PD-ABR-279

HORTICULTURE IMPROVEMENT

TRAINING SUBPROJECT

(HITS)

A STORY OF SUCCESS

1983 - 1989

PD-ABB-379
ISN 67394

A SUMMARY REPORT

of the

HORTICULTURE IMPROVEMENT AND TRAINING SUBPROJECT

(HITS)

IN THE YEMEN ARAB REPUBLIC

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A USAID / CID CONTRACT # AID/NE-C-1698

FEBRUARY, 1990

Horticulture Improvement and Training Subproject

Subproject Objectives and Objectively Verifiable Indicators of Achievement

The purpose of HITS was:

To institutionalize within the Ministry of Agriculture and Fisheries (MAF) an expanded and improved capacity to support increased fruit production through extension, plant protection and delivery of disease-free plant materials for improved fruit varieties to the fruit subsector. The measure of success of accomplishing this subproject purpose (the objectively verifiable indicators) or the End of Project Status was to be the following:

1. Operational horticulture improvement stations providing 50,000 buds to nurseries annually and developing improved varieties.

2. Functional MAF Plant Protection program monitoring nurseries to ensure production and sales of insect/disease free trees to farmers.

3. Functional extension program servicing farmers for expanding fruit production.

4. Increased sales of nursery stock to farmers.

The following were identified as specific outputs of the project:

1. The establishment of two horticulture training and improvement stations.

2. An expanded plant protection department trained in plant protection methods.

3. 250 trained extension agents, horticulture specialists, horticulture technicians, agriculture inspectors, nurserymen.

4. Three expanded horticulture information production and distribution programs for farmers, nurserymen and private horticulture input suppliers.

5. Developed improved fruit varieties in insect/disease free condition.

6. Farmer demonstration program and workshops.

The Horticultural Improvement and Training Subproject has been highly successful in achieving the project purpose and accomplishing the End of Project Status as articulated in the project paper. In most cases, the HITS project has greatly exceeded the outputs identified in the logical framework as being an indication of success.

Summary of HITS Achievements

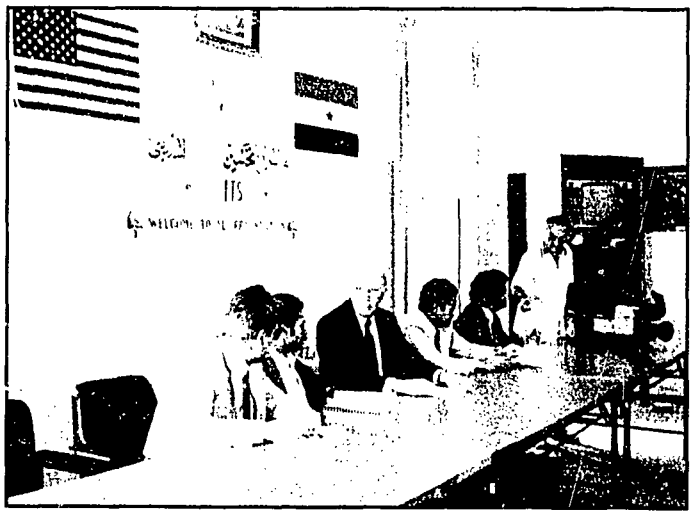
1. The two horticulture stations have been fully developed as model nurseries. The stations are the site of budwood multiplication blocks, rootstock stooling beds, demonstration plots, variety testing and extensive training facilities.

2. The project has greatly enhanced the capability of the plant protection department of the MAF to ensure the production, importation and distribution of insect and disease free trees and vines to farmers and to identify and control existing insects and diseases in the Yemen Arab Republic. MAF staff have participated in U.S. and third country short courses and training programs in inspection and quarantine.

3. The project has trained more than 700 extension agents, MAF employees, Ibb Secondary Agricultural Institute (ISAI) students, local farmers and other nurserymen in basic nursery practices, fruit production and plant protection. Furthermore, the project has invested resources in the future of Yemen through degree training. Three of the HITS sponsored students returned and were in decision making positions.

4. More than 60 instructional pamphlets and video-tapes have been produced for use in the extension and training activities of the project. These include topics such as the safe use of pesticides, insect and disease identification and control measures, tree planting and care guides, and recommended varieties for planting in Yemen. An extensive deciduous fruit tree handbook for the Yemen Arab Republic was produced in collaboration with the British project in Dhamar. A complete list of publications is presented in the Appendices of the HITS End of Contract Report.

