

Semi-annual Report

on

**Agency for International Development Negotiated
Contract No. AID/NE-C-1304 (Yemen)**

Project No: 279-11-110-030

Contract For: National Sorghum and Millet Crop Improvement

**Contents consist of a substantive and administrative
report in accordance with General Provisions, paragraph
12, AID1420-23C (7-1-75)**

**Period of Report: January 15, 1977 through September
15, 1977. The first key personnel
arrived in Yemen March 16, 1977.**

**Prepared by: University of Arizona,
Department of Plant Sciences**

**Department of Plant Sciences
University of Arizona
Tucson, Arizona 85724
Agency for International Development
Washington, D.C. 20543**

Copy to:

**Contracting Officer (3)
Mission (4)
AID Reference Center (2)
Yemen Chief of Party (2)
Coordinator, International Agriculture Programs (1)
Department of Plant Sciences (2)**

Substantive Report

1. Status of work and progress under the contract.

The effective date of this contract was January 15, 1977. However, signatures of all parties required were not obtained until mid-February, 1977. Estimated completion date is March 30, 1979. The first sixty days of the contract period were utilized for final preparation of materials for the project and in obtaining necessary items for personnel to live in Yemen and fulfill contract obligations. Dr. R. L. Voigt, University of Arizona, Department of Plant Sciences is serving as Chief of Party. He arrived in Sana, Yemen, March 16, 1977 having previously assumed responsibilities for the technical direction of field activities for the project.

In Yemen the remainder of March 1977 was spent evaluation and analyzing 1976 raw, untabulated sorghum and millet data. Local farm and research facilities were visited. Discussions on past years operations and procedures were also conducted. There was a critical shortage of vehicles which restricted travel.

April, 1977 was a busy month. Plans were developed for types of testing needed (observation, preliminary yield test, advanced yield test, etc.) Tests were designed as appropriate for the number of entries to be evaluated. Fields were measured and test areas available calculated. Fencing was erected. Irrigation ditches and borders were constructed with hand labor. One third of research plots were planted dry and irrigated after planting.

Field plots continued to be planted in May. Field crews began working continuously on hand weeding. The sun and wind dried the soil to a crust within eight hours after irrigation. Irrigation became necessary every three or four days to soften the crust to allow seedlings to emerge. Emergence took a week to ten days. Irrigation ditch repair was necessary. Plans were made and a bid obtained for a new pump and larger motor on a new well. Dr. D. M. Stewart, Agronomist, University of Arizona, Department of Plant Sciences arrived in country, May 30, 1977 to complete the key personnel list for long term specialists.

During June, irrigation of all research plots continued with the two irrigation wells being used to capacity. The pump and motor were changed on one well, which doubled the capacity. This well now produces 115-120 gallons per minute. Plantings were made on June 1 and 15. One third of fields were sprayed with Dipterex 80 for stem borer control. Spray was repeated in 12 to 15 days. A weed collection of dried, pressed specimens was started. New vehicles arrived in mid-June which greatly alleviated the transportation problem. Requests for future short term specialists were made of the University of Arizona. Requests included: entomologist, weed control, seed storage and soils fertility. A plot thresher was ordered. This item must be shipped surface and will probably take 9-12 months to arrive in Yemen.

Hand weeding continued on all plots during July 1977. Both irrigation wells were run daily. Two fields were hand fertilized. The last planting was made on 13 July 1977. Stem borer was still active in one field after a spray application in June. Field was rerprayed. An agriculture area survey was made observing sorghums and millets growing from seedling to mature stage on different elevations. Erratic stand population and plant development, weed competition, uneven irrigation, stem borer and salt problems were determined as the major environmental influenced which masked genotypic expressions. These influenced make selection of superior genotypes difficult. Hand thinning of some plots was conducted as required. Selfing of the first early blooming genotypes was started in the nursery on 24 July 1977 (85 days after planting). The laboratory and office facilities were still under construction this month. These facilities were needed for inventory, storage and organizing previous seed stocks. Instructional meetings for project personnel were conducted by Dr. Voigt.

