-065-9	24	93	105	HD-R
78	232	76026-066-2	20	90	110	HD-R
79	236	76026-066-6	60	90	120	PYT
80	237	76026-066-7	44	98	125	HD-R
81	251	76026-067-2	24	105	100	HD-R
82	252	76026-067-3	80	94	135	PYT
83	253	76026-067-5	60	94	100	HD-R
84	260	76026-067-12	60	93	95	PYT
85	262	76026-071-2	44	95	130	PYT
86	263	76026-071-3	32	99	145	HD-R
87	265	76026-071-5	32	96	110	HD-R
88	268	76026-073-2	64	92	130	HD-R
89	272	76019-001-2	40	93	110	HD-R
90	273	76019-001-3	68	95	115	PYT
91	274	76019-001-4	76	90	125	PYT
92	275	76019-001-5	8	100	65	HD-R
93	279	76019-001-9	32	99	120	HD-R
94	287	76019-002-7	32	99	105	HD-R
95	288	76019-002-8	92	97	100	HD-R

Table 1. (continued)

Table No.	Test Entry No.	*1 Pedigree	% Stand	*2 Days To 50% Bloom	Ht. in Cm.	*3 Type of Selection
96	289	76019-002-9	68	94	105	HD-R
97	290	76019-002-10	80	95	105	HD-R
98	291	76019-003-1	28	94	110	HD-R
99	296	76019-003-6	72	97	95	HD-R
100	298	76019-003-8	60	95	115	PYT
101	301	76019-004-1	40	93	110	HD-R
102	302	76019-004-2	36	94	120	HD-R
103	304	76019-004-4	24	93	110	HD-R
104	305	76019-004-5	28	97	90	HD-R
105	306	76019-004-6	52	96	110	HD-R
106	308	76019-004-8	16	95	105	HD-R
107	312	76019-005-2	36	94	110	HD-R
108	314	76019-005-6	32	94	105	HD-R
109	315	76019-005-7	44	94	85	HD-R
110	316	76019-005-8	32	94	100	HD-R
111	319	76019-007-1	24	103	110	HD-R
112	324	76019-007-6	24	97	90	HD-R
113	327	76019-009	44	95	115	HD-R
114	225	76026-065-5	64	95	105	PYT-Red

Test Number 78098

Head-to-Row

End of Season Results:

Two hundred fifty one entries including a local check variety repeated at periodic intervals made up this test. The local check plots were phenotypic standards against which the agronomic performance of nearby entries could be compared for selection purposes. A description of this test, its purpose, seed sources, plot size and treatment during the season is given on page 10. A total of 95 of these head rows were selected for further evaluation in 1979. The agronomic phenotypic data collected on these selected genotypes are given in this table. An explanation of these data is given in the "End of Season Results" written up for Test Number 78097.

Table 2. Agronomic Data From Head-To-Row Grown In Test 78098 In 1978 And Selected For Further Testing In 1979.

Table No.	Test Entry No.	*1 Pedigree	% Stand	*2 Days To 50% Bloom	Ht. in Cm.	*3 Type Of Selection
1	56	76026-011-6	20	106	90	PYT
2	83	76026-018-2	4	105	85	HD-R
3	85	76026-018-4	8	108	105	HD-R
4	96	76026-033-6	12	108	110	PYT
5	102	76026-035-2	40	94	130	HD-R
6	104	76026-035-4	32	115	120	HD-R
7	108	76026-036-2	16	100	160	PYT
8	109	76026-036-3	36	99	155	PYT
9	110	76026-036-4	24	99	155	PYT
10	111	76026-036-5	48	99	125	HD-R
11	112	76026-036-6	48	96	125	PYT
12	113	76026-040-1	20	101	140	PYT
13	114	76026-040-2	56	95	145	PYT
14	115	76026-040-3	16	90	150	HD-R
15	116	76026-040-4	48	97	140	HD-R

*1 Plot size = 1 row (.7 m) X 6 m long, unreplicated.

*2 Planted in moisture: Test entry numbers 1-34 = 14 May, numbers 35-101 = 15 May, numbers 102-149 = 25 May, and numbers 150-251 = 30 May.

*3 Purpose of selections: PYT = for Preliminary Yield Trial, HD-R = for Head-To-Row, S-GR = for Short Grain Collection.

Table 2. (continued)

Table No.	Test Entry No.	*1 Pedigree	% Stand	*2 Days To 50% Bloom	Ht. in Cm.	*3 Type Of Selection
16	117	76026-040-6	32	94	155	HD-R
17	118	76026-040-7	24	99	135	HD-R
18	119	76026-040-8	32	95	140	HD-R
19	120	76026-040-9	56	88	130	HD-R
20	121	76026-042-1	40	100	140	HD-R
21	122	76026-042-2	28	100	145	HD-R
22	123	76026-042-3	60	90	130	HD-R
23	124	76026-042-4	72	90	140	PYT
24	126	76026-043-1	32	105	130	HD-R
25	127	76026-043-2	88	104	165	PYT
26	129	76026-043-4	32	99	150	HD-R
27	130	76025-043-5	76	112	170	PYT
28	133	76026-045-3	36	97	170	PYT
29	134	76026-045-4	28	99	175	HD-R
30	135	76026-051-1	40	95	160	HD-R
31	136	76026-051-2	36	99	140	HD-R
32	137	76026-051-3	80	101	160	PYT
33	138	76026-051-6	64	100	150	HD-R
34	139	76026-053-1	88	103	155	PYT
35	140	76026-053-2	84	89	145	HD-R

Table 2. (continued)

Table No.	Test Entry No.	*1 Pedigree	% Stand	*2 Days To 50% Bloom	Ht. in Cm.	*3 Type Of Selection
36	141	76026-053-4	60	89	145	PYT
37	142	76026-053-5	28	104	135	HD-R
38	143	76026-053-7	56	95	140	HD-R
39	144	76026-054-1	88	112	150	PYT
40	145	76026-054-2	100	116	145	HD-R
41	147	76026-054-4	40	99	140	HD-R
42	148	76026-054-5	12	105	150	HD-R
43	149	76026-054-6	48	119	135	HD-R
44	150	76026-055-1	84	111	105	HD-R
45	155	76026-056-1	80	116	115	HD-R
46	158	76026-057-2	64	99	115	HD-R
47	159	76026-057-3	76	102	130	PYT
48	160	76026-057-4	44	96	130	PYT
49	163	76026-059-1	8	103	110	HD-R
50	164	76026-059-3	16	99	125	HD-R-white
51	164	76026-059-3	16	99	125	HD-R-red
52	165	76026-059-4	68	101	135	PYT
53	166	76026-059-5	4	102	160	HD-R
54	167	76026-059-7	12	99	145	HD-R
55	169	76026-060-4	20	103	140	PYT

Table 2.(continued)

Table No.	Test Entry No.	*1 Pedigree	% Stand	*2 Days To 50% Bloom	Ht. in Cm.	*3 Type of Selection
56	170	76026-060-5	76	95	135	PYT
57	171	76026-060-6	56	95	140	HD-R
58	173	76026-060-8	76	101	140	PYT
59	174	76026-061-1	80	90	110	S-GR
60	175	76026-061-2	84	83	110	HD-R
61	177	76026-061-4	76	95	125	PYT
62	180	76026-061-6	72	96	140	PYT
63	181	76026-061-7	56	95	140	PYT
64	182	76026-061-8	76	93	130	PYT
65	183	76026-068-1	44	95	110	HD-R
66	188	76026-068-6	20	94	80	S-GR
67	192	76026-068-10	36	93	95	HD-R
68	194	76026-068-12	44	93	90	S-GR
69	199	76026-069-5	64	90	105	HD-R
70	201	76026-069-7	32	93	105	HD-R
71	205	76026-070-2	60	99	135	PYT
72	206	76026-070-3	48	101	150	PYT
73	208	76026-070-5	28	92	115	S-GR
74	211	76026-070-8	60	96	135	HD-R
75	213	76026-070-10	80	90	150	HD-R

Table 2. (continued

Table No.	Test Entry No.	*1 Pedigree	% Stand	*2 Days To 50% Bloom	Ht. in Cm.	*3 Type Of Selection
76	216	76026-070-13	76	100	140	PYT
77	218	76026-070-15	24	97	130	HD-R
78	219	76026-070-16	12	107	115	HD-R
79	221	76026-072-2	28	94	140	PYT
80	222	76026-072-3	40	100	130	PYT
81	224	76026-072-5	8	95	115	HD-R
82	225	76026-072-6	32	96	125	HD-R
83	226	76026-072-7	48	94	140	PYT
84	227	76026-072-8	52	99	140	HD-R
85	228	76026-072-9	12	101	130	HD-R
86	229	76026-072-10	48	90	130	PYT
87	231	76026-074-1	84	93	155	PYT
88	232	76026-074-2	72	87	175	HD-R
89	233	76026-074-3	84	91	175	PYT
90	234	76026-074-4	64	91	175	PYT
91	235	76026-074-5	76	93	125	PYT
92	238	76026-074-8	64	97	110	S-GR
93	240	76026-074-10	76	98	85	S-GR
94	241	76026-074-11	56	95	90	S-GR
95	247	76026-075-6	32	94	130	PYT

Test Number 78099

Head-to-Row

End of Season Results:

Three hundred fifty two entries including a local check variety repeated at periodic intervals were entered in this test. A description of this test, its purpose, seed sources, plot size and treatment during the season is given on page 11.

A total of 104 of these head rows were selected for further evaluation in 1979. The agronomic phenotypic data collected on these selected genotypes are given in this table. An explanation of these data is given in the "End of Season Results" written up for Test Number 78097.

Table 3. Agronomic Data From Head-To-Row Grown In Test 78099 in 1978 and Selected for Further Testing in 1979.

Table No.	Test Entry No.	*1 Pedigree	% Stand	*2 Days To 50% Bloom	Ht. in Cm.	*3 Type Of Selection
1	6	77093-02-1	56	96	100	PYT
2	15	77093-03-5	76	92	90	S-GR
3	27	77093-05-4	40	89	75	S-GR
4	45	77093-08-8	72	99	80	S-GR
5	46	77093-09-1	64	99	90	HD-R
6	48	77093-09-3	84	95	130	PYT
7	61	77093-13-1	88	94	125	PYT
8	73	77093-15-4	16	89	90	HD-R
9	86	77093-20-2	84	92	115	PYT
10	87	77093-20-3	40	95	105	HD-R
11	92	77093-22-2	60	90	90	S-GR
12	98	77093-24-1	8	97	120	HD-R
13	112	77093-26-3	48	95	140	HD-R
14	117	77093-27-4	72	87	130	PYT
15	132	77093-30-1	80	97	110	PYT

*1 Plot size = 1 row (.7 m) X 6 m long, unreplicated.

*2 Planted in moisture: Test entry numbers 1 - 205 = 31st May, numbers 206-250 = 3rd June, numbers 25-269 = 4th June, and numbers 270 -352 = 5th June.

*3 Purpose of selections: PYT = for Preliminary Yield Trial, HD-R = for Head-To-Row, S-GR = for Short Grain Collection.