5. Over 15 high-yielding, quality deciduous fruit varieties have been tested and recommended as suitable for Yemen, based on variety testing at Al-Irra. Many more varieties have been planted in recent years, including temperate, tropical and subtropical species for which data still need to be collected. It is likely that several, or possibly many, of these are also suitable for Yemen and can be recommended in the future. Hundreds of thousands of fruit trees have been produced and/or imported and distributed under the direction of the HITS project.



MAF and USAID officials in closing ceremony at Al-Irra station.

6. Numerous field days and workshops have been held in addition to the training programs at the two horticulture stations. Thirty-six demonstration plots were developed at sites throughout Yemen for this purpose. Hundreds of farmers each year have benefitted from these activities.

The purpose of HITS was to assist the country to become self sufficient in fruit production by focusing on an intensive program of training and extension. This was to be accomplished by six separate but interrelated activities:

Horticulture station development
Horticulture production and importation
Horticulture Research
Extension and Training
Plant Protection activities
Private sector development initiatives

Horticulture Station Development

Al-Irra Deciduous Station

Station Objectives

Al-Irra station was established with the goal of providing a well-planned and organized facility that would serve the Yemen government and the local farmers in the following ways:

1. Provide clean budwood and cuttings to the government and private sector nurseries throughout Yemen where they were to be reproduced and sold to meet farmers demand.

2. Serve as a model deciduous fruit nursery as an example for existing and future nurseries.

3. Provide a comprehensive facility for training Yemen Arab Republic Government (YARG) personnel and local farmers in fruit production practices and plant protection.

For station development, leveling the land was one of the daily practices at the new station sites.

4. Develop demonstration plots to be used in conjunction with training and extension activities.

5. Provide varietal evaluation and test plots for potential new fruit varieties.

6. Produce limited fruit trees and vines for direct sales to farmers in the immediate vicinity of the station.

Official visit to Al-Irra station by the Minister of Agriculture and Fisheries and the U.S. Ambassador to YAR, along with the HITS technical staff in 1989.

Climate, Soil and Water

Al-Irra station is located approximately in the middle of the temperate highland zone, which stretches from Sadah in the north to Sumarah Pass in the south. This zone comprises the middle and upper reaches of the central mountain chain running roughly from the north to the south through central Yemen at altitudes between 1,800 and 2,500 meters. Al-Irra station is located at approximately 2,300 meters elevation.

Low nightly air temperatures occur between the months of October and March which generally

make possible an adequate dormancy period for low chill deciduous fruit trees such as the varieties being evaluated at Al-Irra.

The soils at Al-Irra station are of a highly stratified silty clay loam composition with a consequently slow rate of water infiltration. Soil pH is fairly constant at 7.6 to 7.7. The well water at Al-Irra station maintains a pH of about 7.0.

Land preparation for deciduous nursery at Al-Irra station.

Major Accomplishments

1. Recommendation of 4 apple varieties, 10 peach varieties, 1 nectarine and 2 plum varieties for distribution throughout the central highlands of Yemen.

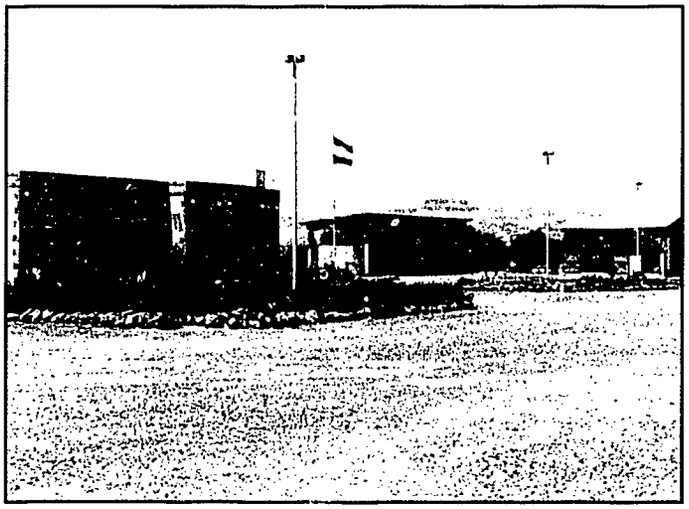
2. The collection of chill units for base data in the central highlands.