Early plots started blooming during the first week of August. Selfing of typical plants in earlier maturing plots continued to purify seed of selected lines in yield trials. The phenotype of the Snowflake, Arizona random mating population was determined as not ideal for Sana, Yemen. It is too small a plant. There were extreme variations among plants within plots with regard to height and maturity. Variations may be due to 1) volunteer plants from 1976 seed in soil; 2) outcrossing in seed; 3) genetic segregation; 4) variable soil and environmental stresses. Weeds were a minor problem in August and rains decreased insect problems to a low level. No leaf diseases of any consequence occurred. Bird activity on the edge of fields and or early plots was noted. Hail damage occurred 14 August 1977 which shredded leaves destroying from 10 to 60% of leaf area. Most hail damage was in the 10 to 30% range. Weekly project meetings were conducted for training and planning. Work on laboratory and office facilities continued. Orders for miscellaneous supplies were submitted to the University of Arizona.

Thru September 15, 1977, irrigation of plots was necessary, but it was not possible to keep up with the water demands of the crop. Plants were observed ready for harvest, still blooming, and coming into boot. Nights cooled off to 50-55^oF, which colored some sorghum plants from cold stress. Pollination problems occurred due to: morning warm up required before pollen was shed and the fact that high winds (25 to 40 mph) started shortly after morning warm up. Winds usually lasted for the majority of the day. The time of breeding and crossing work under these conditions varied from 30 minutes to 14 hours per day before winds dictated termination. Building construction was nearly at a standstill due to lack of supplies and parts. A requirement for a short term irrigation specialist was forwarded to the University of Arizona.

2. Summary of Current Status

This project began operations in 1977. It is a year of orientation and defining of fundamental research procedures and the problems obstructing the obtaining of reliable research data.

The same planting and other agronomic field practices were used this year as on other projects in previous years to become acquainted with their strengths and weaknesses. Most of the materials planted in 1977 were a retesting of nearly all of the material grown for evaluation in 1976. A re-evaluation was considered desirable due to poor plot conditions in 1976 and improper threshing equipment. A few additional plant materials were planted in 1977 up to an estimated limit of land, irrigation, and manpower resources available.

The primary objective of most plots grown in 1977 is for grain yield evaluations of 666 sorghum and millet genotypes. Seven hundred sixty three single plant selections are being evaluated phenotypically in 1977. About two hundred of the better ones will be yield tested in 1978. Bulk populations are being grown in 1977 from which single plants are being selected for plant-row phenotypic evaluation in 1978. The better of these will be yield tested in 1979.

These simple types of plant breeding operations have the quickest application to the grower following seed increase and some further on-farm evaluation. The first field crosses are being made in 1977 to develop a random mating population to furnish the source of further improved and superior variety genotypes for selection 10 to 20 years from now and later.

The current initial program encompasses plant breeding activities to provide materials for on-farm testing in 1978 with new materials following each year after that.

The current research efforts of the project are concentrated at Sana because all facilities, equipment, and personnel are located here.

Supporting data of past years (1973-76) research efforts are rather inconclusive but indicate some genotypic sorghum selections with superiority over locals for grain production.

It is considered advisable and desirable to exchange some appropriate research materials with other Agencies and personnel conducting sorghum and millet research in Yemen. Some materials have been exchanged in 1977 with two Agencies United Nations Development Program/Food and Agriculture Organization (UNDP/FAO) and International Land Development Consultants, Ltd. (ILACO).

We have been told by personnel acquainted with past years field plot conditions that the 1977 research plots are currently in better shape than previous years. However, the 1977 plot conditions still are not fully acceptable for purposes of reliable research.

Weekly meetings of project personnel are held for purposes of training and planning.

3. Plants to Correct Problem Areas

The biggest problem that must be solved or alleviated is that of poor plant emergence and development after planting. Improved agronomic procedure of planting and growing a well developed crop free of variable environmental stresses is fundamental to the generation of reliable data from uninhibited genotypes. This does not involve equipment at this point but is concerned with agronomic problems of seed bed preparation, proper placement of the seed, and correct soil, crop, and irrigation management procedures to cope with specific soil characteristics of the Sana's research farm. As of the close out period of this report, two short term specialists, an entomologist and irrigation specialist, were in their final preparation stage for travelling to Yemen in October 1977. A soils fertility specialist has also been tentatively identified for a tour in early 1978.