Table 3. (continued)

Table No.	Test Entry No.	*1 Pedigree	% Stand	*2 Days To 50% Bloom	Ht. in Cm.	*3 Type Of Selection
16	134	77093-31-2	56	96	145	PYT
17	141	77093-32-4	80	89	100	PYT
18	142	77093-32-5	88	94	130	PYT
19	145	77093-33-2	60	97	110	HD-R
20	147	77093-33-4	80	96	130	PYT
21	148	77093-33-5	64	95	90	S-GR
22	155	77093-36-4	76	96	150	PYT
23	168	77093-38-3	92	89	110	PYT
24	171	77093-39-1	52	104	110	HD-R
25	174	77093-39-4	56	105	115	HD-R
26	175	77093-39-5	84	87	120	PYT
27	176	77093-39-6	52	102	115	HD-R
28	177	77093-39-7	80	91	110	PYT
29	182	77093-41-3	76	94	120	PYT
30	183	77093-41-4	72	95	135	PYT
31	184	77093-42-1	92	96	135	PYT
32	186	77093-42-3	40	97	125	PYT
33	204	77093-47-5	60	94	115	PYT
34	205	77093-47-6	64	99	120	HD-R
35	207	77093-48-2	100	94	140	PYT

Table 3. (continued)

Table No.	Test Entry No.	*1 Pedigree	% Stand	*2 Days To 50% Bloom	Ht. in Cm.	*3 Type Of Selection
36	215	77093-49-4	100	94	110	PYT
37	219	77093-50-1	80	100	105	PYT
38	220	77093-50-2	96	101	105	PTY
39	221	77093-50-3	88	101	110	HD-R
40	222	77093-50-4	68	100	95	HD-R
41	223	77093-50-5	84	100	100	PYT
42	224	77093-50-6	72	99	105	PYT
43	227	77093-51-3	68	101	95	PYT
44	230	77093-52-2	84	92	110	PYT
45	231	77093-52-3	72	99	105	PYT
46	232	77093-52-4	84	94	95	HD-R
47	233	77093-53-1	72	95	100	PYT
48	239	77093-54-4	84	98	85	PYT
49	240	77093-55-1	60	101	110	HD-R
50	241	77093-55-2	88	96	110	PYT
51	242	77093-55-3	80	94	105	PYT
52	243	77093-55-4	76	96	110	HD-R
53	244	77093-55-5	76	101	110	PYT
54	245	77093-55-6	80	97	90	HD-R
55	246	77093-55-7	92	95	115	PYT

Table 3. (continued)

Table No.	Test Entry No.	*1 Pedigree	% Stand	*2 Days To 50% Bloom	Ht. in Cm.	*3 Type Of Selection
56	247	77093-56-1	88	100	115	PYT
57	248	77093-56-2	76	98	130	PYT
58	249	77093-56-3	88	96	110	PYT
59	250	77093-56-4	92	97	115	PYT
60	251	77093-56-5	84	97	160	PYT
61	252	77093-56-6	96	92	105	PYT
62	253	77093-56-7	88	98	120	PYT
63	254	77093-57-1	52	107	110	PYT
64	256	77093-57-3	80	95	125	PYT
65	257	77093-57-4	72	94	120	PYT
66	258	77093-57-5	88	96	125	PYT
67	260	77093-58-2	68	92	95	PYT
68	261	77093-58-3	56	94	105	HD-R
69	262	77093-58-4	48	95	100	PYT
70	263	77093-58-5	16	97	90	HD-R
71	265	77093-59-1	84	97	125	PYT
72	266	77093-59-2	84	97	110	HD-R
73	267	77093-59-3	80	96	110	HD-R
74	269	77093-60-2	96	88	120	HD-R
75	271	77093-60-4	64	93	140	PYT

Table 3. (continued)

Table No.	Test Entry No.	*1 Pedigree	% Stand	*2 Days To 50% Bloom	Ht. in Cm.	*3 Type Of Selection
76	272	77093-61-1	48	91	130	HD-R
77	274	77093-61-3	68	90	140	PYT
78	276	77093-61-5	32	87	120	HD-R
79	280	77093-62-4	68	89	125	HD-R
80	282	77093-63-2	72	96	140	PYT
81	283	77093-63-3	64	98	150	PYT
82	285	77093-64-1	40	92	125	HD-R
83	287	77093-64-3	56	88	125	PYT
84	288	77093-64-4	68	90	115	HD-R
85	289	77093-65-1	84	88	125	PYT
86	290	77093-65-2	84	84	130	PYT
87	291	77093-65-3	52	95	125	PYT
88	292	77093-65-4	68	105	120	HD-R
89	293	77093-65-5	56	86	125	PYT
90	297	77093-66-2	72	88	100	HD-R
91	309	77093-68-3	80	87	120	PYT
92	310	77093-68-4	80	85	115	PYT
93	311	77093-69-1	48	92	95	PYT
94	313	77093-69-3	64	92	95	PYT
95	315	77093-70-2	84	92	120	PYT

Table 3. (continued)

Table No.	Test Entry No.	*1 Pedigree	% Stand	*2 Days To 50% Bloom	Ht. in Cm.	*3 Type Of Selection
96	325	77093-71-4	40	105	110	HD-R
97	329	77093-72-1	76	100	175	HD-R
98	330	77093-72-2	80	103	155	HD-R
99	332	77093-72-4	96	89	135	PYT
100	334	77093-73-2	16	105	120	HD-R
101	340	77093-74-5	96	97	115	HD-R
102	344	77093-75-4	72	89	120	PYT
103	345	77093-75-5	80	92	160	PYT
104	352	77093-76-6	84	97	65	S-GR

Test Number 78100

Head-to-Row

End of Season Results:

One hundred fifty eight entries including a local check variety repeated at periodic intervals were entered in this test. A description of this test, its purpose, seed sources, plot size and treatment during the season is given on page 100.

Fifty nine of these head rows were selected for further evaluation in 1979. The agronomic phenotypic data collected on these selected genotypes are given in this table (Table No. 4). An explanation of these data is given in the "End of Season Results" written up for Test Number 78097.

Table 4. Agronomic Data From Head-To-Row Grown in Test 78100 in 1978 and Selected for Further Testing in 1979.

Table No.	Test Entry No.	*1 Pedigree	% Stand	*2 Days To 50% Bloom	Ht. in Cm.	*3 Type of Selection
1	1	77 COMP. 1	80	93	100	S-GR
2	5	77 COMP. 5	40	96	63	S-GR
3	6	77 COMP. 6	68	100	123	HD-R
4	7	77 COMP. 7	76	87	120	PYT
5	8	77 COMP. 8	68	99	83	S-GR
6	12	77 COMP. 12	84	87	125	PYT
7	14	77 COMP. 14	80	93	90	HD-R
8	17	77 COMP. 17	76	88	140	HD-R
9	20	77 COMP. 20	88	87	93	S-GR
10	21	77 COMP. 21	84	90	97	S-GR
11	27	77 COMP. 27	92	92	110	PYT
12	28	77 COMP. 28	96	97	160	PYT
13	31	77 COMP. 31	84	91	85	S-GR
14	34	77 COMP. 34	84	87	130	PYT
15	35	77 COMP. 35	72	89	135	PYT

*1 Plot size = 1 row (.7 m) X 6 m long, unreplicated

*2 Planted in moisture on June 5, 1978

*3 Purpose of selections: PYT = for Preliminary Yield Trial, HD-R = for Head-To-Row, S-GR = for Short Grain Collection.

Table 4. (continued)

Table No.	Test Entry No.	*1 Pedigree	% Stand	*2 Days To 50% Bloom	Ht. in Cm.	*3 Type Of Selection
16	37	77 COMP. 37	80	91	135	PYT
17	39	77 COMP. 39	52	97	95	S-GR
18	45	77 COMP. 45	84	91	130	PYT
19	46	77 COMP. 46	72	88	90	S-GR
20	49	77 COMP. 49	44	85	100	HD-R
21	51	77 COMP. 51	68	86	95	HD-R
22	56	77 COMP. 56	60	92	115	PYT
23	58	77 COMP. 58	88	87	105	S-GR
24	60	77 COMP. 60	68	86	75	S-GR
25	72	77 COMP. 72	84	89	100	S-GR
26	73	77 COMP. 73	80	95	85	S-GR
27	74	77 COMP. 74	96	87	110	PYT
28	75	77 COMP. 75	80	90	90	S-GR
29	76	77 COMP. 76	68	87	120	PYT
30	77	77 COMP. 77	76	91	100	PYT
31	78	77 COMP. 78	48	94	95	HD-R
32	79	77 COMP. 79	76	91	95	PYT
33	80	77 COMP. 80	80	87	110	PYT
34	84	77 COMP. 84	76	87	90	PYT
35	86	77 COMP. 86	64	93	160	PYT

Table 4. (continued)

Table No.	Test Entry No.	*1 Pedigree	% Stand	*2 Days To 50% Bloom	Ht. in Cm.	*3 Type Of Selection
36	87	77 COMP. 87	80	90	150	PYT
37	92	77 COMP. 92	40	87	80	S-GR
38	104	77 COMP. 104	60	90	117	PYT
39	110	77 COMP. 110	72	90	110	PYT
40	112	77 COMP. 112	88	93	130	HD-R
41	113	77 COMP. 113	88	91	145	PYT
42	116	77 COMP. 116	96	91	130	PYT
43	117	77 COMP. 117	92	91	140	PYT
44	120	77 COMP. 120	72	91	145	HD-R
45	121	77 COMP. 121	92	94	145	PYT
46	122	77 COMP. 122	80	92	135	PYT
47	124	77 COMP. 124	92	98	115	PYT
48	126	77 COMP. 126	92	91	145	PYT
49	127	77 COMP. 127	56	98	140	HD-R
50	128	77 COMP. 128	48	92	95	S-GR
51	130	77 COMP. 130	92	90	135	PYT
52	131	77 COMP. 131	100	90	125	PYT
53	132	77 COMP. 132	76	93	135	HD-R
54	133	77 COMP. 133	80	97	128	HD-R
55	134	77 COMP. 134	68	86	130	HD-R

Table 4. (continued)

Table No.	Test Entry No.	*1 Pedigree	% Stand	*2 Days To 50% Bloom	Ht. in Cm.	*3 Type Of Selection
56	142	77 COMP. 142	88	86	140	PYT
57	145	77 COMP. 145	96	86	140	HD-R
58	155	77 COMP. 155	72	96	155	HD-R
59	158	77 COMP. 158	64	86	155	HD-R

Test Number 78101
Preliminary Yield Test

End of Season Results:

This Preliminary Yield Test had 53 experimental genotypes and a local check variety entered three times for a total of 56 entries. A description of this test, its purpose, seed sources, plot size and planned treatment during the season is given on page 13. These plans were made at the time the entries were selected from the 1977 tests and other plant materials available.

Most characteristics were measured as planned on the two replications of each genotype. These average data are presented in Table No. 5. Bird damage was estimated and the yields of affected plots were adjusted accordingly. The damage by birds seemed to occur by location in the field without any particular association with genotype so these damage estimates were not included in the data presented here. There was practically no lodging so in the interest of conserving space no column of zeros was presented in the table.

The percent stand value is an average value from both replications, of the number of hills with at least one plant, as a percent of the total hills planted.

Table 5. Yield and Other Agronomic Data From a Preliminary Yield Test (78101) of Grain Sorghum Experimental Variety Genotypes at Sanaa, Yemen in 1978.

Rank By Grain Prod.	Entry No.	*1 Pedigree	Origin	% Stand	*2 Days To 50% Bloom	Plant Ht. Cm.	Grain Prod. K/HA	*3 Grain Prod. K/HA/DAY	*4 Agronomic Rating Plant	Head
1	13	76026019-6	77083-108	40	92	132	7491	61	2	1
2	38	Radah Local		60	100	148	6317	49	1.5	1.5
3	8	Local		56	92	138	5188	42	1.5	1.5
4	52	Local		72	92	132	4867	40	2	2
5	7	Sana'a-7	77091	36	92	135	4533	37	1.5	2
6	30	Radah Local		82	96	152	4400	35	1	1
7	24	76026025-2	77083-141	46	97	158	4391	35	1.5	1.5
8	37	Radah Local		64	103	135	4200	32	1.5	1
9	3	Sana'a-3	77091	40	97	122	4052	32	2	2
10	11	FMA53A	Uni. Az.	54	91	78	3879	32	3	1
11	23	76026023-1	77083-136	84	98	140	3852	30	2	2
12	18	76026019-13	77083-115	64	93	122	3762	31	2.5	1.5
13	53	76026-019	77084-1039	52	98	125	3688	29	2.5	1.5
14	42	76041-004	77075-1004	54	94	112	3642	29	3	2
15	4	Sana'a-4	77091	68	94	115	3638	29	2	1

*1 Plot size: 1 row (.7 m between rows) X 6 m long, 25 hills per row spaced 25 cm apart, replicated two times.

*2 Planted in moisture on 29 May, 1978.

*3 Grain production in kilos per hectare per day calculated on a grain development period of from planting to 30 days past 50% bloom.

*4 Agronomic rating scale of plants and heads: 1 = good, 2 = average, 3 = poor.