3. Rest or dormancy intensity testing of apple and peach varieties, 1986-87 season.

4. Al-Irra station infrastructure completed.

5. Power-station connected to the Yemen General Electric Corporation electric line, 1986-87 season.

6. The establishment of fruit yield and maturity records for apple, peach, nectarine and plum varieties.



Al-Irra's office and classroom building (center left), the pesticide storage building with the cold storage box under the overhang (center) and the generator building (center right).

7. Collection and distribution of more than 100,000 buds per year from the budwood tree block.

8. Training of more than 400 extension agents, YARG employees, ISAI students and farmers in the following horticultural activities:

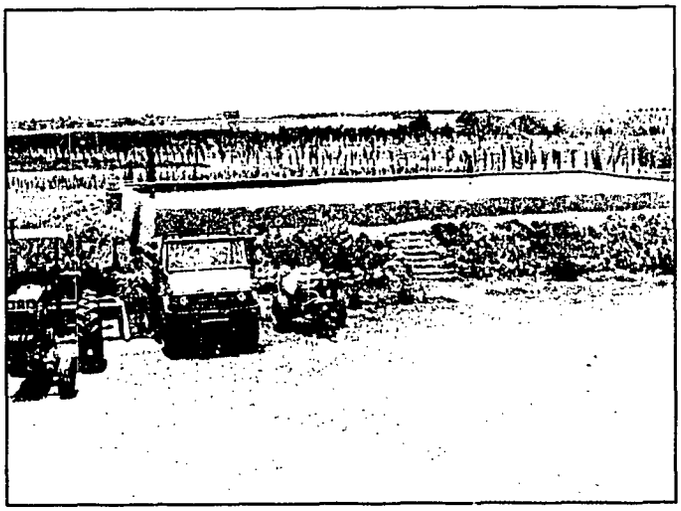
    a. Pest control
    b. Weed control
    c. Pruning
    d. Orchard lay-out
    e. Planting
    f. Budding
    g. Fertilization
    h. Soil management
    i. Fruit thinning

Station Services Completed:

1. Two wells drilled and equipped with pumps and engines. Combined discharge is more than 12 liters per second.

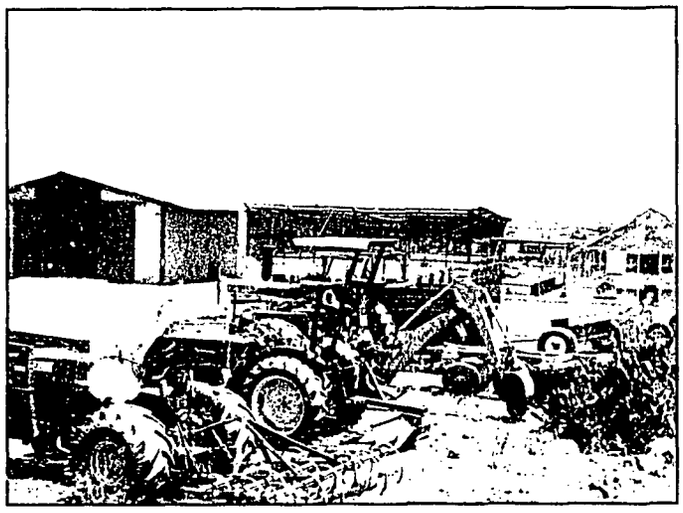
2. Water storage reservoir, capacity 65 cubic meters.

3. Interlinked irrigation system connecting the two pumps and the reservoir to the following field delivery systems:



Al-Irra's reservoir, used for water storage and irrigation.

a. High volume, high pressure impact sprinklers
b. Low volume, low pressure sprinklers
c. Low volume micro jet sprayers
d. Flood Irrigation
e. Furrow Irrigation
f. Low volume, low pressure sprinkler system in the glasshouse and shadehouse