Other serious problems associated with the research plots have been weed competition, bird damage, poorly leveled land, and wind.

The weed problem has previously been worked at rather unsuccessfully with hand labor. Hand sprayers and appropriate herbicides need to be purchased or imported. Weed seeds from Yemen have been forwarded to the University of Arizona. The seeds will be grown in a greenhouse experiment in an attempt to positively identify. Recommendations for herbicide selection to control the weed will follow the experiment. The person conducting the greenhouse experiment has also been tentatively identified for a short term assignment as a weed control specialist in early 1978.

Bird damage to research plots can quickly render research data meaningless. A combination of actions can be taken to partially alleviate the problem such as more bulk borders on the fields (leaving less useable research plot area) and more labor continuously during daylight hours to scare birds out of the plots. As part of the University of Arizona backup program for the Yemen project, research on bird control techniques is currently in progress.

Plans were made to level the land this winter to improve the application of irrigation water.

The high winds break over bagged heads thus destroying valuable breeding materials. Wind breaks of corn plots will be tried next year to try to help the problem.

The absence of any suitable laboratory and office spaces to support the field work has been a very inhibiting factor to the development of an organized plant breeding program. Seed cannot be stored successfully from year to year or adequately processed, evaluated and prepared. Hopefully, these facilities will be available for 1978.

A major piece of equipment needed is a plot thrasher. The current threshing equipment is inadequate and unsuitable for threshing yield test plots. One is on order but is being sent surface. It is unknown when it will arrive in time for the 1977 season because of the long delays in surface shipments to Yemen.

There is the question of determining whether the present experiment station site at Sana is characteristic of a majority of the farm land in the area. Any great soil differences can influence the applicability of results from research on the farm.

The 1977 field research efforts were more than could be properly supported by the resources available of suitable land, irrigation water, and labor. Some very desirable research was not conducted in 1977 due to resource shortages. It appears likely that limited resources will continue to hamper research plans in the future.

Abnormally dry spring and early summer seasons around Sana for the last few years have prevented the planting of much grain sorghum under natural rainfall. Such vagaries of weather may make it difficult to run the local on-farm evaluation program near Sana on a regular yearly schedule except for irrigated plots.

4. Recommendations for the Future

Two more experiment stations need to be set up to represent 2 other environments for sorghum and millet research. One should be in the Tihama and the other at an elevation intermediate between the Tihama and Sana. Personnel and equipment need to be obtained to staff and equip them.

Personnel and equipment need to be obtained to set up an on-farm evaluation program of improved genotypes and agronomic practices when they are developed.

The current breeding and research programs do not include actual work on hybrids. The development of hybrids requires an entirely different approach and would require the diversion of already scarce resources from the research currently underway. Hybrids will come at some time in the future. Work on them is currently deferred.

5. Additional information pertaining to this contract:

- a. Communications: Progress has been limited by the delays associated with mail delivery. A two-four week period is required for first

class mail to travel one way from the University of Arizona to Yemen or vice versa. For paper and packages, this factor is increased to four-six weeks. Under normal situations, over two months may elapse just to obtain an exchange of mail. This process does not lend itself to an immediate response/answer situation. Cabled information can be utilized to shorten the interval between the communication gap; however, they have arrived with messages so mixed up that the information was not readable. An emergency telephone number through the Agency for International Development switchboard in Washington D.C. is available.

- b. Delivery for personal effects of personnel: Excessive delays on delivery for air freight and surface freight of the personnel in Yemen have occurred. Dr. Voigt's surface freight has still not been delivered to him. It contains his house-hold consumables and automobile. Likewise his air freight shipment took 44 days to arrive. Dr. Stewart only sent an air freight shipment; however, it took over 90 days to arrive. These delays in arrival of personal effects required personnel to literally live out of a suitcase for an unexpected and unnecessary period of time. Considerable time was also spent by the Coordinator, International Programs, in frequent follow up action to determine status of shipments.