Table 5. (continued)

Rank By Grain Prod.	Entry No.	*1 Pedigree	Origin	% Stand	*2 Days To 50% Bloom	Plant Ht. Cm.	Grain Prod. K/HA	*3 Grain Prod. K/HA/DAY	*4 Agronomic Rating Plant	Head
16	26	76026025-6	77083-145	88	97	175	3545	28	1	1
17	6	Sanaa-6	77091	66	94	130	3533	28	2	1.5
18	10	NK 300	Uni. Az.	90	82	100	3517	31	3	2
19	29	Local		66	94	112	3362	27	2	2
20	56	76015-067	77084-1106	64	97	105	3352	26	3	1.5
21	40	76016-066	77074-1126	60	94	138	3329	27	3	2
22	34	76013-134	77074-1054	74	90	110	3314	28	3	2
23	46	76015-108	77075-1057	68	94	118	3150	25	3	2
24	25	76026025-4	77083-143	56	96	140	3090	24	1	1
25	51	76025-054	77075-1113	72	99	120	3029	24	2.5	1
26	36	76013-167	77074-1069	64	94	110	3005	24	3	2
27	32	76013-128	77074-1051	74	90	112	2845	24	3	2.5
28	47	76016-016	77075-1063	44	94	102	2798	23	3	2
29	5	Sanaa-5	77091	80	91	120	2724	22	2	2.5
30	48	76025-004	77075-1068	66	94	120	2629	21	2.5	1.5
31	45	76015-024	77075-1047	56	93	125	2464	20	3	2
32	35	76013-135	77074-1055	54	92	90	2457	20	3	2.5
33	2	Sanaa-2	77091	36	99	95	2419	19	2	1.5
34	55	76026-061	77084-1065	56	90	138	2410	20	2	1.5
35	17	76026019-12	77083-114	72	92	105	2252	18	3	2

Table 5. (continued)

Rank By Grain Prod.	Entry No.	*1 Pedigree	Origin	% Stand	*2 Days To 50% Bloom	Plant Ht. Cm.	Grain Prod. K/HA	*3 Grain Prod. K/HA/DAY	*4 Agronomic Rating Plant	Head
36	22	76026021-4	77083-129	72	98	135	2233	17	1.5	2.5
37	31	76013-124	77074-1048	38	96	70	2190	17	3	3
38	21	76026021-2	77083-127	68	94	100	2090	17	3	2.5
39	49	76025-033	77075-1093	54	98	118	2029	16	3	1.5
40	19	76026020-2	77083-117	74	95	115	2022	16	2.5	1.5
41	27	76026025-9	77083-148	80	98	118	1981	16	2.5	1.5
42	50	76025-034	77075-1094	80	100	122	1967	15	2.5	2
43	20	76026020-9	77083-124	50	96	100	1952	16	3	2
44	54	76026-040	77084-1056	82	100	115	1857	14	2.5	2.5
45	1	Sanaa-1	77091	64	96	100	1550	12	2.5	2.5
46	9	WS 1297	UNDP-Taiz	12	128	140			2	1
47	12	76026019-2	77083-104	12	107	105			2	1.5
48	14	76026019-7	77083-109							
49	15	76026019-8	77083-110	14	113	75			3	1
50	16	76026019-9	77083-111	40	99	98			2.5	2
51	28	76026025-10	77083-149	32	112	150			1	1.5
52	33	76013-129	77074-1052	56	94	115			3.	2.5
53	39	76016-058	77074-1121	20	99	98			3	2.5
54	41	76041-001	77075-1001	34	99	98			3	2.5
55	43	76036-047	77075-1018	24	97	105			3	2
56	44	76036-059	77075-1023	32	100	100			3	1

Test Number 78102

Advanced Yield Test

End of Season Results:

This Advanced Yield Test contained a total of 36 experimental genotypes. A description of this test, its purpose, seed sources, plot size and planned treatment during the season is given on page 14. These plans for genotype treatment and evaluation were made at the beginning of the season when the entries were selected from 1977 tests and other plant material available. The type of data actually obtained or collected was modified somewhat by the end of the season.

This "Advanced" yield test represented a second year of actual yield testing. The first years (1977) yield testing of these entries was a "preliminary" yield test. Only those entries showing superiority of production over local checks or having other potentially desirable attributes were selected from the preliminary yield test and carried forward for further evaluation in the advanced yield test this year (1978). Potential genotypes reaching this stage of evaluation need to be more fully tested before possible release. Hence forage yields were taken as well as grain. Test weights of the grain were obtained.

These data are presented in Tables 6, 7, 8 and 9 on pages 85, 86, 87 and 88, respectively.

The data in Tables 6 and 7 are not arranged in any order of grain or forage production. The percent stand value is an average value from four replications, of the number of hills with at least one plant, as a percent of the total hills planted. The value of days to 50% bloom is the number of days from planting in moisture to that date when all of the heads in a plot are half bloomed or in cases of variability in maturity when half of the florets in a plot have bloomed. The plant height in cm is simply the average or

typical height in cm from the ground level to the top of the head of a typical plant.

The value of grain production in kilos per hectare is the average plot grain weight from four replications. The grain had been dried, threshed, and cleaned thus the weights among entries represent a common grain moisture level.

The grain production of each entry was expressed in terms of the days to maturity of each entry or 30 days in addition to the days to 50% bloom. The highest yielding genotypes in general had the highest grain production per day of plant growth through to maturity.

After the heads were hand harvested for grain yields the remaining plants were cut at ground level and an air dried forage production value in kilos per hectare was obtained.

These air dried forage production values were further expressed in terms of grams per hectare of forage produced per cm of final average height of the plants. These values may be of importance in selecting a genotype with greater forage yield. The total plant is used for forage so its forage production per unit of height can well be a function of final total forage yield and be a factor that can be selected for.

A grain to forage ratio (amount of grain produced per unit of air dried forage) was calculated for each entry. This comparison of the main attributes of grain and forage production is helpful to look at in the selection of potential genotypes for further research evaluation.

The visual agronomic ratings for the plant and the head of each experimental genotype is of interest and some importance in selecting those superior genotypes for future research evaluation in the program. In general there is quite a bit of correlation of these visual agronomic ratings with the actual

yields of forage and grain. Thus the visual selections of single plants and of head rows in the beginning phases of our established breeding program appears to have considerable accuracy for the breeder with experience in sorghum.

The date in Table 9 are ranked in order of the average grain and forage production rank of each entry. Yields of grain and forage of each entry are expressed in Table 8 in terms of local currency (Yemen Rials) and of $U.S. as determined from local retail market prices at the time of harvest. It is interesting to note the total value per hectare produced by different genotypes. It is obvious that somewhat different genotypes would be selected if considering grain production, forage production, combined grain and forage production, or total market value per hectare of grain and forage.

Table 6. Agronomic Data From an Advanced Yield Test (78102) of Selected Experimental Sorghum Genotypes at Sana'a, Yemen Arab Republic. 1978.

Table and Entry No.	Pedigree *1	Origin	% Stand *2	Days To 50% Bloom	Plant Ht CM	Agronomic Rating *3 Plant	Agronomic Rating *3 Head
1	76013-031	77074-1012	72	91	135	2.2	2.5
2	76013-069	77074-1022	72	86	125	2.5	2.5
3	76013-107	77074-1036	45	96	106	3	3
4	76013-140	77074-1057	73	88	130	2	1.5
5	76016-002	77074-1105	40	92	88	3	1.7
6	76016-057	77074-1120	65	91	126	2.2	1.5
7	76015-054	77075-1050	68	88	89	3	2.2
8	76015-085	77075-1053	65	83	120	2.5	2.2
9	76015-110	77075-1058	68	88	128	2	1.7
10	76025-017	77075-1077	52	92	130	2	1.5
11	76025-019	77075-1079	66	94	122	2	2.5
12	76025-026	77075-1086	60	88	136	2	1.7
13	76025-032	77075-1092	74	93	169	1	1.5
14	76025-044	77075-1100	57	92	141	2	1.2
15	76025-043	77075-1102	66	93	145	1.2	2
16	76025-052	77075-1111	70	93	145	1.2	1.2
17	LOCAL	LOCAL	58	90	142	1.7	1.7
18	76026-014	77084-1034	72	94	131	1.7	2
19	76026-023	77084-1043	68	98	132	1.7	1.7
20	76026-024	77084-1044	78	99	144	1.2	1.2
21	76026-025	77084-1045	58	90	145	1.5	1.2
22	76026-032	77084-1051	64	91	108	2.7	1.7
23	76026-033	77084-1052	56	97	118	2	1.2
24	76013-029	77084-1141	68	86	100	2.7	2.2
25	SANA'A-1	77091	46	94	134	2	1.7
26	SANA'A-2	77091	53	94	108	2.2	2.2
27	SANA'A-3	77091	54	92	121	1.7	2
28	SANA'A-4	77091	64	96	104	2.2	2
29	SANA'A-5	77091	74	89	116	2	2.5
30	SANA'A-6	77091	52	92	111	2.5	1.7
31	SANA'A-7	77091	42	92	138	2	1.7
32	LOCAL	LOCAL	57	91	132	1.5	1.5
33	FM-A53A	UNIV. AZ	80	92	84	3	1
34	ACCO-R920	UNIV. AZ	86	82	84	3	1
35	NK 300	UNIV. AZ	94	80	95	2.7	2.5
36	WS 1297	UNDP-TAIZ	9	129	127	2	2.5

*1 - Plot size = two rows each six m long with .7m between rows, 25 hills per row and four replications in a randomized complete block design.

*2 - Planted in moisture: replications I and III on 25 May 1978 and replications II and IV on 30 May 1978.

*3 - Agronomic ratings of plant and head: 1 = good, 2 = average, 3 = poor.

Table 7. Grain and Forage Production Data From an Advanced Yield Test (78102) of Selected Experimental Sorghum Genotypes at Sana'a, Yemen Arab Republic. 1978.

Entry and Table No.	Grain Prod. K/HA	Grain Prod. K/HA/DAY *1	Grain Test WT K/HL	Forage Prod K/HA	Forage Prod. K/HA/DAY	Forage Prod. K/HA/ Cm HT	Grain To Forage Ratio
1	2817	23	70.8	4881	40.3	36	.57
2	2846	24	69.5	4133	35.6	33	.68
3	910	7	-	7190	57.1	68	.12
4	4246	36	72.3	5833	49.4	45	.72
5	2510	21	70.9	2633	21.6	30	.95
6	3470	29	70.9	5110	42.2	41	.67
7	2376	20	67.8	4345	36.8	49	.54
8	2979	26	71.4	4098	36.3	34	.72
9	3979	34	70.6	4740	40.2	37	.83
10	3572	29	68.4	8988	73.7	69	.39
11	1874	15	70.2	7532	60.7	62	.24
12	4422	38	68.2	6310	53.5	46	.70
13	2762	22	69.7	7702	62.6	46	.35
14	3077	25	67.5	7145	58.6	51	.43
15	2545	21	69.4	8500	69.1	59	.29
16	3813	31	71.4	7556	61.4	52	.50
17	3272	27	66.0	7643	63.7	54	.42
18	3370	27	68.3	10877	87.7	83	.30
19	3382	26	71.3	6411	50.1	49	.52
20	3117	24	72.2	9520	73.8	66	.32
21	4001	33	70.2	7955	66.3	55	.50
22	3376	28	70.8	5738	47.4	53	.58
23	4954	39	69.5	8393	66.1	71	.59
24	2162	19	70.8	3043	26.2	30	.71
25	3566	29	68.6	9531	76.9	71	.37
26	3168	26	69.4	6848	55.2	63	.46
27	3051	25	67.7	7601	62.3	63	.40
28	3199	25	68.0	4845	38.4	47	.66
29	2816	24	67.1	5202	43.7	45	.54
30	3322	27	70.2	8443	69.2	76	.39
31	4756	39	67.8	6708	55.0	49	.70
32	4040	33	66.8	6845	56.6	52	.59
33	2966	24	72.8	3473	28.5	41	.85
34	3586	32	72.4	2901	25.9	34	1.23
35	1633	15	72.2	2744	24.9	29	.59
36*2	-	-	-	-	-	-	-

*1 - Grain production of kilograms per hectare per day based on number of days from planting to 30 days past 50% bloom.

*2 - Entry WS 1297 submitted from the UNDP/FAO at Taiz did not bloom early enough to set and develop seed in this environment. The percent stand obtained in the experimental plots were too low to harvest for forage production.

Table 8. Presentation of Grain Monetary Values, Forage Monetary Values, and Total Monetary Values per Hectare for the Production of 36 Experimental Sorghum Genotypes in an Advanced Yield Test (78102) at Sana'a, Yemen Arab Republic. 1978 *1

Table No.	Entry No.	Grain Value Per HA YR	Grain Value Per HA $	Forage Value Per HA YR	Forage Value Per HA $	Total Grain and Forage Value Per HA *2 YR	Total Grain and Forage Value Per HA *2 $
1	18	4718	1040	19640	4330	24358	5370
2	25	4992	1100	17210	3794	22202	4894
3	23	6935	1529	15155	3341	22090	4870
4	20	4363	962	17190	3790	21553	4752
5	10	5000	1102	16229	3578	21229	4680
6	21	5601	1235	14364	3167	19965	4396
7	30	4650	1025	15245	3361	19895	4386
8	16	5338	1177	13643	3008	18981	4185
9	15	3563	785	15348	3384	18911	4169
10	31	6658	1468	12112	2670	18770	4138
11	17	4580	1009	13800	3042	18380	4051
12	32	5656	1247	12360	2725	18016	3972
13	27	4271	941	13725	3026	17996	3967
14	13	3866	852	13907	3066	17773	3918
15	12	6190	1364	11393	2512	17583	3876
16	14	4307	949	12901	2844	17208	3793
17	26	4435	977	12365	2726	16800	3703
18	4	5944	1310	10532	2322	16476	3632
19	19	4734	1043	11576	2552	16310	3595
20	11	2623	578	13600	2998	16223	3576
21	22	4726	1042	10361	2284	15087	3326
22	3	1274	280	12982	2862	14256	3142
23	9	5570	1228	8559	1887	14129	3115
24	6	4858	1071	9227	2034	14085	3105
25	29	3942	869	9393	2071	13335	2940
26	28	4478	987	8748	1928	13226	2915
27	1	3943	869	8813	1943	12756	2812
28	8	4170	919	7399	1631	11569	2550
29	2	3984	878	7462	1645	11446	2523
30	7	3326	733	7845	1729	11171	2462
31	33	4152	915	6271	1382	10423	2297
32	34	5020	1106	5238	1155	10258	2261
33	24	3026	667	5494	1211	8520	1878
34	5	3514	774	4754	1048	8268	1822
35	35	2286	504	4954	1092	7240	1596
36	36	-	-	-	-	-	-

*1 - The price basis for these monetary values were current local market values on an air-dry dry matter basis for grain @ YR 1.4/K and US $.3087/K, and for forage @ YR .75/K and US $ .1654/K.

