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Fifth
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, AID 1420-23C (7-1-76)

Period of Report: March 16, 1979 through
September 15, 1979

Previous Reports: January 15, 1977 through September 15, 1977
September 16, 1977 through March 15, 1978
March 16, 1978 through September 15, 1978
September 16, 1978 through March 15, 1979

Prepared by: University of Arizona
Department of Plant Sciences

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)

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Substantive Report

Status of work and progress under the contract

The following reports submitted by Dr. Robert L. Voigt, Yemen Chief-of-Party, and Mr. David L. Robinson, Research Assistant in Yemen, portray actual activity on a bi-weekly basis.

SANAA (ID)

DEPARTMENT OF STATE

WASHINGTON, D.C. 20520

Contract No. AID/NE-C-1304 Yemen

Activities Report No. 46, March 16-31, 1979

PROGRESS:

1. Completed packaging second shipment of Yemen Sorghum Collection seed for mailing to the Germplasm Resources Laboratory in Washington, D.C. The 24 boxes have been mailed by U.S. air pouch at rate of 4 boxes per week.
2. Mimeograph stencils of data for the Yemen Sorghum Collection were mailed to the University of Arizona to have copies of this report run off there. All machines capable of running these stencils in Sanaa were broken or not available for use by this contract.
3. Completed putting up seed for most of the 1979 research tests at Sanaa.
4. Rechecked seed envelopes of 1979 research tests to be sure they were ready and correct for planting.
5. Sorted out segregating seed colors of seed of an advanced selection.
6. Checked and proofed tabular data from 1978 field research data.
7. Planned outreach (on-farm-test) activities and procedures among project and mission personnel. Arranged for 5 outreach tests with local co-operators during this reporting period,--two on Hodeidah road, two on Taiz road and one on Saada road.
8. Monitored progress of land leveling on the Bir-Al-Gohoum farm.
9. Treated storage containers of seed stocks with shell-no-pest strips to control grain storage insects.
10. Maintained a rodent (rat) control program with poisoned bait in the laboratory spaces.
11. Assembled rest of furrow openers that had been received by air freight some months earlier.
12. Completed bulk threshing of non-yield-plot material harvested from the research farm fields. This grain and straw delivered to the poultry project for feed and bedding respectively.

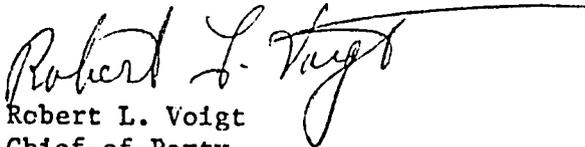
13. Made out cards for newly acquired academic textbooks so that project personnel could check them out for home study. Covered these textbooks to give protection from hard use.
14. Cleaned and straightened up laboratory areas.
15. Chief-of-party, R. L. Voigt and family left Sanaa on 14 March and arrived in Tucson early morning of 17 March, 1979 to complete two year tour in Yemen. Mr. David Robinson, technician, currently is the sole University of Arizona employee in residence in Yemen to represent the University of Arizona and coordinate and/or supervise project activities.

PROBLEMS:

1. Leveling equipment borrowed by the project and project engineering expertise (IVS Agricultural Engineer) were diverted to Horticulture project thus seriously delaying eventual 1979 planting of the Bir-Al-Gohoum farm.
2. Delay of renewal of the Contract for this project has prevented having a replacement Plant Breeder and an Agronomist in country to take over in a timely manner from those leaving.

PLANS:

1. Complete leveling of Bir-Al-Gohoum research farm as soon as possible.
2. Furrow out Bir-Al-Gohoum research farm fields.
3. Begin pre-irrigation of Bir-Al-Gohoum research fields before mid-April.


Robert L. Voigt
Chief-of-Party

SANAA (ID)

DEPARTMENT OF STATE

WASHINGTON, D.C. 20520

Contract No. AID/NE-C-1304 Yemen

Activities Report No. 47, April 1-15, 1979

PROGRESS:

1. Mailed last boxes of second shipment of 24 boxes of seed to Washington, D.C. of the Yemen Sorghum Collection.
2. Completed notations and calculations in "Seed Logbook" of the Yemen Sorghum Collection.
3. Put up sorghum seed entries for the National Cooperative Sorghum Yield Test and the National Cooperative Sorghum Observation Nursery for distribution by the Yemen Ministry of Agriculture to other research organizations in Yemen. Mr. Yahya Shuga delivered the seed.
4. Made a two day trip on April 1 and 2 visiting Huth, Al Ashe, and Wadi Khaywan to set up outreach tests for 1979.
5. Contacted two farmers on Marib road to set up outreach tests. Contacted the German Al Bonn Project and revisited several farmers contacted in March relative to outreach tests.
6. Compiled a preliminary list of plants in the collection made by Dr. D. M. Stewart.
7. Monitored progress of land preparation at the Bir Al Gohoum farm for research plantings.
8. Surveyed the irrigation system at the Bir Al Gohoum farm for needs of replacing broken pipes.
9. Hauled the chicken manure stored by the ramada by the Horticulture Project out to the field at Bir Al Gohoum.
10. Unpacked books and reprints from boxes in hallway and arranged them in some usable order on shelves in project offices.
11. Straightened up and cleaned up laboratory and storage areas. Cleaned up project ground areas outside.

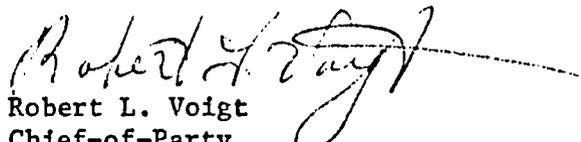
12. Sorted as to usable condition, washed, and counted cloth sacks in preparation for field harvest later this year.
13. Cleaned and serviced sprayers for future use for insect, disease and weed control.
14. Dr. R. L. Voigt arrived in-country on 11 April 1979 on TDY to supervise land preparation for and planting activities of the 1979 sorghum, millet, and corn tests at Sanaa.

PROBLEMS:

1. Leveling and furrowing out of fields at Bir-Al-Gohoum delayed about two weeks longer than planned resulting in a delay of pre-irrigation and starting of planting.
2. Unofficial verbal comments from the Yemen Ministry of Agriculture indicated that there was official thinking to close out the Sanaa Research Farm at Bir-Al-Gohoum and not even plant the 1979 tests. We are just about ready to begin planting so we will proceed to complete preparations and start planting if no written official notice is received telling us not to proceed with our 1979 research testing at Sanaa.

PLANS:

1. Furrow out fields at Bir-Al-Gohoum Research Farm followed by pre-irrigation and planting as soon as possible.
2. A . . . for some 10 or 12 outreach tests if there are sufficient travel resources and plant as environmental conditions permit.


Robert L. Voigt
Chief-of-Party

SANAA (ID)
DEPARTMENT OF STATE
WASHINGTON, D.C. 20520

Contract No. AID/NE-C-1304 Yemen

Activities Report No. 48, April 16-30, 1979

PROGRESS:

1. Furrowed out fields A, B, C, and D of Bir-Al Gohoum Research Farm. The new furrow openers from the USA have a different design from the ones used in 1978 from the UNDP, Taiz necessitating a row width of .75 m rather than .70 m as used previously.
2. Began pre-irrigating on field A. Plans are to apply about 8 inches of water as per instructions from irrigation specialists.
3. Counted furrows (rows) measured fields and then arranged tests in fields to allow pre-irrigation of a portion of the field before proceeding to the next portion as was done last year (1978). Replications of tests were divided among different pre-irrigated blocks so that if a certain pre-irrigated planting block of a field did not produce reliable stands because of problems of pre-irrigation and timing of planting, no complete test would be lost. With this procedure a problem in a certain "planting block" would affect only one replication of a test.
4. A separate detailed set of plans and field maps to describe the field tests, planting design and dates of planting and being drawn up as planting progresses.
5. Planting in moisture started during last few days of April.
6. Trips were made periodically to arrange for on-farm (outreach) tests near Sanaa.
7. No official instructions were received to 'not plant' 1979 research tests at Sanaa so efforts continued to plant all research tests.

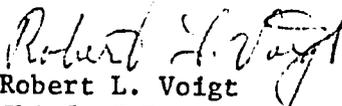
PROBLEMS:

1. A vehicle shortage has resulted in plans for fewer outreach trials and also closer to Sanaa so that once we plant an on-farm test we can be more sure of being able to follow through the rest of the season.

2. Progress in land leveling and development of the irrigation facilities at Al Jaroubah are proceeding too slowly for any planting of sorghum or millet before August or September, 1979.

PLANS:

1. Inventory sacks on hand and compare with calculated harvest needs for grain and forage. To purchase more used flour sacks if necessary.
2. Prepare planting plans for Al Jaroubah.


Robert L. Voigt
Chief-of-Party

SANAA (ID)

DEPARTMENT OF STATE

WASHINGTON, D.C. 20520

Contract No. AID/NE-C-1304 Yemen

Activities Report No. 49, May 1-15, 1979

PROGRESS:

1. Continued pre-irrigating followed by planting in moisture after about 3 to 4 days - depending on weather. Field planting crews reported to work at the field prior to 0600 in order to plant during cool part of morning. Hot sun and drying winds usually made soil planting conditions unsuitable after 1000 to 1100.
2. Made some on-farm visits to arrange for additional out-reach tests or to check on possible planting dates of previously arranged on-farm tests.
3. Worked several days on breaking crust on about 2/3 of field A which received a week of rainy weather just after planting and prior to emergence.

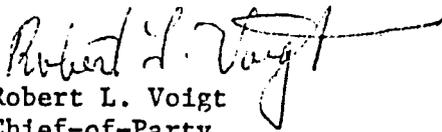
PROBLEMS:

1. Vehicle shortages prevented making some visits to farms to arrange for outreach tests. The long term outlook for the 1979 season is poor so outreach plans are being reduced accordingly.
2. A week of rain showers stopped field plantings for about 10 days during the early part of May.
3. Dr. Gassert, a plant pathologist from the German Farm, visited our plots and determined the cause of death of some newly emerging seedlings as an unidentified fungus which has caused much field loss for farmers in the last year or two.
4. Attached is a copy of a letter from the Central Planning Organization of the Yemen Arab Republic to the Director of USAID. The letter directs that this project terminate sorghum and millet research at Sanaa and concentrate only in Al Jaroubah. Comments relative to the points raised by C.P.O. (1) the British, Dutch and Germans are not doing breeding work on sorghum. (2) Bir-Al-Gohoum has problems but we coped very well against the birds in 1978 and hope to hold them off as well in 1979. (3) Sorghum is about the only crop possibility for the farmer in the Sanaa area under low rainfall. Any other higher moisture conditions allows the farmer to go to other higher income crops. The objective of this project has been development of sorghum for low rainfall conditions

(marginal lands). (4) Sorghum research at Al Jaroubah means throwing all of the recent years work away at Sanaa and starting all over with entirely different sorghums adapted to a different environment and breeding for irrigation and production under high cost conditions. (5) A whole research station would have to be built at Al Jaroubah. (6) All educated and trained Yemenii technicians and Americans now in Sanaa would have to be moved to Al Jaroubah and housing built.

PLANS:

1. Continue with planting and all other routine research procedures for the season at Sanaa, Al Jaroubah, and on-farm tests.


Robert L. Voigt
Chief-of-Party

(TRANSLATION)

5-16-79

Yemen Arab Rep.
C.P.O.
Ref. No. 1812
Date 5-7-79

To: Dir. of USAID

Dear Sir,

The sorghum and millet project in Sana which is under performance and cooperation with USAID, has been started since 1973 at Bir Al-Guhum then the project expanded to Tehama area at Al-Garuba to be prepared for the coming planting season on August. Since the beginning of the project there were not research stations available on the Northern area as there are three research stations established recently, they are Damar Station cooperated with British, Rada Station with Holland and Gaa Al-Bone Station with West German. They research and study different agricultural experiments essentially sorghum.

In fact millet is not planted in Sana'a, as Sorghum plantation decrease due to less of rain fall, increase of rents for man power and farmers interest in planting vegetables and potatoes etc.

Bir-AlGhuhum farm area is not considered an adequate place for Sorghum experiments due to the absent of other sorghum fields, the fact that causes attack of birds which results damages in your experiments.

It is difficult to protect the farm practically from the birds.

The Ministry of Agriculture concentrates on the productive results, and priority is given to experiments in Tehama area. Therefore, the Ministry declared the termination of sorghum and millet experiment in Bir-Al-Guhum and advise the project to concentrate on Al-Garuba Farm. The project has to continue its assistance in submitting experimental seeds to the above mentioned stations as well as your consultation.

Minister of Development

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

Yemen Arab Republic
PRIME MINISTER'S OFFICE
CENTRAL PLANNING ORGANISATION

P. O. Box : 175 - SANA'A
Teleg. : GENPLAN
Phone : 2992-3

وزارة التخطيط
مكتب وزير التخطيط
وزارة الزراعة
الجهاز المركزي للتخطيط
صندوق بريد : ١٧٥ - صنعاء
تلفون : ٢٩٩٢-٣

Dept :
Our Ref :
Date :

ادارة :
رقم صادر : ٨٦٥
التاريخ : ١٤/٥/١٩٧٤

Subject : الموضوع :

المحتيم السيد / مدير عام الوكالة الأمريكية
بعد انتحسة

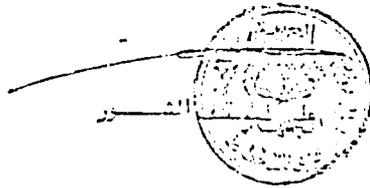
أن مشروع تحسين الذرة والدخن في صنعاء الذي يتم تنفيذ بالتعاون مع
الوكالة الأمريكية للتنمية قد بدأ العمل به في عام ١٩٧٣ م في مزرعة بشر الفحوم
في صنعاء ثم تم تيسيره فيما بعد ليشمل العمل في تمام وقد خصصت الوزارة
مسااحة كافية من الارض لهذا الغرض الحرص ووضعها تحت تصرف المشروع لتتم
تجهيزها واستخدامها في الموسم القادم في شهر اغسطس .
وتند بدء المشروع لم تكن اراضي المرتفعات الشمالية مغطاة بمحطات تجارب
أما الان فقد اصبح لدينا ثلاث محطات في تلك المناطق وهي محطة نمارالت
مع بريشانيا ومحطة رداع بالتعاون مع هولندا ومحطة فاع البين بالتعاون مع ألمانيا
الغربية وتتم هذه المحطات بالتجارب الزراعية على المحاصيل المختلفة واحصيا محصول
الذرة .
أن الدخن أصلا لا يزرع في منطقة صنعاء ، ومحصول الذرة قد تطلعت زراعته
كثيرا في المناطق المحيطة بصنعاء ، وذلك بسبب قلة الأمطار وارتفاع اجور الأيدي العاملة
واجتلاء المزارعين التي زراعة المحاصيل ذات الدخل المرتفع مثل الخضار والبطاطا وغيرها
وأن مزرعة بشر الفحوم التي أصبحت ضمن مدينة صنعاء لم تعد مكانا ملائما لاجراء التجارب
فيها على الذرة فإضافة الى انها لم تعد تمثل اراضي زراعة الذرة فأن المناطق المحيطة
بها والتي مسافات بعيدة قد أصبحت خالية من زراعة الذرة الامر الذي ينسب في تركيز
هجوم العسافير على تلك التجارب ولا يمكن الحماية منها عطا الامر الذي يؤدى الى
الاخلال في نتائج التجارب .
أن وزارة الزراعة تقوم بالتركيز على الاعمال الجديدة التي يتوقع منها نتائج ايجابية
وتنسى ذلك تركيز في تجاربها على المحاصيل في المناطق الهامة لزراعة تلك المحاصيل
ومن هذا المنطلق ترى الوزارة أن يركز هذا المشروع جهودا في مناطق تهاهه .

لذلك قررت الوزارة وقف تجارب الذرة والدخن في مزرعة بشر القحوم وتـ. رجعت مشروع تحسين الذرة والدخن الى تركيز فعاليتها وجهد ه في مزرعة الجرمية في شمسامه اما ما يتعلق بالذرة في المرتفعات الشمالية فيمكن للمشروع أن يستمر بالساعده في مجال تقديم عينات البذور لتجربتها وتقييمها في المحطات الثلاثة المذكوره أعلاه وكذلك بعض الخبرات الاستشارية التي يمكن تقديمها بين الحين والاخر عند الحاجة ومسبب برنامج زمني يتم الاتفاق عليه بين الوزارة والوكاله .
يرجى العلم بهذا واتخاذ التدابير اللازمه لتنفيذ ذلك .

وتقبلوا تحياتنا ” ”

وزير التسمه

ورئيس الجهاز المركزي للتخطيط



SANAA (ID)
Department of State
Washington, D. C. 20520

Contract No. AID/NE - C-1304 Yemen
Activities Report No. 50, May 16 - 31, 1979

PROGRESS:

1. Pre-irrigated half of Field B and D and all of Field C at the Sana'a research farm. This is the first year Field C and D have been planted for research. Field C had been in alfalfa for the previous five years; D had been idle. Thus about 70% more acreage is being planted this year than in 1978.
2. Fields B and C were planted during this period.
3. Hand-sprayed in Fields A and B with Thiordan 35 to control sorghum stem borer (Sesamia sp.).
4. Began re-irrigation in Field A, approximately one month after planting.
5. Farm labourers began hand weeding at the Sana'a research farm.
6. Continued to contact farmers to obtain land for on-farm Outreach tests. One Outreach test was planted during this period at Bani Maymoon, north of Sana'a.
7. During the course of Outreach-extension work some farmers requested help with weed control, especially of bermuda grass (Cynodon dactylon). Some herbicide spraying for demonstration purposes was done at various locations.
8. On May 26 the CID Design Team on the Title XII Yemen Program arrived. Dr. R.P. Upchurch served as the Team Leader. Work was done preparing their housing facilities and establishing office space therein for them.
9. Dr. Robert L. Voigt, Chief-of-Party, who had returned to Yemen to direct the planting, departed on May 17. Mr. David L. Robinson, Research Assistant remains in Sana'a.

PROBLEMS:

1. There were real problems with land levelness in Field D which had been idle in past years. An equal amount of water could not be applied throughout the field; this will cause variations in seed emergence and plant growth that reduces the reliability of data collected. There were ten rows that were so high in the middle that even after labourers dug them out, water could not be pushed up into them. These rows, located in the centre of the field, could not be planted.
2. At least two vehicles normally available for project work were in repair during this period. Due to lack of parts for American made vehicles in Sana'a and inadequate garage facilities and mechanics, a broken vehicle may take several weeks to repair. Vehicles are required for going between the laboratory area and research farm, for out-of-Sana'a extension work as well as for transporting all personnel to and from work and at lunchtime. One Outreach test could not be planted because of this problem.
3. Two on-farm tests have been planted so far. Only Museid Attic, who was extension technician-interpreter for Dr. Stewart last year, is active in locating potential cooperators now. Shortage of rainfall in some areas and the tendency of farmers of irrigated land to grow higher value crops like grapes and cat rather than sorghum is making it more difficult identifying farmers agreeable to sorghum tests on their land. As mentioned above vehicles are sometimes not available for extension work. Due to this lack of personnel and transportation the Outreach program is concentrating only in other areas located relatively near Sana'a.

PLANS:

1. Finish pre-irrigation and planting on the Sana's research farm.
2. Locate more sites for on-farm tests and plant them. Care for those already planted.
3. Continue hand weeding by farm labour.
4. Continue chemical control of stem borer.
5. Re-irrigate when necessary.

J. Robinson (AYU)

SANA'A (ID)
Department of State
Washington, D.C. 20520

Contract No. AID/NE - C-1304 Yemen
Activities Report No. 51, June 1 - 15, 1979

PROGRESS:

1. Rest of Field D was pre-irrigated and planted. Sowing at the Sana'a research farm was completed on June 13. This is a late date to still be planting. An early frost in the fall could damage some of the sorghum planted in Field D.
2. Sprayed with Thiodan 35 against stem borer in Fields A and B as required.
3. Completed re-irrigation in Field A.
4. Farm labourers began a hand operation which partly covers the above ground sorghum crowns with soil. Dirt is pulled across the furrows from the backside of adjacent rows. This gives the plant additional support as well as cultivate the soil and help control weeds.
5. Hand weeding continued throughout this period.
6. Continued contacting farmers to cooperate with on-farm testing. One Outreach test location scheduled to be planted during this period was found on the appointed day to have already been planted with another crop. This was in spite of repeated visits with the farmer preceding planting. Outreach tests already planted were sprayed against stem borer where appropriate.
7. On June 12 one of the two irrigation pumps was out of order. All three of the mounting bolts on one base plate, which attaches the pump to its foundation, broke thus causing the pump to vibrate too much. Mechanics worked late into the evening to fix it.

PROBLEMS:

1. Vehicle availability was still a problem during this period. Three fully operational vehicles are minimally required to run the project properly. Due to high usage and maintenance problems sometimes only one automobile was available. Trying to attain adequate transportation for just the barest of project needs has become a routine and time consuming chore.

2. This is the season for high afternoon winds of 20 - 30 m.p.h. Between June 7 - 14 even stronger gusts of wind at 40 m.p.h. or more predominated. Long-time residents of Sana'a said these winds were stronger than in years past. Beginning at about 9 a.m. each day, the winds severely hampered planting due to its drying effect on soil that needs to be of high moisture for good seed germination.

PLANS:

1. Re-irrigation on the research farm where necessary.
2. Continue hand cultivation and pulling weeds and volunteer sorghum.
3. Continue chemical control of stem borer.
4. Locate more sites for on-farm tests and plant them. Care for those already planted.

D. Robinson (R&H)

SANAA (ID)
Department of State
Washington, D. C. 20520

Contract No. AID/NE-C-1304 Yemen
Activities Report No. 52, June 16-31, 1979

PROGRESS:

1. Re-irrigated Field B, more than one month after planting it.
2. Began thinning during this period. Most of the tests are thinned to two plants per hill or to three plants in hills next to blank spots. Because the soil at the Sana'a research farm becomes very hard when dry, thinning must be carefully timed to follow irrigation.
3. Continued pulling weeds and volunteer sorghum, hand cultivation and spraying for stem borer.
4. Dr. Deckert, entomologist from the German Farm in Sana'a, visited the farm and claims fly larvae is attacking the very young seedlings in Field D. He says seed treatment is best control.
5. One Outreach test was planted at Bany Hoshysh. Previously planted tests were visited and sprayed with Thiordan against stem borer.
6. Training sessions with the research technicians on subjects relevant to sorghum work were held during this period.
7. Several conferences between certain project personnel and Title XII Design Team members took place involving sorghum research and extension in Yemen.

PROBLEMS:

Vehicle availability was still the biggest problem during this period.

PLANS:

1. Re-irrigate, cultivate, weed and spray for stem borer at the research farm as required.
2. Continue thinning tests.
3. Begin fertilizing.
4. Continue Outreach extension work.

D. Robinson (RHV)

SANA'A (ID)
Department of State
Washington, D. C. 20520

Contract No. AID/NE-C-1304 Yemen
Activities Report No. 53, July 1-15, 1979

PROGRESS:

1. Continued thinning. All of Fields A, B and C had been thinned by the end of this period.
2. Reirrigated the last of Field D one month after planting it.
3. Continued hand cultivation and weeding.
4. Began fertilizing with urea (46% nitrogen). This is timed to be done just prior to irrigation to reduce the possibility of plant damage.
5. On July 12, the Sana'a farm was visited by a group of agricultural researchers working at various locations in Yemen. They were particularly interested in observing the National Cooperative Trials of sorghum, millet and corn, which is composed of seed from other Yemen research stations.
6. Visited all Outreach locations. Sprayed against stem borer where appropriate.
7. Training sessions for the project research technicians were held during this period. Subjects relevant to sorghum research were discussed.

PROBLEMS:

1. Vehicle availability problems which have persisted since March still have not been solved.
2. One of the two wells at the Sana'a research farm used for irrigation has been observed to pump significantly less water than it was pumping this spring. Land area requiring irrigation has increased by 70% from last year. Thus the farm irrigators remain busy keeping up. Additionally, even though July is a normally rainy season in Sana'a, no rain has occurred yet.

PLANS:

Continue necessary farm operations and laboratory activities in a timely manner.

D. Robinson (RFD)

SANA'A (ID)
Department of State
Washington, D. C. 20520

Contract No. AID/NE-C-1304 Yemen
Activities Report No. 54, July 16-31, 1979

PROGRESS:

1. Thinning in Field C was completed during this period.
2. Aphids were observed on the sorghum. Spraying with Thiodan 35 was done as suggested by German Farm entomologists.
3. Birds are beginning to be seen at the research farm. They eat at freshly exerted sorghum heads which occur in some parts of Field A.
4. Began taking bloom notes in Field A on July 25.
5. Harvested some plots of a forage yield test at the Sana'a Research Farm.
6. One of the two irrigation pumps was out of order during this period. Until it is fixed the irrigators have use of only the smaller well. This is causing the irrigation and fertilizing program to run behind schedule.
7. An agriculture library was established in the technician training room. Shelves had to be put up and books organized.
8. Began preparations in lab areas for this year's harvest.
9. Mr. Rick Scott, Program Coordinator for the International Volunteer Service, was in Yemen from July 16-22. He came to review the IUS program in Yemen with regard to the three IUS volunteers associated with this project. Their contracts here end in December of this year.
10. Ramadan, a month-long Moslem holiday, began on July 24. During this time local employees work only six hours a day.

PLANS:

1. Repair the broken pump needed for irrigation as soon as possible.
2. Hire birdwatchers to prevent bird damage to the flowering sorghum.
3. Finish spraying against aphids.
4. Continue other routine field operations such as bloom note-taking, thinning, fertilizing, irrigation, weeding, cultivation, etc.

D. Robinson (R&U)

Note: Remaining bi-weekly reports have not been received as of final typing of this report. They will be forwarded under separate cover upon receipt.

PLANS FOR ENSUING PERIOD

1. Grow out part (about 1000 lines) of the Yemen Sorghum Collection in Puerto Rico in late 1979 and early 1980 for botanical classification and seed increase. Increase about 100 lines with a very minimal seed supply (less than 50 seed) in the greenhouse in Arizona.
2. Grow out Elite Test Entries from Sana (1979) in Arizona for seed increase and purification and evaluate for root rot resistance in Yuma in the fall of 1979.
3. Bring the Al Jarubah research station to operational status and begin research plantings there in 1980.
4. Develop plans for research plantings and for on-farm outreach programs for 1980.
5. Develop a procedure for training current project employees in the technical and academic aspects of the sorghum/millet project. Current ministry employees are eligible.
6. Select and begin development of a new field research site for the Sana experiment station.

Note: On-going progress of items 3, 4, 5, and 6 are generally in abeyance until in-country permission is received for the two regular replacement professional employees to enter the country, reside at the experiment station site, and proceed with all aspects of the in-country program.

RECOMMENDATIONS COVERING CURRENT NEEDS IN FIELD OF ACTIVITY

1. There is a need for a professional with expertise in soils and field experiment station development and operation, to proceed to Yemen on a short term basis to select a new field experiment station site.
2. There is a need for a weed control specialist to visit in-country during the growing season on a short term basis.
3. There is a need for more laboratory spaces at the Sana Experiment Station to dry and process harvested research materials.
4. There is a need for better vehicle maintenance in-country.
5. There is a great need to resolve the political aspects of gaining in-country approval to send an Agronomist and Plant Breeder to Yemen per contractual requirements.

ADDITIONAL INFORMATION PERTAINING TO THIS CONTRACT

- a. Dr. Robert L. Voigt, Yemen Chief-of-Party, arrived at the University of Arizona campus on March 17, 1979 after completing his regular tour of duty. He returned to Yemen for 5 weeks on April 11, 1979 to supervise land preparation and planting activities for the 1979 sorghum and millet experimental tests at Sana. He handcarried brake parts for a 1977 Chevrolet Blazer vehicle in his luggage on his return trip to Yemen. Dr. Voigt assumed the duties as Campus Assistant Technical Director/Plant Scientist effective July 1, 1979.
- b. The original contract on this project had an interim termination date of March 30, 1979. As this date approached, contract negotiations for a 2 year extension were still in progress. The contract was amended to continue through April 30, 1979. Recruitment effort to identify replacements for the in-country Chief-of-Party and an agronomist also continued during this time frame. Budget line item adjustments were required to continue procurement action on supply and equipment items. By the end of April, final negotiations were complete. The contract was extended through March 31, 1981.
- c. Dr. Harneh S. Sandhu was selected and nominated to fill the plant breeder vacancy in Yemen. As of the close out date of this report, approval for him to proceed had not been received.
- d. Dr. Deran Markarian was selected, nominated and his travel approval obtained to proceed to Yemen in September 1979. He was to serve as the in-country agronomist and Chief-of-Party. While he was at the University of Arizona finalizing departure plans and receiving his departure orientation, communication was received which specified he would be required to perform the sorghum and millet crop improvement program exclusively in the Tihama area of Yemen. In addition to this new requirement, he would be expected to live in this area. Since there were insufficient facilities to conduct such a program and housing is nonexistent in this area, Dr. Markarian did not proceed as originally planned. He returned to his home in California to await the outcome of this new development.
- e. Dr. Donald M. Stewart, who served as an agronomist in Yemen under the original contract completed his final report. This report is included as attachment one. It was distributed to applicable agencies earlier in the reporting period.
- f. Photographs from Dr. Stewart's personal Yemen collection were selected and reproduced. The selected reproduced photographs, which portrayed the farmer outreach program in Yemen, were forwarded to Sana for distribution to the applicable farmers.
- g. Twenty five seed storage containers were constructed at the University of Arizona to hold the Yemen sorghum seed collection. The seed was then sorted, labeled and placed in the containers. The containers were subsequently stored in the cold seed storage laboratory at the Campbell Avenue Farm. This laboratory required extensive maintenance to maintain proper cooling temperatures as the summer wore on. Two

large fuse box panels were removed and replaced and both airconditioners were repaired. Project funds were not used for this maintenance activity.

- h. Seed from the Yemen Sorghum Collection was sent to Puerto Rico for grow out. This grow out should provide an increase of seed and aid in the botanical classification of approximately 1000 lines.
- i. Seed from the Yemen Sorghum Collection which contained only a minimal seed supply has been planted and is growing in a University of Arizona greenhouse. This grow out contains approximately 100 lines.
- j. Seed from the Sana Elite Test Entries has been planted at the University of Arizona Experiment Station located at Yuma, Arizona. This grow out should provide for an increase of seed, as well as an evaluation for root rot resistance.
- k. Procurement and supply activity occurred in the following areas:
 - (1) Order 25, 26, 27, were shipped in a 8' x 8' x 20' Sea-Land metal, sealed, container to Yemen via surface transportation. The supply items for this shipment had been procured over a six month period. Each individual item was labeled with order number and item number prior to loading in the container. Twelve barrels were filled with smaller equipment items and also loaded in this container. Equipment and supply items consisted of such things as: tool sets, jacks, coveralls, parts for various vehicles, filters, hoses, herbicide, batteries and fertilizer. This container departed the University of Arizona on May 31, 1979. The estimated arrival date in Hodeida, Yemen was July 25, 1979. At the end of July 1979, we were finally able to confirm the container was in Antwerp, Belgium. The Stateside shipper made frequent attempts to determine the new Hodeida estimated arrival date, ships name from Antwerp to Yemen and a copy of the bill of lading on this shipment. Bill of lading information was mailed by the shipping vender to the Sana, USAID, Procurement Officer, Mr. Morgan Stickney in USAID/Washington office and the University of Arizona on July 31, 1979 and August 10, 1979. On September 7, 1979, we were able to determine the container was on board the ship named, "Driczwalk", estimated to arrive Hodeida September 18, 1979. This information was immediately sent to Mr. Arthur Brittan at Sana, Yemen, by means of a telgram.
 - (2) Order 28 was filled and sent to Yemen via the pouch. This order contained various parts for a Kohler engine which was mounted on a welding machine.
 - (3) Two Chevrolet Suburbans and associated spare parts order was filled by General Motors Overseas Distribution Corporation. By mid-June the vehicles had been shipped from Detroit to Baltimore for AID emblem and locking mechanism installation. General Motors had researched into a shipping companies background and declined to ship the vehicles to Yemen via a company called "Container Lloyd". This delayed the vehicles at Baltimore, but a French Line Company was selected upon the recommendation of the Agency for International Development Transportation Office. General Motors selected the first available French Line ship, named the "Rousseau", scheduled to depart August 10, 1979, with 35 days enroute to Hodeida, Yemen. The "Rousseau" ended up in dry dock for repairs as the scheduled departure date arrived. Another ship, named "Rodin", was selected with an August 21, 1979 departure date and 35 days

enroute. This ship eventually sailed August 25, 1979 with the vehicles and most of the spare parts on board. Bill of Ladings were forwarded to Sana as they became available. It should be noted, this order arrived the University of Arizona in late September 1978 and the scheduled Hodeida arrival date is September 1979. One years time evolved in filling the order, although priority was given to all aspects of the procurement and shipment process. (4) Routine action was taken in follow up of supply and equipment purchase orders to void those portions of orders which could not be filled due to unavailability. (5) No supply orders are at the University of Arizona at the present time. A three step platform, order 27, item 8 is on hand at the University of Arizona. This platform came in after the Sea-Land container had departed. The decision was made to assemble it and use it in the sorghum work area until such time as the next shipment is filled. It would be uneconomical to send one small equipment item, such as this platform, by itself.

- l. Routine administrative support occurred in the following areas: negotiations were finalized to permit Mr. David Robinson, to remain as a Research Assistant in Yemen through approximately the end of the year; monthly reports of telegrams sent and long distance phone calls made were forwarded to proper agencies for billing; The Office of International Programs checked the status of past air freight charges and finalized the billing of same; travel, billet, and agenda arrangements were made for visiting professionals interviewing for positions in Yemen.
- m. Dr. Robert Phillip Upchurch, Head, Department of Plant Sciences posted photographs of the Yemen sorghum/millet activity in a prominent area of the Agriculture building main lobby. He made frequent trips to Yemen during this reporting period in conjunction with the Title XII program. Photographs were taken on each trip and posted for viewing by faculty and students.
- n. Routine maintenance was performed on the University of Arizona Campbell Avenue Farm sorghum greenhouse, which is being used to grow out portions of the Yemen Sorghum Seed Collection. Maintenance included: repairing the roof opening mechanism, cleaning the water cooling system, weakly treatment of the cooling water, oiling pump bearings, etc.
- o. Dr. Robert L. Voigt finalized his plans to visit Yemen and Hyderabad, India in October 1979. While in Yemen, he will supervise and assist in the harvest of the experiment plots at Sana. On his visit to India, he will coordinate the aspects of entering the Yemen seed collected into the World Sorghum Seed Collection.
- p. Although not on the Yemen sorghum/millet project, Dr. Orrin J. Webster, Adjunct Professor, Plant Sciences, and Carl Schmalzel, Research Assistant, Plant Sciences, were instrumental in processing the Yemen Sorghum seed collection. Dr. Webster was of great assistance in coordinating the requirements associated with the grow out of seed in Puerto Rico. Mr. Schmalzel assisted in labeling and sorting the seed for storage, as well as preparing for and planting the greenhouse experiments.

Administrative Report

This segment of the semi-annual report covers expenditures and personnel employed under the contract. A report on foreign national trainees is not applicable since the contract does not include any provisions for participant training.

Expenditures

As mentioned in the last semi-annual report, adjustments to budget line items were anticipated to realign line items with actual expenditures. Adjustments were made in on-campus salaries and other direct costs as the March 30, 1979 contract termination date approached. The contract was then extended for one month, through April 30, 1979. During April, further adjustments were requested and approved by the contracting office. Attachment two is a copy of a April 13, 1979 letter from the University of Arizona International Agriculture Programs Director to the Agency for International Development Contracting Officer. Refer to attachment two for the total adjustments which were approved and the reasons adjustments were requested. During the latter part of April 1979, the contract was extended through March 31, 1981.

The latest inception to date computerized report dated October 4, 1979 is included on the following pages. This report is for the month ending September 30, 1979. The report is generated by the University of Arizona computerized accounting system and can be used to determine overall expenditures from original inception of contract through September 30, 1979.

5 copies to Beryl - Plant Sci.

REPORT NO. GA3204
 ACCOUNT NO: RA7381
 ACCOUNTANT: J COOK & P BROWN
 NEXT LEVEL: 050011

UNIVERSITY OF ARIZONA
 IIR RESPONSIBILITY REPORT
 FOR MONTH ENDING 09-30-79
 YEMEN SUPPORT 5010410120

PAGE NO 1
 RUN DATE 10-04-79

AGENCY: AID GRANT NUMBER: AID TA-G-1111

W G MATLOCK
 036AGI

AWARD AMOUNT: 950000 TERMINATION DATE: 03/31/81

***** CURRENT MONTH *****

***** INCEPTION TO DATE *****

BUDGET CHANGES	EXPENDITURES	ENCUMBRANCES ADDED	BUDGET	EXPENDED	ENCUMBRANCE BALANCE	BUDGET AVAILABLE
			PERSONAL SERVICES & EPE	424,764		
	3,910.41		SALARIES			
	-----		SALARIES	213,540		213,540-
	3,910.41		CLASS TOTAL	213,540		
	-----			-----		
			WAGES			
	1,038.40		STUDENTS - HOURLY	342		342-
	-----		REGULAR WAGES	22,524		22,524-
	1,038.40		CLASS TOTAL	22,855		
	-----			-----		
			ADJ TO SAL &/OR WAGES			
			ADJ TO SAL &/OR WAGES	1,582		1,582-
			ADJUSTMENTS TO ERE	244		244-
			CLASS TOTAL	1,826		
	-----			-----		
	895.81		EMPLOYEE RELATED EXPEND			
	-----		EMPLOYEE RELATED EXPENSE	2,376		2,376-
			DO NOT USE	247		247-
			FICA TAX	8,313		8,313-
			DO NOT USE	11,377		11,377-
			DO NOT USE	3,702		3,702-
	895.81		CLASS TOTAL	26,015		
	-----			-----		
	5,844.62		CATEGORY TOTAL	424,764	264,347	160,417
	-----			-----	-----	-----

REPORT NO. GA3204
 ACCOUNT NO: R67381
 ACCOUNTANT: J COOK & P BROWN
 NEXT LEVEL: C50C11

UNIVERSITY OF ARIZONA
 ITD RESPONSIBILITY REPORT
 FOR MONTH ENDING 09-30-79
 YEMEN SUPPORT 501C410120

PAGE NO 2
 RUN DATE 10-04-79

W G MATLOCK
 036AGI

AGENCY: AID GRANT NUMBER: AID TA-G-1111

AWARD AMOUNT: 950000 TERMINATION DATE: 03/31/81

***** CURRENT MONTH *****

***** INCEPTION TO DATE *****

BUDGET CHANGES	EXPENDITURES	ENCUMBRANCES ADDED	BUDGET	EXPENDED	ENCUMBRANCE BALANCE	BUDGET AVAILABLE
	OPERATING EXPENDITURES		162,666			
	OUTSIDE AND PROFESSIONAL CONSULT-LECTUR/SPKRS-EXP			498		498-
	OPERATIONAL ADVANCE				5,000	5,000-
	OTHER OUTSIDE + PROFESS.			4,757		4,757-
	SUSPENSE ACCOUNT					
	----- CLASS TOTAL		-----	----- 5,255	----- 5,000	
	OFFICE SUPP. AND POSTAGE					
	OFFICE SUPPLIES	60.81		491		491-
	PRINTED FORMS	1.79		140		140-
	STAMPS STMPD ENV E CARDS	75.00		1,474		1,474-
	POSTAGE- OTHER			124		124-
	----- CLASS TOTAL	----- 137.60	-----	----- 2,219	-----	
	OPERATING SUPPLIES & SVC					
	RESEARCH SUPPLIES	89.60		23,623	840	24,463-
	EDUCATIONAL SUP - OTHER			93		93-
	RECREATIONAL SUP - OTHER			35		35-
	ANALYSIS SHOPS			10		10-
	SUSPENSE ACCOUNT					
	----- CLASS TOTAL	----- 89.60	-----	----- 23,921	----- 840	
	MAINTENANCE AND REPAIRS					
	OFFICE EQUIPMENT			75		75-
	----- CLASS TOTAL	----- 1	-----	----- 75	-----	

REPORT NO. GA3204
 ACCOUNT NO: 867381
 ACCOUNTANT: J COOK & P BROWN
 NEXT LEVEL: C50C11

UNIVERSITY OF ARIZONA
 LTD RESPONSIBILITY REPORT
 FOR MONTH ENDING 09-30-79
 YEMEN SUPPORT 5010410120

PAGE NO 4
 RUN DATE 10-04-79

AGENCY: AID GRANT NUMBER: AID TA-G-1111

AWARD AMOUNT: 950000 W G MATLOCK
 036AGI TERMINATION DATE: 03/31/81

***** CURRENT MONTH *****

***** INCEPTION TO DATE *****

BUDGET CHANGES	EXPENDITURES	ENCUMBRANCES ADDED	BUDGET	EXPENDED	ENCUMBRANCE BALANCE	BUDGET AVAILABLE
			TRAVEL	145,265		
	10.44		IN-STATE TRAVEL			
			IN-ST MIDGE+VEH ST VEH	1,141		1,141-
			IN-STATE SUBSISTENCE	190		190-
			IN-ST REG FEE-CONFERENCE	10		10-
			PERSONAL EFFECTS TRANS	27,831		27,831-
			IN-ST OTHER TRAVEL EXP	63		63-
	10.44		CLASS TOTAL	27,225		
			OUT-STATE TRAVL-DOMESTIC			
			OUT/DOM SUBSISTENCE	1,390		1,390-
			OUT/DOM PUBLIC TRANS	2,052		2,052-
			OUT/DOM OTHER TRAVEL EXP	4,700		4,700-
			CLASS TOTAL	8,142		
			OUT-STATE TRAVEL-FOREIGN			
	83.35		OUT/FRN MIDGE+VEH PRIVAT	78		78-
			OUT/FOREIGN SUBSISTENCE	2,335	174	2,509-
			OUT/FOREIGN PUBLIC TRANS	27,355	1,120	28,475-
			OUT/FOREIGN REG FEE-CONF	60		60-
			OUT/FOREIGN OTHER TRAVEL	513		513-
	83.35		CLASS TOTAL	30,341	1,294	
	93.79		CATEGORY TOTAL	145,265	67,708	76,263
			CAPITAL	79,053		

PERSONNEL EMPLOYED UNDER THE CONTRACT

Mr. David L. Robinson, Research Assistant in Yemen, full time.

Dr. Robert Phillip Upchurch, Head, Department of Plant Sciences, spent 15% of his time as Campus Technical Director.

Dr. Melvin H. Schonhorst, Department of Plant Sciences, spent 30% of his time from March 16, 1979 to July 1, 1979 as Campus Assistant Technical Director/Plant Scientist.

Dr. Robert L. Voigt spent 100% of his time on the project from April 9, 1979 through May 18, 1979. Dr. Voigt traveled to Yemen during this time period to supervise and assist in the planting of sorghum and to participate in the Outreach program. He assumed the duties of Campus Assistant Technical Director/Plant Scientist on July 1, 1979 and has spent 30% of his time since then in that capacity.

Dr. William Gerald Matlock, Director for International Agriculture Programs, spent 8% of his time performing duties as Campus Coordinator since July 1, 1979.

Mr. Dale E. McDonald, Department of Plant Sciences, spent 66% of his time performing procurement related duties and as a Research Assistant.

Mr. William Rea, Mr. Floyd Stevenson and Mr. Robert Nieto all served as Research Technicians during this time period. For ease of accountability, only Mr. Stevenson was placed on the Yemen payroll for 83% of his time for a 5 week period.

Ms. Anna Fisk, Department of Plant Sciences, spent 35% of her time performing secretarial duties associated with the project.

Dr. Deran Markarian, the proposed and approved in-country agronomist and Chief-of-Party, spent 100% of his time in orientation and preparation to travel from September 1 through 15, 1979. He did not proceed as explained earlier in this report.

Mr. Mark Collen, University of Arizona student, who worked part time, spent 66% of his time during July and August assisting with the Yemen sorghum seed collection and field plantings of same. Other students also assisted in this operation, but were not placed on the payroll.

Report to U.S. Agency for International
Development - Sorghum/Millet
Improvement Project in the Yemen
Arab Republic

Report Prepared By:
Donald M. Stewart, Agronomist
Department of Plant Sciences
University of Arizona
Tucson, Arizona 85721

Contract No. AID/NE-C-1304 (Yemen)

Contract For: National Sorghum and
Millet Crop Improvement

Date of Report: May 4, 1979

INTRODUCTION

This report covers my activities in the Yemen Arab Republic beginning with my arrival in Sana'a on May 30, 1977 until departure from the same city on November 30, 1978. The subject matter during this period has been arranged under seven main categories presented in the following order:

- A. Herbarium
- B. Plant Disease Collection & Identification
- C. Attendance at 1977 Egyptian Pesticide Conference
- D. Insect Collection
- E. Control of Pests in the Sorghum-Millet Nursery and Laboratory
- F. On-the-Farm Grain Drying and Storage Studies
- G. 1978 Outreach Program for Yemen Farmers

A. HERBARIUM

Soon after my arrival in North Yemen on May 30, 1977, a collection of indigenous plants was initiated. This collection included troublesome weeds and prevalent plants in the Sorghum-Millet Nursery at Bir Al Gahoum, surrounding cultivated fields in the Sana'a area and along roadside fields enroute to Hodeidah, Taiz, and SaDah.

Intact plants in various stages of growth were pressed and dried in a handmade plant press constructed from scrap pieces of plywood on the USAID grounds. When dried, specimens were mounted in legal size manila folders and placed in file drawers in the agronomist's office.

Dr. Shaukat A. Chaudhary, former Taxonomist and Ecologist at Sana'a University kindly indentified many of the specimens and sent an unfamiliar species of Conyza to the Kew Gardens in London, England for assistance in indentifying the species. "Students' Flora of Egypt" by Vivi Täckholm (second edition), Published by Cairo University, Cooperative Printing Company, Beirut, 1974, was used for identifying many other specimens. A total of 136 mounted specimens were identified plus about 60 duplicates. These mounts represented 22 plant families, as follows:

AIZOACEAE	CARYOPHYLLACEAE
AMARANTHACEAE	CHENOPODIACEAE
BORAGINACEAE	COMPOSITAE
CAPPARIDACEAE	CONVOLVULACEAE

CUCURBITACEAE
 CRUCIFERAE
 CYPERACEAE
 EUPHORBIACEAE
 GRAMINEAE
 LEGUMINOSAE
 MALVACEAE

ORBANCHACEAE
 NYCTAGINACEAE
 PLANTAGINACEAE
 POLYGONACEAE
 SCROPHULARIACEAE
 SOLANACEAE
 ZYGOPHYLLACEAE

B. Plant Disease Collection and Identification

During 1977-78, many disease specimens from crop plants and common weeds were collected in North Yemen. Locations of plant specimens included the Bir Al Cahoum Sorghum-Millet Nursery, Tihama Region, Taiz, Hodeidah Road, Bany Hoshysh, Al Baun German Farm (Raydah), Al Ashe, and numerous other locations visited in connection with the Outreach Program.

Host, common name of disease, and scientific designation of pathogen are listed as follows:

<u>Host</u>	<u>Common Name</u>	<u>Scientific Name</u>
<u>Sorghum</u> (<u>Sorghum vulgare</u>)	Leaf Blight	<u>Helminthosporium turcicum</u>
	" "	<u>Ramulispora sorghi</u>
	" "	<u>Ramulispora sorghicola</u>
	Downy Mildew	<u>Sclerospora sorghi</u>
	Covered Kernel Smut	<u>Sphacelotheca sorghi</u> Link (Clint)
	Head Smut	<u>Sphacelotheca cruenta</u> Kuhn, Potter
	Long Smut	<u>Tolyposporium ehrenbergii</u>
	Bacterial Leaf Spot	<u>Pseudomonas syringae</u> (?) ^{1/}
	Bacterial Stripe	<u>Pseudomonas andropogonis</u> (?) ^{1/}
Yellow Stripe	Virus	
<u>Millet</u> (<u>Pennisetum glaucum</u>)	"Green Ear"	<u>Sclerospora graminicola</u> , Sacc. Schrot
<u>Wheat</u> (<u>Triticum aestivum</u>)	Leaf Rust	<u>Puccinia recondita</u> , Rob. ex Desm.
	Stem Rust	<u>Puccinia graminis</u> , Pers.
<u>Barley</u> (<u>Hordeum vulgare</u>)	Leaf Rust	<u>Puccinia recondita</u> , Rob. ex Desm.

<u>Host</u>	<u>Common Name</u>	<u>Scientific Name</u>
<u>Barley</u> (<u>Hordeum vulgare</u>)	Stem Rust	<u>Puccinia graminis</u> Pers.
	Stripe Rust	<u>Puccinia striiformis</u> West.
	Loose Smut	<u>Ustilago nuda</u> Jenson Rostr.
<u>Maize</u> (<u>Zea mays</u>)	Rust	<u>Puccinia sorghii</u> Speg.
	Leaf Blight	<u>Helminthosporium turcicum</u> Pass.
	Yellow Stripe	Virus
<u>Common Weeds</u>		
<u>Euphorbia hypericifolia</u> L.	Rust	<u>Melampsora euphorbiae</u> ^{2/} (Schub.) Cast II
	<u>Carthamus tinctorius</u> L.	Rust

1/ Identified by Mr. C. Michael Pfeiffer, Plant Pathology, University of Arizona.

2/ Identified by Dr. George B. Cummins, Visiting Research Professor, Plant Pathology, University of Arizona.

C. The Second Arab Pesticide Conference (1977), Tanta University, Arab Republic of Egypt

My official attendance at this conference covered the period of September 26-29, 1977. The conference was organized by Dr. Ahmed Sayed El-Nawawy, Dean of the Faculty of Agriculture, Kafr El-Sheikh, Egypt, which comprised the following objectives:

1. To stimulate laboratory and field research.
2. Encourage application of pesticides in agricultural crops.
3. To point out huge losses caused by pests.
4. To study the toxicology of pesticides to man, animals, and pests.
5. Effects of pesticides on pollution, resistance, and interaction with other soil constituents, etc.

Dr. El-Nawawy designated me as chairman of one of the conference sessions where several interesting papers were presented on new types of pesticides. One of these, presented by a British Scientist, involved "Actellic" with data showing an effective "pest-kill" with little or no side effects to man.

After presentation of research papers, a field trip was scheduled to nearby horticultural crops of jasmine, geranium, etc. which was coordinated with a trip through a factory to observe commercial extraction of oil from jasmine flowers for export to the perfume industry in France.

During the conference meetings, I met Professor Dr. Fred Klingauf¹, Entomologist, Bonn, West Germany and his friend, a representative of a pesticide company headquartered in Nuremberg, West Germany. One of the products of this company, Drawin 755, EC, is reportedly effective against aphids. The company subsequently shipped (1977) about 25 kg of this product to me for experimental testing in North Yemen on USAID projects.

My return trip to Sana'a on Sept. 30, 1977, was linked with the USAID Horticulture and Poultry Projects. I hand carried four ginger plants (Zingiber officinale) and 10-dozen hatching eggs on the Yemen Airways plane.

- a) The ginger plants were to be tested for adaptation in the Tihama Region. These plants were furnished by Dr. Talat El-Wakil, Director of the Horticulture Institute, Giza, Orman, Cairo.
- b) The hatching eggs were from the Fayoum and Dokki-4 breeds reportedly carrying disease resistant genes from the ancient Egyptian Fayoum chickens. The eggs were furnished by Dr. A. M. Makky, Director of Animal Production Research Institute, Ministry of Agriculture, Dokki, Cairo.

¹Professor Dr. Fred Klingauf and Dr. R. Sikora, Nematologist (Bonn, West Germany) visited me in Sana'a on June 2, 1978 at which time the three of us discussed pest problems and their control in North Yemen.

D. Insect Collection

Beginning in 1977, an insect collection was initiated in conjunction with the Sorghum-Millet Project. The objective was to trap, kill, mount, and preserve specimens that were destructive or threatening to sorghum-millet culture or other agricultural crops.

Adult insect specimens were first placed in a killing bottle and subsequently mounted in collection boxes. Caterpillars, cutworms, armyworms, white grubs, etc., were killed and preserved in small glass vials containing an alcohol solution. A binocular-microscope was used in the laboratory for more precise determinations.

Early in July 1978, the USAID office in Sana'a was alerted relative to the presence of several swarms of the desert locust (Schistocerca gregaria) in the

Tihama Region that had presumably migrated across the Red Sea from Ethiopia where recent and extensive damage had occurred. The Outreach Sorghum-Millet team was requested to survey the Sana'a area and northern regions for detecting swarms of this insect. There were numerous observations of the migratory grasshopper (Locusta migratoria) in the Sana'a area which were confirmed by a check of our insect collection. However, the survey through the northern part of the country revealed no swarms of the desert locust. This is an example of the usefulness of an insect collection during a possible outbreak of an "insect plague". An unusual type of praying mantis possessing an unusual mottled green coloration was collected near Sana'a in 1978. Mr. Tony Kerzmann, Entomologist, German Plant Protection Project, kindly gave me assistance in identifying many specimens in our insect collection but was unable to identify the praying mantis specimen. This insect may prove to be a significant addition to the insect collection.

E. Control of Pests in the Sorghum-Millet Nursery and Laboratory

a. Stem Borer

The pink stem borer (Sesamia cretica Led.) is the most widely distributed and damaging pest of sorghum and millet in North Yemen. In 1978, light to heavy infestations were observed in farmer's fields in the Outreach Program. Stalks and sometimes entire plants are killed by emerging larvae that enter the stalks and tunnel as they feed. Grain heads may be distorted, stunted, and sometimes sterile. Regrowth at nodes is common which delays crop maturity. Mature larvae measure about 25 mm in length and most have a light pink coloration. This stem borer has also been the most damaging insect in the Bir Al Gahoum Nursery. In 1977, a spray regime with Dipterex S. P. 80 was established every two weeks during the insect larval stage. Since the effectiveness of this spray program was disappointing I contacted Dr. Werner Gassert, Pathologist, Yemeni-German Plant Protection Project in Sana'a, regarding an improved spray control program for 1978. Dr. Gassert recommended Thiodan 35 (Hexachlorobicycloheptene-bisoxymethylene-sulphite) manufactured by Hoechst Ag., Frankfurt, Germany, and thought this pesticide would be more effective and give a longer period of protection against the stem borer than Dipterex S.P. 80. The 1978 stem borer program included three spray applications at two-week intervals with Thiodan 35 in Fields A and B which proved to be a highly effective control measure.

b. Cut worms and Soil Inhabiting Insects

In a 1978 test program to control these early appearing insects, a baited

mixture of Dipterex S.P. 80, sugar, and water was worked up into a crumbly mass and spread over the newly sown seed beds beginning the first week in June. High temperatures and persistent winds soon dried the bait into hard baked lumps and unappetizing to the insects. Thus, the results of this baited treatment was questionable and was discontinued by mid June.

c. Aphids

In 1978, a heavy infestation of aphids was observed on a prevalent perennial weed (Peganum harmala) along the borders of the nursery. There was evidence that aphids had already spread to young sorghum and millet plants in the nursery. Infested weeds and young sorghum and millet plants were sprayed with a Thiodan 35 solution which controlled the aphid outbreak. Later in the same week, this wild host plant was eradicated from the nursery borders.

d. Rats

Serious damage to stored sorghum and millet seed from rats was observed in the laboratory the latter part of May 1978. Dr. J. Zschintzsch, Head, Yemini-German Plant Protection Project, in Sana'a, was consulted about our rat problem who kindly assigned Mr. Jan-Uwe Heckel, Rodent Specialist, to assist in establishing a control regime.

A ground corn mixture of Racumin (active ingredient 0.75% Coumatetralyl 1) - Bayer Leverkusen Product - was placed in sections of plastic water pipes, 10-12 cm dia x 50 cm in length. On May 27, 1978, the pipe bait containers were placed on shelves, floor, and other locations in the Laboratory. The bait was replenished as soon as it was eaten by the rats. By the first week in August, about two months after placing the bait traps, 13 rats' carcasses had been found. Although this may appear to be a small kill, many dead rats are not usually visible since they seek out remote locations i.e., under buildings, holes in the ground, etc. before succumbing to the poison. Thus, the rat kill should be much higher than the above record indicates.

F. On-the-Farm Study of Drying and Storage of Sorghum and Millet Grain

During the period of February 27 to March 3, 1978, Mr. Robert A. Saul, Grain Storage Expert, and I made a survey of grain storage facilities in the Tihama, Middle and High Central Plateaus in North Yemen. Stopovers at farms and villages were made, along the hiway between Sana'a, Hou'eidah, Mokha, Taiz, and Khamar.

There are three types of storage commonly used in North Yemen, as follows:

1. Siddle Storage

Approximately 40 kg or more of grain is placed in a woven reed

basket ("kasgas") and set on a rock base insulated by stems and leaves of a local plant (Calligonum sp.) known as "marweed". It is collected near the Red Sea coast but we did not observe its natural habitat. A separate teepee of sorghum and/or millet stalks is provided as a complete canopy for each grain basket.

2. Gunny Bag Storage

These bags are used for grain storage in houses, farm buildings and village shops. They were often placed on dirt floors with no circulation of air which allowed moisture uptake and the risk of insect damage as observed in some locations.

3. Medfan Storage

This is an underground type for long-term storage of up to 5 years or more. It comprises a bottle-shaped underground pit in soil or rock ranging in diameter from 1.5 to 5.5 m and 2 to 7 m in depth. The neck of the pit measures about one meter or less in diameter with a "sealing plug", a stone cover, and a mound of soil for the outside cap.

Many medfans are grouped near villages throughout the country as emergency sources of food supplies in times of drought or other disaster. For example, a remote village located northeast of Raydah has seed of a drought resistant local cultivar stored in a village medfan which is available to residents for sowing only during periods of drought. No grain samples from medfan storage were available for our tests since farmers were unwilling to break the seal and expose the grain to weathering, insects and deterioration.

Nine sorghum samples and three millet were collected and tested for moisture content. Although the sorghum samples ranged from 12.6 to 16.0% only one sample fell into the latter mentioned class. The millet samples ranged from 12.2 to 14.6% moisture. By and large, most moisture levels of stored grain were satisfactory in spite of the high humidity readings in the Tihama Region which often reaches 72% (R.H.) in February.

Although it was not possible to test samples of grain from medfan storage it would be interesting to compare the oxygen levels of a recently filled pit with one that had held stored grain over a period of 5 years or more.

1/ See report prepared by Robert A. Saul, 1412 Martin Road, Albert Lea, Mn. 56007, "A Farm Level Study of the Drying and Storage of Sorghum and Millet Grain in the Yemen Arab Republic to U.S. Agency for International

Development". Contract No. AID/NE - C - 1304 (Yemen) Contract for:
National Sorghum & Millet Crop Improvement.

G. 1978 Outreach Program

1). Introduction

In early April, the writer and two Yemen technicians, one of whom acted also as interpreter, contacted 26 farmers to present a cooperative plan for establishing a sorghum yield trial location on their land. Although the farmers were seriously interested in the plan, many changed their sowing plans later in the spring due to lack of moisture at sowing time. Spring rains are very localized in the Sana'a Province with some terraces receiving adequate moisture whereas a short distance away terraces will be "bone dry" or have insufficient moisture for sowing sorghum. Of the 26 farmers contacted, 11 cooperators were finally selected for the program. (Table 1).

2). Objectives

- i) Establish yield trial studies on individual farms to assess, evaluate and compare performance of the farmer's variety with other local and introduced cultivars.
- ii) Direct attention to weed problems and demonstrate control measures through "spot applications" of appropriate herbicides.
- iii) Identify pests and diseases causing damage to the crop and demonstrate control measures through timely applications of specific pesticides and/or fungicides. Detect probable genetic resistance among sorghum genotypes to insects, diseases and weeds.
- iv) Collect, study, and analyze soil samples for structure and chemical composition.
- v) In general, the program was designed to gain a clearer insight and understanding into the agronomic needs and interests of the Yemeni farmer at the farm level.

3). Cooperative Approach

A low profile approach was used in contacting the farmer when he was usually engaged in field work on his land. Emphasis was directed towards our assistance in trying to help him with major problems, i.e., insects, diseases, weeds, etc. The yield trial study was offered as a test to compare the performance of two local sorghums, a USA hybrid with his own baladi or local variety. These comprised Sana'a 1 and Sana'a 7 selections from the Bir Al Gahoum Nursery; and one or more . . .

Table 1 - Name of Cooperating Farmer, Nearby Village,
Distance from Sana'a, and Approximate
Elevation of the Site, Yemen Arab
Republic, 1978

Farm Location No.	Name of Farmer	Name of Village	Distance from Sana'a (Kms)	Approx. Elevation (Meters)
1	Nagib Ali Salah Khaled	Hedran	50 NE	2424
2	Mohssin Hussen	May Moon	34 NW	2270
3	Ali Ebn Ali Al Negar	Hizyez	17 S	2242
4	Hussen Salah Zaid	Dubre Sunhan	27 S	2424
5	Mohamed Saad Al Oubadi	Maf-Dan	43 SW	3000
6	Salah Nagi	Yozle	35 SW	2424
7	Sneikh Al Faishi	Batina	148 NW	1100
9	Sheikh Al Surabi	Sa'Dah	240 N	1818
10	Mohssin Dirhim Samin	Khaywan	140 NE	1930
11	Asker Abulshowarib	Bilsin	101 NE	436
12	Konrad Engleberger	Raydah	68 NE	636

(German Agric. Extension - Al Baun Project)

1/ Location No. 8 was discontinued on July 12, 1978 due to excessive feeding on sorghum leaves by a nearby flock of barnyard poultry which was subsequently replanted to spring wheat by the farmer.

American hybrids (USA) selected from among four entries, ACCO R920, Ferry Morse A53A, Pioneer 894, and Northrup King 125, and Baladi.

In the establishment of the trial, the farmer furnished his own plow and animal power and participated in sowing the seed using his own row and hill spacing and method of thinning and weeding. Although no commercial fertilizer was furnished at sowing time or thereafter, one farmer had applied animal manure at soil preparation time. The USAID team made periodic visits to each location, about every two weeks, during the growing season to apply appropriate chemicals for pest control and also help to maintain the interest of the farmer. When the crop was ripe, it was understood the farmer work cooperatively with the team in harvesting operations.

4). Weed Control

Of all agronomic activities, the Yemeni farmer showed the most interest in weed control measures. The increasing labor shortage in the agricultural sector and escalating wage rates of labor have made hand weeding out of reach for most farmers. Current daily wage rates range from 50 yr (US \$11.03) and upward.

Among weeds in Yemen, five are the most prevalent and troublesome.

These are, as follows:

<u>Common Name</u>	<u>Scientific Name</u>
"Zoheyra" or "Makhreba" (Compositae Family)	<u>Flaveria repanda</u> Lag.
"Wobel" or "Zeel" (Bermuda Grass) (Gramineae Family)	<u>Cynodon dactylon</u> (L.) Pers.
"Helgub" or "Shager" (Cruciferae Family)	<u>Diplotaxia eruroides</u> L.
"Se'ed" (Cyperaceae Family)	<u>Cyperus rotundus</u> L.
"Edar" (Scrophulariaceae Family)	<u>Striga hermonthica</u> Benth.

The USAID team initiated "spot spraying" demonstrations on eight farm locations with excellent control of the target weed on these farms. After viewing the results of the herbicide treatments many farmers indicated an interest to control weeds and inquired about a Yemen source of supply for sprayers and herbicides (Table 2).

Dr. Voigt had earlier talked to an outlet of the Hayel Saeed Anam Company in

TABLE 2. - OUTREACH HERBICIDE DEMONSTRATIONS ON FARMS IN YEMEN ARAB REPUBLIC

1978

No.	Name of Farmer	Location	Weed Species		Herbicide Used	Concentration of Chemical Used for Spot Spraying
			Common Name	Scientific Name		
1.	Sheikh Abdella Hussen Al Faishe	Al Asha (Batina) 148 km NW/Sana'a	"Zoheyra" or "Makhreba"	<u>Flaveria repanda</u>	2,4-D Amine Salt 4 lbs/gal.	22 c.c./16 liters H ₂ O 16 liter backpack pump used for application
2.	Sheikh Nasser Mabkut	Near Huth 126 km N/Sana'a	Bermuda grass "Wobel" or "Zeel"	<u>Cynodon dactylon</u>	Dowpon II (Wettable powder)	.75 oz/liter H ₂ O
3.	Sheikh Hussen Al Surabi	SaDah 240 km N/Sana'a	"	"	"	"
4.	Sheikh Abdella Hamis Al Aojari	Wadi Nashor 25 km NW/SaDah	"	"	"	"
5.	Hussein Ebn Hussein	Bany Hoshysh 36 km NE/Sana'a	"	"	"	"
6.	Ahmed Salah Al Zumary	Bany Hoshysh 38 km NE/Sana'a	"	"	"	"
7.	Nagib Ali Salah Khaled	Bany Hoshysh 50 km NE/Sana'a	"	"	"	"
8.	Haje Shamy	Village of Maf-Dan 43 km SW/Sana'a	"Helgub" or "Shager"	<u>Diploaxis erucoides</u>	2,4-D Amine Salt 4 lbs/gal.	22 c.c./16 liters H ₂ O 16-liter backpack pump used for application

Sana'a about their threshers, sprayers, and chemicals. On October 14, 1978, the office in Taiz was visited by Dr. Voigt and the writer to discuss the details of the hand sprayer and were shown a superior Swiss model. This company also carries spare parts for this sprayer and a complete line of herbicides and pesticides.

It should be emphasized, however, that an On-the-Farm training course in application techniques and hazards associated with herbicides be a prerequisite for weed control, in the Yemen Arab Republic.

5). Pest Control

The pink stem borer (Sesamia cretica) and aphids (to a much lesser extent) were the two most serious pest problems on the Outreach Program. Dipterex 30 and Thiodan 35 were the two chemicals used for control of the stem borer. As the season advanced Dipterex 30 was replaced with Thiodan 35 since it was *found to* be more effective in controlling this insect. Nine locations were sprayed once and locations No. 1 and No. 9 were sprayed twice to control the borer. In a periodic visit to location No. 5, a mountain terrace (Elev. 3,000 m) on the Hodeigah Road, a heavy infestation of aphids was observed. A single spray application with Drawin 755 (West German pesticide) gave effective control of this pest.

6). Soils

Yemen has a restrictive soils environment constituting a wide distribution of calcium carbonate in loess-like soils with pH readings as high as 8.20 or more. Sorghum is mostly grown on terraces high in silt content and relatively low in clay and virtually void of organic matter (Table 3).

For rough analyses of soil structure, 8 to 10 soil probes were collected to a depth of 15 cm below the soil surface and used as a composite sample at each location. The soil constituents were determined by a simple old fashioned method prescribed by USDA soil experts. It involved placing two cups of water in a quart-size jar and a cup of soil. After thoroughly shaking the mixture and letting it stand for about 10 days or two weeks the water cleared and exposed the layered soils below the water surface. Organic matter on the water surface followed by clay, silt, fine sand, and coarse sand at the bottom of the jar. Of these tests, location OR 78-7 was the only one classified as sandy loam whereas OR 78-1, 2, 4, 5, 6, and 10 were sandy-silt-clay; OR 78-9, 11, and 12 were sandy-silt; and OR 78-3 was 95% sand. These data illustrate the tremendous diversity in the structure of Yemen soils (Table 3).

Table 3. - Summary of Soil Structure Analyses of
 Out-Reach On-Farm Test Locations From Water-Soil-Jar
 Settlement Test, Yemen Arab Republic
 1978

Test Location	Date Sample Taken	Organic Matter %	Clay %	Silt %	Fine Sand %
OR 78-1	8/21/78	tr	10	30	60
OR 78-2	9/16/78	tr	40	20	40
OR 78-3	8/16/78	tr	5	--	95
OR 78-4	8/16/78	tr	15	25	60
OR 78-5	8/15/78	tr	30	45	25
OR 78-6	9/09/78	tr	5	15	80
OR 78-7	8/26/78	2	45	40	13
OR 78-8	--	-	--	--	--
OR 78-9	8/27/78	tr	--	10	90
OR 73-10	9/10/78	tr	5	95	--
OR 78-11	9/14/78	tr	0	95	5
OR 78-12	8/14/78	tr	3	10	87

Soil analysis data for the Outreach locations and the Bir Al Gahoum Nursery Station, Sana'a were determined by the Soil and Water Research Station at Taiz. The lowest pH reading of 7.60 was recorded at Al Ashe (Batina) and the highest pH of 8.20 at the Bir Al Gahoum Station. The highest N reading of 0.118 was recorded at Al Ashe where animal manure is used as fertilizer and the next highest reading of 0.079 at the Bir Al Gahoum Station where animal manure is also applied during soil preparation (Table 4).

7). Germplasm Collection Made in Conjunction with the Outreach Program

It is well known that sorghum and millet have been grown as the principal food crops in Yemen for centuries or probably thousands of years. During this great span of time, natural and man-derived selections have had a major impact on the genetic variability of these crops. In fact, the genetic diversity of sorghums in Yemen is probably as great or greater than in any other country in the world.

Most Yemeni farmers are knowledgeable on traits and special characteristics of local cultivars they grow. It was through the contact with Sheikh Al Faishi, Al Ashe (Batina) on the Outreach Program that some significant characters about local cultivars were revealed. Among 25 seed samples of sorghum and one millet collected directly from farmers in 1978, the most important were from Al Ashe. These included a sorghum and millet both carrying resistance to "Edar", also known in the USA as Witch Weed (Striga hermonthica) which is parasitic on the roots of sorghum and millet and one of the most difficult plant parasites to control in the Middle and Near East. Collections of this parasitic plant were made and identified by the writer who had previous experience with this same species in Upper Egypt where it is prevalent in the sorghum region.

Table 4. - Soil Analysis Data For Outreach Locations And
Bir Al Gahoum Station, Sana'a, Yemen Arab Republic

Determinations made by Soil and Water Research Section,
Central Agriculture Organization Taiz/Ibb Projects (UNDP/
FAO/YEM/010), Ministry of Agriculture, Yemen Arab Republic

1978 (Depth 15 cm)

Sample No.	Location	PH	Available/ppm		Total N	E.C. mmhos *	*
			P ₂ O ₅	K ₂ O			
1.	Hendran (Bany Hoshysh)	7.90	5.75	390	0.015	1.15	
2.	May Moon	7.80	2.30	360	0.017	0.96	
3.	Hizyez (near Sana'a)	8.10	7.59	840	0.071	1.16	
4.	Sunhan	7.70	1.15	420	0.055	1.53	
5.	Maf-Dan	8.00	3.91	840	0.050	1.03	
6.	Yazil	7.80	1.15	258	0.046	1.04	
7.	Al Ashe (Batina)	7.60	2.30	240	0.118	1.14	
8.	Sa'Dah	8.00	1.61	138	0.042	1.14	
9.	Wadi Khaywan	7.70	5.75	264	0.008	1.01	
10.	Wadi War War (Bilsin)	7.80	3.91	540	0.038	1.05	
11.	Al Baun Project ** (So. ½ of location)	7.90	8.74	396	0.029	0.35	
12.	Al Baun Project ** (No. ½ of location)	8.10	2.07	420	0.038	0.44	
13.	Bir Al Gahoum Plant Breeding Station, Sana'a	8.20	1.84	570	0.079	0.48	

* Electrical Conductivity - Millimhos

** German Farm Near Raydah

The Striga resistant cultivars from Al Ashe were:

"Bahry" sorghum - red with a loose head

Pearl Millet - no common name

Since Striga hemonthica is becoming more prevalent in the Al Ashe Valley, Sheikh Al Faishi plans to expand the planting area of "Bahry" in 1979.

It was also learned from Sheikh Al Faishi that a local variety, "Harity" or also known as "Beyda", a white type with a compact head, is resistant to lodging.

During his many years of growing crops in the Al Ashe Valley, Sheikh Al Faishi stated that he had never observed a stem borer infestation on the local millet. This may be indicative of genetic resistance and should warrant experimental studies.

8). Grain and Forage Production

In three tests for grain yield, OR 78-5, OR 78-6, and OR 78-12, Sana'a 7 ranked first with an average of 119.3%, the hybrid second with 69.4% and Sana'a 1 with 52.2% of the local genotype. However, in test OR 78-7 (excluded from above data), Sana'a 1 with 114.0% outranked Sana'a 7 with only 18.7% of the local genotype in grain yield (Table 6). It is interesting to note that this test location rated the highest of 11 tests in soil structure which was classed as a sandy soil type with 2% organic matter and had the lowest pH of 7.60 (Table 3, 4). Unfortunately, birds had destroyed the grain of hybrid FMA53A before harvest.

9). Market Values of Grain & Forage

The Yemen farmer considers stover (sorghum and millet stalks) used for animal forage and household fuel plus animal feed of green leaves clipped from growing plants prior to grain ripening, of higher value than grain. Current prices (11/15/78) at the souk. (market) in Sana'a are:

	<u>Cost per kilogram</u>	
	<u>Y.R.</u>	<u>US \$</u>
Grain	1.7	0.374
Dried Stalks	0.25	0.055
Green Leaves	1.0	1.10

Table 5. - Grain and Forage Production Relationships of Experimental Sorghum Genotypes in Percent of Local Genotypes in Outreach Tests in The Yemen Arab Republic in 1978.

Outreach Test	Sorghum Genotype	Grain Production (% of Local)	Forage Production (% of Local)
OR 78-5	Hybrid	58.2	26.7
	Sana'a 1	38.8	90.2
	Sana'a 7	135.3	90.3
OR 78-6	Hybrid	35.4	28.3
	Sana'a 1	40.1	68.2
	Sana'a 7	102.5	104.9
OR 78-7 ^{*1}	Hybrid	*2	-
	Sana'a 1	114.0	-
	Sana'a 7	18.7	-
OR 78-12	Hybrid	114.7	36.8
	Sana'a 1	77.6	108.5
	Sana'a 7	120.2	75.1
Average	Hybrid	69.4	30.6
	Sana'a 1	67.6	89.0
	Sana'a 7	94.2	90.1
Average (Without OR 78-7)	Hybrid	69.4	30.6
	Sana'a 1	52.2	89.0
	Sana'a 7	119.3	90.1

*1 Difficulties of obtaining research plot production data from OR 78-7 prevented obtaining some data and made the nature of the data that was collected somewhat questionable. A more realistic overall average performance would seem to be the average without OR 78-7.

*2 Destroyed by birds.

In tests OR 78-5, OR 78-6, and OR 78-12, Sana'a 7 grain value ranged from US \$350, 275, 167 respectively for an average of US \$264 compared to the local genotype with 258, 268 and 138 for an average of US \$221. In only one test (OR 78-7), Sana'a 1 with US \$829 surpassed the local genotype (727) and Sana'a 7(136). In test OR 78-3, hybrid NK 12 with US \$146 surpassed hybrid FM A53A (91), Sana'a 1 (100) and Sana'a 7 (73). There was no local genotype in this test (Table 6).

These data, based on three tests, OR 78-5, OR 78-6, and OR 78-12, indicate an improved average grain value for Sana'a 7 of US \$43 over the local genotype. Sana'a 7 appears to be well adapted to soil conditions in the Sana'a area and may be an improved genotype for some farmers. In contrast, test OR 78-7 Sana'a one had an unusually high value of US \$829 compared to the local genotype (727) and only US \$136 for Sana'a 7. These data may reflect improved adaptation of Sana'a 1 over Sana'a 7 on better soils.

Forage values for Sana'a 7 in tests OR 78-5, OR 78-6, and OR 78-12 ranged from US \$1918, 745, and 116 respectively for an average of US \$926; Sana'a 1 from 1917, 484, and 167 for an average of US \$856; the local genotype ranged from 2125, 710, and 154 for an average of US \$996; the hybrid ranged from 567, 201, and 56 with an average of US \$275 (Table 6).

These data demonstrate the wide gap in forage values between Yemen genotypes and American hybrids. In the above example, the average forage value of the local genotype was US \$721 above the American hybrid which falls short of the farmer's expectations. Difference in stover production was the principal objection plus the greater vulnerability to bird damage due to earlier maturity of hybrids over the local genotypes.

Table 6. - Market Values of Grain and Forage Production of Outreach Tests in the Yemen Arab Republic in 1978.

Outreach Test	Sorghum Genotype	Grain Yield k/ha	Forage Production k/ha	Grain Value		Forage Value		Total Value	
				Y.R.	\$	Y.R.	\$	Y.R.	\$
OR 78-3	NK 125 (hybrid)	474	769	662	146	1387	306	2049	452
	Sana'a - 1	326	1222	453	100	2204	486	2657	586
	FM A53A (hybrid)	295	889	412	91	1600	353	2012	444
	Sana'a - 7	238	395	331	73	711	157	1042	230
OR 78-5	Sana'a - 7	1134	4819	1587	350	8698	1918	10285	2268
	Local	838	5338	1170	258	9636	2125	10806	2383
	FM A53A (hybrid)	488	1425	680	150	2571	567	3251	717
	Sana'a - 1	325	4816	453	100	8693	1917	9146	2017
OR 78-6	Sana'a - 7	892	1873	1247	275	3378	745	4625	1020
	Local	870	1785	1215	268	3219	710	4434	978
	Sana'a - 1	349	1218	485	107	2194	484	2679	591
	FM A53A (hybrid)	308	506	430	95	911	201	1341	296
OR 78-7	Sana'a - 1	2687	--	3759	829	--	--	--	--
	Local	2356	--	3296	727	--	--	--	--
	Sana'a - 7	441	--	616	136	--	--	--	--
	FM A53A (hybrid)	-- *	--	--	--	--	--	--	--
OR 78-12	Sana'a - 7	541	292	757	167	526	116	1283	283
	Pioneer 894 (hybrid)	516	143	721	159	253	56	974	215
	Local	450	389	625	138	698	154	1323	292
	Sana'a - 1	349	422	485	107	757	167	1242	274

* Damaged by birds.

RECOMMENDATIONS FOR 1979

1. It is recommended the Outreach locations be limited to seven areas:

- i) Bany Hoshysh
- ii) Wadi Khaywan
- iii) Al Ashe (Batina)
- iv) Wadi War War (Bilsin)
- v) Al Baun Project near Raydah
- vi) Hodeidah Road between Yazil and Manakha
- vii) Al Mahweit (new area)

Farmers in the first six mentioned areas were cooperative and helpful during the 1978 season and expressed their willingness to cooperate again in 1979.

2. Employment of a weed control specialist is recommended for an 8-10 month period in 1979. The duties should include an intensive On-the-farm program to test different herbicides including timing, concentrations and rates of application. Demonstrations and training in proper handling and health safeguards of herbicides should also be a part of the training. Local contact should be made with a dealer in Sana'a who is honest and trustworthy and who is a distributor for a top grade hand sprayer, spare parts, and chemicals.
3. Distribute seed and exploit the Striga resistant sorghum and millet from Al Ashe in northern provinces and the Tihama. Likewise, seed of the lodging resistant sorghum should be distributed and tested in various parts of Yemen. The local millet from Al Ashe which has been reported to be resistant to the stem borer should be tested locally in Sana'a as well as the Tihama.
4. Establish plots at Al Jarouba Research Station to test resistant millet genotypes to downy mildew disease caused by Sclerospora graminicola. This disease, commonly known as "Green Ear" is particularly prevalent and often damaging during seasons of high rainfall in the Tihama. Seed of resistant materials received in Sana'a in 1978 from ICRISAT should be included in the 1979 tests.
5. Establish some type of incentive for farmers cooperating in the Outreach Program. It has been suggested that the farmer be paid an excess over the market price for sorghum grain and stover harvested by and removed from the location by the USAID team. For example, for a small location of 108 square meters the farmer would be paid 25% above the market price for grain and stover whereas for the large location of 432 square meters, 100% above market price. A stipulation that the payment be made by the USAID team at harvest time should prevent advance harvest of the location before team arrival.

6. In spite of improvements in nursery plot studies at the Bir Al Cahoum Research Station in 1978, the writer questions whether or not this sorghum research center should be phased out in the near future and moved to a new location. Soil at this station is a major constraint for reliable and consistent results for future research studies. The 1978 data on soils revealed the highest pH reading of 8.20 when compared to 11 Outreach farm locations. Although this reading is within the sorghum pH culture scale (5.5 to 8.5) it is nevertheless in the upper range. This location also has one of the highest readings of silt (93%) and almost the lowest in clay (5%). Soil compaction is a major problem with heavy cement-like surface crusting. The present well discharge (both wells) is six liters per second, whereas the peak consumptive use rate for sorghum is 6.6 mm/day for Field A and B comprising 4.3 acres. To increase overall water efficiency at this station will require an additional investment for construction of a reservoir or a new well.
7. Yemen has a virtual "gold mine" of local sorghum and millet genotypes which have been grown for centuries. Why not exploit these local selections through adaptive research at outlying sub-stations on better sites? Wadi Khaywan is a large block of high-producing local sorghums where there is considerable land area owned by the Yemen Government. Another alternative or addition is at Ma'ber located about 79 km south of Sana'a near the British Farm.

It is not the intent of this writer to suggest a country-wide policy for sorghum and millet, but only to point out various factors which should be considered in developing an effective and efficient long-term program.

Acknowledgements are made and greatly appreciated for the technical support and assistance given by Dr. R. L. Voigt, Chief-of-Party and assistance of other project personnel in the 1978 Outreach Program. Recognition should also be cited for the cooperation from the USAID Outreach team consisting of Museid Attic, technician and interpreter, Ahmed Abdella Ismail, technician, and Abdella Senan Hamza, driver, also M. S. Acharya, I.V.S. Agriculture Engineer who provided irrigation data used in this report for the Bir Al Cahoum Research Station.



THE UNIVERSITY OF ARIZONA

TUCSON, ARIZONA 85721

COLLEGE OF AGRICULTURE

INTERNATIONAL PROGRAMS
211 ALUMNI BUILDING

13 April, 1979

(602) 884-171

Franklin H. Moulton
Contracting Officer
Regional Operations Division-NE
Office of Contract Management

Subject: Contract AID/NE-C-1304 Yemen

Dear Mr. Moulton:

The following adjustments to budget line items have been made in accordance with your March 20, 1979 letter to me, same subject:

1. Local hire-has been adjusted down from \$20,000 to \$15,497 to provide on campus salaries of \$58,156 through April 30, 1979.
2. Allowances - has been adjusted down from \$81,000 to \$77,700 to provide other direct costs of \$8,000 through April 30, 1979.

At the present time we have approximately \$45,000 available out of the original \$100,200 Travel and Transportation budget line item. Request approval to decrease travel and transportation by \$35,730 to \$64,470. The Equipment line item of \$105,000 would be increased to \$140,730 as a result of this change. This adjustment is needed for the following reasons:

1. We presently have expensed or encumbered \$8,900 over the \$105,000.
2. The spare parts bid for the two new Suburbans at Detroit has been received for \$9,030. This item has not been funded.
3. Our bid received on 2 above did not include shipping cost from a United States port to Yemen. Our estimate for this cost is \$2,500.
4. Bids on portions of order number 26 have been received for \$9,500. Items not funded.
5. It is estimated \$4,000 will be required to ship order 26 when all items are procured. This is the 8' x 8' x 20' containerized shipment.
6. Order number 28 has been received, but procurement action has not started. We estimate \$1,500 will be required to fill this order.

We need to confirm paragraph 2 above to our Detroit vendor by the end of April to keep the quoted price firm. Suggest immediate approval of the equipment line item adjustment to prevent unnecessary delays on shipment.

Attachment two

Request approval to ship the two 1979 Suburban vehicles and spare parts on other than a U.S. Flag carrier. Mr. Paulsen of your Transportation Office has recommended we ship to a Fleet Along Side (FAS) vessel Baltimore, then via a French Company to Hodeidah. The French Company is called "The French Line". We also plan to ship Order 26, (the containerized shipment) via this method with your concurrence.

Sincerely,

SIGNED

W. G. Matlock
Director, International Agriculture
Programs, University of Arizona