- c. The on campus backup activities significantly increased during the latter three months of the reporting period. After the field personnel met immediate objectives, gained an insight into the Yemen arid land farming methods, and performed the last planting on July 13, 1977, it was time to consider future requirements. Supply and equipment orders were received, procured, inventoried upon campus delivery, repacked and mailed parcel post via the pouch to Yemen. The recruitment process of filling short term specialist requirements got into full swing. Numerous letters, telephone conversations and personal conference periods were utilized to find potential qualified short term personnel. For example, arrangements for an irrigation specialist were finalized in less than a month. An entomologist was also selected and final travel of both of these specialists is slated for October 1977. In addition, coordination was undertaken to identify a soil fertility specialist, a weed control specialist and a grain storage specialist. The weed emergence situation was identified as being critical to the sorghum seedlings in Yemen. Seeds from this weed were forwarded to the campus for identification. Library research was conducted and discussion with local experts revealed the seed to be from a mustard type plant. A weed control expert was identified to conduct a greenhouse experiment with these seeds. The experiment will grow the seeds along with sorghum. This growth will be treated with herbicides at different stages of the growing cycle. The end result should select the best herbicide and recommending how to control the weed in Yemen. Literature review, personal conferences and exchanges of ideas with Yemen key

personnel have also been conducted for a possible solution for the control of birds and soil crusting. The short term irrigation specialist may provide a solution to the crusting problem. Periodic progress reports on ways to control birds will be forwarded to the Yemen team. The on campus support included help on personal problems associated with pay changes, insurance changes, etc, and all related administrative details of doing business within the already described mail system.

- d. It was anticipated during the negotiation stage of this contract that personnel from the International Voluntary Services (IVS) would supply technicians for support of this sorghum/millet project. This support has not been available during this reporting period.
- e. The University of Arizona acknowledges the effort of Mr. Morgan Stickney, US/AID Yemen Mission Director, and Mr. John Young, US/AID Yemen Agriculture Division Chief. These individuals have been most cooperative and have aided in fulfilling the requirements of this contract.

Administrative Report

This segment of the semi-annual report covers expenditures and personnel employed under the contract. A report on foreign national trainees was not applicable during this period.

No expenditures were incurred during the period January 15-31, 1977. Dr. Robert L. Voigt, Chief of Party, with the exception of five days, has been on the project 100% of the time since February 1, 1977. His duties during February and early March were associated with technical activities related to the project and included: development of literature; arranging for germplasm, conferring with local experts relative to technical aspects of arid farming; exploration of potential candidates for future selection as short term specialists; making arrangements for shipment of personal effects to Yemen; attended an Agency for International Development orientation in Washington, D.C. He arrived in Yemen March 16, 1977.

Dr. Donald M. Stewart also started preparation for assignment as a regular employee to Yemen on February 1, 1977. His time prior to departure for the cooperating country was spent: assembling a list of needed equipment; locating sources of supplies and catalogues; requesting seed genotypes for trial in Yemen; packaging and shipment of seed/miscellaneous equipment to Sana; arranging for shipment of personal effects; reviewing literature and sources of information on Yemen and arid land agriculture; conferring with local professionals relative to contract objectives; attended an Agency for International Development orientation in Washington D.C. Dr. Stewart was on the contract for the month of April 1977 and again starting June 1, 1977. He arrived in Yemen May 30, 1977, and has been on project 100% of the time since arrival.

Dr. Robert Phillip Upchurch, Head, Department of Plant Sciences, has spent 1/6th of his time since February 1, 1977 as Project Director for the contract.

Ms. Anna Fisk, Department of Plant Sciences has spent 1/3rd of her time since February 1, 1977 performing secretarial duties associated with the contract.

Dr. Gerald Matlock, Coordinator for International Agriculture Programs, has spent 1/12th of his time since July 1, 1977, performing duties associated with the contract.

Dr. Victoria Marcarian, Department of Plant Sciences, was assigned to the project July 1, 1977. Dr. Marcarian spent 2 months of professional support time on the project.

Mr. Dale McDonald was hired August 15, 1977 as a full time technician to support the contract in an on campus capacity.