*2 - The monetary values in this column are total Yemen Rial and U.S. Dollar values of grain and forage produced of each entry genotype.

Table 9. Presentation of Grain and Forage Production Ranks and Their Average Ranks for 36 Experimental Sorghum Genotypes in an Advanced Yield Test (78102) at Sana'a, Yemen Arab Republic. 1978.

Table Rank No.	Entry No.	Grain Prod. Rank	Forage Prod. Rank	Ave. Grain and Forage Prod. Rank *1	Selected For 1979 *2
1	23	1	7	4	G,F,FG
2	25	11	2	6.5	G,G,FG
3	10	10	4	7	G,F,FG
4	21	6	8	7	G,F,FG
5	18	15	1	8	F,FG
6	16	8	12	10	G,FG
7	31	2	18	10	G,FG
8	30	16	6	11	F,FG
9	32	5	17	11	FG
10	12	3	20	11.5	G,FG
11	20	20	3	11.5	F,FG
12	4	4	21	12.5	G,FG
13	17	17	10	13.5	
14	19	13	19	16	SEL.
15	27	22	11	16.5	
16	9	7	27	17	G,F
17	15	29	5	17	
18	26	19	16	17.5	
19	6	12	24	18	G
20	14	21	15	18	SEL.
21	22	14	22	18	SEL.
22	13	28	9	18.5	
23	34	9	33	21	
24	28	18	26	22	
25	11	33	13	23	
26	3	35	14	24.5	
27	29	27	23	25	
28	1	26	25	25.5	
29	8	23	30	26.5	
30	2	25	29	27	
31	33	24	31	27.5	
32	7	31	28	29.5	
33	24	32	32	32	
34	5	30	35	32.5	
35	35	34	34	34	
36	36	36	36	36	

*1 - The values in this column are numerical averages of the production ranks for grain and for forage of each entry genotype.

*2 - Superior experimental genotypes were selected from this test for further evaluation in 1979 on the basis of high grain production (G), high forage production (FG), or for other reasons (SEL).

Test Number 78103

Elite Yield Test

End of Season Results:

This "Elite" yield test was to be the final evaluation of those genotypes with the most potential in the breeding program. However, this test was a total loss due to difficulties of obtaining a stand or population in the test plots suitable for producing reliable research data. Prior reports pointed out the difficulties of obtaining reliable research data from this farm in 1977 and 1976, and probably even in prior years. A great effort to revamp field plot research procedures in 1978 to obtain better data resulted in 80% or more of the plots giving much better data. However, unfortunately this test was one that was lost.

A visual evaluation for adaptation was made of the remaining partial populations of each genotype. Some genotypes were discarded as a result of this evaluation and were not retested in 1979. Table 10 lists the thirty entries, their origin, and the type of testing for 1979 that was decided for each entry.

Table 10. List of Sorghum Genotypes Planted for Field Testing for Grain and Forage Production in the Elite Yield Test (78103) at Sanaa, Yemen, in 1978.

Entry No.	Pedigree *1	Origin	Seed Selected For:
1	Sana'a-1	77091	
2	Sana'a-2	77091	
3	Sana'a-3	77091	
4	Sana'a-4	77091	
5	Sana'a-5	77091	
6	Sana'a-6	77091	
7	Sana'a-7	77091	
8	Local		
9	FM-A53A	Uni. AZ.	
10	NES 746	77077-140	

*1 Plot Size = 2 rows 6 m long spaced .7m apart. Four replications. Replication I planted in moisture on 14 May and replications II, III, and IV were planted on 15 May, 1978.

From visual observation of the sparse population obtained, seed from selected plants will be used for re-entry in the 1979 Elite Yield Test.

*3 From visual observation of the sparse population obtained, seed from selected plants will be placed in a "short grain" collection for possible future breeding work.

Table 10. (continued)

Entry No.	*1 Pedigree	Origin	Seed Selected For:
11	NES 843	77077-145	*2
12	NES 864	77077-148	*2
13	NES 1421	77077-154	*3
14	NES 1559	77077-158	*3
15	NES 1570	77077-160	*3
16	NES 1773	77077-164	*2
17	NES 1789	77077-169	*3
18	NES 7000	77077-177	*2
19	NES 7003	77077-180	*2
20	NES P721	77077-184	
21	IS 410	77077-186	*3
22	IS 825	77077-187	*2
23	IS 2927	77077-189	*3
24	Local		
25	WS 1297	UNDP-Taiz	
26	75012-136	77076-110	*2
27	76014-071	77076-131	*2
28	76014-077	77076-135	*2
29	75016-061	77076-153	*2
30	75016-183	77076-166	

Test Number 78104
International Sorghum Disease and Insect Nursery

End of Season Results:

The purpose and composition of this test are described on page 16. Agronomic data on percent stand, days to 50% bloom and height in cm were recorded.

Some observational notes on disease and insect damage was recorded for individual entries.

The very sparse population or stand obtained in the plots indicates the poor adaptation to this environment of most of the entries. This poor adaptation of exotic germplasm to the higher environments of the Yemen Arab Republic is very typical.

Table 11. Agronomic Data and Observational Notes From 37 Sorghum Genotypes Including the 1976-1977 International Disease and Insect Nursery (Test 78104) Sana'a, Yemen A.R. 1978.

Entry No.	Pedigree	Origin	*1 % Stand	*2 Days To 50% Bloom	HT CM	Observational Notes on Leaf Blight Symptoms & Aphid Infest'n: Percent Leaf Area w/ Leaf Blight	Aphid Infestation
1	SC 56-14	TAM 1977	24	-	50		
2	SC 103-12	"	4	94	45		
3	SC 108-14	"	2	116	40		
4	TAM 428(SC 110-9)	"	14	98	52		
5	SC 110-14	"	12	98	58		
6	SC 112-14(UC)	"	4	97	50		
7	SC 170-6-17-(4267)	"	7	110	58		
8	SC 170-14	"	9	107	58		
9	SC 173-12-6	"	8	100	55		
10	TAM 2566(SC 175-9)	"	12	99	50		
11	SC 175-14	"	8	93	42		
12	SC 237-14	"	18	112	42		
13	SC 279-14	"	8	109	60		
14	SC 326-6	"	5	110	55		
15	SC 414-12E-PI	"	6	106	48		
16	SC 599-6-3(9247)	"	33	98	58	10%	Infested
17	SC 599-11-E	"	33	96	75	20%	None
18	SC 748-5-3	"	33	95	60	5%	Infested
19	TX 430	"	6	88	100	10%	None
20	BTX 624	"	15	99	72	None	None
21	GPR 148	"	7	111	60	None	None
22	(SC56XSC33)sel 1778	"	25	120	55	10%	Infested
23	(B3197XSC170)sel 1750	"	8	109	60	None	None
24	(152930X153922)	"	4	83	110	Trace	Infested
25	QL 3 Selection	"	24	90	90	10%	Infested
26	TAM 2567	"	2	98	75		
27	BTX 378	"	18	94	82	None	Infested
28	BTX 378	"	27	91	75	Trace	Infested
29	TX 7078	"	12	94	55	Trace	Infested
30	TX 2536	"	9	94	48	Trace	Infested
31	FOLIAGE BLT-R	Sana'a -77	12	92	110	Trace	None*3
32	" " "	"	8	102	85	5%	Infested
33	" " "	"	16	94	88	Segregating	None
34	" " -S	"	4	97	88	Segregating	None
35	MDMY	"	12	100	85	None	Infested
36	FOLIAGE BLT-R	"	20	96	130	None	Infested
37	" " "	"	42	88	80	Trace	None

*1 Plot size = 2 rows (.7m between rows) x 6m long, 25 hills per row spaced 25 cm apart, replicated three times.

*2 Planted in moisture (Plots 101-115 = 14 May; Plots 116-137, 201-237 = 30 May).

*3 Covered kernel smut in row.

Test Number 78105

National Cooperative Sorghum Grain

Yield Trial

End of Season Results:

The purpose and composition of this test are described on page 17. Yield and other agronomic data obtained from these plots are presented in Table 12.

Three locally selected entries performed in a superior manner in grain production to the only other entry (AWASH 1050) from the Taiz area. AWASH 1050 had excellent appearing plants and heads. Its main problem seemed to be its late maturity. Entry WS 1297 had only about 11% stand so no grain production figures could be obtained.

The lack of broad adaptation of genotypes from other environments in Yemen is illustrated here. This is due not so much to the narrow adaptability of sorghum genotypes as it is to the extremely broad range in environmental conditions found within short distances.

Table 12. Yield and Other Agronomic Data from National Co-operative Sorghum Yield Trial (78105) at Sana'a, Yemen, 1978.

Rank No.	Entry No.	Pedigree *1	Origin	Grain Yield K/HA	Grain Prod. K/HA/DAY	% Stand	Days To 50% Bloom *2	Plant Ht. Cm.	Agronomic Rating *3 Plant	Agronomic Rating *3 Head
1	4	Sana'a-7	US-AID	4022	33	50	93	118	1	1
2	5	Check	Local	3692	30	43	92	122	1	1
3	3	Sana'a-1	US-AID	3567	28	48	96	122	1	1
4	2	Awash-1050	UNDP/ FAO TAIZ	1452	10	49	114	142	1	1
5	1	WS-1297	UNDP/ FAO TAIZ	--	--	11	119	130	-	-

*1 Plot Size: 3 rows 6 m long. Rows spaced 70 cm apart. 25 hills per row spaced 25 cm apart. Center row of plot harvested for yield. 3 replications.

*2 Planted in moisture on May 29, 1978.

*3 Agronomic Rating Scale of Plants and Heads: 1 = Good, 2 = Average, 3 = Poor.

Test Number 78106

National Cooperative Sorghum Observation Nursery

End of Season Results:

The purpose and composition of this test are described on page 18. Other agronomic data obtained from these plots are presented in Table 13 .

Since this test is totally observational with no yield aspect, the agronomic ratings given for plant and head are our best measurements for indicating adaptation for the Sana'a location. Entries 3, 4, 5, and 11 appear to be quite well adapted. Entries 6, 9, 10, and 18 seem to be a little less well adapted. Entry 1 did not have sufficient stand to be evaluated. All other entries seemed rather poorly adapted regarding plant and head phenotype.

Table 13. Agronomic Data From National Co-operative Sorghum Observation Nursery (78106) at Sana'a, Yemen, 1978.

Entry No.	Pedigree *2	Origin	Percent Stand	Days To 50 % Bloom *1	Plant Ht. Cm.	Agronomic Rating *3 Plt.	Agronomic Rating *3 Hd.
1.	Daber	Taiz	4	99	70	-	-
2.	Ibb 14-1	Taiz	71	97	95	3	2
3.	Ibb 16-2	Taiz	79	97	130	1	1
4.	Ibb 16-6	Taiz	23	100	125	1	1
5.	Ibb 17-1	Taiz	17	99	125	1	1
6.	Ibb 19-1	Taiz	23	96	105	2	1
7.	Ibb 19-4	Taiz	51	97	85	-	-
8.	Ibb 21-1	Taiz	40	102	145	1	3
9.	Ibb 23-2	Taiz	35	99	160	1	2
10.	Ibb 24-1	Taiz	56	95	135	1	2
11.	Takil	Radha	88	96	175	1	1
12.	Fahari	Batina	75	115	160	2	2
13.	Harathi	Batina	79	108	135	2	2
14.	Temee	Batina	59	110	150	1	3
15.	Joo	Albon	69	92	115	2	3
16.	Sana'a-2	US-AID	68	95	120	2	2
17.	Sana'a-3	US-AID	63	93	110	2	2
18.	Sana'a-4	US-AID	76	95	115	2	1
19.	Sana'a-5	US-AID	60	92	115	2	2
20.	Sana'a-6	US-AID	40	95	115	3	2
21.	Check	Local	31	93	110	3	2

*1 Planted in moisture on May 29, 1978.

*2 Plot Size: 3 rows 6 m. long. Rows spaced 70 cm apart. 25 hills per row spaced 25 cm apart. Unreplicated design.

*3 Agronomic Rating Scale of Plants and Heads: 1 = good, 2 = average, 3 = poor.

Test Number 78107

National Cooperative Maize Yield Trial

End of Season Results:

The composition and purpose of this test are described on page 19. Yield and other agronomic data obtained from these plots are presented in Table 14. Dates of silking and pollen shedding were not obtained due to an oversight in field data collection.

Across 7542 from Albon (German) was quite superior in yield with our local Sana'a check in rather close second place. All other entries were decidedly lower in yield.