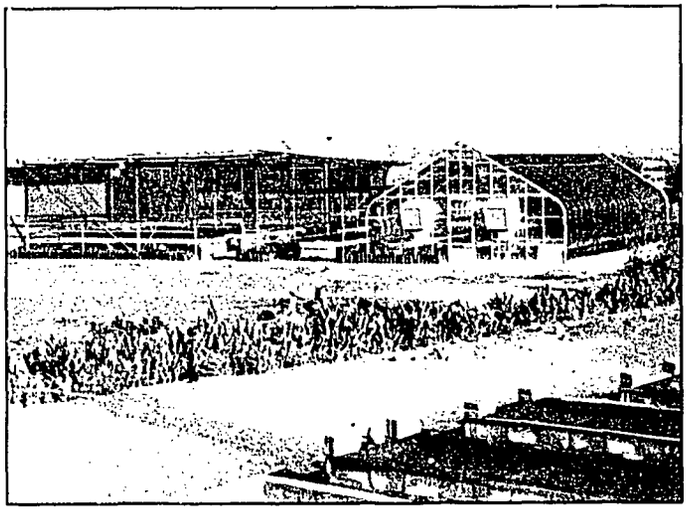


Farm machinery at Al-Irra station.

4. Full complement of agricultural equipment provided including:
   a. Tractors
   b. Tillage equipment
   c. Pest control equipment
   d. Weed control equipment

Fruit Tree Varieties

Sixty-five different varieties of deciduous fruit trees have been planted at Al-Irra. There are a total of 1,500 trees including both the trees in the



Climate and irrigation control greenhouse and shadehouse built by HHS at Al-Irra station

variety trial blocks and the trees in the budwood blocks. Several hundred of these trees are too young to bear fruit, and a few varieties have shown an inability to flower at Al-Irra. In addition to these trees, there are 10,000 EMLA 106, 1000 EMLA 111, 1000 EMLA 26 and 500 MM[7] apple rootstocks planted in stooling beds for propagation, along with approximately 10,000

The lay out of a deciduous experimental and extension orchard at Al-Irra station

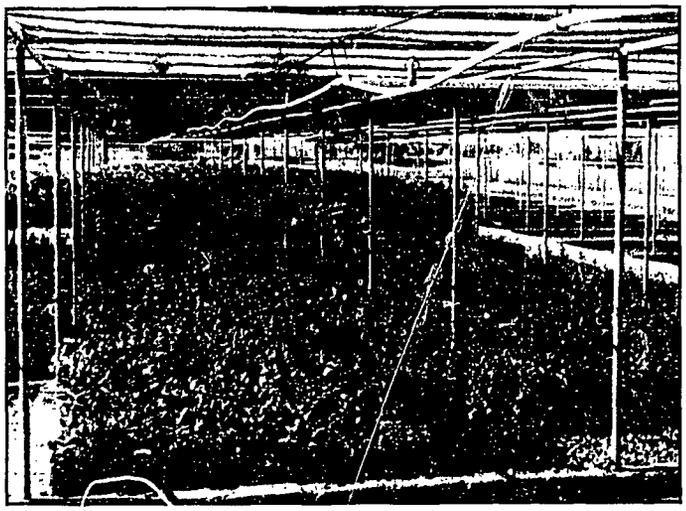
seedling rootstocks of apple, pear, apricot, plum and peach.

Al Jarouba Tropical/Subtropical Station

Existing facilities at Al Jarouba in 1982 included a trailer house, two wells with pumps, an unlined reservoir, a shade house and a shop.

Preparation work to transform the previously under-developed 12-hectare site into a functional horticulture station began in 1983.

A new 1800 square meter shadehouse was completed in July 1984. Permanent housing and an office/classroom complex were completed by September 1984. Four houses were built, each is 12m x 9m located within a walled compound and

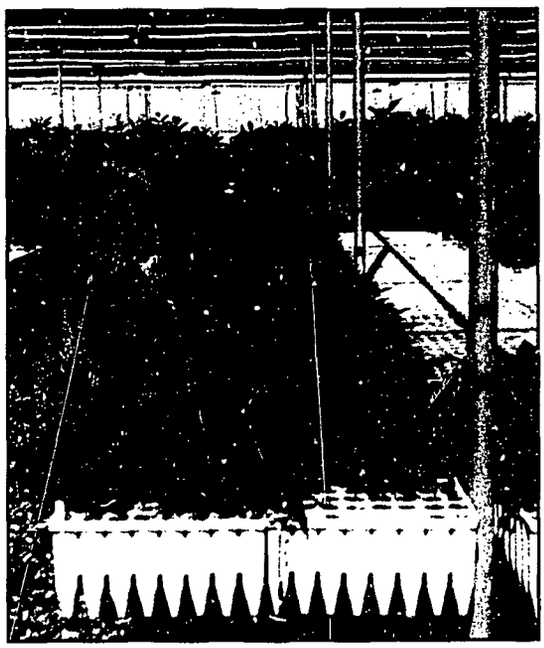


One of the new shadehouses at Al Jarouba station.

the classroom/office complex consists of a large classroom, 4 offices, a bathroom, a kitchen and a storage room. A second well was drilled during the summer of 1984. A new PVC irrigation system was installed during the summer of 1985 utilizing state of the art technology including micro jets, minisprinklers and sand filtration equipment. The irrigation system has 6' main lines.

Climate

Al Jarouba station is located in the tropical Tihama lowlands, along the Red Sea coastal plain, which is about 35 to 65 km wide and 1600 km long.



Citrus production at Al Jarouba station.

Station Objectives

Al Jarouba station was established with the goal of providing a well-planned and organized facility that would serve the Yemen government and the local farmer's in the following ways:

1. Provide clean budwood and cuttings to the government and private sector nurseries throughout Yemen where they were to be reproduced and sold to meet farmer's demand.

2. Serve as a model tropical/subtropical fruit nursery as an example for existing and future nurseries.

3. Provide a comprehensive facility for training YARG personnel and local farmers in fruit production practices and plant protection.

4. Develop demonstration plots to be used in conjunction with training and extension activities.

5. Provide varietal evaluation and test plots

for potential new fruit varieties.

6. Produce limited fruit trees and seedlings for direct sales to farmers in the immediate vicinity of the station.

HITS Research

A number of commercial varieties of fruit trees were purchased in 1984, 1985 and 1986 and planted at Al-Irra station for variety testing. The objective was to select fruit tree varieties that are suitable for Yemen.

As a result, HITS research and evaluation identified some very productive and high quality, acceptable varieties that are now being reproduced by public and private nurseries. These varieties were also distributed to farmers who are planting them on a large scale. The best of these varieties are shown in the pictures.

One of the Yemeni counterparts involved in varietal testing.

HITS Production and Importation

The following table summarizes the total deciduous fruit and tree production at Al-Irra Station from 1985-1989:

Fruit:	30,075 kg
Budwood:	147,000
Rootstocks:	62,000
Budded Trees:	63,000

The following pictures show some of the suitable deciduous fruit varieties for Yemen which were identified by HITS.

These are some of the pictures taken at Al-Irra station in Yemen.

Dorsette Golden Apple

Anna Apple

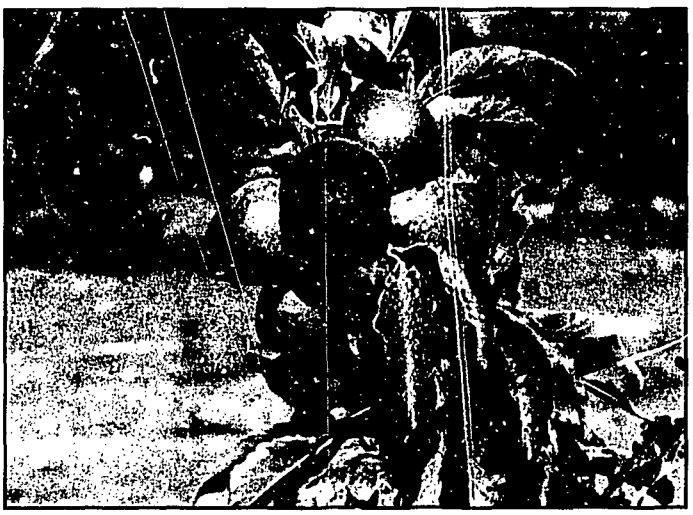
Ein Shemer Apple

Tropical/Subtropical Fruit Tree Production at Al Jarouba Station

In 1982, the primary emphasis was on citrus at Al Jarouba and thousands of rootstock seeds were planted. Because of the outbreak of citrus canker in the Tihama area and the eventual infestation at Al Jarouba, the citrus seedling, budded trees and budwood production program was halted. All of the citrus at Al Jarouba, approximately 185,000 citrus trees and seedlings, were destroyed in 1986.