Minor expenses were obligated in preparation for short term travel during this reporting period. Plans were finalized for an entomologist and irrigation specialist to travel to Yemen in October 1977. As short term specialists proceed to fulfill contract obligations, increases in expenditures will be noted for per diem, travel and transportation, and other direct costs.

Supplies and equipment orders from Yemen started arriving in Tucson during the month of August. The next report should portray an increase in monies spent for equipment as the final cost of these items are tabulated.

Inception of contract to August 31, 1977 financial report is attached. It should be noted the University of Arizona implemented a new computerized accounting system effective July 1, 1977. This system is called CORE and is both a financial accounting and procurement accounting system. CORE is the foundation for the Universities entire accounting system. The August 31, 1977 inception to date report is the latest computerized product available, as of October 26, 1977.

attch: Inception to date report.

REPORT NO. GA3204
 ACCOUNT NO: 867381
 ACCOUNTANT: BULLINGTON TP

UNIVERSITY OF ARIZONA
 FID RESPONSIBILITY REPORT
 FOR MONTH ENDING 09-30-77
 YEREN SUPPORT 9010410120

PAGE NO 1
 RUN DATE 09-23-77

AGENCY: MDOS GRANT NUMBER: ATO NE C 1904

U G RATLOCK
 036ACT
 AWARD AMOUNT: 0000000000 TERMINATION DATE: 03/30/79

***** CURRENT MONTH *****
 BUDGET CHANGES EXPENDITURES ENCUMBRANCES

***** INCEPTION TO DATE *****
 BUDGET EXPENSES ENCUMBERED AVAILABLE

| PERSONAL SERVICES & ERE | | 404,561 | | | |
|-------------------------|-----------|--------------------------|---------|--------|---------|
| | | SALARIES | | | |
| 16,937.14 | 39,572.00 | SALARIES | 43,176 | 47,322 | 98,498- |
| 16,937.14 ✓ | 39,572.00 | CLASS TOTAL | 43,176 | 47,322 | |
| | | EMPLOYEE RELATED EXPEND | | | |
| | | WORKMEN'S COMP INSURANCE | 70 | | 70- |
| | | UNEMPLOYMENT INSURANCE | 22 | | 22- |
| 424.49 | | FICA TAX | 2,883 | | 1,887- |
| 751.62 | | RETIREMENT CONTRIBUTION | 2,371 | | 2,371- |
| 233.43 | | GROUP HEALTH INSUR PREM | 455 | | 455- |
| 1,409.54 ✓ | | CLASS TOTAL | 4,881 | | |
| 18,346.68 | 39,572.00 | CATEGORY TOTAL | 404,561 | 47,977 | 309,262 |
| | | OPERATING EXPENDITURES | 41,127 | | |
| | | OUTSIDE AND PROFESSIONAL | | | |
| | | SUSPENSE ACCOUNT | 331 | | 331- |
| | | CLASS TOTAL | 331 | | |
| | | OFFICE SUPP. AND POSTAGE | | | |
| 22.65 ✓ | | OFFICE SUPPLIES | 111 | 72 | 183- |
| 65.00 ✓ | 94.50 ✓ | STAMPS STMPD ENV & CARDS | 122 | 94 | 216- |
| 87.65 | 94.50 | CLASS TOTAL | 233 | 166 | |
| | | OPERATING SUPPLIES & SVC | | | |
| | | EDUCATIONAL SUP - OTHER | 144 | | 144- |
| | | SUSPENSE ACCOUNT | 95 | 45 | 140- |
| | | CLASS TOTAL | 239 | 45 | |

REPORT NO. CA3204
 ACCOUNT NO: 867301
 ACCOUNTANT: BULLINGTON TR

UNIVERSITY OF ARIZONA
 ITS RESPONSIBILITY REPORT
 FOR MONTH ENDING 09-30-77
 YEMEN SUPPORT 5010410120

PAGE NO 3
 RUN DATE 09-29-77

H G MATLOCK
 096661

AGENCY: MOOS GRANT NUMBER: AID ME C 1304 AWARD AMOUNT: 0000000000 TERMINATION DATE: 03/30/79

***** CURRENT MONTH ***** BUDGET CHANGES EXPENDITURES ENCUMBRANCES
 ***** INCEPTION TO DATE ***** BUDGET EXPENDED ENCURRED AVAILABLE