Table 14. Yield and Other Agronomic Data from National Co-operative Maize Yield Trial (78107) at Sana'a, Yemen, 1978

Rank No.	Entry No.	Pedigree *1	Origin	Yield K/Ha *2	% Stand	Plant Ht. Cm.
1	4	Across 7542	Albon	3669.8	71	153
2	6	Check	Local	3183.8	85	128
3	2	Rampur 7433	Taiz	2373.8	76	157
4	3	Obregon 7542	Albon	1992	92	138
5	1	Vijay Comp.	Taiz	1758	88	157
6	5	Poninbai	Batina	458.7	84	138

*1 Plot Size: 3 rows 6 m long. Rows spaced 70 cm apart. 25 hills per row spaced 25 cm apart. All 3 plot rows harvested for yield. 3 replications.

*2 Planted in moisture on 4 June 1978.

Test Number 78108

National Cooperative Maize Observation Nursery

End of Season Results:

The purpose and composition of this test are presented on page 20 . Unreplicated yield data and other agronomic data were obtained from these plots and are presented in Table 15. Dates of silking and pollen shedding were not obtained due to an oversight in field data collection.

Entries are ranked in this table according to their unreplicated yields. The reader is cautioned against attaching too much significance to these unreplicated yields particularly since there are relatively small differences in yield between many entries throughout the table.

Table 15. Unreplicated Yield and Other Agronomic Data From National Co-operative Maize Observation Nursery (78108) at Sana'a, Yemen, 1978.

Rank No.	Entry No.	Pedigree *1	Origin	Yield *2 K/Ha	% Stand	Plant Ht. Cm.
1	9	Aus 77-1 Comp.	Taiz	4140.6	61	150
2	7	Obregon 7533	Taiz	3640.7	75	160
3	8	Aus 77-2 Comp.	Taiz	3577.9	65	160
4	2	Mex 17	Taiz	3515.3	88	170
5	1	Comp.A 53-54	Taiz	3377.1	92	160
6	10	Amarillos	Taiz	3152.2	87	145
7	6	Khumaltar(1)7633	Taiz	3139.8	79	150
8	18	Check	Local	2935.6	75	140
9	5	Obregon 7442	Taiz	2618.3	84	150
10	3	Pnmi	Taiz	2444	73	150
11	13	Tlattizpan	Taiz	2395.6	76	150
12	17	VL 71	Albon	2275.8	83	145
13	12	VL 54	Taiz	2164.6	80	155
14	11	VL 74	Taiz	2159.1	83	140
15	4	ZCA Comp.	Taiz	1773.2	93	160
16	14	Ukiriguru 7542	Albon	1760.2	77	125
17	15	Sids 7542	Albon	1305.6	81	120
18	16	Khumaltar(1)7642	Albon	839.2	79	125

*1 Plot Size: 3 rows 6 m long. Rows spaced 70 cm apart. 25 hills per row spaced 25 cm apart. All 3 plot rows harvested for yield. One replication.

*2 Planted in moisture on 4 June 1978.

Test Number 78109
National Cooperative Pearl Millet Yield Trial

End of Season Results:

A description of this test and its composition and purpose are presented in page 21. The National Cooperative Millet Yield Trial consisting of three entries was planted at the Bir Al-Gohum USAID Research Farm at Sana'a. Agronomic data on days to bloom and plant height were obtained from these plots and are presented in Table 16.

The average stand across all three replications ranged from 10 to 23 percent. These extremely low plot plant populations did not make grain yield evaluations possible.

Table 16. Agronomic Data from National Co-operative Millet Yield Trial (78109) at Sana'a, Yemen, 1978.

Entry No.	*1 Pedigree	Origin	% Stand	*2 Days To 50% Bloom	Plant Ht. Cm.
1	Serer Comp.	Taiz	10	121	85
2	Nigerian Comp.	Taiz	23	114	102
3	Check	Local	19	114	97

*1 Plot Size: 3 rows 6 m long. Rows spaced 70 cm apart. 25 hills per row spaced 25 cm apart. 3 replications.

*2 Planted in moisture on 31 May 1978.

Test Number 78110

National Cooperative Pearl Millet Observation Nursery

End of Season Results:

A description of this test and its composition and purpose are presented on page 22 . Agronomic data on days to bloom and plant height were obtained from these plots and are presented in Table 17.

It can be assumed that the taller entries are better adapted to this environment since additional height usually means greater forage production.

Table 17. Unreplicated Agronomic Data From National Co-operative Millet Nursery (78110) at Sana'a, Yemen. 1978.

Entry No.	Pedigree *1	Origin	% Stand	Days To 50% Bloom *2	Plant Ht. Cm.
1	World Comp.	Taiz	23	114	115
2	Bxbornu	Taiz	36	108	130
3	Aus. Comp.	Taiz	44	108	120
4	Souna	Taiz	43	104	125
5	Y-72	Taiz	65	105	135
6	Synon-691	Batina	65	95	65
7	Soyalikhyan	Batina	41	97	60
8	Tannon	Batina	51	98	77
9	Sana'a-1	USAID	24	103	80
10	Check	Local	36	112	105

*1 Plot size: 3 rows 6 m long. Rows spaced 70 cm apart. 25 hills per row spaced 25 cm apart. One replication.

*2 Planted in moisture on 31 May 1978.

Test Number 78111
F_4 Generation of Populations

End of Season Results:

A description of this test with its composition and purpose is presented on page 23. A number of single plant selections were made from each of 76 populations in the F_4 generation in single row plots. Some average agronomic data regarding the days to 50% bloom and plant height of the F_4 generation of each population is given in Table 18. The number of single plants selected from each population is also given.

These populations gave good single plant segregates in the F_2 (1976) and F_3 (1977). The genotypes in these populations produce plants with desirable phenotypes for plant and head for this environment. Unselected but still quite desirable plants in the F_2 and F_3 generations had been selected and hulked to produce seed for the succeeding generation.

Seed from earlier generations of these populations had been given to the UNDP (Taiz) who were able to make many adapted selections indicating a broad range of genotypic variability in these populations.

Table 18. Agronomic Data From 76 Populations In The F4 Generation (Test 78111) From Which 277 Single Heads Have Been Selected For Head-To-Row In 1979.

Entry No.	*1 Pedigree	% Stand	*2 Days To 50% Bloom	Plant Height Cm.	No. Heads Selected
1	NES 110 X NES 6970	52	90	125	1
2	NES 110 X NES 6971	64	91	110	3
3	NES 110 X NES 6972	60	95	150	4
4	NES 110 X NES 6973	48	90	105	1
5	NES 110 X NES 6974	84	93	110	2
6	NES 110 X NES 6975	80	89	100	2
7	NES 110 X NES 6976	84	85	120	4
8	NES 110 X NES 6977	72	94	135	5
9	NES 110 X NES 6978	84	97	145	4
10	NES 110 X NES 6979	68	91	145	1
11	NES 110 X NES 6981	84	87	115	2
12	NES 110 X NES 6986	48	87	100	1
13	NES 1500 X NES 6973	76	83	170	4
14	NES 1500 X NES 6975	84	86	145	3
15	NES 1500 X NES 6976	68	83	130	5

*1 Plot size = 1 row (.7 m) X 6 m long, unreplicated.

*2 Planted in moisture on 8 June, 1978.

Table 18. (continued)

Entry No.	*1 Pedigree	% Stand	*2 Days To 50% Bloom	Plant Height Cm.	No. Heads Selected
16	NES 1500 X NES 6983	84	87	165	3
17	NES 2141 X NES 6971	72	87	155	4
18	NES 2141 X NES 6972	44	86	155	2
19	NES 2141 X NES 6973	28	97	125	1
20	NES 2141 X NES 6974	64	88	145	4
21	NES 2141 X NES 6975	56	88	130	5
22	NES 2141 X NES 6976	64	85	125	3
23	NES 2141 X NES 6978	80	87	185	3
24	NES 2141 X NES 6982	80	89	110	2
25	NES 2141 X NES 6983	60	93	170	6
26	NES 3329 X NES 6970	72	91	175	3
27	NES 3329 X NES 6971	68	88	140	4
28	NES 3329 X NES 6972	64	92	150	5
29	NES 3329 X NES 6973	80	93	135	5
30	NES 3329 X NES 6974	40	96	115	1
31	NES 3329 X NES 6975	56	95	110	3
32	NES 3329 X NES 6976	96	92	115	4
33	NES 3329 X NES 6977	60	96	125	4
34	NES 3329 X NES 6978	76	92	170	3
35	NES 3329 X NES 6979	68	94	140	1

Table 18. (continued)

Entry No.	*1 Pedigree	% Stand	*2 Days To 50% Bloom	Plant Height Cm.	No. Heads Selected
36	NES 3329 X NES 6980	76	90	160	4
37	NES 3329 X NES 6982	80	89	165	5
38	NES 3329 X NES 6985	68	83	115	2
39	NES 3329 X NES 6986	60	88	125	6
40	IS 509 X NES 6970	72	86	160	2
41	IS 509 X NES 6971	76	87	150	3
42	IS 509 X NES 6974	96	87	160	5
43	IS 509 X NES 6978	60	90	165	5
44	IS 509 X NES 6979	72	91	155	3
45	IS 509 X NES 6980	52	96	185	3
46	IS 509 X NES 6982	92	90	175	6
47	IS 509 X NES 6983	72	94	160	5
48	IS 509 X NES 6986	88	86	145	5
49	NES 2197 X NES 6970	84	95	150	4
50	NES 2197 X NES 6971	84	98	155	5
51	NES 2197 X NES 6972	44	110	145	1
52	NES 2197 X NES 6973	80	86	160	5
53	NES 2197 X NES 6974	88	91	150	3
54	NES 2197 X NES 6975	92	95	160	5
55	NES 2197 X NES 6976	88	91	175	5

Table 18. (continued)

Entry No.	Pedigree *1	% Stand	Days To 50% Bloom *2	Plant Height Cm.	No. Heads Selected
56	NES 2197 X NES 6977	96	113	170	4
57	NES 2197 X NES 6978	48	116	160	2
58	NES 2197 X NES 6979	84	85	140	4
59	NES 2197 X NES 6980	80	97	190	3
60	NES 2197 X NES 6981	80	89	165	5
61	NES 2197 X NES 6982	92	86	180	5
62	NES 2197 X NES 6985	88	86	150	5
63	NES 2197 X NES 6986	84	85	165	7
64	IS 9958 X NES 6970	88	80	170	5
65	IS 9958 X NES 6971	88	80	130	6
66	IS 9958 X NES 6972	80	81	125	3
67	IS 9958 X NES 6973	68	82	110	4
68	IS 9958 X NES 6974	92	83	140	4
69	IS 9958 X NES 6975	80	83	145	5
70	IS 9958 X NES 6977	76	94	155	2
71	IS 9958 X NES 6978	72	87	155	4
72	IS 9958 X NES 6979	60	100	135	3
73	IS 9958 X NES 6981	56	90	100	3
74	IS 9958 X NES 6982	76	93	130	4
75	IS 9958 X NES 6983	60	92	145	4
76	IS 9958 X NES 6984	64	92	140	3

Test Number 78112
Advanced Hybrid Generation Populations

End of Season Results:

A description and purpose of this test are presented on page 24. A change was made in the entries from test 77080 that were to be included in the test after the original design was drawn up. There are actually 28 entries of record in this test as compared to the 15 mentioned in the original design. Several of the 28 entries are of a common source so the number of different entry populations is actually about 11.

Average agronomic data that were collected on all of these population are presented in Table 19 . A count of the open pollinated (O.P.) heads that were selected from each population for growing out in head rows in 1979 is given in this table. One hundred forty six single plant selections were made from this test.

Table 19 . Agronomic Data and Number of Single Plant Selections from Advanced Generations of Hybrid Populations of Sorghum (Test 78112) at Sanaa, Yemen in 1978.

Entry No.	*1 Pedigree	Origin	% Stand	*2 Days To 50% Bloom	Plant Ht. Cm.	O. P. Heads Selected
1	NES 110 X NES 6970	77080101	56	93	108	3
2	NES 3329 X NES 6976	77080102	88	90	125	10
3	NES 3329 X NES 6976	77080103	92	92	100	5
4	(DD 50F2 X Local)	77080105				
5	(P894F2 X Local)	77080106	88	89	115	9
6	(P866F2 X Local)	77080107	80	90	120	4
7	(P8681F2 X Local)	77080108	80	89	128	4
8	(P8681F2 X Local)	77080108	60	90	97	8
9	(NK 233F2 X Local)	77080109	80	90	130	9
10	PB-IBR Day Neutral X Local	77080110	88	86	138	4
11	PB-IBR Day Neutral X Local	77080112	88	85	140	6
12	PB-IBR Day Neutral X Local	77080113	80	86	125	7
13	PB-IBR Day Neutral X Local	77080115	92	86	130	6
14	PB-IBR Day Sensitive X Local	77080116	80	86	140	7
15	PB-IBR Day Neutral X Local	77080119	52	92	138	6

*1 Plot Size: 1 row (.7 m) X 6 m long, unreplicated.

*2 Planted in moisture on 6 June 1978.

Table 19. (continued)

Entry No.	*1 Pedigree	Origin	% Stand	*2 Days To 50% Bloom	Plant Ht. Cm.	O. P. Heads Selected
16	PB-IBR Day Neutral X Local	77080122	96	86	133	4
17	PB-IBR Day Neutral X Local	77080123	76	87	138	5
18	PB-IBR Day Neutral X Local	77080124	56	91	130	4
19	PB-IBR Day Neutral X Local	77080125	100	82	145	4
20	PB-IBR Day Neutral X Local	77080126	88	79	140	8
21	PB-IBR Day Neutral X Local	77080127	68	82	131	4
22	PB-IBR Day Neutral X Local	77080129	64	86	130	1
23	PB-IBR Day Neutral X Local	77080130	88	87	128	3
24	PB-IBR Day Sensitive X Local	77080137	80	87	130	6
25	PB-IBR Day Sensitive X Local	77080138	76	83	142	5
26	PB-IBR Day Neutral X Local	77080142	68	87	125	4
27	CSH-2	77080147	72	83	135	4
28	CSH-3	77080148	96	90	120	6

Test Number 78113
Nursery

End of Season Results:

A description of this test and its purpose are presented on page 25. Agronomic data on days to 50% bloom and plant height are presented in Table 20. The purpose of this test varied according to the entry or entries.

Sixteen different sets of cytoplasmic steriles were grown for observation as to adaptation and use as steriles in this environment. Only row No. (entry no.) 76 (CK60AXHydro Kafir) showed promise toward developing into a Hydro Kafir A and B line set adapted to the Sana'a environment.

Most of the remaining plots (or entries) were lines or genotypes which were observed for adaptation. Most lines were selfed for seed increase whether they were well adapted or not.

Plot numbers 83 through 98 represented parental material of crosses from which many well adapted selections had previously been made at Sana'a and at Taiz. Seed increase was quite difficult in most of these lines. No seed increase was obtained from same lines.

A number of selfed selections were made from plot numbers 107 through 154.

The detailed data of just how many selections were made from each plot and some other observational data is not available during the writing of this report. These data are in the field books at the project offices in Sana'a.

Table 20. Some Agronomic Data on Various Sorghum Genotypes Grown in a Breeding Nursery in Sanaa, Yemen. 1978. Test Number 78113.

Row No.	Pedigree *1	Origin	% Stand	Days To 50% Bloom *2	Plant Height cm.
1	Broom Corn	Univ. of Az.	70	102	195
2	Broom Corn	Univ. of Az.	68	102	200
3	Broom Corn	Univ. of Az.	54	102	200
4	Broom Corn	Univ. of Az.	60	102	195
5	Broom Corn	Univ. of Az.	56	103	190
6	Sana'a - 1	77091	28	92	90
7	Sana'a - 1	77091	14	91	105
8	Sana'a - 1	77091	10	101	115
9	Sana'a - 1	77091	24	95	100
10	Sana'a - 2	77091	30	94	110
11	Sana'a - 3	77091	36	96	115
12	Sana'a - 4	77091	40	91	100
13	Sana'a - 5	77091	46	86	115
14	Sana'a - 6	77091	20	91	98
15	Sana'a - 7	77091	20	87	105

*1 Plot Size = variable number of rows with all rows 6 m long and spaced .7 m apart. 25 hills per row spaced .25 m between hills with 2 to 3 plants per hill.

*2 Planted in moisture on June 9 and 10, 1978.

Table 20. (continued)

Row No.	*1 Pedigree	Origin	% Stand	*2 Days To 50% Bloom	Plant Height cm.
16	Sana'a - 7	77091	28	87	105
17	Sana'a - 7	77091	28	87	105
18	Sana'a - 7	77091	26	88	90
19	Local (Radah)		68	87	110
20	Local (Sana'a)		10	86	100
21	IS 185	ICRISAT	20	107	75
22	IS 1521	ICRISAT	32	100	75
23	IS 7438	ICRISAT	52		90
24	IS 10788	ICRISAT	78	123	150
25	IS 15075	ICRISAT	66	102	140
26	IS 15537	ICRISAT	34	123	110
27	P - 721	Purdue	60	103	68
28	76PP - 15	Purdue	38	84	105
29	IS 11758	Purdue	6	82	98
30	954063	Purdue	24	92	85
31	954114	Purdue	6	111	65
32	954206	Purdue	70	113	70
33	Q - 10	Univ. of Az.	26	103	95
34	BAT 148 (71)	ALAD	46	87	108
35	IS 83	ALAD	8	107	100

Table 20. (continued)

Row No.	*1 Pedigree	Origin	% Stand	*2 Days To 50% Bloom	Plant Height cm.
36	IS 509	ALAD	4	117	95
37	CVAP-71-24-1	Mexico	22	89	103
38	CK 60 A	Univ. of Az.	44	100	77
39	CK 60 A	Univ. of Az.	34	105	70
40	CK 60 B	Univ. of Az.	24	96	60
41	Martin A	Univ. of Az.	64	94	70
42	Martin A	Univ. of Az.	32	94	78
43	Martin B	Univ. of Az.	8	100	63
44	KS 24 A	Univ. of Az.	6	106	45
45	KS 24 A	Univ. of Az.	32	87	80
46	KS 24 B	Univ. of Az.	32	94	80
47	Redlan A	Univ. of Az.	68	95	89
48	Redlan A	Univ. of Az.	66	95	88
49	Redlan B	Univ. of Az.	66	96	93
50	I 3659 A	ALAD	12	104	60
51	I 3659 B	ALAD	30	111	72
52	I 10244 A	ALAD	4	100	73
53	I 10244 A	ALAD	10	101	70
54	I 10244 B	ALAD	18	95	80
55	I 10254 A	ALAD	36	100	74

Table 20. (continued)

Row No.	*1 Pedigree	Origin	% Stand	*2 Days To 50% Bloom	Plant Height cm.
56	I 10254 A	ALAD	34	101	80
57	I 10254 B	ALAD	2	104	45
58	I 10446 A	ALAD	10	130	80
59	I 10446 A	ALAD	4	97	80
60	I 10446 B	ALAD	6	101	93
61	I 10576 A	ALAD	22	113	65
62	I 10576 A	ALAD	28	103	70
63	I 10576 B	ALAD	38	106	73
64	I 10620 A	ALAD	42	95	75
65	I 10620 A	ALAD	50	91	68
66	I 10620 B	ALAD	46	91	64
67	I 10690 A	ALAD	54	104	115
68	I 10690 A	ALAD	56	104	115
69	I 10690 B	ALAD	44	104	125
70	I 10694 A	ALAD	12	108	100
71	I 10694 B	ALAD	46	108	90
72	Maldandi A	ALAD	10	115	125
73	Maldandi A	ALAD	2	112	147
74	Maldandi B	ALAD	6	118	125
75	76016-002 X Local F2	76016-002	60	86	105

Table 20. (continued)

Row No.	*1 Pedigree	Origin	% Stand	*2 Days To 50% Bloom	Plant Height cm.
76	CK 60 A X Hydro Kafir F1	77088-104	30	102	105
77	CK 60 A X T X Black Hull Kafir F1	77088-119	4	114	105
78	Hydro Kafir	77088-377	30	110	105
79	Texas Blackhull Kafir	77088-383	58	99	103
80	Double Dwarf Shrock	77088-426	30	127	70
81	Arkansas Leafy 44	77088-482	34	88	120
82	CIMMYT 76 BJ 197	77088-272	74	84	85
83	NES 6970	77088-313	56	84	100
84	NES 6971	77088-314	52	82	115
85	NES 6973	77088-316	10	84	95
86	NES 6974	77088-317	72	83	100
87	NES 6975	77088-318	88	89	95
88	NES 6976	77088-319	76	87	118
89	NES 6977	77088-320	22	125	220
90	NES 6978	77088-321	90	106	215

Table 20. (continued)

Row No.	*1 Pedigree	Origin	% Stand	*2 Days To 50% Bloom	Plant Height cm.
91	NES 6979	77088-322	70	87	175
92	NES 6980	77088-323	24	119	162
93	NES 6981	77088-324	90	84	135
94	NES 6982	77088-325	88	92	165
95	NES 6983	77088-326	80	89	145
96	NES 6984	77088-327	70	103	170
97	NES 6985	77088-328	14	84	127
98	NES 6986	77088-329	54	86	130
99	Stewart Sorghum	77088-161	44	111	93
100	Local (Shadder)		76	111	163
101	Tigre	India	-	.	-
102	Pop Sorghum	Arizona	38	79	124
103	Soy Beans	Arizona	6	88	115
104	Soy Beans	Arizona	-	.	.
105	PP 14	Purdue	54	89	100
106	PP 15	Purdue	40	87	109
107	516 Bulk ⊗	77088	40	93	95
108	521	77088	44	88	73
109	526 Bulk ⊗	77088	36	103	70
110	1541-1	77088	38	87	80

Table 20. (continued)

Row No.	*2 Pedigree	Origin	% Stand	*2 Days To 50% Bloom	Plant Height cm.
111	546 Bulk ⊗	77088	48	89	120
112	556-1	77088	54	90	90
113	571 Bulk ⊗	77088	32	87	95
114	581-1	77088	48	98	83
115	586 Bulk ⊗	77088	34	89	80
116	591 Bulk ⊗	77088	18	86	93
117	601-1	77088	46	88	107
118	606-1	77088	56	113	80
119	606 X F3 Selns.	77088	54	89	100
120	611 Bulk ⊗	77088	56	87	65
121	616 Bulk ⊗	77088	66	92	70
122	616 X Adopted Types	77088	54	89	145
123	621 Bulk ⊗	77088	46	86	63
124	626 Bulk ⊗	77088	60	89	87
125	631 Bulk ⊗ Brown	77088	56	80	100
126	631 Bulk ⊗ White	77088	48	86	75
127	636 Bulk ⊗ Brown	77088	86	84	109
128	636 Bulk ⊗ White	77088	64	87	80
129	641 Bulk ⊗	77088	52	87	85
130	646 Bulk ⊗	77088	14	101	70

Table 20. (continued)

Row No.	*1 Pedigree	Origin	% Stand	*2 Days To 50% Bloom	Plant Height cm.
131	651 Bulk ⊗	77088	30	99	65
132	656 Bulk ⊗	77088	42	90	63
133	661 Bulk ⊗	77088	14	112	60
134	666 Bulk ⊗	77088	72	91	95
135	671 Bulk ⊗	77088	32	92	87
136	676 Bulk ⊗	77088	50	88	100
137	676 Resist	77088	42	92	87
138	686 Bulk ⊗	77088	66	87	100
139	691 Bulk ⊗	77088	28	94	65
140	696 Bulk ⊗	77088	64	91	90
141	701 Bulk ⊗	77088	66	83	80
142	706 Bulk ⊗	77088	48	85	70
143	531 X SIB	77088	32	91	70
144	541 X SIB	77088	4	90	100
145	546 X SIB	77088	10	89	85
146	551 X SIB	77088	6	103	85
147	576 X SIB	77088	22	105	100
148	591 X SIB	77088	18	102	79
149	676 X SIB	77088	10	88	90
150	606 X SIB	77088	10	86	85

Table 20. (continued)

Row No.	*1 Pedigree	Origin	% Stand	*2 Days To 50% Bloom	Plant Height cm.
151	616 X SIB	77088	24	83	80
152	621 X SIB	77088	52	87	43
153	681 X SIB	77088	32	104	70
154	691 X SIB	77088	42	92	60
155	PR-1 BR	Arizona	42	79	70
156	PR-1 BR	Arizona	26	82	80
157	PR-1 BR	Arizona	36	84	70
158	PR-1 BR	Arizona	20	87	75

Test Number 78114

1978 International Food Grain Sorghum Yield Trial

End of Season Results:

A description of this test, its entries and purpose are presented on page 26. Agronomic data concerning days to 50% bloom and plant height are presented in Table 21. All thirty entries had a very poor phenotypic appearance as far as potential for both grain and forage production. No specific data had been recorded by entry at the time the test was grown and observed. All entries were universally bad in phenotypic appearance. There was very little seed set or grain production by even the best appearing entry. Some entries did not even produce a head that bloomed to indicate any sort of bloom date.

The environment at Sana'a is so extreme relative to other parts of the world regarding successful sorghum production. None of the detailed objectives of this test for evaluating grain of the entries was attained. The entry genotypes themselves were unadapted to this environment.

Table 21. Agronomic Data From International Food Grain Sorghum Yield Trial (78114) at Sanaa, Yemen, 1978.

Entry No.	Pedigree *1	Origin	% Stand	Days To 50% Bloom *2	Plant Ht. Cm.
1	121180	Purdue Univ.	50		63
2	IS0865	Purdue Univ.	36	112	78
3	IS10219	Purdue Univ.	45	114	80
4	121183	Purdue Univ.	39	112	80
5	IS2057	Purdue Univ.	38	127	73
6	166024	Purdue Univ.	47	113	53
7	121089	Purdue Univ.	48	104	80
8	D-55(Hybrid)	Purdue Univ.	66	107	80
9	E-57+(Hybrid)	Purdue Univ.	57	104	82
10	954206	Purdue Univ.	72	123	65
11	954114	Purdue Univ.	50	117	68
12	954066	Purdue Univ.	36	89	72
13	IS10524	Purdue Univ.	17	116	60
14	IS2812	Purdue Univ.	49	90	62
15	IS15391	Purdue Univ.	29	120	65

*1 Plot Size = Three rows 6 m long with .7 m between rows and replicated three times, 25 hills per row with two to three plants per hill.

*2 Planted in moisture on 3 and 4 June 1978.

Table 21. (continued)

Entry No.	*1 Pedigree	Origin	% Stand	*2 Days To 50% Bloom	Plant Ht. Cm.
16	IS0466	Purdue Univ.	34	124	52
17	IS8708	Purdue Univ.	23	115	70
18	IS10642	Purdue Univ.	53		63
19	IS12278	Purdue Univ.	60	118	65
20	IS0475	Purdue Univ.	36	118	62
21	IS0158	Purdue Univ.	45	111	70
22	IS0223	Purdue Univ.	65	123	77
23	954063	Purdue Univ.	11	119	62
24	954062	Purdue Univ.	38		62
25	954130	Purdue Univ.	56	125	73
26	X-863(Hybrid)	Purdue Univ.	56	123	67
27	Local Check(1)	Sanaa	19	120	100
28	Local Check(2)	Sanaa	62	93	112
29	Local Check(3)	Sanaa	65	89	102
30	Local Check(4)	Sanaa	85	90	80

Test Number 78115

Early Maturity and Tall Hybrid Yield Test

End of Season Results:

A description of this test, the source of its entries and the purpose of the test are presented on page 27. Grain yield and other agronomic data are presented in Table 22.

It is interesting to note that the two local checks ranked first and fifth in yield out of all 18 entries.

In 1977 it was observed that several hundred different sorghum genotypes from the U.S. were all very uniformly reduced in height and bloomed later in this environment. I attempted to select the tallest and earliest (in maturity) grain sorghum hybrid genotypes available in the United States and evaluate them for height, maturity and grain yield. Most of these tall U.S. hybrids were considerably reduced in height. This height reduction is detrimenta l to the plants' ability to produce a high yield of forage.

The maturities were quite in keeping with the local checks. The grain yield of local varieties seemed to be superior or equal to the best of these American hybrid grain sorghums.

From the abnormally shortened heights of all of these hybrid genotypes in this environment I plan to conduct an evaluation in 1979 of a large number of U.S. hybrid forage sorghums, the idea being that if U.S. type forage sorghums that normally are two to four meters in height in the U.S. then perhaps they may be only $1\frac{1}{2}$ to 2 meters in this environment which would be an ideal height. These forage sorghums should probably be of an early maturity and/or low heat unit requirement.

Table 22 . Yield and Other Agronomic Data From a Test (78115) of Tall, Early Maturing Grain Sorghum Hybrids at Sanaa, Yemen in 1978.

Rank No.	Entry No.	Pedigree *1	Origin	% Stand *2	Days To 50% Bloom	Plant Ht. Cm.	Grain Prod. K/HA	Grain Prod. K/HA/DAY *3
1	18	Local(Rada-1978)	Local	71	88	177	5080	43
2	13	Dekalb FS4	Uni.Az.	96	86	152	3581	31
3	4	Excel 202 C	Uni.Az.	92	85	83	3468	30
4	8	Northrup King 125	Uni.Az.	87	82	96	3049	27
5	17	Local(Sana'a 1977)	Local	74	84	125	2995	26
6	2	Asgrow Dorado E	Uni.Az.	92	85	83	2971	26
7	11	Pioneer 8901	Uni.Az.	93	81	77	2927	26
8	3	Dekalb A25a	Uni.Az.	88	84	74	2801	25
9	7	Northrup King 123	Uni.Az.	79	82	91	2688	24
10	16	Northrup King 300	Uni.Az.	92	79	114	2642	24
11	1	Acco R-920	Uni.Az.	85	81	86	2475	22
12	5	FM Advance 53A	Uni.Az.	72	90	89	2394	20
13	6	Funks G 251	Uni.Az.	83	83	79	2359	21
14	9	Northrup King 129	Uni.Az.	85	85	85	2347	20
15	14	Frontier DUO	Uni.Az.	82	81	93	2302	21

*1 Plot Size = 2 rows (.7 m between rows) X 6 m long, 25 hills per row spaced 25 cm apart, replicated three times.

*2 Planted in moisture on June 6, 1978.

*3 Grain production in kilos per hectare per day calculated on a grain development period of from planting to 30 days past 50% bloom.

Table 22. (continued)

Rank No.	Entry No.	Pedigree *1	Origin	% Stand *2	Days To 50% Bloom	Plant Ht. Cm.	Grain Prod. K/HA	Grain Prod. K/HA/DAY *3
16	10	Pioneer 894	Uni.Az.	89	82	74	2256	20
17	12	Taylor Evans 44C	Uni.Az.	79	83	84	1937	17
18	15	Frontier Hikane II	Uni.Az.	85	89	107	1227	10

- Section 6 -

On-Farm Tests

The on-farm tests were reported on by Dr. Stewart in his end of tour report. A number of other project activities were carried on in addition to the specific experiment farm field tests of plant genotypes. The subject matter items reported on by Dr. Stewart are as follows:

1. Herbarium
2. Plant Disease Collection and Identification
3. Attendance at 1977 Egyptian Pesticide Conference
4. Insect Collection
5. Control of Pests in Sorghum-Millet Nursery and Laboratory
6. On-the-farm Grain Drying and Storage Studies
7. 1978 Outreach Program for Yemen Farmers.

Following are Tables 23 through 34, giving detailed descriptions of each of the twelve on-farm outreach tests. Dr. Stewart did not include the tables in his report, so they are presented here to provide some additional data not presented in Dr. Stewart's report. Dr. Stewart's report mentions the initiation of twelve outreach test sites. Only four were harvested. In seven out of the eight tests that were lost, the farmer-cooperator deliberately harvested the plots a couple of days ahead of our pre-arranged scheduled date of harvest with the farmer. In all cases they said they couldn't wait for some reason or other--even though there were still many adjacent unharvested sorghum fields. Our Yemeni project employees were not at all surprised by these actions. The reasoning was that the farmer simply wanted to make very sure he got all of the grain.

From these experiences we began planning cash incentives for the next year (1979) with a portion of it payable "after harvest and when the harvest w as done by project personnel."

Table 23. Information Relative to a Test of Four Sorghum Genotypes Planted on a Farmer's Field at Hedran 40 km Northeast of Sanaa, Yemen. 1978. Test Number OR 78-1.

1. This test was harvested in bulk by the farmer just prior to the planned harvest for research purposes by project personnel.

2. Four entries planted were Sanaa 1 (experimental), Sanaa 7 (experimental), ACCO R-920 (hybrid) and Beida (local). The farmer assisted in planting these plots using his equipment and methods.

3. Plot size = 3 rows 6 m long and .4 m between rows. Two replications. Middle row planned to be harvested for yield.

4. Planted in moisture from rain on July 1, 1978. Rainfed through season.

5. Name of farmer = Nagib Salah Khalid.

6. Town and location = Hedran 40 km northeast of Sanaa (Bani Hushysh Al Shurafa) at about 8000 feet elevation.

7. Soil samples collected on September 25, 1978, and results reported elsewhere.

8. Sprayed with Thiodan 35 for pink stem borers twice (July 31 and August 21, 1978).

Table 24. Information Relative to a Test of Four Sorghum Genotypes Planted on a Farmer's Field at Bani Maymoon 33 km Northwest of Sana'a on Road to Amran. 1978. Test Number OR 78-2.

1. This test was harvested in bulk by the farmer for no good reason just prior to the planned harvest for research purposes by project personnel.

2. The four entries planted were Sana'a 1 (experimental), Sana'a 7 (experimental), Ferry Morse A53A (hybrid), and a Local. The farmer assisted in planting these plots using his equipment and methods.

3. Plot size = 3 rows 6 m long and 38 cm between rows. Two replications. Middle row planned to be harvested for yield.

4. Planted on May 26, 1978 in moisture from rain. Rainfed through season.

5. Name of farmer = Mohssin Hassen.

6. Town and location = Bani Maymoon on Amran road 33 km northwest of Sanaa.

7. Soil samples collected on September 16, 1978 and results reported elsewhere.

8. Sprayed with Thiodan 35 for pink stem borers on July 16, 1978.

9. These plots experienced considerable drought or moisture stress throughout the growing season. Very small heads.

Table 25. Grain and Forage Yields of Four Sorghum Genotypes Grown on a Farmer's Field at Hizyez 17 km South of Sanaa, Yemen. 1978. Test Number OR 78-3.

Entry	Percent Stand	Plant Ht. cm.	Grain Yield k/ha	Forage Yield k/ha
NK 125 (hybrid grain)	100	90	474	769
Sana'a 1 (experimental)	37	127	326	1222
FM A53A (hybrid grain)	61	92	295	889
Sana'a 7 (experimental)	76	102	238	395

Additional Data:

1. Plot size = 3 rows 6.5 m long and .86 m between rows. Two replications. Middle row harvested for yield.

2. Planted in moisture on May 19, 1978. Rain or irrigation for moisture as needed throughout growing season. The farmer assisted in planting these plots using his equipment and methods.

3. Name of farmer = Ali Ebn Ali Al Negar.

4. Town and location = Hizyez on Taiz road 17 km south of Sanaa.

5. Thinned by farmer on August 16, 1978.

6. Soil samples collected on August 16, 1978 and results reported elsewhere.

7. Sprayed with Thiodan 35 on July 24, 1978 for heavy pink stem borer infestation.

Table 26. Information Relative to a Test of Four Sorghum Genotypes Planted on a Farmer's Field at Dubre Sunhan 127 km South of Sanaa on Road to Taiz. 1978. Test Number OR 78-4.

1. This test was harvested in bulk by the farmer for no good reason just prior to the planned harvest for research purposes by project personnel.

2. The four entries planted were Sana'a 1 (experimental), Sana'a 7 (experimental), Ferry Morse A53A (hybrid), and a Local. The farmer assisted in planting these plots using his equipment and methods.

3. Plot size = 3 rows 6 m long but row width was not measured. Two replications. Middle row planned to be harvested for yield.

4. Planted on May 29, 1978 in moisture from rain. Rainfed through season.

5. Name of farmer = Hussen Salah Zaid.

6. Town and location = Dubre Sunhan on Taiz road 127 km south of Sana'a.

7. Soil samples collected on August 16, 1978 and results reported elsewhere.

8. Sprayed with Thiodan 35 for pink stem borers on July 24, 1978.

Table 27. Grain and Forage Yields of Four Sorghum Genotypes Grown on a Farmer's Field at Mafdan 43 km West of Sana'a, Yemen on Hodeidah Road, 1978. Test Number OR 78-5.

Entry	Percent Stand	Plant Ht. cm.	Grain Yield k/ha	Forage Yield k/ha
Sana'a 7 (experimental)	46	89	1134	4819
Local	64	96	838	5338
Ferry Morse A53A (hybrid)	98	86	488	1425
Sana'a 1 (experimental)	62	92	325	4816

Additional Data:

1. Plot size = 4 rows 4 m long and .4 m between rows. Four replications. Two middle rows harvested for yield.

2. Planted on May 13, 1978 in moisture from rain. Rainfed through season. The farmer assisted in planting these plots using his equipment and methods.

3. Name of farmer = Mohammed Saad Al Oubadi.

4. Town and location = Mafdan on Hodeidah road 43 km west of Sana'a.

5. Soil samples collected on August 15, 1978 and results reported elsewhere.

6. On June 23, 1978 sprayed with Drawin 755 for severe aphid infestation.

7. On July 30, 1978 sprayed with Thiodan 35 for moderate pink stem borer infestation.

8. Fifty percent head smut on local cultivar. Porcupine damage to plots during growing season.

Table 28. Grain and Forage Yields of Four Sorghum Genotypes Grown in a Farmer's Field at Yazle 35 km West of Sana'a, Yemen on Hodeidah Road, 1978. Test Number OR 78-6.

Entry	Percent Stand	Plant Ht. cm.	Grain Yield k/ha	Forage Yield k/ha
Sana'a 7 (experimental)	88	100	892	1873
Local	80	100	870	1785
Sana'a 1 (experimental)	60	110	349	1218
Ferry Morse A53A (hyyrid)	91	82	308	506

Additional Data:

1. Plot size = 3 rows 6.5 m long and .7 m between rows. Two replications. Middle row harvested for yield.

2. Planted on May 14, 1978 in moisture from rain. Rainfed through season. The farmer assisted in planting these plots using his equipment and methods.

3. Name of farmer = Salah Nagi.

4. Town and location = Yazle on Hodeidah road 35 km west of Sana'a.

5. Soil samples collected on September 9, 1978 and results reported elsewhere.

6. On July 30, 1978 sprayed with Thiodan 35 for control of pink stem borer.

Table 29. Grain Yields of Four Sorghum Genotypes Grown in a Farmer's Field at Al Asha 170 km North of Sana'a, Yemen on Sa'ada Road, 1978. Test Number OR 78-7.

Entry	Percent Stand	Plant Height cm.	Grain Yield k/ha
Sana'a 1 (experimental)	93	398	2687
Local	94	410	2356
Sana'a 7 (experimental)	91	387	441

Additional Data:

1. Plot size = 4 rows 9 m long and .85 m between rows. Four replications. Two middle rows harvested for yield.

2. Planted on May 23, 1978 in moisture from rain. Rainfed through season. The farmer assisted in planting these plots using his equipment and methods.

3. Name of farmer = Sheik Abdela Faishi.

   Town and location = Al Asha 148 km morth from Sana'a on Sa'ada road and 22 km west from Huth.

5. On June 19, 1978 sprayed with Thiodan 35 to control a moderate infestation of pink stem borer.

6. Used 2-4D at 22 cc/16 liter to control Flavora Rependa, a very troublesome weed in this area.

7. Soil samples collected on August 26, 1978 and the results are reported elsewhere.

Table 30. Information Relative to a Test of Four Sorghum Genotypes Planted on a Farmer's Field at Huth 126 km North of Sana'a, Yemen. 1978. Test Number OR 78-8.

1. The farmer destroyed this test and replanted to wheat about mid-July because chickens (?) had destroyed most of the young sorghum plants.

2. The four entries that had been planted were Sana'a 1 (experimental), Sana'a 7 (experimental), Pioneer 894 (hybrid), and a Local.

3. Plot size = 3 rows 6 m long but row width was not measured.

4. Planted on June 11, 1978 in moisture from pre-irrigation. Irrigation available as necessary. The farmer assisted with the planting of these plots using his equipment and methods.

5. Name of farmer = Sheik Nasser.

6. Town and location = Huth 126 km north of Sana'a on Sa'ada road.

7. On July 2, 1978 the test flooded from heavy rains.

Table 31. Information Relative to a Test of Four Sorghum Genotypes Planted on a Farmer's Field at Sa'ada 240 km North of Sana'a, Yemen. 1978. Test Number OR 78-9.

1. This test was harvested in bulk by the farmer for no good reason just prior to the planned harvest for research purposes by project personnel.

2. The four entries planted were Sana'a 1 (experimental), Sana'a 7 (experimental), Ferry Morse A53A (hybrid), and a Local. The farmer assisted in planting these plots using his equipment and methods.

3. Plot size = 4 rows 8 m long but row width was not measured. Four replications. Two middle rows planned to be harvested for yield.

4. Planted on May 24, 1978 in moisture. Both irrigation and rain available during the growing season.

5. Name of farmer = Sheik Hussen Al Surabi.

6. Town and location = Sa'ada 240 km north of Sana'a.

7. Soil samples were collected on August 27, 1978 and the results are reported elsewhere.

8. On June 11, 1878 sprayed with Dipterex S.P. 80 for control of pink stem borer but this chemical was not very effective. On June 18 and on July 11 sprayed with Thiodan 35 for more effective control of pink stem borer.

9. Spraying with Dowpon M was not effective in control of Bermudagrass growing in the sorghum plots.

10. A new irrigation well was being dug during the growing season leaving only sparse natural rain for most of the moisture source.

Table 32. Information Relative to a Test of Four Sorghum Genotypes Planted on a Farmer's Field at Wadi Khaiwan 136 km North of Sana'a, Yemen. 1978. Test Number OR 78-10.

1. This test was harvested in bulk by the farmer for no good reason just prior to the planned harvest for research purposes by project personnel.

2. The four entries planted were Sana'a 1 (experimental), Sana'a 7 (experimental), Pioneer 874 (hybrid), and a Local. The farmer assisted in planting these plots using his equipment and methods.

3. Plot size = 3 rows 6 m long but row width was not measured. Two replications. Middle row planned to be harvested for yield.

4. Planted on June 1, 1978 in moisture from rain. Rainfed through season.

5. Name of farmer = Mussen Dirhim.

6. Town and location = Wadi Khaiwan 138 km north of Sana'a.

7. On June 9, 1978 sprayed with Thiodan 35 for control of moderate infestation of pink stem borer.

8. Several plots destroyed by porcupine digging.

9. Soil samples were collected on September 10, 1978 and the results reported elsewhere.

Table 33. Information Relative to a Test of Four Sorghum Genotypes Planted on a Farmer's Field at Wadi War War 105 km North and East from Sana'a, Yemen. 1978. Test Number OR 78-11.

1. This test was harvested in bulk by the farmer for no good reason just prior to the planned harvest for research purposes by project personnel.

2. The four entries planted were Sana'a 1 (experimental), Sana'a 7 (experimental), Pioneer 897 (hybrid), and a Local.

3. Plot size = 4 rows 9 m long but row width was not measured.

4. Planted on May 31, 1978 in moisture from rain. Rainfed through season. Plots were planted by the farmer using farmer equipment and methods.

5. Name of farmer : Asker Abushuareb.

6. Town and location = Wadi War War which is 33 km northeast of Rayday located 72 km north of Sana'a.

7. On August 1, 1978 sprayed with Thiodan 35 to control a moderate infestation of pink stem borer.

8. Soil samples were collected on September 14, 1978 and the results are reported elsewhere.

Table 34. Grain and Forage Yields of Four Sorghum Genotypes Grown on the German Al Boun Project Research Farm 67 km North of Sana'a, Yemen. 1978. Test Number OR 78-12.

Entry	Percent Stand	Plant Height cm.	Grain Yield k/ha	Forage Yield k/ha
Sana'a 7 (experimental)	84	94	541	292
Pioneer 894 (hybrid)	90	82	516	143
Local	86	92	450	389
Sana'a 1 (experimental)	82	119	349	422

Additional Data:

1. Plot size = 4 rows 9 m long and .75 m between rows. Four replications. Two center rows harvested for yield.

2. Planted on June 17, 1978 in moisture from pre-irrigation. Irrigation available as needed throughout the season.

3. Name of research station supervisor = Mr. Konrad Engleburger.

4. Location = 62 km north from Sana'a on Sa'ada Highway, then 5 km to the east.

5. Soil samples collected on August 14, 1978 and results reported elsewhere.

6. On August 14, 1978 sprayed with Thiodan 35 for stem borer infestation.

- Section 7 -

Training of Project Employees

The heart of this project, or of any research project, is its staff of trained employees at all levels. Without trained employees at all levels of expertise within the project no research can be conducted that will give meaningful results. One professional cannot run a very large program by himself with no capable help.

The project employees actually assisting in the field with research and in the laboratories were quite poorly educated academically. Two supposedly had a high school education. One had had some previous exposure to some type of research. These types of employees had to be trained on the job to assist the professional directly. They could not assume very much responsibility because of their lack of education, training and life experience. Yet these employees were considered quite good relative to the rest of the Yemen population.

Classes were held weekly to try to explain the various research activities going on and to try to explain how and why certain things were done. The professional had to personally take charge and do most of the activities and use the Yemeni staff as much as possible--under direct supervision. In 1978 there were three International Volunteer Service mid-level technicians available to assume some direct responsibility.

The project did the best it could to train on-the-job these low-level technicians to work under direct supervision. Further formal academic training was necessary for these employees to move up to mid-level technician status. Efforts were made continually in 1978 to try to get some of these employees into training out of Yemen to no avail.

This will have to be done if Yemen is to ever operate its own program.

A regular daily schedule of English classes was conducted for all project employees. None of the employees was outstanding in the use of the English language and there were considerable differences in levels of competency.

Toward the end of the contract period (in 1978) a library of agricultural science books on a high school and college level had been ordered, received and set up. These were used for study relative to the formal on-the-job training sessions and were also used for individual home study.

- Section 8 -

Equipment Acquisition

The lack of proper equipment can greatly hinder most any agricultural research. There was almost no experimental equipment on hand at the beginning of this contract. A long list of equipment and supplies was ordered during the first few months of this contract. A detailed accounting of all equipment and supplies that were ordered, purchased and shipped is a matter of separate record and need not be reported in duplicate here.

Research activities during the first year (1977) and even the second year (1978) were greatly hindered. Certain procedures could not be carried out because of a lack of proper equipment. These problems were all reported in regular semi-monthly and semi-annual reports during the contract period.

A large proportion of the time of the professional in the field in Yemen was spent in working out these orders and receiving and cataloging them as per USAID regulations. Some orders took over a year enroute and air freight supplies particularly could take weeks of work to get them through customs.

All of this had to be done in order that the project could build a resource base upon which to proceed to do research and improvement of sorghum and millet in a professional manner.

- Section 9 -

Development of Second Agrucultural Research Station--Al Jarubah

The original project objectives include the development of several agricultural research stations in order that research may be conducted under various environments to develop sorghum and millet genotypes and cultural practices suited to various environments. In 1977 a site in the Tihama at Al Jarubah was finally selected. Work on the development of an agricultural experiment station at Al Jarubah proceeded at full speed by the Mission (USAID) during 1978. This work centered around the development of the irrigation well and water system and an access road. This work was primarily the responsibility of the USAID Mission but these developmental activities directly influenced our project activities at Sanaa. The farm superintendent, auto mechanics, some farm labor, our agricultural engineer and project drivers all would spend a week to two weeks at a time in Al Jarubah. They would return and recuperate at Sanaa and then go back to Al Jarubah. Vehicles, trucks and much project equipment went to Al Jarubah during these times.

The commitment by the Mission of these limited project resources essentially stopped the development of the Sanaa agricultural station which was just getting underway in 1978. We were also shorthanded in carrying out normal project activities at Sanaa.

- Section 10 -

Short Term Consultants

A number of short term consultants made professional visits to Yemen in 1978 to assist with project objectives. All of these consultants made individual trip reports which are a matter of record elsewhere.

The short term consultants in 1978 were as follows:

Mr. Herman Fred Arle, Weed Control Specialist:
18 January 1978 thru 15 February 1978

Dr. Fred Turner, Jr., Soils Specialist:
18 January 1978 thru 15 February 1978

Mr. Robert A. Saul, Grain Storage Specialist:
22 February 1978 thru 8 March 1978

Mr. Orrin F. French, Irrigation Specialist:
12 April 1978 thru 17 May 1978

Dr. Robert Phillip Upchurch, Administrative Visit:
23 August 1978 thru 30 August 1978

Mr. David F. Robinson, Research Technician:
16 November 1978 thru end of 1978.

- Section 11 -

Summary of Accomplishments to Date

1. Training of project personnel in field research work and the operation and care of technical equipment. Classes were conducted on scientific matters and studying the English language. Trained personnel are necessary for a crop improvement program to succeed.
2. Acquisition of equipment and supplies necessary for operation of a crop improvement program.
3. Development of the Sanaa Experiment Farm was pursued as resources permitted. Laboratory facilities were put in place and developed. Office space was developed.
4. Greatly improved field research procedures were developed so that more reliable research data could be obtained.
5. Adapted germplasm resources with wide genetic variability was developed for selection of superior genotypes for grain and forage production and local adaptation. There was very little promising germplasm available at the beginning of this project. Most of the material was imported United States types which are generally very unadapted to the conditions in Yemen. Nearly all of this inherited imported germplasm from the United States was eliminated by being surpassed by better adapted genotypes in field testing. Several thousand potentially different adapted genotypes were on hand for further testing by the end of this project period. Superior genetic variability from which to make superior selections is absolutely necessary to make progress in a crop improvement program.
6. When this project began work in early 1977 there was no germplasm (seed) storage. What seed there was was in a corner of a large

warehouse with building supplies. Birds, rats, insects, etc., had the run of the seed with disastrous effect. With such poor germplasm storage conditions even good germplasm would soon be lost. A new building was erected permitting the use of improved procedures for the control of birds and rats. Metal boxes and insecticides were used to control insects. Refrigerated seed storage is still needed to properly store germplasm over longer time periods as necessary.

7. Segregating generations of very superior adapted germplasm developed by this project was shared with the UNDP/FAO sorghum program at Taiz. They have been able to select some superior genotypes for their environment.

8. A reasonably well adapted male sterile A and B line was developed for potential future hybrid production.

9. A sorghum germplasm collection of about 4,500 types was accumulated to be added to the world sorghum collection.

10. The first outreach or on-farm tests were established in 1978. Valuable experience was gained by the project and useful contacts were established in many villages. Much favorable public relations work was done in establishing and conducting these on-farm tests.

11. A uniform set of personnel job descriptions for job classifications and promotions were devised by the project and adopted by USAID.