Production emphasis was switched to mango and other crops. More than 30,000 budded mangos were produced and distributed between 1986-1989. Mango budwood from the station was distributed to other nurseries for propagation. As these new trees grow in the next few years, the station will be able to supply in excess of 100,000 buds of many different fruit varieties to the Yemen nurseries for propagation.

Yellow Plum



Santa Rosa Plum

Florda King Peach

Total of trees, rootstock and seeds imported by HITS (1983-1989).

Rootstock	352,200
Mother trees (Budded trees)	240,700
Seeds	540,000 plus 15 lbs. of Apple seeds

HITS Training Activities

An important part of the objectives of the stations were the training of MAF horticultural personnel, agricultural students from the state university and from the secondary agricultural training schools, in the technique of horticultural production. Al-Irra has been used extensively and will continue to be used as a horticultural training station. For this purpose an excellent lecture room was built into the station office building. Trainees can be given instruction in normal horticltural practices, irrigation, pruning, thinning of fruit, fertilization, and insect and disease control. These are routine operations carried out on the trees in the permanent experimental orchard blocks of the station.

Good facilities and a large portion of the field area have been allocated to fruit tree propagation. Facilities include a shadehouse, a glasshouse and a refrigerated cold storage container. More than 400 extension agents, YARG employees, ISAI students and farmers have been trained at Al-Irra. Trainees received hands-on experience in seed dormancy requirements, germination, budding, grafting, bagging and transplanting. A stooling bed of 10,000 apple rootstocks was established at the station in 1986 to provide both rootstocks for tree propagation and training for students in methods of clonal rootstock multiplication.

During the project implementation, it was normal to run at least two major training courses a year, each for two to four weeks in duration. One-day demonstrations were held throughout the year for specific horticultural practices, such as pruning, thinning and budding. Usually fifteen to twenty local fruit growers were invited and attended these one-day demonstrations.

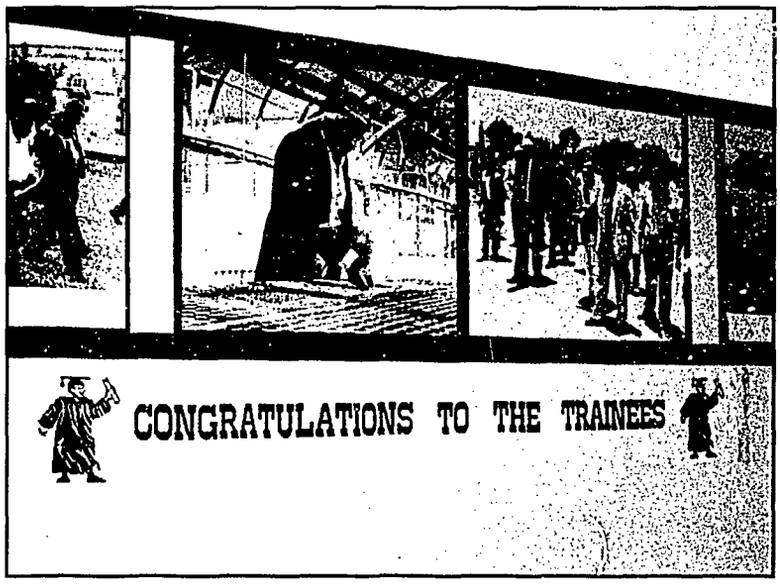
The young Yemeni who were trained by HITS then train other Yemeni in the budding techniques of apple rootstock at Al-Irra station.

One of the opening ceremonies for a training program at Al-Irra station.

Budding process of apple rootstocks by Yemeni trained technicians..

Demonstration of Bubbler Irrigation System to Yemeni trainees at Al-Irra station.

In addition to responding to the heavy emphasis placed on tree production by the MAF, HITS has been tremendously successful in providing hands-on training in production and plant protection over the past seven years. The training facilities at Al-Irra and Al Jarouba have been used extensively for workshops and short courses, as have the demonstration plots established throughout the country. HITS also sponsored more than 15 MAF employees in short course training in the U.S. and in other countries. Furthermore, two students sent for degree training in the U.S. have returned to Yemen and are in management positions with the project. The



Picture exhibition of HITS activities in the classroom at Al-Irra station.

three other degree seeking students are completing their training in the United States and will be returning to Yemen within the next two years.

Probably the most significant accomplishment of HITS has been the training of qualified technicians to run Al-Irra and Al Jarouba stations. During the first few years of the project, much of the time and effort of the HITS staff was directed towards station infrastructure and staff development.

HITS In-Country training program at Al-Irra station.

HITS Extension Activities

The objective of the HITS extension program was to provide formal and informal training to a cadre of professionals, technicians and extension specialists in the MAF and the private sector in basic fruit production, nursery management, plant protection and extension skills. At the same time, the project was expected to expand and upgrade the MAF horticulture, plant protection and extension information production and distribution program for farmers, nurserymen and the private sector. This was accomplished through extensive use of radio, television, extension pamphlets and visual demonstration aids. HITS has been extremely successful in achieving the objectives in this area.

Demonstration Plots

Thirty-six field plots have been established in cooperation with farmers from throughout Yemen. These demonstration plots have been established to serve two main purposes: 1) Further varietal testing of deciduous, subtropical and tropical fruit trees in comparison to the varietal testing at Al-Irra and Al Jarouba stations; 2) the transfer of technology of modern fruit production practices to the farmers and extension agents.

Field Days and Extension Visits

Several field days were held each year at the farmer's demonstration plots. Cultural practices such as tree propagation, planting, pruning, fruit thinning and harvesting were demonstrated. Practical demonstrations on varietal differences and pest management also have been conducted at each location. Videotape records of the training programs have been maintained. Over two hundred extension visits to farms were made each year by the extension specialist, many of the visits were at the request of MAF. At one of the field days at Al-Irra station, more than 100 people attended, including high ranking MAF officials, USAID officials, ADSP team leaders, private sector individuals and the Yemen news media.

Instructional Materials

Over 20 extension packages including video tapes and extension pamphlets were provided.

HITS Plant Protection

Plant protection was recognized as being critical to the success of HITS activities and was one of the major components of the HITS program from the beginning of the project.

The HITS project has specifically focused on expanding and improving the Plant Protection Department of the MAF to ensure the production, importation and distribution of insect and disease-free trees to farmers, and to identify and control the existing insects and diseases in the YAR.

The following activities were a part of the plant protection effort of HITS and were initiated in full cooperation with MAF counterparts:

1. Conduct extensive field trips and surveys to determine existing insect, disease and physiological problems.

2. Provide support to strengthen Yemen plant quarantine and inspection efforts, and develop and implement a plan to regulate movement of plant materials in Yemen, including imported and locally produced materials.

3. Construct a green house and small insectary for HITS entomological activities and rearing of beneficial insects.

4. Produce pamphlets and videotapes as instructional aids.

Demonstration of safe use of pesticides to trainees at Al-Irra station.

5. Establish a model integrated pest management program in Yemen.

6. Develop integrated pest management programs for the HITS horticulture stations.
7. Promote pesticide use in YAR.

8. Import and release about 1/2 million parasites in Yemen for establishment of biological control and integrated pest management.

Private Sector Development Initiatives

One of the most important and successful programs of HITS was to involve private sector individuals in fruit and fruit tree production in Yemen during 1988 and 1989. With USAID support, HITS convinced MAF that in order to enable Yemen to meet its fruit production goal of self-sufficiency, highly enthusiastic private sector individuals must be involved in the undertaking. Subsequently, HITS began to provide technical and material support to five selected farmers and to three HITS demonstration plots by providing them with thousands of apple rootstocks and nemaguard seeds. The establishment of the first fruit tree nurseries in Yemen in 1988 was completely supervised by HITS.

Support to the private sector for expanded fruit and fruit tree production was continued in 1989. Thousands of rootstocks were imported and more private sector individuals were involved. Farmers who had some previous experience were encouraged to observe the achievements at Al-Irra station and at other MAF nurseries in the commercial nursery business. As a result of HITS success in this area, there is a strong belief that The Yemen Arab Republic will become self-sufficient in fruit and fruit tree production in the next two to three years.

A comprehensive survey of 21 existing MAF nurseries in Yemen was initiated by HITS in 1987. The purpose of the survey was to identify those nurseries with the greatest potential for expansion to help YARG successfully meet its target of increased fruit production.

The HITS team recommended five nurseries for upgrading. These nurseries are in different geographic and climactic locations of The Yemen Arab Republic. USAID and MAF presented a plan to The Central Planning Organization (CPO) with a request for PL 480 funds to implement the upgrading plan.

Upgrading MAF Nurseries

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