| ***** CURRENT MONTH ***** | BUDGET CHANGES | EXPENDITURES | ENCUMBRANCES | ***** INCEPTION TO DATE ***** | BUDGET | EXPENDED | ENCURRED | AVAILABLE |
|---------------------------|----------------|--------------|--------------|-------------------------------|---------|----------|----------|-----------|
| | | | | IN-STATE TRAVEL | | | | |
| | | | | IN-ST OTHER TRAVEL EXP | | 63 | | 63- |
| | | | | CLASS TOTAL | | 63 | | |
| | | | | OUT-STATE TRAVL-DOMESTIC | | | | |
| | | | | OUT/DOM SUBSISTENCE | | 8,990 | 213 | 9,011- |
| | | | | OUT/DOM PUBLIC TRANS | | 1,997 | | 1,997- |
| | | | | OUT/DOM OTHER TRAVEL EXP | | 97 | | 97- |
| | | | | CLASS TOTAL | | 10,692 | 213 | |
| | | | | OUT-STATE TRAVEL-FOREIGN | | | | |
| | 59.10 | | | OUT/FORFIGN SUBSISTENCE | | | 80 | 80- |
| | | | | OUT/FOREIGN PUBLIC TRANS | | 99 | | 99- |
| | | | | OUT/FOREIGN REG FEE-COMP | | | 200 | 200- |
| | 59.10 | | | CLASS TOTAL | | 99 | 200 | |
| | 59.10 | | | CATEGORY TOTAL | 104,200 | 10,814 | 493 | 92,893 |
| | | | | CAPITAL | 55,000 | | | |
| | | | | CATEGORY TOTAL | 55,000 | | | 55,000 |
| | | | | INTERNAL CHGS AND ALLOCA | | | | |
| | | | | INDIRECT COSTS | | | | |
| | 3,514.21 | | | IND COSTS - APPLIED | 105,977 | 12,006 | 93,992 | 1- |
| | 3,514.21 | | | CLASS TOTAL | 105,977 | 12,006 | 93,992 | 1- |
| | 3,514.21 | | | CATEGORY TOTAL | 105,977 | 12,006 | 93,992 | 1- |
| | 25,478.03 | 35,733.99 | | ACCOUNT TOTAL | 710,865 | 87,634 | 192,022 | 471,209 |

REPORT NO. 6A3204
ACCOUNT NO: 867301
ACCOUNTANT: BULLINGTON TR

UNIVERSITY OF ARIZONA
ITD RESPONSIBILITY REPORT
FOR MONTH ENDING 08-31-77
YEREN SUPPOTY 9010410120

PAGE NO 2
PRN DATE 09-23-77

AGENCY: MOOS GRANT NUMBER: AID ME C 1304

AWARD AMOUNT: 0000000000 W G HATLOCK
036AGI TERMINATION DATE: 03/30/79

***** CURRENT MONTH *****
BUDGET CHANGES EXPENDITURES ENCUMBRANCES

***** INCEPTION TO DATE *****
BUDGET EXPENDED ENCUMBERED AVAILABLE

MAINTENANCE AND REPAIRS
REPAIRS + MAINT - OTHER

20 20-

CLASS TOTAL

20

TELEPHONE
TEL EQUIPMENT CHARGES
SUSPENSE ACCOUNT

93 93-
30 30-

CLASS TOTAL

93

PRINTING AND PHOTOGRAPHY
PRINTING - OTHER

12.75

119 119-

12.75

CLASS TOTAL

119

RENT
LEASE + RENTAL - OTHER

96 96-

CLASS TOTAL

96

MISC AND OTHER COSTS
OTHER EXPENSES
SUSPENSE ACCOUNT

3,457.64 3,932.51-

1,019 1,019-
14,599 24,703-

3,457.64 3,932.51

CLASS TOTAL

19,610 10,104

3,958.04 3,830.01

CATEGORY TOTAL

41,127 10,315 14,099

104,200

PROJECT: GRAVE
CATALOGUE
ABSTRACT
FICHE
COMMENTS: