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**DIVERSIFIED AGRICULTURE RESEARCH PROJECT:
SRI LANKA**

FINAL REPORT

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DEVELOPMENT ALTERNATIVES, INC.

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EXECUTIVE SUMMARY

The purpose of the Diversified Agriculture Research Project (DARP), which was supported by the U.S. Agency for International Development (USAID), was to expand Sri Lanka's self-sufficiency in rice to general food self-sufficiency. The project purpose included agricultural diversification, with special emphasis on other field crops (OFCs) under both rainfed and irrigated conditions.¹ Because of past research emphasis on rice production, OFCs had been neglected, as had the seed and extension program. The outputs and achievements of DARP contributed to three objectives: diversification of crop production, which transformed the rice-based system to an export-based system; increase in the number and quality of seed enterprises; and improvement in the ability of the Department of Agriculture (DOA) to conduct applied research, extension, seed development, and plant quarantine. DARP was also successful in assisting DOA to shift policies toward a market economy, private sector development, and export promotion.

The first phase (1985-1990) of the project began with a focus on research of OFCs; during the extension phase (1990-1993), greater resources were dedicated to horticultural industry development, delivery of services to the private sector through communications activities in extension, seed industry development, and assessment of DOA options to meet the needs of a changing client base.

Highlights of DARP research activities include selecting 14 appropriate crops for diversification, introducing improved germplasm, and determining the appropriate farming systems for the expansion of food crop production for local consumption. Agronomic research focused on soil fertility, plant spacing, and cropping systems. Technical assistance experts in agronomy advised DOA officers on research plans for OFCs, analysis and interpretation of data, and guidance in writing research reports.

In the extension phase, the research agenda shifted from import substitution to a mixed import substitution and export strategy to support a more open, market-oriented system. This shift in the research strategy also encouraged an emphasis on diversification, decentralization of the agricultural research community, and linkage of research organizations with the private sector.

Thus the emphasis of the extension phase on horticultural crops and seed enterprise development followed research findings from the first phase and facilitated changes in public policy. Market analysis also became more important in the extension phase of the project. Emphasis on horticulture increased with the importation of germplasm and funding of research grants. The plan for development of the Uva Province, which was derived from a prefeasibility study for the improvement of commercial horticulture in the region, pointed out that the major constraints hindering growth were the availability of suitable land and water.

¹OFCs refer to all nonpaddy crops; these crops are also referred to in the literature as subsidiary food crops. The term OFC is used in this report.

MEASURABLE DARP IMPACTS

Crop Diversification

One major purpose of DARP was to increase production of crops other than paddy. The idea was to diversify cropping patterns, not necessarily to increase yields. Therefore production — not area planted or yields — was used as the primary impact indicator. The net increase in local production as a result of crop diversification was at least \$4 million each year from 1981 to 1992. Chilli and onion, two higher-value crops, achieved significant success. Prospects for increases in both the production and value of tropical fruits and vegetables for the local market and tropical foliage for export are excellent if the recommendations made at the completion of the Uva Province study are implemented. These recommendations include controlling virus and bacterial diseases, water management for year-round production, technical assistance throughout the system, operation of production units as commercial enterprises, improving postharvest handling technology, improving infrastructure, emphasizing market-based decision making, and increasing farmer involvement in the marketing system.

Seed Industry Development

During the first phase of DARP, selected accomplishments in seed industry development included a national workshop to evaluate and chart the current status of the industry and a reduction in the number of government seed farms from 37 to 19. During the extension phase, DOA took more initiative to assist in formation of independent enterprises and, notably, formed more than 15 seed enterprises, which are producing between 25 and 50 percent of all locally produced seed.

These new enterprises were guided and assisted by DOA, and were provided basic seeds and use of DOA facilities for storage and processing. These seed enterprises together produced 410 metric tons of seed paddy, 10 metric tons of bean seed, and 5 metric tons of chilli seed in their first season of operation, Maha season 1992-1993. By the end of the project, independent enterprises were producing 100 percent of commercial chilli seed, about 20 percent of paddy seed, and 15 percent of bean seed.

The emergence of new enterprises and support in processing and marketing are evidence of the recent strategy being pursued by DOA. DARP assisted with efforts to communicate this strategy to a wider audience and to develop a policy statement that would serve as a guide to the rapidly growing number of participants in the seed industry.

DARP provided funding for six participants to conduct a lengthy study tour to explore alternative approaches to seed industry development. Upon return, the group drafted a new seed policy for Sri Lanka, which emphasizes support to the development of independent seed enterprises and promotion of production and use of high-quality seed. Based on this document, a new policy statement was drafted and is nearing release by the Government of Sri Lanka. The statement refocuses the DOA seed program to take a proactive industry promotion approach and to place the responsibility for commercial seed production entirely in the private sector.

Institutional Strengthening of DOA

Institutional strengthening of DOA was facilitated through extensive participant training programs, which have significantly increased the capacity of DOA to convert from an import substitution approach to a market-oriented agricultural system. DOA must continue to evaluate its human resource development needs and develop a training plan with clear priorities. Such a plan would state clearly the need for training in a particular discipline and enhance DOA's capabilities to fulfill its mandate to provide applied research resources to Sri Lankan farmers. As DOA redefines its client groups and objectives, there will likely be several new and valid training objectives to meet client needs.

The two most important project inputs for the strengthening of DOA were participant training and the special projects fund. The Institute of International Education managed the participant training program under a subcontract with Development Alternatives, Inc. Sixty-two scholars received long-term training in 24 disciplines. Short-term training included participation in study tours, and attendance at conferences, seminars, workshops, and short courses. A total of 383 participants received short-term training. As the project evolved, study tours were used increasingly to bring focus to particular policy areas. While on tours, participants were required to collect germplasm from countries visited. By including the collection of germplasm as an express goal of study tours, participants were provided the time and resources to select healthy plant materials and promptly transport them to Sri Lanka for propagation.

The special projects fund was provided through DARP to facilitate project activities in areas where DOA operational budgets were inadequate. Special project funds were used to support 48 activities including the printing of a *Crop Recommendations Technoguide*; mass media campaigns in radio, television, and publications; and a National Horticulture Exhibition.

EXPECTED FUTURE IMPACTS AND RECOMMENDATIONS FOR DOA

The process of crop diversification in Sri Lanka did not begin with DARP, but was accelerated by the project through its strengthening of DOA. Many of the impacts of the project will be seen only in future years. Future impacts and some recommendations follow.

- *Crop diversification.* Expanding cultivation of crops such as chilli, onion, and other vegetables is to be expected. Increased production of green gram might occur with the expansion of cultivation in the Maha season. Other grains such as maize and soybean can be increased with coordinated efforts to link growers with markets. DOA should routinely publish statistical series related to important crops, including fruits and ornamental plants, and should include indicators of crop diversification in regular reports.
- *Seed industry development.* With proper support, the number of seed enterprises could double or triple in the next two to three years. It will take several years before these enterprises gain sufficient experience to become mature concerns, capable of providing high-quality seed and promoting its use among farmers. A seed industry association will be increasingly important to support the developing seed trade. Perhaps a federation among three private groups—seed enterprises, nurserymen, and seed importers—would be effective. Assistance to these organizations is an appropriate target for USAID and DOA support.

Seed quality is also important to the growth of the seed industry. Seed crops are now being produced in the off-season to reduce the storage time before seeds are used in the next growing season. Timely harvest and immediate drying are also important factors in preserving seed quality. Practical research and demonstration programs on the preservation of seed quality in Sri Lanka are needed. Seed certification must also become a more open system where all producers and distributors can become active.

- *Adoption of technology.* DOA should be particularly concerned about following through with its client groups to measure the degree to which new technology is adopted and the extent and kind of problems farmers and other clients experience. In this way DOA can obtain feedback and develop modifications to be incorporated into the research agenda. Baseline information is available, including not only cropping patterns but improved technology applied in growing high-value crops. Key technology interventions developed and recommended by DOA should be identified and monitored.
- *Use of personnel trained under the project.* Monitoring of trained DOA participants should be conducted by DOA. Results would be useful in formulating new plans and priorities for future training.
- *Germplasm introduction and distribution.* An ongoing record and report of the germplasm introduction and of the distribution of plant materials would be useful. This would serve as a means of advising nurserymen and others about the availability of plant materials in the country, and demonstrate the quality of those materials that are being distributed to the private sector.

PART ONE

BACKGROUND AND OVERVIEW

The Diversified Agriculture Research Project (DARP) was implemented under an agreement between the Department of Agriculture (DOA) and the U.S. Agency for International Development (USAID). Development Alternatives, Inc. (DAI) provided technical and managerial assistance to the project.

The first phase of DARP was implemented from 1985 through 1990. An excerpt from the original Project Paper described the purpose and design of the project:

While the country is approaching self-sufficiency in rice, there is a growing deficit in coarse grains (primarily for livestock and poultry rations), grain legumes, oil crops, and poultry and livestock products. The Government of Sri Lanka (GSL), recognizing the need to maintain stable farm incomes and reduce foreign exchange expenditures, and conscious of the declining nutritional status and inefficient land and water use, has moved from a policy of rice self-sufficiency to food self-sufficiency--i.e., towards agricultural diversification with special emphasis on subsidiary crops under both rainfed and irrigated conditions.

Diversification in field crop production, however, faces technological and institutional constraints. Because of the past emphasis on rice production, the subsidiary field crops (SFCs) have been generally neglected. Research work on the SFCs has not been effectively supported and directed, with the result that relatively few appropriate, improved production technologies have been developed. This neglect has carried through to the seed and extension programs, with the result that both prevailing SFC production technologies, as well as the infrastructure to generate and support improvements, have remained at very low levels of development.

The purpose of the project is to strengthen the institutional capability to generate and effectively transfer technologies and seed required to increase and sustain SFC production on small farms.

To accomplish this objective, the project will assist in upgrading the capability of the Department of Agriculture (DOA) to program and carry out sound agroclimatic and farmer-relevant research; effectively transfer new and adapted technologies to farmers; and ensure the supply of SFC seed. Private sector efforts will be enlisted in undertaking the latter. The project is an institution building effort, assisting the DOA to strengthen its capability vis a vis subsidiary field crops while maintaining a strong program in rice.

Although the two interim evaluations (1987 and 1989) found that the project was making meaningful progress toward its objectives, two original assumptions were no longer valid:

- The national extension service had not remained fully funded under the training and visitation (T&V) system. The extension function was devolved to the provincial level;

- Markets for some of the alternate food crops, especially some of the grain crops, were not as favorable as anticipated.

The Project Paper Supplement (1990) adjusted to these changes by placing more emphasis on use of mass media in extension communications and on market analyses and linkage with the private sector through other USAID-funded projects. The supplement also suggested more emphasis on horticulture. With these changes, the project was extended to August 31, 1993.

Throughout this document, the 1985-1990 period will be referred to as the original phase of the project, and the 1990-1993 period as the extension phase. The term other field crops (OFCs) will be used to refer to the set of alternative crops emphasized by the project.¹ Descriptions of the field crops and vegetables with which DARP worked are found in Annex A.

DAI's proposal for the extension phase included additional emphasis on high-value horticultural crops, a horticultural assessment, and continued improvement of germplasm, postharvest handling, and marketing. Most of the immediate gains from diversification were achieved in vegetable crops such as chilli and onion. Over time, the project contributed to development of tropical fruits, other vegetables, and the ornamental plant and tropical foliage industry.

These changes in project activity were accompanied by a shift in Sri Lankan Government policies toward a market economy, private sector development, and export promotion. In addition, the USAID Strategic Framework called for expanding opportunities through a new private-public partnership that resulted in an evolution of project activities as the project matured. Whereas the original phase began with a central focus around research on OFCs, during the extension phase greater resources were dedicated to the delivery of services to the private sector through activities in extension communications, seed industry development, horticultural industry development, and the assessment of DOA options to meet the needs of a changing client base.

¹The SFC crops referred to in the Project Paper above are discussed in this report under the rubric of OFCs.

PART TWO

INPUTS AND DELIVERABLES

This section summarizes the life-of-project inputs provided in five categories: technical assistance, participant training, special project funds, facilities construction, and commodities procurement.

TECHNICAL ASSISTANCE

DAI was the primary technical assistance contractor responsible for project implementation and technical assistance. DAI provided long-term and short-term advisors, home office backstopping, and local project staff. DAI was also responsible for management of the Participant Training and Special Project Funds. Two ongoing subcontractors that provided technical advisors were Oregon State University (OSU) and Resource Development Consultants (RDC).

Oregon State University provided long- and short-term expatriate advisors throughout the project. RDC provided local technical short-term advisors and handled payroll and benefits for Sri Lankan project staff.

Additional services for specific technical assistance requirements were acquired by DAI from Mississippi State University (MSU), Oklahoma State University, World Education, Training Resources Group (TRG), and Queensland Department of Primary Industries (DPI).

MSU evaluated seed pricing structures, developed systems for tracking seed sales, and analyzed problems facing the establishment of viable seed enterprises. Oklahoma State University identified statistical software packages and trained Division of Agricultural Economics and Projects (DAEP) staff. World Education initially helped study and make suggestions for improving training of trainers in DOA.

TRG conducted management needs assessments and three management training workshops for senior DOA officers. Queensland Department of Primary Industries (DPI) helped conduct five courses in nursery management and propagation of perennial tropical fruits.

A total of 375 person-months of technical assistance was supplied by DAI over eight years, 230 through long-term advisors and 145 through short-term consultants. In addition, another 33 person-months of assistance were closely associated with DARP through linkages with other organizations. DARP funds were used for some of this assistance, paid directly by USAID outside the DAI contract.

Annex Table B-1 lists all short- and long-term consulting assignments and the level of effort in person-months under the DARP project. A brief description of technical assistance assignments is provided in Annex Table B-2, organized according to technical areas.

PARTICIPANT TRAINING

Under the management of the Institute of International Education, 62 scholars received long-term training in 24 disciplines as summarized in Table 1 and presented in detail in Annex Table B-3.

TABLE 1
NUMBER OF M.SC. AND PH.D. SCHOLARS WHO RECEIVED
TRAINING IN VARIOUS DISCIPLINES 1985-1993

Seed Technology	8	Food Science	1
Insect Taxonomy	1	Entomology	5
Agric. Economics	6	Agric. Extension	2
Extension Management	1	Rural Sociology	1
Agric. Education	4	Agronomy	3
Plant Pathology	4	Plant Breeding	5
Weed Science	3	Cropping Systems	1
Farming Systems	1	Pesticide Chemistry	1
Water Management	4	Soil & Water Management	1
Soil Science	1	Statistics & Biometry	1
Agric. Machinery	1	Dev. Communication	2
Horticulture	4	Library & Info. Science	1

Short-term training included participation in study tours, and attendance at conferences, seminars, workshops and short courses. A total of 383 participants received short-term training, 245 during the original five-year phase (Annex Table B-4) and 138 during the three-year extension phase (Annex Table B-5). In total, 152 training programs were conducted. Under the original phase, 484 person-months of short-term training were completed, 69.25 in the United States, 338.25 in developing countries, and 76.50 in Sri Lanka. In the extension phase, 106 person-months were completed including 27 in the United States, 69 in developing countries, and 10 in Sri Lanka.

As the project evolved, study tours were used increasingly to bring focus to particular policy areas. While on tours, participants were also obliged to collect germplasm from countries visited. By including collection of germplasm as an express goal of study tours, participants were provided the time and resources to select healthy plant materials of desired types and promptly transport them to Sri Lanka for propagation.

Numerous local workshops, seminars, and conferences were also sponsored and managed by the project. In addition to the above, 200 DOA officers attended local training in the use of computer software programs. The basic series consisted of familiarity with DOS, word processing, and spreadsheet analysis. Advanced training was offered in word processing, desktop publishing, statistical analysis, computer graphics, spreadsheets, and database management.

SPECIAL PROJECT FUNDS

Funds were provided through DARP to facilitate project activities in areas where DOA operational budgets were inadequate. Use of these resources was limited during the original phase of the project, primarily for lack of a system of disbursement and accountability. During this time, several workshops, grants for socioeconomic research, and installation of the Seed Development Unit were facilitated through DARP. In 1992, more than \$500,000 was added to the DAI contract to be managed on behalf of the project. Special Project Funds (SPF) were used to support 48 activities including the following:

- Printing *Crop Recommendations Technoguide*;
- Mass media campaigns: radio, television, and publications;
- Installation of a farm broadcasting recording studio;
- Importation of germplasm;
- Field demonstration programs;
- Research grants program;
- Workshop on biotechnology;
- National horticultural exhibition;
- Special studies;
- Farm manager, farmer, and nurserymen/women training;
- Seed enterprise manager;
- Installation of seed cleaning equipment;
- Management training workshops; and
- Training in software applications.

Although the mechanisms for disbursement and DAI staff to manage the funds were put in place only in early 1992, all of the funds allocated were fully utilized (Annex Table B-6).

FACILITIES CONSTRUCTION

To strengthen DOA's research facilities for OFCs, DARP identified the major needs of DOA stations directly linked to crop diversification. A total of 43 facilities were commissioned by the third quarter of FY 1992 at a cost of \$850,000. These facilities were the major OFC research and seed stations for which DARP trained staff and to which the bulk of DARP commodities and equipment were assigned. Highlights of the construction program include:

- Five major regional research centers were provided research laboratories, screenhouses, living quarters, field and equipment stores, water supply, and drainage systems; and
- Three major DOA Seed Centers (production and processing) in the OFC growing regions were provided with seed processing and storage facilities, living quarters, drying and processing floors, and improvements to existing seed warehouses.

Details of the facilities construction component are provided in Annex Table B-7.

COMMODITIES PROCUREMENT

The Department of Agriculture was provided with commodities/equipment valued at \$2,240,000. Some of the items supplied to DOA included agricultural equipment, tractors, passenger vehicles, motorcycles, utility vehicles, laboratory equipment, mass media (audio-visual) equipment, computers and accessories, seed cleaners, and an array of office equipment and supplies.

The agricultural equipment (such as tractors, plows, harvesters, and sprayers) was assigned to the major DOA seed centers producing basic and registered seed. Six seed cleaners were installed in seed centers at Pelwehera, Aluttharama, and Nikaweratiya. Two new seed cleaners and a DOA seed cleaner were assigned for use by seed enterprises as support to the seed producers.

The transport vehicles (45) were assigned to all major divisions of DOA. The bulk of the nearly \$400,000 of research laboratory equipment was distributed among the major Regional Agricultural Research Centers (RARCs) dealing with diversification research.

In the second phase of the project, the audio visual center, farm broadcasting units, and television units of the DOA Technology Transfer Division were provided with sophisticated audio-visual equipment and accessories.

A large number of computers were provided to DOA divisions (research, economics, technology transfer, seed, and other) to directly support DARP-funded programs on computerization and training for DOA staff.

PART THREE

OUTPUTS AND ACHIEVEMENTS

Highlights of DOA/DARP activities in research, extension, seed industry development, horticultural industry development, and institutional strengthening are briefly described in this section. References are made to the original phase and extension phase only when required for clarification.

In each case, project outputs were accomplished by teams of DOA and contractor personnel. Details of the individuals and units responsible for carrying out project activities are omitted in the discussion of project outputs. For specific information on the assignment of technical advisors, see Annex Tables B-1 and B-2.

RESEARCH CAPABILITY

The original phase of DARP concentrated heavily on research to select appropriate crops for diversification, introduce germplasm, and determine the best farming systems for the expansion of production of food crops for local consumption. Agronomic research focused on soil fertility, plant spacing, and cropping systems. Technical assistance in agronomy concentrated on advising DOA officers on research plans for OFC s, analysis and interpretation of data, and guidance in writing research reports. Research conducted during the original phase established a knowledge base for the extension phase with information and technology that determined appropriate activities and workable solutions to agronomic problems in Sri Lanka. Socioeconomic research was geared to development of data collection and management systems.

The evolution of public policy from import substitution to a mixed import substitution and export strategy to support a more open, market-oriented system led to changes in the research agenda. This shift encouraged an emphasis on diversification, decentralization of the agricultural research community, and cooperation between research organizations and the private sector. At the same time, the extension phase emphasis on horticultural crops and seed enterprise development, which followed research findings, perhaps facilitated changes in public policy.

Market analysis became more important in the extension phase of the project. Emphasis on horticulture increased with the importation of germplasm and funding of research grants. Reviews of research management, seed policy, varietal release, and plant quarantine procedures were also carried out by the project.

Research Planning and Ccoordination

Fourteen crops were selected for special attention in DOA's plan for crop diversification. Timely research planning became a routine activity in the department with the establishment and operation of the Research Planning Cell.

DARP assisted in preparation of a five-year research plan after a lengthy analysis of priorities. A survey of research officers throughout the country was conducted concerning such areas as crop priorities, research priorities, management systems, allocation of resources, and professional development.

The Deputy Director/Research (DD/R) convened an intensive two-day seminar attended by 50 Research and Agricultural Economics Division staff members to discuss the results of the survey and identify the priorities of a new research strategy. Of the 80-90 crops under the mandate of DOA, 10 were proposed for top research priority and another 20 for secondary priority. Research thrusts were then identified for these top 30 crops and for specified technical disciplines.

Seminars and discussions with directors and research officers of RARCs across the country led to increased cooperation and communication between staff working on the same commodity at different research centers. Appointing research coordinators to area-wide projects further improved communication between RARCs and research staff. These activities helped Regional Technical Working Groups (RTWGs) to involve the Extension Division in research planning. More frequent visits by research management staff to RARCs and the establishment of an annual series of seminars also contributed to a better flow of information.

Linkages between DOA, international agricultural research centers, and national centers in neighboring countries with similar agroclimatic and cultural conditions were established or expanded during the project.

Recognition of the need for better communication between researchers on a national basis led to the formation of professional societies in extension, socioeconomics, and weed management.

Sri Lanka's varied physical environment requires special attention to research methodology. Careful placement of research plots and greater replication of experiments are necessary to produce results with coefficients of variation that permit identification of significant differences. Routine contacts with research officers resulted in the adoption of experimental procedures that permitted valid comparison of research data.

Assistance with analysis of research data was provided and reporting and publishing of results were encouraged through weekly contact with research officers at RARCs. This was supported by a research workshop held in cooperation with the DOA and the University of Peritonea at which the steps between the conception of a research idea and reporting and publishing research results were reviewed and discussed.

Socioeconomic Research

The baseline study conducted under DARP was the first large-scale computer-assisted agricultural survey to be conducted by DOA. The study consolidated information on production and marketing of OFCs to support research and extension activities, and provided inputs for the project monitoring and evaluation system. The two-season survey included 12 crops under rainfed and irrigated conditions in 60 crop settings from 4,000 farms. About 50 computer routines were developed to analyze the data and produce meaningful results. The procedure also served as a training exercise for research officers in DAEP who were closely involved in all aspects of the survey.

Five socioeconomic studies were conducted by staff of the University of Peritonea in cooperation with DOA.

A workshop on Farming Systems Research/Extension (FSR/E) held during the first year of the project reviewed the status in Sri Lanka. DARP financed the participation of 15 DOA officers at the Asian FSR/E Workshop held in Colombo in 1992.

Through other DARP surveys, some useful information about the farm population was generated with implications regarding the probability of adopting diversified crops (Table 2). About 32 percent of farmers indicate that farming is not their primary occupation, and another 35 percent paid rent or divided their harvest with a landlord. Both of these factors are negatively correlated with cultivation of crops other than paddy. Only 44 percent of farmers are not affected by these two factors.

TABLE 2
PRIMARY OCCUPATION AND STATUS OF FARMERS
(% of 170 respondents)

Primary Occupation	Farm Independently	Farm with Landlord	Total
Farming	44.1	24.7	68.8
Other	20.6	10.6	31.6
Total	64.7	35.3	100.0

*Numbers in total column do not equal 100.0 because of rounding.

Another study looked at policy issues surrounding diversification and made recommendations on future directions for DOA programs.

A special study compared the profitability of conservation farming systems with traditional farming. Adopters of conservation farming, combining perennial crops and livestock with annual crops, were found to be more efficient in their use of resources.

Market Analysis

DAEP staff wrote 9 papers on marketing of 7 crops and an overview of production and marketing of OFCs. A paper analyzing trends in area planted, production, and yields of 14 OFCs was also completed. Based upon findings of the studies, a policy paper was written listing the information requirements for farmers to make sound production and marketing decisions.

Cost of cultivation (COC) data collected by DAEP were used to conduct trend analyses and to produce production and marketing studies. Project assistance in the collection and analysis of COC data included modification of questionnaires, revision of computer programs, and preparation of a user's manual.

A study on data uses and methodologies demonstrated how available economic data could be put to better use. A shift in focus from studies on cost of cultivation by crop to whole-farm economic analysis was recommended. Three workshops were held to train DAEP staff in the appropriate use of software for different types of economic analysis.

In-depth studies were carried out on maize, soybean, and onion, focussing primarily on marketing issues, including estimates of demand and projections to the year 2000. Each report recommended specific programs and policy measures needed to encourage production of these crops. The reports concluded that further investments in research and extension on grain crops are not worthwhile, but that emphasis on onion production was economically justifiable.

Introduction of New Germplasm

Approximately 2,500 germplasm lines of field crops, vegetables, tropical fruits, and ornamental plants were imported for field trials and variety improvement programs. A breeding program was developed for legume crops. During the initial phase of the project, weekly contact was maintained with OFC breeders to provide assistance with research planning and assessment of results. Although vegetable crops were not included in the original DARP work plan, the introduction of germplasm by DARP and DOA staff resulted in support for vegetable research in the third year of the project.

During the extension phase, more than 200 varieties of orchids and 300 varieties of fruits were imported into Sri Lanka under closely monitored conditions. These materials were selected by DOA officers while on study tours in Thailand, Australia, and Malaysia. All materials were propagated immediately with high rates of success, and were carefully maintained by the Plant Quarantine Service while at DOA facilities. The materials were then distributed to research stations and seed farms. Because many varieties are already thought to hold promise for Sri Lanka, steps were outlined on setting up budwood gardens of sufficient size for propagation. Grafted trees from these gardens would be distributed to private nurserymen/women as "mother plants" from which they will propagate more plants for sale to interested farmers.

Reviews of Varietal Release and Plant Quarantine Procedures

The purpose of the Review of Varietal Release Procedures was two-fold: to suggest ways in which this mechanism may be improved, and to examine ways in which private enterprise may take responsibility for certain stages in the seed system. The most probable role of private enterprise is the introduction of new varieties (after appropriate testing) and seed multiplication for sale. The report proposed pathways in which the seed importer can enter the DOA's series of evaluative steps and achieve "recommended" status, or elect to present less evaluative documentation and request "listed" status. Procedures were also recommended for materials developed in Sri Lanka by non-DOA organizations, such as universities.

It was recommended that the two key committees involved in variety approval (National Seed Certification Committee and Variety Registration Committee) be reconstituted to include private sector and grower representatives. The recommendations were scrutinized in detail by participants at a

workshop, which was an important example of public and private sector cooperation to achieve common goals.

A DARP team worked closely with officers of the Seed Certification and Plant Protection Division (SC&PP) to complete a review of plant quarantine policies and procedures. As a result of this review, the plant quarantine system was streamlined for many low-risk items, while maintaining the restrictive policies for other plant materials where appropriate. A workshop was subsequently held with representatives of the private sector and other institutions.

The new policies were adopted and implemented, without the immediate need of amending existing laws and regulations. The SC&PP Division is strengthening its staff capabilities and facilities to implement an effective plant quarantine service.

Pest Management

DARP has made important contributions in weed management research programs. A national weed coordinator was appointed to organize weed management research in a systematic manner. A survey was conducted to determine farmers' weed problems and the effectiveness of their existing weed management practices. One hundred and forty-five weed specimens were collected, preserved, and deposited in the National Herbarium.

Effective control of *Cyperus rotundus*, one of the most serious field weeds in Sri Lanka, resulted from experiments in which herbicides were applied by an applicator modified by the weed coordinator and a DARP consultant.

The program on weed management resulted in the development of a 28-page technoguide, *Department of Agriculture Recommendations on Weed Management in Field Crops*, for use by farmers and extension staff.

TECHNOLOGY TRANSFER

The project design called for improved cultivation practices to be used by farmers in growing OFCs. As pointed out earlier, few DARP resources were aimed specifically at technology transfer in the early stages of the project. However, after devolution of extension personnel to the provinces, the village-level worker and T&V extension systems were discontinued. In response to this changed environment, DOA called upon DARP to dedicate resources to develop mass media communications systems to facilitate information and technology transfer.

Improved Practices

A comprehensive publication called *Crop Recommendations Technoguide* was developed and printed in English, Sinhala, and Tamil. The guide includes recommendations for farmers on 35 crops and 32 crop combinations. The *Technoguide* has been widely distributed and is used throughout the country.

Intercropping experiments and on-farm demonstrations of maize and legumes were organized resulting in increased unit area productivity and profits of 15 to 35 percent in some districts. Intercropping was adopted by farmers in both Maha and Yala seasons.

Extensive demonstrations were carried out to show the benefits of growing new crops in low-lying paddy lands during Meda (just after Maha) and in Yala season. Cultivation in Meda seems to have good prospects for expansion, especially because there is no competition with other crops during that season, and per acre cost of cultivation is low. In 1993, the area of demonstrations for Meda crops was expanded from 20 hectares to 250 hectares.

Yala season demonstrations focused on use of low-lying paddy lands where water is insufficient for paddy cultivation. Crops included onion, blackgram, chilli, cowpea, green gram, groundnut, red onion, soybean, sweet potato, and other vegetables. In many cases farmers were growing these crops for the first time. In other cases, they had grown the crops in uplands, but had not previously used fallow paddy lands for these crops. In a few instances, such as with sweet potato, the idea of the demonstrations was to expose farmers to a new variety and new cultivation techniques. Field days to draw farmer attention to the demonstrations were well attended. (Impacts of the new technologies are described in Annex A, Commodity Assessment.)

Mass Media Programs

An analysis of mass media activities, staff, equipment, and facilities was conducted and a pilot project using an optimal mix of available media was recommended. A communications baseline survey was conducted with field interviews of 170 farmers throughout Sri Lanka.

Farm Broadcast Service staff were trained on the job continuously over a three-month period in 1993. Methodology of program planning was covered in detail and practiced in a farmer magazine quiz program in Colombo and field documentaries. Under this methodology, program objectives were listed on the planning board at least two weeks prior to the respective broadcast day. Senior management made their observations and suggestions on the same planning board. Other local training was provided in video production and desk-top publishing.

Four mass media campaigns were carried out. The campaigns were designed to focus activities of the Audio-visual, Farm Broadcasting, and Publications centers around specific topics of high priority for the agricultural sector. The campaigns were as follows:

- **Safe use of pesticides:** October 1992 to July 1993. A 15-minute TV discussion program was held. Newspaper articles appeared in May and August 1992. Eight radio spots in Sinhala and Tamil developed and broadcast daily through the Maha growing season (November, December). A total of 436 banners, 5,300 posters and 25,000 fliers were distributed during this period through provincial extension officers. A leaflet on neem as a pesticide was distributed.
- **Meda season cultivation:** December 1992 to April 1993. Several radio announcements and programs were broadcast over regular DOA radio programs. A 15-minute TV discussion was held in February 1993. Lead newspaper articles featured Meda season cultivation in December 1992 and January 1993. About 8,000 fliers were printed and

distributed. Some provincial extension services produced a limited number of banners and posters. This mass media effort supplemented the massive field demonstration program described earlier.

- **Cultivation of OFC in paddy lands:** March to August 1993. Materials for this campaign included radio spots, TV program, newspaper articles, and leaflets. Leaflets covered a wide range of crops, including big onion, chilli, rambuttan, passion fruit, pineapple, and mangosteen. A booklet was published on big onion. Over 250 banners were distributed to provincial extension offices. This campaign was implemented to support DARP field extension activities.
- **Quality seed promotion:** March to September 1993. Planning for this campaign included persons from inside and outside the department to get new views and inputs. The focus of the campaign was to promote use of high-quality paddy seed either from the farmers' own fields or from formal suppliers. Additionally, the messages stressed that farmers look for seed certification labels when they purchase seed. Materials are being prepared, including two radio spots, a video, TV spot, a lead newspaper article, and a leaflet. This effort supports other work in seed industry development (see below).

Recommendations for the DOA effort in using mass media communications to support extension and to publicize activities were:

- Establishment of Communication Advisory Boards;
- Routine assessment of impacts of communication efforts;
- Staff and work flow organization;
- Delegation of decision making and streamlining approvals;
- Establishment of a provincial presence for extension communications;
- Institution of an employee development program;
- Expansion of good public relations program; and
- Technical support and operating budget.

The Honorable Minister of Agricultural Development and Research, R. M. Dharmadasa Banda, led a half-day seminar on the topic of community radio. The seminar, organized by DARP, presented the concept of community radio, which involves participation of the local population in selection of topics and design of programs. This two-way communication can only be achieved on a localized basis. Prior to the seminar, a 30-minute video, prepared during a DARP training exercise, was shown depicting the activities of the DOA.

SEED INDUSTRY DEVELOPMENT

The project was challenged with development of a seed industry based on private enterprise even at a time when the state (through DOA) produced, imported, and marketed all seed sold in Sri Lanka. The project design called for production and distribution of sufficient OFC seed to cover 10 percent of the area planted. However, development of the seed industry was to include all important seed crops, including paddy.

Private Seed Enterprise Development

Selected accomplishments during the first phase of DARP included a national workshop to evaluate the current status of the seed industry and chart directions for continued development, cost-of-production studies, establishment of the Seed Development Unit to provide technical assistance to new seed companies, establishment of a Seed Association comprised of seed importers, reduction in the number of government seed farms from 37 to 19, research into improved seed packaging, and increased certification of OFC seeds.

During the extension phase, DOA took more initiative to assist in formation of independent enterprises. A Multipurpose Cooperative Society showed the most initiative in paddy seed production. A business plan was outlined and discussed with the manager and his staff and with contract growers. This business plan revealed that producing seed paddy is a worthwhile venture, and that it is possible to cover costs with a modest increase over DOA's current price.

After the initial enterprise began successful operation as "Royal Seeds," the plan was quickly replicated by three more cooperatives and other private agribusinesses. DARP assisted seed enterprises in other crops such as chilli, beans, and tomato. (See Annex C for a list of nearly 20 seed enterprises currently in operation.)

These new enterprises were guided and assisted by DOA, and were provided basic seeds and use of DOA facilities storage and processing. These seed enterprises together produced about 410 metric tons of seed paddy, 10 metric tons of bean seed, and 5 metric tons of chilli seed in their first season of operation, Maha 1992/1993. By the end of the project, independent enterprises were producing 100 percent of commercial chilli seed, about 20 percent of paddy seed, and probably 15 percent of bean seed. Okra is the next crop that could receive attention of private seed enterprises. Others vegetables such as tomato may soon follow.

It appears that importation of most onion seed is a better use of resources than domestic production. DARP helped promote a limited amount of onion seed production to help guard against interruptions in supplies from other countries. Targets for grain seeds, such as maize and green gram, were not viable due to limited demand. Soybean seed is produced by one seed enterprise and has possibilities for expansion.

Seed Processing and Marketing

New processing equipment was imported and installed in DOA facilities to replace older, existing equipment. These will be useful in the processing of basic (foundation and registered) seed by DOA. Some of the older machines, appropriate for commercial seed cleaning, are being transferred to independent enterprises. The first of these transfers had been initiated as the project ended. DARP funded the procurement of two additional cleaners that will also be provided to independent enterprises. This equipment will help enable the new enterprises to meet the standards stipulated by the Seed Certification Service.

A major seed marketing study was conducted using a farmer survey and secondary information sources. Some highlights were:

- Farmers recognize the importance of using high quality seed in almost all crops. This suggests that the seed market can very likely expand given increased promotion and distribution.
- Cooperatives and private dealers are the most likely channels to improve distribution, because they have sales outlets already in existence.
- The formal seed market is characterized by repeat buyers who purchase seed every year or once in two or three years.
- Low prices may help attract a first-time buyer, but high quality will attract repeat customers.
- High germination is the dominant factor that leads to increased productivity. Poor germination is the most serious problem with seed quality in Sri Lanka, even with seed purchased from formal sources.

Seed Policy

The emergence of new enterprises and support in processing and marketing are evidence of the recent strategy being pursued by DOA. DARP has assisted with efforts to communicate this strategy to a wider audience and to develop a policy statement that would serve as a guide to the rapidly growing number of participants in the seed industry.

Provincial seed workshops became a forum to discuss efforts of all organizations involved in production; management of resources for the development of the seed industry; private sector seed enterprises; cooperatives; farmer organizations; and regional, provincial, and national officers. The discussions led to the evolution of policies to promote the seed industry and efficient management of scarce resources.

DARP provided funding for six participants to conduct a lengthy study tour to visit the United States, two countries in the region (Thailand and Indonesia), and two in South America (Colombia and Bolivia) to explore alternative approaches to seed industry development. After the tour, the group drafted a new seed policy for Sri Lanka, which emphasizes support to the development of independent seed enterprises and promotion of production and use of high-quality seed.

Based on this document, a new policy statement was drafted and is nearing release by the Government of Sri Lanka as of August 1993. The primary objectives of this policy are to refocus DOA seed programs to take a proactive industry promotion approach and to place the responsibility for commercial seed production entirely with the private sector. Elements of the draft policy include:

1. The Ministry of Agricultural Development and Research (MADR) will explore new ways to foster collaboration between government crop improvement programs and the private sector.
2. The commercial seed production/distribution program of DOA will be refocused toward the provision of basic seed to seed-producing enterprises.

3. The private sector will be encouraged to carry out production, processing, distribution, and marketing of commercial seed with technical and quality promotion services from DOA.
4. The private sector will continue to import seeds and planting materials while strictly observing the plant quarantine policies of MADR.
5. A National Seed Development Committee will be formed to help coordinate and develop the seed industry in Sri Lanka.
6. Seed certification programs will adopt a proactive stance in the promotion of quality seeds. Quality standards attained by the seed industry will lend prestige to the seed industry and will enhance farmer confidence.

HORTICULTURE

Several reviews of horticultural crops and the horticultural industry were conducted, culminating with the horticultural assessment conducted at the beginning of the extension phase of the project. This effort led to two specific studies:

- Plan for development of perennial tropical fruits; and
- Plan for development of the horticultural industry in Uva Province.

The assessment pointed out that the lack of a specialized institution to focus on horticulture has hampered the development of tropical fruit production. The plan for tropical fruits recommended methodologies for selection of priority fruit species. Six sites were identified for concentration of DOA activities in propagation, including establishment of budwood gardens and mother tree orchards.

In 1993, DARP conducted a prefeasibility study for the improvement of the commercial horticultural industry in Uva Province. The major constraints hindering growth of the commercial horticultural industry in Uva Province are the availability of suitable land and water. Larger tracts of 100 hectares or more are needed for commercial-scale nucleus estates if fruits are to be developed for processing or export markets. The analysis covered not only horticultural production, but also postharvest handling, processing, and marketing, both domestic and export. The recommendations for improving the horticultural system in Uva Province are germane to the national horticultural industry:

- Control of virus and bacterial diseases;
- Water management for year-round production;
- Technical assistance throughout the system;
- Procurement of appropriate planting material;
- Operation of production units as commercial enterprises;
- Expanding contract growing;
- Improving product flow;
- Improving postharvest handling technology;
- Improving infrastructure;
- Emphasizing market-based decision making; and

- Increasing farmer involvement in the marketing system.

Agribusiness groups, including existing plantations, and farmer-owned marketing associations are seen as driving forces for future development. At the same time, support from the Provincial Government and DOA are essential.

In addition to the two studies, DARP developed five courses in nursery management and tropical fruit propagation. The courses included theoretical discussions and practical training. The first course was for DOA technical staff such as budders, grafters, and farm managers; the second targeted DOA officers. The next three were for private nurserymen.

An awards ceremony was held with all 140 participants, the Honorable Minister, R. M. Dharmadasa Banda, and the Director of the USAID Mission, Richard Brown. High-quality budding knives were presented to each participant along with a certificate for completion of the course.

The First National Horticultural Exhibition was presented by DOA in July 1993 near Peritona. The exhibition ran for 10 days and drew more than 40,000 visitors each day. Virtually every arm of DOA carried out its role in making this exhibition a major success, getting national attention of the public and policy makers throughout Sri Lanka.

MANAGEMENT CAPABILITIES

DARP was originally conceived as an institutional strengthening project. Development of management systems was to focus on inter-divisional coordination in decision making. In addition, later in the project, DARP helped automate data handling systems through provision of computers and training in the use of software packages.

Management Systems

Throughout the project, management techniques were periodically discussed with DOA officers. Several DOA professionals received short-term training abroad in the administration of agricultural programs.

A program of merit-based promotion for Extension Division personnel was established along with systems to monitor performance and provide incentives to extension staff. Job descriptions were developed for employees in the Education and Training Division.

The above activities were a prologue to two short-term consultancies on organizational development, leadership, and management. The first included interviews with 15 top leaders in DOA and five workshops attended by 130 professionals. These activities led to an identification of DOA's leadership and management needs. The second consultancy featured a workshop for the Directorate and 20 other top leaders in the department. This workshop produced a mission statement for DOA to facilitate departmental policy formulation and guide decision making. Another workshop with leaders of each division resulted in the development of goals, operational management objectives, and a list of

concepts for learning modules to be included in the department's long-term leadership and management training programs.

In 1990, DOA modified its structure, reducing the number of divisions. Though helpful, these changes did not solve some of the continuing problems of leadership and decision making, especially related to interdivisional coordination. At the request of the Director of DOA, DARP assisted with a training program for 24 DOA executives and senior officers over a one-year period. This group participated in three training needs assessments and workshops that focused on individual management skills and DOA organizational issues. One of the exercises asked the participants to define their vision of the DOA in the year 2010. A selection of results follows:

Primary DOA Clients:	Producers of staple foods Export-oriented farmers Processors Consumers and general public Private sector organizations Farmer organizations
DOA Services:	Research Production, processing, and value added technology Regulatory functions Environmental protection Information services Training Planning, monitoring and evaluation of agricultural programs

While these workshops were being conducted, the Minister of Agricultural Development and Research announced plans for a major restructuring of DOA into commodity-oriented units, as opposed to the current functional breakdown of divisions. A Management and Organization Development Task Force (MODTF), appointed by the director from the group of participants, reviewed some of the proposals for restructuring and provided comments and guidance.

Data Management Systems

Computerization and data management gradually became a project theme for institutional strengthening in most units in DOA.

In the original project phase, workshops provided training in data management and microcomputer software technology to 97 professionals, while 20 officers received personal instruction. The first computer network in DOA was installed at the Seed Division with DARP assistance in March 1990.

A computerized payroll system was developed and put into operation after an initial assessment and specification of appropriate equipment and software. During the extension phase, more than 200 officers received training through local institutions. Specific improvements related to statistical data handling and analysis and desk top publishing are discussed above.

PART FOUR

CURRENT STATUS AND OUTSTANDING ISSUES

The outputs and achievements of DARP contributed to three objectives:

- Diversification of crop production;
- Seed industry development; and
- Institutional strengthening.

End-of-project status and outstanding issues are discussed under these three headings along with additional comments regarding impacts that may be realized over time.

CROP DIVERSIFICATION

Crop Priorities

The results of the brief commodity assessment (Annex A) demonstrate that the process of crop diversification is taking hold in Sri Lanka. Progress in grain crops has been limited, but significant achievements are apparent in higher-value crops such as chilli and onion. The value of production of crops considered as initial targets for diversification increased by more than \$4 million per year from 1981 to 1992.

Currently, half the value of all food crops under the responsibility of DOA can be attributed to fruits and vegetables; about 40 percent to paddy (rice); and only 10 percent to other grains. Data on the value of ornamental plant production were not available, although potential for expansion in this sector is significant. Along with ornamental plants, prospects for increases in both the production and value of fruits and vegetables are excellent.

For many years, crop selection for diversification followed the import substitution or national self-sufficiency policies in place at the time. Although not diminishing successes in chilli and onion production, the project (and DOA) missed important income-earning possibilities for farmers in other crops, notably tropical fruits for the local market and tropical foliage for export.

In recent months, the project and DOA have moved to adapt institutional and operational mechanisms to support income-generating activities of Sri Lankan farmers. Expansion of DOA efforts from an import substitution approach to market-oriented agricultural systems include developing and improving agricultural technologies aimed at existing markets; improving crop genetic resources, particularly for underexploited crops targeted at existing domestic and export markets; developing plant quarantine procedures that facilitate the import of genetic resources and export of agricultural products; diversifying the DOA client base from "the farmer" to the actors in the agricultural and food system

network; and changing the institutional orientation of the department towards a more broadly defined client base.

Client Diversification

It is no longer sufficient to identify the DOA client as the farmer. To serve the needs of commercial agriculture, DOA must take a broader view of clients. Possible client groups that may require support through DOA services are:

- General public;
- Rural population;
- Subsistence farmers;
- Commercial farmers;
- Part-time farmers;
- Agricultural enterprises;
- Organized farmer groups;
- Persons engaged in marketing and handling;
- Plant nurserymen and women; and
- Policy makers.

This list is not definitive nor can DOA meet all the needs of each client group. DOA should carry out an environmental scan to further identify and characterize its clientele into meaningful groups, identify services that each group needs or wants, and prioritize DOA resources to deliver those services. Discussions on these topics were initiated in recent management training exercises under DARP.

Research and Development

Project support to agricultural research has been effectively used, although continuity of long-term technical assistance in agronomic and horticultural research should have been provided throughout the extension phase of the project. Special funding on a competitive grant scheme would be useful for research to meet the needs of specific client groups in the future. The DARP evaluation report also suggested an arrangement of this type in DOA.

Research officers must begin to consider themselves to be development officers rather than merely reporting research findings in their own narrow discipline. Research conducted within the parameters of a clearly defined strategy, where officers understand the importance of their work in the context of developing commercial crops and products, may be transferred more readily to DOA clients. Specialized programs could be developed for major crops providing an effective interface for researchers, producers, and commercial enterprises. Specialized programs should be located in primary areas of production for each crop.

The major food crops in terms of value (in no particular order) are paddy, banana, mango, onion, chilli, and potato. Study teams, to include an agronomist or horticulturalist and an economist, should be formed to conduct assessments of these six crops, including both demand and supply analyses, and export potential where relevant (not to the exclusion of input from client groups!). Recommendations of these studies would be used to formulate department strategies and focus future programs.

Statistical series need improvement, especially for fruits and ornamental plants. Data is reported regularly from the field, but up-to-date data series are difficult to obtain, even for standard crops such as OFCs. There is duplication of efforts between DOA divisions, MADR, and Census and Statistics.

The *Technoguide* has been well received. The list of subscribers needs to be maintained, and updates should be made periodically.

Field Programs and Media Support

Data suggest that upland areas during Maha season are being fully utilized, and that cropping on paddy lands during Yala is increasing. Judging from feedback from field days organized by provincial staff, crop demonstrations seem to have an impact on farmers. However, the planning and setting priorities for research, extension, and demonstrations needs to become more of an interactive process, requiring the support and commitment of DOA officers. Follow-up monitoring of farmer adoption and reporting experience is badly needed to modify and improve programs. Without an efficient information exchange and management system to guide extension work, field programs tend to become routine and repetitive, and may fail to address real needs of the client.

Mass media programs are being carried out effectively and skillfully, as planned. Centering activities around "campaigns" gave focus to efforts, and linked mass media with other ongoing field activities. Systematic monitoring will be needed to tailor messages and balance the use of different media. Impact assessments are essential, because there is no solid evidence available at this early stage to verify that these campaigns are having an impact on awareness and behavior of the target audiences. Priority topics need to be continually reviewed and discussed by program planners and DOA client groups.

Horticultural Development

Improved plant materials have been imported and established on DOA farms and research stations. The primary concern should now be to identify ways of getting this material channeled through nurserymen to the grower. This is another instance where specialized services will be needed: for example, to provide training in nursery management and propagation of perennial fruits.

For the development of a significant fruit and vegetable industry, market integration will be necessary: wholesalers and produce handlers linked with growers in a coordinated system, similar to contract growing schemes, where farmers are producing crops for a particular market. (One agribusiness company is currently distributing mango plants to outgrowers to develop this kind of production program.) Although agribusinesses must necessarily take the lead in implementing these systems, DOA and other public agencies can provide assistance in appropriate technologies such as postharvest handling and extension programs oriented towards agroenterprises and integrated production-marketing systems.

The undoubted success of the National Horticultural Exhibition suggests that DOA might consider establishing a permanent exhibition site and appointing staff to organize and hold events of this kind. With such an infrastructure, DOA could support exhibitions in other disciplines besides horticulture.

SEED INDUSTRY DEVELOPMENT

More than 15 seed enterprises are now operating in the country, producing 25-50 percent of all locally produced seed. These enterprises were formed during the past year, and more are being formed. With proper support, the number of seed enterprises could double or triple in the next two to three years. It will take several years before these enterprises gain sufficient experience to become mature concerns, capable of providing high-quality seed and promoting its use among farmers. Further DOA and USAID support is highly justified in the development of this industry.

Seed quality rapidly deteriorates under prevailing conditions in Sri Lanka. One strategy to improve seed quality is to produce seed crops in the off-season to reduce the storage time before seeds are used in the next growing season. Timely harvest and immediate drying are also important factors in preserving seed quality. Practical research and demonstration programs on the preservation of seed quality in Sri Lanka are needed.

The seed certification process must also become a more open system where all producers and distributors are involved. The system needs to actively promote seed quality and use, rather than simply identify seed lots that do not meet standards. The Certified Seed label should be promoted and should gain prestige with improvements in quality. Certification personnel, however, need to adopt the concept of Development Officers and work with seed growers to help them produce a high quality product.

A national seed market study was completed under DARP. Additional specific studies will be needed as enterprises diversify into more crops and as they require more specific information about potential clients and markets.

The transfer of four seed cleaners from DOA to private enterprises should be completed as soon as possible. DOA will be left with several times the capacity it will require for cleaning of basic seed. The six new cleaners installed in DOA facilities by DARP are sufficient to meet DOA needs for basic seed production. All others are better utilized if transferred to commercial enterprises.

A seed industry association will be increasingly important to support the developing seed trade in Sri Lanka. A federation may eventually emerge among three private groups: seed enterprises, nurserymen, and seed importers. Assistance to these organizations is an appropriate target for USAID support.

A national committee with equal representation of public and private sectors could be formed to help coordinate the growth of the seed industry and consider policy changes that would promote the production, marketing, and utilization of quality seed by farmers.

INSTITUTIONAL STRENGTHENING

Human Resources Development

The extensive participant training program under DARP has significantly increased the capacity of the organization to carry out complex technical tasks in research, extension, seed development, plant quarantine, and many other areas.

DOA must continue to evaluate its human resource development needs and develop a training plan with clear priorities. Such a plan would state clearly the need for training in a particular discipline and how the program would enhance the DOA's capabilities to fulfill its mandate to provide services to Sri Lankan agriculture. As DOA redefines its client groups and objectives, there will likely be several new and valid training objectives to meet client needs.

Efforts to link long-term DOA training with degree programs in local universities were not successful. Attempts to conduct a portion of degree programs through local universities should be carefully planned and agreed upon in advance. The attitudes of participants and DOA toward obtaining degrees from local universities should be reviewed in planning these programs.

Data Handling and Computerization

Efforts in this area were not included originally in the DARP project design but evolved over time with changing project and DOA requirements. DARP provided equipment and a great deal of local training in basic computer operations. An improved payroll program is now operational.

The need to continue to update equipment, software, and "liveware" are never ending. Still more equipment will be needed in the future to keep up with the demands of a more varied clientele.

DOA should train and assign one or two officers to become in-house backstoppers for other computer users.

Project Management

Project management on the part of DOA consisted primarily of one part-time officer to assist with internal communications between the director and deputy directors and project staff, and with USAID. Personnel was not sufficient to take the lead in planning activities, monitoring, reporting, and assisting with logistics of implementation.

The Project Manager reported to a deputy director, placing him in a compromising situation with limited authority. For a project of this magnitude that embraced various divisions, the Project Manager should have reported to the Director of Agriculture.

DOA project management should use most of its time and energy bringing focus to activities, bringing divisions together to define desired outputs, outlining steps to obtain the desired outputs, and setting up monitoring and impact evaluation systems.

Management and Leadership

DOA adopted a useful mission statement developed during a DARP management training workshop. Several senior officers and executives attended courses in management and administration through the participant training program in the United States and elsewhere. More recently a group of senior officers participated in three week-long management training workshops.

DOA modified its structure in 1990, consolidating several divisions in an effort to achieve better coordination among working units and to scale back on the number of people reporting to the director. Although successful for a time, it is now seen that further change is desirable. The Honorable Minister of Agricultural Development and Research has announced plans for a restructuring of the institution, primarily by combining functional divisions and organizing commodity-focused institutes.

Although the concept of change seems to be generally accepted, the new directions are still not clear and are not agreed upon by all those concerned (stakeholders). An environmental scan, mentioned above, is needed to help guide the organization through this change. Outside assistance of professional organization and development specialists would be extremely useful to facilitate open deliberation and communication.

Throughout this process, the department should focus on identifying the services that it has clear mandate to perform. (Client/stakeholder input is critical.) It should tailor those services and delivery mechanisms to meet the needs of its clients. Further, DOA should cut back in areas of low priority, especially in areas where it overlaps and competes with other organizations in the private and public sectors.

FOLLOW-UP ON DARP IMPACTS

As shown in the commodity assessment referred to earlier, the process of crop diversification did not begin with DARP, but instead was accelerated by the project through a stronger DOA. Many of the impacts of the project will be seen only in future years. Future impacts that could be monitored are:

- *Crop diversification.* Expanding cultivation of crops such as chilli, onion, and other vegetables is to be expected. Expansion of green gram might occur with the expansion of cultivation in the Meda season. Other grains such as maize and soybean can be increased with coordinated efforts to link growers with markets. The department should routinely publish statistical series related to important crops, including fruits and ornamental plants, and should include indicators of crop diversification in regular reports.
- *Adoption of technology.* DOA should be particularly concerned about following through with its client groups to measure the degree to which new technology is adopted and the problems farmers and other clients experience, and to obtain feedback on and possible modifications that might be worth exploring. Baseline information is available, including not only cropping patterns but also many aspects of technology applied in growing

selected crops. A handful of key technology interventions developed and recommended by DOA could be identified and monitored.

- *Utilization of personnel trained under the project.* Monitoring could be done internally by DOA. Such information would be useful in formulating new plans and priorities for future training.
- *Germplasm introduction and distribution.* An ongoing record and report of the introduction of germplasm and of the distribution of plant materials would be useful. This would serve as a means of advising nurserymen and others about the availability of plant materials in the country, and demonstrate the amounts of these materials that are getting out to the private sector.

ANNEX A

COMMODITY ASSESSMENT: OTHER FIELD CROPS

OTHER FIELD CROPS

This brief assessment provides an overview of production trends in alternative promoted by DARP. It then goes on to estimate the overall impact of the project. Some of the conclusions cited in the main report will draw upon the information presented here.

For the first several years of DARP, efforts were centered around crop diversification into other field crops (OFCs). OFCs, as defined in Sri Lanka, included crops that might be regarded as field crops, like maize and green gram (mung bean) and others that would normally be categorized as vegetables, such as onion and chilli. Thus, the OFC category refers to intensively produced crops, such as potato (which could also be regarded as a vegetable here due to the nature of its cultivation and high value), and extensive crops such as sesame (locally known as gingelly). We first consider only field crops. Onion, chilli, and potato are classified as vegetables and are included later.

The table below lists field crops other than paddy in order of importance according to value of production.

MAJOR FIELD CROPS BY VALUE OF PRODUCTION, 1989/90

OTHER FIELD CROPS	EXTENT (hectares)	PRODUCTION (m.t.)	PRICE (Rs./m.t.)	VALUE (Rs. 000,000)
Green Gram	34,000	26,500	28,400	752.6
Cowpea	27,000	21,600	23,000	496.8
Maize	41,300	45,300	9,250	419.0
Groundnut	9,000	8,200	20,000	164.0
Gingelly	16,500	8,500	17,000	144.5
Kurakkan	8,000	6,800	17,000	115.6
Soybean	5,800	5,200	18,000	93.6
Black gram	7,700	3,700	17,500	64.8

Source: Division of Agricultural Economics and Planning (DAEP),
Department of Agriculture

Insufficient time series data were available on sweet potato for it to be included. Five more OFCs were dropped from this presentation because of their low overall economic importance. They were groundnut (peanut), sesame (gingelly), finger millet (Kurakkan), soybean, and black gram. The ones remaining are:

- Green Gram
- Cowpea
- Maize

A brief overview of each of the crops listed above is given in the following sections.

Green Gram and Cowpea

These crops, and others such as pigeon pea, are usually grown as substitutes for lentils, which are imported in a hulled and split form known as dhal. Lentil dhal, commonly referred to as Mysore

dhal, is widely consumed as a curry. The production of green gram (mung bean) and cowpea surged after import restrictions on dhal were put into place in the late 1970s. The table below demonstrates that cowpea production rose especially between 1976 and 1981.

LOCAL PRODUCTION OF GREEN GRAM AND COWPEA

	Green Gram (000 metric tons)	Cowpea
1976	5	12
1981	19	39
1986	17	17
1991	36	20

By 1986, about the beginning of DARP, cowpea production had declined to its current levels, around 20,000 metric tons per year. From 1986 to the present, however, local production of green gram has risen to fill the void. Green gram demands a higher price in the local market than cowpea (usually 40 percent higher or more at the farm gate), while yields of the two crops are similar. Green gram yields have seen some ups and downs, but have improved significantly during the last 8 years.

Both crops are grown mostly on highland soils during Maha season. Production during Yala is increasing, by planting on paddy lands in places where irrigation water is insufficient for a crop of paddy. Therefore expanding area of these crops has not been in competition with growing of paddy in either season. It is apparent, however, that the two crops do compete with each other for land and other resources. Farmers likely consider growing either cowpea or green gram on a given parcel of land.

Green gram cultivation is also being promoted as a sandwich crop after Maha, making use of residual moisture and fertility after a crop of paddy. This is referred to as the Meda season. It is believed that with continued promotion, the Meda season can become important, perhaps up to the tens of thousands of hectares.

Maize

The primary market for maize is as an ingredient in feed for the expanding poultry industry in the country. Most maize used in the local feed milling industry is imported. Therefore increased production of this crop is also of interest for import substitution.

The majority of maize production in Sri Lanka is found in a belt running along the eastern portion of the country, from the North Central Province to Southern Province. It is grown almost exclusively during Maha season on highland areas. Because of the place this crop takes in the farming system virtually covering land with an extensive crop and applying little labor or other inputs yields have been low and have not improved over the years. Area planted, however, increases at about 1,000 hectares per year, undoubtedly associated with the opening of new lands throughout many of the remote areas on the eastern side of the country. Around 45,000 hectares are grown each year, producing about 1 metric ton per hectare.

Marketing and transportation have been costly because the point of delivery to the main feed miller is located across the island in Colombo. Therefore farm gate price is low, making this crop even less attractive to farmers.

Although research results show that yields of 3 to 4 tons or more are commercially feasible, it appears that farmers that have the capacity to intensify cultivation can choose other crops which would provide even more income.

Horticultural Crops

DARP has assisted with the development of several horticultural crops, including fruits, vegetables, and ornamental plants. This effort gained momentum over time, and was not included in the impact tracking system of the project. Information is available on several vegetable crops starting only in 1985. Data on fruit production can be found, but is thought to be unreliable. Data on the ornamentals industry is not routinely gathered and reported, but instead exists only in specific studies which are not comprehensive in nature.

The table on the following page provides a glimpse of horticultural crops that fall under DOA. Crops in each category are listed in order according to their estimated gross value.

Sufficient time series data is available only for a few of these crops. The following were singled out for more detailed presentation:

- Potato
- Chilli
- Red Onion
- Big Onion

Potato

Potato is widely consumed in Sri Lanka, and importation of consumption potato is prohibited. Local production has been restricted primarily to the up-country, where land is scarce and costly. Therefore, the potato price is very high in Sri Lanka compared with other countries. Without the ban, there would certainly be a large quantity of potatoes brought into the country. Therefore promotion of this crop is also in the category of import substitution.

Total area planted — total of both seasons — was around 3,000 hectares during the 1970s, but expanded to 6,000 hectares by 1983. It then leveled off to between 6,000 and 8,000 hectares during the past 10 years. Yields are around 12 metric tons per hectare. The troubled northern region of the country used to produce an important amount of potato, but current production reported from those areas is now very low.

Potato seed free of disease has been a limiting factor to improvement of yields. To be kept free of virus diseases, seed would ideally be grown from material propagated in screenhouses, and then multiplied in the field at very high altitude. Greenhouse capacity is currently insufficient, and land for multiplication naturally becomes more scarce and costly as elevations rise. Consequently, clean seed potato is not available in sufficient quantities and demands a high price even over the already high price of consumption potato.

Besides increasing yields in the up-country, it is thought that this crop may in the future be grown in other parts of the country. There are also proposals to open the door to imports, which would be less expensive for the consumer. It can be argued that up-country farmers can grow alternative high-value

MAJOR HORTICULTURAL CROPS BY VALUE OF PRODUCTION, 1989/90

	EXTENT	PRODUCTION	PRICE	VALUE
FRUIT CROPS	(hectares)	(000 units)	(Rs./1000)	(Rs. 000,000)
Banana	36,000	27,500	80,000	2,200.0
Mango	12,000	308,400	5,200	1,603.7
Passion Fruit	1,400	42,800	9,800	419.4
Papaya	3,300	36,000	8,700	313.2
Orange	3,200	34,000	8,700	295.8
Pineapple	4,300	28,600	9,790	280.0
Subtotal	60,200			5,112.1
VEGETABLES	(hectares)	(m.t.)	(Rs./m.t.)	(Rs. 000,000)
Red Onion	8,500	92,000	36,500	3,358.0
Chilli	32,000	35,075	89,150	3,126.9
Brinjal	4,600	65,000	12,800	832.0
Cabbage	2,100	59,000	13,800	814.2
Beans	5,300	41,500	18,000	747.0
Tomato	1,380	34,000	19,850	674.9
Okra	4,500	32,500	13,800	448.5
Beet	1,500	21,500	16,400	352.6
Big Onion	810	8,542	36,100	308.4
Bitter Gourd	3,500	20,700	13,750	284.6
Carrot	800	11,000	19,500	212.3
Leeks	640	9,600	18,500	177.6
Raddish	1,450	16,500	9,600	158.4
Knolkhol	1,250	11,500	11,550	132.8
Subtotal	68,330			11,628
OTHERS	(hectares)	(m.t.)	(Rs./m.t.)	(Rs. 000,000)
Potato	7,900	96,000	27,000	2,592.0
Turmeric	1,400	12,000	40,000	480.0
Ginger	1,600	10,000	35,000	350.0
Subtotal	10,900			3,422
Grand Total	139,430			20,162

Source: Division of Agricultural Economics and Planning (DAEP), Department of Agriculture

Notes: Includes major horticultural crops falling under the responsibility of the DOA

Figures for annual vegetable crops are from 1989 Yala and 1989/90 Maha seasons

vegetable and fruit crops, and that reduction of potato cultivation would ease pressure on the up-country physical environment.

Chilli

Chilli is a very important crop to Sri Lanka, and widely consumed. Dry chilli is ground and included in curries. Green chillies are also consumed, along with a larger chilli pepper called capsicum. Production of this crop increased gradually over past 25 years, due in large part to increases in yield. The north and east has been an important producer, but reports from this region show marked highs and lows since the outbreak of civil disturbances.

Chilli was once mainly a Maha season crop, but production in Yala season has risen dramatically. It is grown about equally in Maha and Yala seasons today, but Yala season production continues to expand more than that of Maha season. The table below demonstrates this change for dry chilli in the years leading up to DARP and during the project.

EXTENT, PRODUCTION AND AVERAGE YIELDS OF DRY CHILLI,
TWO SELECTED PERIODS

	<u>Maha Season</u>		<u>Yala Season</u>	
	<u>1981-85</u>	<u>1986-92</u>	<u>1981-85</u>	<u>1986-92</u>
Extent (hectares)	15,226	16,149	13,230	16,742
Production (mt)	9,553	12,450	15,853	20,634
Average Yield (mt/ha)	627	771	1,198	1,233

Yields are much higher during Yala season when the crop is grown mostly on low-lying paddy lands.

Onion

There are two distinct kinds of onion grown in the country, called red onion and big onion. Red onion or shallots are grown from bulbs, whereas big onion is grown from seed. The propagation of big onion therefore requires two seasons, one for planting seed and producing bulbs for consumption. In the other season, selected bulbs are planted for producing seed. Most seed, however, is imported at present.

Both onions are widely consumed. The smaller red onion is more pungent, and is generally preferred. However when big onion is scarce, its price actually goes higher than that of red onion, showing that some consumers prefer big onion. Because big onion has traditionally been imported, it is possible that urban consumers the ones with access to centrally located markets have become accustomed to it. Preparing foods with the larger onion may also be more convenient for the urban housewife. In practice, both onions seem to be nearly perfect substitutes for each other in the market place.

Red onion was produced predominately in the Northern Province, or more specifically the Jaffna peninsula. Since the disturbances in that region have interrupted supplies, production migrated into the Kapitiya peninsula of the Puttalam District. More recently, production has increased in Ratnepura District and elsewhere. During the last three years, production in the rest of the country has been greater than that of the north.

Big onion production was of little significance until recently. During the past 3-4 years however, production has soared from a level of about 2,000 tons in 1985, to nearly 10,000 in 1989 to over 27,000 tons in 1992. The dramatic rise in production came about largely by increasing area cultivated, but yields of both red and big onion have also improved gradually.

Red onion is grown throughout the year. Fortunately production is tending more toward Maha season as it shifts to new regions of the country. Big onion production has been heavily concentrated in Yala season, flooding the market for a period of about two months.

MEASURABLE DARP IMPACTS

Clarity of purpose is crucial to define meaningful impact indicators. One major purpose of DARP was to increase production of crops other than paddy. The idea was to diversify cropping patterns, not necessarily to increase yields. Therefore production not area planted or yields is used as the primary impact indicator.

Increases in yields could be important for some crops, but was not the central theme in most cases. In fact, for some crops such as red onion, expansion to other areas outside of Jaffna and Kapitiya in this case will cause a decrease in the national average yield. Many alternative crops had already been shown to be highly profitable for farmers. Therefore the challenge was not to increase yields and profitability, but instead to increase production.

Impacts were estimated for selected crops from 1981 to 1992. A time trend showing yearly increase (or decrease) in production of each of these crops was estimated. First however, the north and east were removed from the analysis. DOA does indeed carry on much of its work in these areas; however, production and supply systems have been severely interrupted, causing up and down swings in production levels reported from 1983 onward. The north and east are major producers of red onion, chilli, and maize, three important crops promoted by the project.

Time trends were run on seven crops. Five showed significant increases in production (see table below) and one a significant decrease during the reference period. Only in the case of potato was the relationship of production to time insignificant. The negative coefficient corresponding to cowpea implies that this crop has been partially displaced with green gram and perhaps others such as chilli during this period.

TIME TRENDS IN PRODUCTION OF SELECTED MAJOR CROPS
PROMOTED BY DARP, 1981-1992

	Annual Change in Production	Farm Gate Price	Total Value
	(mt/yr)	(Rs/kg)	(Rs 000)
Green gram	1276	19.13	24,410
Cowpea	-1809	13.3	(24,060)
Maize	1273	5.54	7,052
Chilli	1160	95.7	111,012
Red Onion	3450	20.27	69,932
Big Onion	2289	20.27	46,398
Total			234,744

Note: Based on time trends from 1981 to 1992, production levels. Farm gate price is from 1991/1992 Maha season. Price reported for red onion was also used for big onion.

Interestingly none of these crops seem to compete for land with paddy. Area planted to paddy in Maha season has declined according to census and statistics data during the 12-year period. However none of the crops are grown on paddy lands during Maha season. Instead the nonpaddy crops that are grown in Maha are planted on highlands, because paddy lands are flooded at that time of year. Paddy extent cultivated has increased in Yala season. Here again, the chances of competition would be small in any case, because alternate crops are usually planted only when water is insufficient to plant paddy.

Therefore, it seems unlikely that green gram, big onion, chilli, or red onion are taking land away from paddy.

Naturally the gross value of the additional production is not a net gain to the country. Some costs of production are made up of inputs, which are imported. Most of the value of production is attributable to farmer's labor and land. Generally we can say that the net increase in local production each year due to crop diversification is at least \$4 million.

The increases (and decrease) in production represent additional volumes available each year throughout the 12-year period. The net gain of \$4 million each year is therefore cumulative over time.

ANNEX B
INPUT TABLES

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TABLE B-1
TECHNICAL ASSISTANCE LEVEL OF EFFORT
October 1985-August 1993

ORIGINAL PROJECT			EXTENSION PHASE	GRAND TOTAL
GRAND TOTAL	265.75			374.75

Long-term Technical Assistance				
SUBTOTAL	188.5	41		229.5
Development Alternatives, Inc. (DAI)				
Selleck	61	Pattie	34	
Henderson	18	Reusche	7	
Reusche	49			
Tickoo	12			
Oregon State University (OSU)				
Morris	24.5			
Navarro	24			

Short-term Technical Assistance				
SUBTOTAL	77.25	68		145.25
Development Alternatives, Inc. (DAI)				
Wolf	3	Paroda	0.5	
Erickson	5.5	Hatfield	2	
Classen	6	Kuhnle	12	
Alex	2	Marlowe	1.5	
Henderson	2	Santacroce	2	
Nott	5.75	Chapman	1.5	
Haws	5.25	Hurelbrink	2.5	
Douglas	1.25	Marlowe	2	
Tickoo	7.25	Ross	2	
Malone	2.75			
Panditha	3			
Robinson	1.25			
Roberts	1			
Gajanayake	0.75			
Oregon State University (OSU)				
Morris	4.5	Nickel	4	
Crabtree	2	Williams	1	
Dhillon	1.5	Duncan	1.5	
Vollmer	0.5	Martin	1	
Warkentin	1	Mannion	1.5	
Weiser	0.75	Price	1.5	
Youngberg	0.5			
Resources Development Consultants (RDC)				
Fernando	4	Samarakoon	2.5	
Abeygunawardane	3.5	Albert	1.5	
Zuhair	7	Pinto	1.5	
		Perera	2.5	
		deSilva	2	
		Rajapakse	2	

	Premaratne	2	
	Pinto	3.5	
	Jayaratne	4	
	World Education		
Kahler	0.75		Department of Primary Industries (DPI)
			Nissen 1.5
Mississippi State Univ. (MSU)			
Couvillion	2.5		Training Resources Group (TRG)
			TRG
Oklahoma State University			Jennings 2.5
Li	1		Surles 3
Stoeker	1		Abhayagoonaward 3
Additional Collaborative Assistance associated with DARP			
Stewart	6.00		
Gleason	10.00		
Davis	2.50		
Ray	0.75		
Lubigan	10.00		
Sattel	4.00		
Tinsley	0.75		

TABLE B-2
SUMMARY OF TECHNICAL ASSIGNMENTS

Long-term Assignments

Bill Selleck/Preston S. Pattie

The Chief of Party was responsible for representing DAI and the contractor group in Sri Lanka. He oversaw all long-term and short-term technical assistance as well as participant training and management of special project funds. During the original Project phase, Dr Selleck contributed technical to agronomic research. During the extension phase, Dr Pattie helped prepare studies in agricultural economics.

D W Henderson

Conducted research in soil and water management for growing SFCs. Helped identify the technology to grow SFCs in Yala season, rather than only in rainfed areas in Maha season. This opened vast opportunities for diversification without affecting paddy production.

Gary Reusche

The long-term seeds advisor helped establish the Seed Development Unit for promoting private sector development. Seed imports were liberalized and he assisted with establishment of a network of private seed dealers. Policies on reducing the number of state seed farms were emphasized.

J L Tickoo

Conducted research in breeding legume crops--cowpea, mungbean (green gram), pigeon pea, chickpea, lentil, soybean and groundnut. Also contributed to research and extension methodologies.

R A Morris

Conducted research in soil fertility, especially related to long-term phosphorus fertilizer management and cycling in alley cropping systems. Helped determine effective rainfall needed for dry zone agriculture. Assisted research office in data analysis and interpretation of results. Contributed to farming systems research methodologies.

Luis Navarro

Conducted agricultural economic studies summarizing the performance of various OFCs over the past two decades. Most studies were based on existing time series data covering the past two decades. Assisted with baseline survey on SFC cultivation. Formulated policies to guide diversification activities.

Short-term Assignments**James M Wolf**

Prepared water management research plan for Kirini Oya project area and evaluated water management research programs in research stations.

Ian J Stewart/G S Dhillon

Stewart analyzed 100 years of agroclimatic data for the two major growing seasons. Dhillon conducted analyses pertaining to agrological conditions for SFCs in the dry zone, recommended crops and cultivation practices. Designed and established demonstration plots and identified methods for estimating crop yields.

J F Alex/Ian J Tinsley

Alex formulated recommendations on integrated pest management (IPM) in SFCs and weed control research programs. Tinsley addressed problems associated with pesticide poisoning and environmental effects.

Garvin Crabtree/Lubigan

Crabtree helped develop arrangements for joint training by local universities with Oregon State University. Held a workshop and formulated recommendations on weed control. Lubigan assisted with a survey on weed control and conducted trails on control of Cyperus rotundus.

Gladys Nott

Presented workshop on Farming Systems Research/Extension (FSR/E).

Bob Davis

In collaboration with the NIFTAL Project, developed a proposal for production of Rhizobia in Sri Lanka for inoculation of legume seed.

L Dale Haws/Howard E Ray**Darryl Kuhnle/Tilak Jayaratne**

Haws and Ray prepared recommendations for use of mass media technology in extension communications. Kuhnle helped make the mass media extension system become operational. He and Jayaratne provided on-the-job training.

Johnny Douglas

A team of persons headed by Douglas developed seed policy recommendations for Sri Lanka and laid out a program for development of the seed industry.

Carl E Classen/Covillion/Piyasena Abeygoonawardena/Benjamin Hatfield

Classen examined seed distribution methods of DOA. Covillion focussed on seed marketing including costs of production.

Abeygoonawardena conducted economic analyses of seed production programs on selected government seed farms. Hatfield presented workshops to train seed farm managers in business practices.

Kahler/Jaya Gajanayake/Violet M Malone

Kahler evaluated progress in training the trainers of the in-service centers. Malone conducted 1) training of trainers in extension, 2) how to present research results, and 3) conflict management among senior executives.

Jerry Robinson

Lee Jennings/Jane Surles/Piyadasa Abhayagoonawardhana

Robinson helped assess the status of DOA programs and led a workshop to develop a vision for the future. Later the three-person team led by Jennings trained senior officials in management skills through a three-workshop series spanning an entire year. This activity was useful in helping the Department adjust to change as it embarked on a major institutional restructuring.

Robin B Erickson/Zuhair

Erickson carried out data analysis and prepared report on baseline survey on SFC cultivation. Zuhair was economics research assistant.

Elton Li/Art Stoeker

Reviewed statistical procedures and recommended software packages for agricultural economic analyses. Conducted an assessment and formulated recommendations for computer applications in various units under the Department.

Gleason/Price

Gleason conducted economic analyses to promote soybean production. Price reviewed the progress and directions and crop diversification and provided guidance on future directions.

Paroda

Reviewed the agenda of the Plant Genetics Resources Center and provided recommendations on its future activities.

John Nickel

Assisted in the preparation of the Five-year Research Strategy Plan. The Plan defines priorities for agricultural research and addresses operational issues related to consolidation of personnel into more workable units.

C J Weiser/Ray William

Duncan/Frank Martin/Harry Mannion

Carried out horticultural reviews. Weiser did an initial review of horticultural crops, including comments on postharvest technology. William focused on up-country, temperate climate crops. The three-person team conducted an overall horticultural assessment. Both assignments helped guide DARP activities into the horticultural field during its extension phase.

George Marlowe/Albert/Pinto

Conducted a review of the varietal release system.

M L Panditha

Provided technical guidance on breeding methods in vegetable crops.

R L de Silva, Santacrose, Jayasiri Remaratne, Rohan Rajapakse

Conducted a review of plant quarantine systems and recommended improvements. Policies were adopted and put into practice.

Samarakoon

Developed and supported a computerized payroll program.

Keith Chapman/Rufus Pinto/Robert Nissen

Developed a plan of action for establishment of budwood gardens of perennial tropical fruits and distribution of material to nurserymen/women. Carried through with training of nurserymen/women.

TABLE B-3
LONG-TERM PARTICIPANT TRAINING ORIGINAL AND EXTENSION PHASE TRACKING RECORD

Name	Current position	Station
PhD		
1 WGD Fernando	Left Dept	
2 DSDZ Abeysiriward	RO	A'pelessa
3 HM de Alwis	Left Dept	
4 GAC de Silva	Ag. Economist	Peradeniya
5 LG Herat	RO	Bandarawela
6 L Amerasnghe	RO	Maha Illup.
MSc		
7 H Lansakkara	Left Dept	
8 TDW Siriwardena	RO	Gannoruwa
9 WP Madawanarachch	ADA	Peradeniya
10 GAMS Emitiyagoda	ADA Ext	Peradeniya
11 L Hathurusinghe	AO	Colombo
12 V Pemajayantha	Left Dept	
13 A Lecamwasam	DDR	A'ganwila
14 NPU Kuruppu	RO	Makandura
15 WHD Kularatne	Ag. Economist	Maha Illup.
16 JDKM Jayawardena	RO	Maha Illup.
17 K Subramaniam	Seg AO	N&E Province
18 GAW Wijesekera	RO	Gannoruwa
19 RM Nandasiri	ADA	A'pura
20 PBL Premnath	Seg AO	N Cent Prov
21 ST Dassanayake	ADA	Peradeniya
22 KE Karunathileke	ADA	Peradeniya
23 KWSD Abeyratne	Further stud.	USA
24 EMG Edirisinghe	ADA	Kegalle
25 APR Jayasinghe	ADA	Peradeniya
26 G Balasuriya	Ag. Economist	Peradeniya
27 H Hemaratne	Ag. Economist	Bombuwela
28 RA Wijesena	Asst Sec	Kegalle
29 H Kularatne	ADA	Kundasale
30 SGR de Silva	Seed Cert Off	Gannoruwa
31 GM Chandrasena	ADA	Gannoruwa
32 WSC Perera	ADA	Getambe
33 H Rajapakse	Left Dept	
34 W Palitha	AO	Kurunegala
35 TA Booso	Lect. AgEng	Kundasale
36 A Jayatileke	ADA	A'pura
37 M A Ariyasinghe	ADA	Puliyankulam
38 MIM Rafeek	Ag. Economist	A'wila
39 S Kanagasunderam	Left Dept	
40 TD Jayaratne	Left Dept	
41 S Kandiah	Left Dept	

TABLE B-3
LONG-TERM PARTICIPANT TRAINING ORIGINAL AND EXTENSION PHASE TRACKING RECORD

Name	Current position	Station
42 P Mylvagnam	Left Dept	
43 SC Gunasekera	Librarian	Gannoruwa
44 GDJL Sunil	ADA	Pelwehera
45 MA Wimal	Ag. Engineer	FMRC, MI
46 A Wettasinghe	RO	Peradeniya
47 K Hettiarachchi	RO	Maha Illup.
48 DEDJ Abeysekera	ADA	Maha Illup.
49 KG Sriyapala	Asst Sec	Getambe
50 AHL Somatileke	ADA	Matara
51 K Piyasena	ADA	Peradeniya
52 WMJ Bandara	AO	Bentota
53 SN Jayawardena	RO	Maha Illup.
54 PMN Dayaratne	ADA	Ampara
55 ARM Mahrouf	Ag. Economist	Bandarawela
56 SK Tharamarajah	RO	Bombuwela
57 DPP Jayakody	RO	Makandura
58 I Medagoda	RO	Gannoruwa
59 HU Warnakulsuriya	RO	Gannoruwa

Extension Phase

	In program	USA
60 PAP de Silva	"	"
61 KSU Jayaratne	"	"
62 J Abeygunasekera	"	"
63 I Ariyaratne	"	"
64 EMDSN Ekanayake	"	"
65 GLB Delungahawatte	"	"

TABLE B-4
SHORT-TERM PARTICIPANT TRAINING, ORIGINAL PHASE (1985-1990)

NAME	COURSE	DATE
AM Abeyratne WD Albert SW Seneviratne MD Samarasinghe WMM Kandegama	Thai Seed Prog. Thailand Cowpea, Soyabean	Dec 85 Jan/Feb 86
ST Jayatileke DM Saddhasena	Res Prodn, IITA Nigeria	
TB Samarakoon	Remote Sensing	Jan/Apr 86
TMJ Bandara	AIT, Thailand	
RP Mahindapala	Cropping Syst IRRI, Philippines	Feb/Jun 86
RGAS Rajapakse	Rhizobium Tech & Inoc Prod, NIFTAL Bangkok	Mar 86
WMS Gunasekera RSK Keerthisena	Alley Crop Alley Farming IITA, Nigeria	May 86
PS Wijesuriya	Remote Sensing Applicn. New Mexico, USA	Jun/Jly 86
J Kannangara	Seed Quality Control	Jun/Sep 86
KKG Jayakody WM Bandaranayake	& Seed Certification, Philippines	
WMU Weerakoon W Devasiri RD Hendrik DS Haputanthri	Farm Management, IRRI, Philippines	Jly 86
EMWD Ekanayake	Integrated Pest Mngmt	Jly/Nov 86
CMD Dharmasena WT Huruggamuwa	IRRI, Philippines	
H Somapala	Management & Agric Res. WDC, USA	Jly/Sep 86
LB Kumarasinghe	Irrig & Extension CINADCO, Israel	Aug/Sep 86

TABLE B-4 - Continued

UKB Doloswala	Farm Water Mngmt	Sep/Nov 86
DMPM Dassanayake PCG Jinasena	AIT, Thailand	
WAMH Banda S Somasuriyam		
TMA Tennakoon	Organiz & Mngmt Agric	Sep/Oct 86
MM Premachandra	Ext Service, Illinois USA	
H Samaratunga	Veg Prod & Research	Oct/Feb 86
A Palamakumbura	AVRDC, Thailand	
SIMR Abeysekera	Farming Syst, Socio	Oct/Dec 86
A Nadarajah M Hulangamuwa MM Jayawardena	Econ Res Trng, IRRI, Philippines	
AP Bentota	Cowpea & Soyabean Course	Oct/Dec 86
SP Bandara DM Gunasekera AKD Perera	IITA, Nigeria Cowpea & Soyabean Prodn IITA, Nigeria	Oct/Dec 86
DSP Kuruppuarachchi RM Karunaratne	Irrig & Soil Mngmt VOLCANI, Israel	Oct/Dec 86
A Abeysinghe WAK Karunathileke BS Raphael CL Ranasinghe S Wirasinghe W Ratnayake A M de Mel A Nagendram	Farming Systems IRRI, Philippines	Nov 86
EAP Wijesena	Cowpea, Soyabean, Intl	Jan/Mar 87
VC Vidyaratne	Res & Prod, IITA, Nigeria	
RMT Rajapakse	Stats Proced & Computer Applic, IRRI, Phil	Mar/Jun 87
ARM Mahrouf	Proj Planning for Agriculture, WDC	May/Jun 87

TABLE B-4 - Continued

NAME	COURSE	DATE
SM Sumathipala	Cropping Systems, ICRISAT, India	May/Nov 87
KK Jayasekera	Trop Root Crop Res Prod	May/Jul 87
CNN Nillegoda	IITA, Nigeria	
WN Alwis	Mngmt Agric Organiz. USDA, WDC	May/Jun 87
WL Weerakoon	Sust Agric Role in Green Manure Crops, IRRI, Phil	May 87
S Amarasiri	Study Tour	May/Jun 87
LG Herat	LEHRI, Indonesia	
J Handawela	Sust Agric Role in Green Manure, IRRI, Phil	May 87
SMK Godawita	Seed Improvement	Jun/Jly 87
W Wijedasa	USAD, WDC	
AAB Hafi	Proj Impl Agric Rural Development, WDC	Jly/Aug 87
M Sikurajapathy	Mngmt Agric Res, WDC	Jly/Aug 87
DEF Suraweera	Familiarize, Socio Econ	Jly 87
GAC de Silva	Res Cropng Syst, IRRI Philippines	
LB Mahagedera	Intl Pest Mngmt	Jly/Nov 87
SKL Fernando	IRRI, Philippines	
GR Dharmasena	Tech Transfer Course	Jly/Oct 87
S Weeratunga BM Abeyratne TK Subramanium	IRRI, Phil	

TABLE B-4 -- Continued

NAME	COURSE	DATE
DI Kommale AA Athapthu		
S Weeraratne	Mngmt of Training Cent.	Jly/Sep 87
EMPB Ekanayake	AIT, Thailand	
KP Alwis	Plant Quarantine	Aug/Sep 87
EJ Ekneligoda	WDC	
A Jayatileke	Irrig Water Mngmt	Aug/Oct 87
TA Booso	IRRI, Phil	
KW Jayasena	Chilli Narrow Leaf Disorder, IRRI, Phil	Sep/Oct 87
K Gamage	On Farm Mngmt Trng	Sep/Oct 87
WMM Gunatileke C Kodithuwakkuarachchi SG Gamage	AIT, Thailand	
TT Ranasinghe	Orgn & Mngmt Agric Ext Syst, Illinois, USA	Sep/Oct 87
GGRUW Somaratne TN Musaffer AG Nandawathie RP Karunapala	Seed Tech Veg Crops UPLB. Phil	Sep/Dec 87
MA Wimal	Procurement & Supply Mngm AAFC, NJ	Oct 87
BG Dayananda	Cowpea Soyabean Res	Oct/Dec 87
CTS Seneviratne MDS Abeyratne	Prod, IITA, Nigeria	
A Hettiarachchi	Tissue Culture Trng AVRDC, Thailand	Oct/Mar 87

TABLE B-4 - Continued

NAME	COURSE	DATE
JCK Basnayake	Sweet Potato Breeding	Oct/Mar 87
GAMD Gunaratne	AVRDC, Thailand	
N Albert	Farming Syst Socio Econ	Oct/Dec 87
RM Abeyratne Bandara	Res, IRRI, Phil	
J Fernando	IDRC, India	Nov 87
CB Hindagala	Plant Genetic Res	Nov/Dec 87
	IBPGR, India	
G Munasinghe	Soil & Plant Analysis	Jan/Feb 88
MP Dayananda	IITA, Nigeria	
LA Wickremasinghe	Soil Consv Conference	Jan 88
CD Gangodawila	Thailand	
DM Gunasekera	Weed Mngmt	Feb 88
N Parajasingham	IITA, Nigeria	
AM Gunasekera		
T Liyanage		
BE Piyadasa		
PLE Pannila		
HKDAPS Annakage	Tech Transf, IIRI, Phil	Feb/Apr 88
T Jayawardena	Seed Tech	Feb/Mar 88
N Kanagaratnam	IITA, Nigeria	
AM Dharmasena		
SW Abeysekera		
DL Wickremasinghe		
AM Seneviratne	Alley Farming,	Mar 88
	IITA, Nigeria	
SSG Jyawardena	Symp Biotec Diversity	May 88
	Germpl Preservation, USA	
JBDS Kahandawela	Trop Root Crop Res	May/Jly 88
HD Sunil Kumara	IITA, Nigeria	
SP Dayaratne	Seed Improvement	May/Jly 88

TABLE B-4 - Continued

NAME	COURSE	DATE
GDA Weerasuriya BV Gunasekera	Mississippi, USA	
SW Seneviratne	Seed Improv, Missisp	May/Jly 88
NK Atapatthu	USA Dev Market for Agric	Jun/Jly 88
DEF Suraweera	Prod, Colorado, USA Micro Comp Applic, USA	Jun/Aug 88
B Palarajah	Water Mngmt	Jly/Aug 88
KA Ranawana PB Rambukwella	Arizona, USA	
GG Saparamadu	Plant Quarantine	Jun/Aug 88
EHJDM Francisco	USDA, WDC	
BASS Padmalal	Water Mngmt, USDA, WDC	Jly/Aug 88
K Shanthi Iddagoda	Planning Rural Services	Aug/Oct 88
R Jaywardena MMP Muthunayake RSB Yaparathne	Israel	
GB Navaratne	Monit & Eval of Projects DTCP, Thailand	Aug 88
B Sivakadacham	Plant Pathology, Japan	Aug 88
A Wanigarathne	Seed Tour	Aug/Sep 88
D Wijewardena	Thailand, Phil	
S Weerasinghe MHJP Fernando WD Albert G Reusche		

TABLE B-4 - Continued

NAME	COURSE	DATE
N Selvanathan	Irrig Water Mngmt IRRI, Phil	Aug/Oct 88
DB Weeratunga	Org & Mngmt of Agric Ext Syst Illinois, USA	Sep 88
HB Herath	Planning & Mngmt Thailand	Sept 88
MIM Rafeek	Farming Syst, IITA, Nigeria	Sep 88
JPK Abeykoon	Seed Tech	Sep/Dec 88
TMAKB Tennakoon	UPLB, Phil	
PA Samaratunga	Proj Eval Strategy	Sep 88
JATP Gunawardena	Minnesota, USA	
S Karunandarajah	Veg Production	Oct88/Mar89
HM Ariyaratne	AVRDC, Thailand	
ARM Mahrouf	Farming Syst Ext Symp Arkansas, USA	Oct 88
MWMAG Wijesundera R Kandiah RM Dharmadasa	Cowpea, Soyabean Res IITA, Nigeria	Oct/Dec 88
N Vignarajah	Farming Syst Res, USA	Oct 88
DN Sirisena	Irrig & Soil Mngmt Israel	Oct/Dec 88
SN Dhanasena	Mngmt of Rainfed Agric	Nov/Dec 88
DG Kulatunga DJP Nanayakkara KG Karunawathi J Amarasooriya	AIT, Thailand	

TABLE B-4 - Continued

NAME	COURSE	DATE
DB Muthukuda Arachchi	Plant Biotech, Nairobi	Dec 88
AM Abeyratne	Financial Restructng USA	Jan/Feb 89
IHMS Herath	Librarianship, UPLB Philippines	Apr/May 89
KSU Jayaratne	Crop Prod Agron, ICRISAT	May/Nov 89
N Govinna	Seed Marktng Distrbution UPLB, Philippines	Jun/Aug 89
SL Amarasiri	Res Dev, USA	Jun/Jly 89
DMW Dassanayake	Commun & Media Strat, WDC	Jun/Jly 89
SL Weerasena	Seed Cert, Oregon, USA	Jun/Jly 89
OPK Chandrasiri		
MP Anulawathi S Weralugolla RS Premachandra TE Nandasiri	Planning of Micro Regions, Israel	Jun/Aug 89
DL Siriwardena	Rural Reg Dev, AIT, Thai	Jly 89
JASS Gunawardena	Proj Impl for Agric	Jly/Aug 89
BHAC Senanayake	USDA, WDC	
HA Arulgnanam	Mngmt of Trng Centres	Jly/Aug 89
S Wadhuhewa	AIT, Thailand	
PH Sugathadasa	Agric Planning	Jly/Sep 89
BWH Nandawathi MS Mendis AR Ekanayake RM Jayatileke	CINADCO, Israel	

TABLE B-4 - Continued

NAME	COURSE	DATE
HMW Banda	Radio Prod Dev Communc	Jly/Aug 89
RB Seneviratne	Media Tech, Thailand	
SHSA de Silva	Irrig Water Mngmt, IRRI Philippines	Aug/Oct 89
W Kapupahana	Human Res Dev, USDA, WDC	Sep/Oct 89
SM Somaratne	Org & Mngmt Agric Ext Syst, Illinois, USA	Sep 89
SK Yasakethu	Planning Mngmt	Sep 89
P Ganeshmoorthy	DTCP, Phil	
HB Herath	Org & Mngmt Agric Ext Syst, Illinois, USA	Sep 89
VS Ginigaddara	Integr Farming Syst Mngmt	Sep/Oct 89
ST Fernando	AIT, Thailand	
L de Silva	Proj Analysis, USDA, WDC	Sep/Oct 89
HP Ariyaratne	Grain Legumes, Vegetab.	Sep/Oct 89
GM Wasantha Chitral K Weersinghe A Senthianathan MAP Munasinghe N Fernando ASU Liyanage PB Jayamanne	Stdy Tour Pakistan, India Bangladesh	
BR Chandrasoma	Seed Tech, UPLB, Phil	Sep/Dec 89
KSB Abeysinghe		
MM Weerakoon Banda	Seed Tech, UPLB, Phil	Sep/Dec 89
HKL Atapatthu	Integ Farming Syst Mngmt	Sep/Oct 89

TABLE B-4 - Continued

NAME	COURSE	DATE
K Chandrasekera	AIT, Thailand	
T Gamage	Integ Farming Syst Mngmt	Sep/Oct 89
	AIT, Thailand	
DDB Dodanwela	Plant Pathology, IRRI	Oct89/Apr90
SL Weerasena	Onion Production	Oct/Nov 89
RM Karunaratne	India, Indonesia	
A Krishnar		
YSHP de Silva		
W Ratnayake		
M Bogahawatte		
GDA Weerasuriya		
N Kurukularachchi	Rice Based Cropping Syst	Oct/Dec 89
WGDA Wimalaratne	Thailand	
G Wijewickrema	Mngmt of Rainfed Agric	
WAG Sisira Kumara	AIT, Thailand	Nov/Dec 89
GB Chandralatha	Trng Methods	Nov 89
NPC de Silva	DTCP, Phil	
N Pathmanathan		
EA Dias	Trng Methods, DTCP, Phil	Nov 89
IM Gunawardena	Prepn of Printed Material	Nov/Dec 89
P Vasudevah	for Communication	
GJ Mendis	Thailand	
ARM Samarasekera		
KA Ranaweera	Seed Strategy, Accounting	Feb 90
B Palarajah	& Mngmt, Bangkok	
WP Madawanarachchi		
N Govinna		

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TABLE B-5
SHORT-TERM PARTICIPANT TRAINING, EXTENSION PHASE (1991 - 1993)

NAME	COURSE	DATE
S Gnanachandran SMSSA Senanayake	Computer Course AIT, Thailand	May 91
IS Padmasiri H Samaratinga	Intl Symp on Trop Fruit Res, Thailand	May 91
RS Abeysekera WM Jayasena	Strategic Mngmt for USDA, Washington DC	Oct 91
SPR Weerasinghe	Plant Quarantine Germ Plasm Conserv. USA, Philippines	Oct 91
WP Madawanarachchi NA Alwis Perera RMG Weerakoon	Seed Technology UPLB, Philippines	Nov 91
K Vincent KK Siripala		
SM Sudu Banda SM Gunapala		
H Rajapakse	Orchid Conference Chiang Mai, Thailand	Jan 92
P Ganashan	Biotechnology Conf Banana, Costa Rica	Jan 92
GDA Weerasuriya DD Weerakkody A Nadarajah KD Dharmadasa PK Hulugalle S Bodhipakse R Dikkumbura	Seed Technology UPLB, Philippines	Feb 92
V Abeykoon	Intl Symp on Nutrient Mngmt for Sustained Productivity, India	Feb 92
A Wettasinghe	FAO/CIPAC Pesticide Meeting, Thailand	May 92
PNP Jayasinghe HA Sarath Chandra	Study Tour, Field Crops Ext, Thailand	Jun 92
HM Wickremasinghe		
GR Chandratilleke Banda		

TABLE B-5 -- Continued

NAME	COURSE	DATE
EM Dassanayake Banda		
DM Jayawardena		
JS Kurukulasooriya		
KD Kumarasinghe Appuhamy		
UB Gankewela		
GV Thomis		
JP Atapattu		
RM Karunaratne		
SSBDG Jayawardena DEF Suraweera OPK Chandrasiri PLE Pannila H Samaratunga	Mngmt Leadership in Agric Production Practices, Nebraska, USA	Jun 92
RM Piyadasa	Study Tour, Field	Jun 92
M Atham Charles Silva HAVT Navaratne HD Banda DK Kulatunga HA Chandrasekera AR PUNCHIBANDA KG Premaratne IM Balasuriya S Periyasamy DB Weeratunga	Crops Ext, Thailand	
H Rajapakse DG Ranmukarachchi	Study Tour of Plant Nurseries, Planting Material, Thailand	Jul 92
HMC Kapilaratne MHJP Fernando SL Weerasena GGM Sikurajapathy WP Madawanarachchi HGP Nelson	Seed Policy Study Tour - Thailand, WDC, Mississippi, Bolivia, Colombia, California, Indonesia	Aug 92
S Suntharalingam	Post Harvest	Aug 92

TABLE B-5 - Continued

NAME	COURSE	DATE
S Ekanayake	Handling, Davies, California, USA	
M Agalawatte	Proj Mngmt & Eval Seminar, WDC, USA and OSU, Oregon	Aug 92
AVS Weerasinghe	Soil Consv & Mngmt Stdy Tour, Utah, USA	Sep 92
V Vingnanakulasingam	Chilli Plant Path. LSU, USA	Sep 92
H Gamage KN Mankotte P Weerakkody	Agric Communic. Illinois, USA	Sep 92
N de Silva	Media Tech Planning Product & Utiliz., Thailand	Sep 92
EM Dassanayake	Cross Protection Res	Sep 92
HM Jayawardena Banda	Australia Plant Quarantine Pro Thailand	Sep 92
N Ranatunga	Training Mngmt,	Oct 92
RP Mahindapala SK Yasakethu BW Somapala KL Jayatissa	AIT, Thailand	
P Ganashan	Chilli Pepper Produc Malaysia	Oct 92
SPR Weerasinghe SL Amarasiri N Vignarajah G Jayawardena KA Mettananda A Lecamwasam M Joseph H Samaratunga E Suraweera	Second Asian Farming Systems Symp Sri Lanka	Nov 92

TABLE B-5 - Continued

NAME	COURSE	DATE
GAC de Silva		
ARM Mahrouf		
G Balasuriya		
S Wirasinghe		
H Gamage		
J Fernando		
S Weerasena		
PLE Pannila		
WP Madawanarachchi		
B Sumithrarachchi		
C Kudagamage	World Neem Conf India	Feb 93
S Amarasiri		
HP Ariyaratne	Hort/Study Tour Australia	Feb/Mar 93
LD Dissanayake		
JA Sirisena		
S Peiris		
BASS Padmalal		
M Dionysius	Tropical Fruits Course Australia	Mar/Apr 93
RRA Wijekoon	Training on Graphics Production, USA	Mar 93
D Abeysuriya	Onion Study Tour India	Mar/Apr 93
SA Ratnapala		
EA Gnanasena		
BM Jayasundera Banda		
MP Weerasekera		
AJM Seneviratne		
DB Jayaratne		
KAD Ariyaratne	Plant Quarantine Malaysia	Mar/Apr 93
MHD De Silva		
KDG Dalugoda		
H Senerath	APPPC Workshop	Apr 93
HM Jayawardena Banda	Plant Quarantine Malaysia	
YC Piyaseeli	Project Mngmt AIT, Thailand & Indonesia	May/July 93
MAG Wimalasena		
SH Leelawathie		

TABLE B-5 -- Continued

NAME	COURSE	DATE
R Weerasekera MA De Silva		
GDA Weerasuriya	Seeds Enterp Mngmt USA	Jun/Jly 93
KWMV Mapitigama	Managing Rural Development AIT, Thailand	Jly/Aug 93
CB Hindagala	Hort Tour Malaysia	Aug 93
SJBA Jayasekera KK Perera AS Vivekanandan		
H Samaratunga	Horticulture	Aug 93
P Wijesundera J Kannangara SP Gunadasa UM Abeyratne AD Sathyapala WM Subasena	Study Tour Thailand	

**TABLE B-6
UTILIZATION OF DARP SPECIAL PROJECT FUNDS**

EXPENDITURE AGAINST SPECIFIC ACTIVITY BUDGETS WITHIN LINE ITEMS AS AT 20 AUGUST '93

ACTIVITY	APPROVED AMOUNT	TOTAL EXPENDED TO DATE	COMMITMENTS TO PACD
Line Item.Sub-line Item.Specific Activity		(US Dollars)	
1.4.01 Modifications to Computer Room	1,605	1,602.57	
1.5.01 Special Studies	3,000	2,438.37	
3.2.01 Strengthening Comm. Unit (Software)	4,000		4,000.00
3.3.01 Expand Farm Broadcasting Capacity	30,000	27,716.11	
3.5.01 Printing Technoguide	37,515	37,513.39	
3.5.02 Newspaper Campaigns	30,045	30,041.82	
3.5.03 Mass Media Campaigns	75,000	73,692.39	9,500.00
4.1.01 Orchids	10,000	9,984.00	
4.1.02 Tropical Fruits	880	878.92	
4.1.03 Other Germplasm	1,000		500.00
4.6.01 Onion Storage Structure Improvement	4,400	4,316.51	
4.7.01 Meda Demonstrations '92	1,690	1,686.78	
4.7.02 Meda Demonstrations '92	15,000	14,055.29	
4.8.01 Yala Demonstrations '92	8,785	8,776.49	
4.8.02 Yala Demonstrations '92	9,000	2,359.66	
4.9.01 Cross Protection	17,000	27,247.86	
4.9.03 Mealy Bug	2,600	2,116.26	
4.9.04 Leafy Vegetables	2,600	1,023.71	
4.9.05 Vegetable Pest	2,250	2,217.26	
4.9.06 Ripening of Banana	4,000	2,425.47	
4.9.07 Pre-basic Seed Potato	2,000	499.16	
4.9.08 Apple and Pear Diseases	2,600	773.00	
4.9.09 Cooking Quality of FLCG Crops	6,000	1,299.90	
4.9.10 FGR and Cucubits Productivity	2,000	869.95	
4.9.11 Latex in Mangosteen	2,500	1,389.30	
4.9.12 Chilli NLD Studies	1,000	203.56	
4.9.13 Insect Tests:Floriculture	3,200	2,489.27	
4.9.14 Leaf Twister Disease:Onion	1,300	2,072.81	
4.9.15 Tissue Culture:F. benjamina	2,000	1,698.67	
4.9.16 Weaning Plantlets	2,000	2,450.63	
4.9.17 Potato Tuberlet Production	2,000	2,052.93	
4.10.01 Bio-Technology Workshop	7,850	4,237.71	3,500.00
4.10.02 Horticulture Exhibition	59,500	54,169.03	
5.2.01 Seed Market Study	9,500	8,751.16	
5.2.02 Farm Manager Training	1,500	1,493.00	
5.2.03 Nurserymen Training	9,600	10,159.37	
5.2.04 Seed Development Unit	3,000	1,853.04	
5.3.01 Seed Enterprises Manager	40,000	37,879.16	2,500.00
6.1.01 Install. of Seed Equip - Nikeweratiya	21,000	20,293.72	
6.1.02 Install. of Seed Equip - Pelwehera	19,500	17,420.21	2,600.00
6.1.03 Install. of Seed Equip - Aluttarama	20,000	17,929.88	1,000.00
6.2.01 Extend Certification Services	6,000	6,017.37	
6.2.02 SC&PP Building Repairs	11,000	10,832.26	
6.2.03 Labelling Mother Plants	7,000	7,894.74	

TABLE B-6 - Continued

TABLE B-6 - Continued

6.3.01 Demonstrate Large Onion Seed Prod.	4,200	4,161.70	
7.1.01 Management Training	20,000	18,962.88	
7.1.02 DOA Management Workshop	1,380		
7.2.01 Software Training	16,000	14,352.58	3,500.00
GRAND TOTAL	544,000	502,299.85	27,100.00

TABLE B-7
FACILITIES CONSTRUCTION

<u>STATION</u>	<u>TYPE OF BUILDING</u>	<u>COST REIMBURSED (Rs)</u>
Regional Research		
Centre Maha Iluppallama Research Laboratory,		3,599,765
Screen house	976,898	
Girls' hostel	1,185,726	
Quarters Class IV	873,470	
" " IV	870,170	
" " III	617,872	
Screen House (renov.)	451,640	
Regional Research		
Centre	Field stores/process st	1,045,938
Screen House		1,093,164
Angunukolapelessa Impts to workshops		521,175
Quarters Class IV		837,615
" " III		536,798
Central Agriculture		
Research Institute	Research Laboratory	2,635,983
Gannoruwa/Peradeniya	Green House	973,224
	S/Water Disposal system	200,000
Regional Research Centre		
Bandarawela	Quarters Class IV	742,254
" " IV		782,564
Regional Research Centre		
Makandura	Research Laboratory	791,000
Stores room		201,000
Vehicle yard		242,000
Water supply sys:		119,000
Equipment: workshop		240,000
Quarter Class III		215,000
" " III		224,000
" " IV		325,000
" " IV		339,000
" " IV		359,000
Seed Centre Processing & Storage		
Bldg		2,569,792
Pelwehera	Storage with RSF	2,722,351
Drying floor		227,850
Storage remodelling		314,890
Quarters Class IV		865,717

TABLE B-7 - Continued

Seed Centre Processing & Storage		
Bldg	3,081,020	
Aluttharama Drying floor	76,625	
Storage remodelling	314,890	
Quarters Class III	583,719	
" Class II	308,174	
Res/Seed (Potato) Screen Houses (2)	708,000	
Nuwara Eliya		
Seed Centre Seed Processing/Storage		
Bldg	850,000	
Nikaweraitya Storage Remodelling		595,000
Drying Floor	84,000	

TABLE B-8
 CONTRACTOR BUDGET, June 30, 1993

CATEGORY	BUDGET AMOUNT	EXPENDITURES TO DATE	PERCENT EXPENDED
	(US\$)	(US\$)	(%)
SALARIES & WAGES	1,329,749	1,390,352	104.6
FRINGE BENEFITS	131,262	126,322	96.2
OVERHEAD	1,002,062	1,038,409	103.6
TRAVEL & TRANSPORTATION	318,690	184,696	58.0
ALLOWANCES	557,457	577,359	103.6
EQUIPMENT & SUPPLIES	88,251	91,057	103.2
OTHER DIRECT COSTS	438,069	468,670	107.0
SPECIAL PROJECT FUND	759,498	579,183	76.3
PARTICIPANT TRAINING	4,154,957	3,986,562	95.9
OTHER SUBCONTRACTORS	1,668,173	1,517,893	91.0
FEE	442,502	384,734	86.9
TOTAL	\$10,800,670	10,345,236	95.0

ANNEX C
OUTPUT TABLES

TABLE C-1
IMPLEMENTATION EXPERIENCE 1985-1990

Research Planning and Management

Fourteen crops were selected for special attention in the Department's plan for crop diversification.

Establishment and operation of the Research Planning Cell.

Increased cooperation and communication between staff working on the same commodity at different research centers.

Communication between RARCs improved when research coordinators were appointed for area-wide projects.

Appointment of university staff to research coordination committees. Regional Technical Working Group (RTWG) involve Extension Division in research planning.

Establishment of an annual series of research seminars.

Adoption of experimental procedures which permit valid comparison of research data.

Research workshop at which steps between the conception of a research idea and reporting and publishing research results were reviewed and discussed.

Increased linkages between the DOA and international agricultural research centers and national centers in neighboring countries with similar agro-climatic and cultural conditions.

Formation of professional societies in extension, socio-economics, and weed management.

Process Management

Summaries of management techniques written and distributed to Deputy Directors.

Four DOA professionals received short-term training abroad in management techniques.

A program of personnel promotion based on performance introduced by the Extension Division.

Job descriptions developed for employees in the Education and Training Division.

Five workshops attended by 130 professionals leading to the identification of the DOA's leadership and management needs.

Workshop for the Directorate and 20 other top leaders resulted in adoption of a mission statement.

Workshops with Divisional leaders resulted in development of goals and operational management objectives.

Information Systems Management

Plan for computer procurement.

Training in data management and microcomputer software technology to 97 professionals.

Research

Agronomy/Farming Systems

Research officers introduced to the use of MSTAT.

Workshop on FSR/E held during the first year of the project.

Concept, design and requirements of a soil laboratory were provided to the DOA.

Plant Breeding

Approximately 2,000 germplasm lines of both field crops and vegetables imported for field trials and variety improvement.

New crops--pigeonpea, lentil and chickpea--introduced through the DARP/ICRISAT/AGLIN program.

Breeding program written for legume crops.

A legume workshop was held. Four plant breeders received advanced degrees.

Weed Management

A national weed coordinator appointed to organize weed management research in a systematic way.

Survey conducted to determine farmers' weed problems and the effectiveness of their weed management practices.

One hundred forty-five weed specimens collected and deposited in the National Herbarium.

The most effective control ever recorded of *Cyperus rotundus*, the most serious field weed in Sri Lanka resulted from DARP experiments.

Development of a 28-page guide, Recommendations on Weed Management in Field Crops.

Water Management

Establishment of a water management coordinating committee to support and advise researchers.

A plan developed for water management research.

Recommendations for irrigation and drainage systems which are being used by extension and farmers

Other Research

Recommendations for local manufacture of Rhyzobia.

Analysis of 100 years of weather records.

Extension

Printing of 35 publications of value to extension staff and farmers.

An analysis of media activities, staff, equipment and facilities in the DOA

A media pilot project utilizing an optional mix of available media was recommended

Two scholars received short-term training in the use of mass media.
A week-long workshop was attended by 30 participants to upgrade expertise in farm broadcast programming.

A comprehensive technoguide, Department of Agriculture Recommendations for Field Crops, was published

Seeds

National workshop to evaluate the current status of the seed industry and chart directions for continued development.

A program of action designed to increase private sector participation in the supply and distribution of seeds.

Economic and cost-of-production studies on seed production.

Technical input in the design of four seed processing plants and the development of specifications for seed processing equipment.

Establishment of the Seed Development Unit to provide technical assistance to new seed companies.

Establishment of an association comprised of retailers engaged in the sale of seeds.

Restructuring of seed pricing to include a retail margin.

Registration of private sector seed dealers selling government seed.

Reduction in the number of government seed farms from 37 to 19.

Policy Framework and Economics

Baseline Survey: Large scale agricultural survey consolidating information on production and marketing of SFCs

Nine Agricultural Production and Marketing Studies on 7 crops.

Paper analyzing trends of area planted, production and yields of 14 SFCs.

Policy paper including a list of requirements needed by farmers to make sound marketing and production decisions.

The questionnaire for cost of cultivation (COC) data data collection modified and a revised version of a computer program, along with a user's manual, prepared for reporting and analyzing COC data.

Soybean Industry Study addressed issues and made recommendations designed to achieve more fully the goals of the Soybean Project.

Five socio-economic studies conducted by staff of the University of Peradeniya in cooperation with the DOA.

Study on data uses and methodologies, including recommendations to shift focus to whole-farm economic analysis.

Three workshops staff on the appropriate use of software for different types of economic analysis.

TABLE C-2
MAJOR OUTPUTS, 1991-93

Below are targets for various outputs envisioned under the extension phase of DARP, 1991-93. The list was revised from time to time to reflect more closely the evolution in expectations of the DOA and USAID. The first column shows the overall target and the second shows the number actually completed. In parentheses after the description of some of the output targets, a brief note explains the nature of the particular output which has been completed. This listing follows the order of the extension phase Work Plan.

TECHNICAL AREA 1: COMMODITY ANALYSIS AND POLICY REVIEW

LOP		
TARGET	COMPLETED	DESCRIPTION OF OUTPUT TARGET
4	3	One crop-sector study per quarter for 2nd, 3rd, and 4th quarters of 1991 and the 1st quarter of 1992 (completed: Maize, Soybean, Onion)
1	1	Horticultural Assessment identifying principal functions of the DOA and recommending programs for support of horticultural industry development by first quarter 1992 (completed)
2	2	Review of plant quarantine procedures, amendment to legislative acts by mid 1992 (completed)
1	0	Review of food crop and diversification policies by mid 1993 (incomplete)
3	2	Special studies pointing to policy implications (ornamental plants, diversification in rainfed areas)

TECHNICAL AREA 2: RESEARCH PRIORITIES AND STRATEGY

1	1	Research Strategy and Work Plan by mid 1992 (complete)
1	1	Document identifying limitations of current varietal release procedures and actions for streamlining by mid 1992 (complete)
1	0	Incorporation of a section on economic significance in research designs and programs, by mid 1993 (dropped)

TECHNICAL AREA 3: COMMUNICATION TECHNOLOGY

1	1	Print Crop Technoguide in English, Sinhala, and Tamil, by end 1992 (complete)
1	1	Comprehensive Action Plan, 1st quarter 1992 (complete)

TABLE C-2 - Continued

1	1	Installation of recording studio by end of Project (complete)
1	1	Desk-top publishing system in place by early 1993 (complete)
4	4	Four multi media campaigns (Meda, Yala, Pesticide Safety, and Seed Quality completed)
TECHNICAL AREA 4: RESEARCH AND TECHNOLOGY TRANSFER PROGRAMS		
200	401	Introduce lines of horticultural plants (melon trials completed, orchid materials imported, tropical fruit plant materials imported.)
100	0	100 lines of 14 OFCs to be introduced by DOA
20	17	Development and release of new varieties by DOA (17 released since 1985. Three more expected in 1993)
2	2	Steps in tropical fruit propagation by 3rd quarter 1993 (plan prepared, training in plant propagation completed)
2	0	Publish IPM strategies for 3 crops and develop action plan for a pesticide residue analysis service (dropped)
1	1	Intensive, focused mass media and extension campaign on pesticide safety (complete)
1	1	Develop a Strategy/Action Plan for Development of the horticultural industry in Uva Province (complete)
16	15	Construction of onion storage demonstration units (complete)
40	270	20 hectares of demonstrations in dry and intermediate zones in 1992 and 250 hectares in 1993 to promote cultivation in Meda (completed)
1	1	Mass media campaign to draw farmer attention to Meda season (complete)
20	20	Demonstrations in Yala season to demonstrate OFC production technology (1992 and 1993 complete)
18	16	Research grants administered (16 grants completed)
1	1	Carry out a National Horticultural Exhibition, July 1993 (complete)

TABLE C-2 - Continued

TECHNICAL AREA 5: SEED RESTRUCTURING AND ENTERPRISE DEVELOPMENT

1	1	Prepare Comprehensive Policy to guide development of the seed industry (complete, pending adoption by DOA)
1	1	Simplified seed law developed and presented for enactment (legal comments complete)
1	1	National seed market study (complete)
1	1	Promotional campaign for seed marketing with mass media and extension support (complete)
2	2	Seed Farm Management Workshops (complete)
6	10	Formation of seed enterprises including producer groups that will be involved in seed production and distribution (Of about 15 enterprises, DARP can take credit for directly supporting about 10)

TECHNICAL AREA 6: SEED TECHNOLOGY

6	6	Installation of six lines of new seed equipment (complete)
1	1	Certify horticultural planting materials by 1993 (complete)
15	15	Large onion seed demo plots (complete)

TECHNICAL AREA 7: ORGANIZATION AND MANAGEMENT SYSTEMS

1	1	Needs assessment in second quarter of 1992 (complete)
3	3	Executive level management training, beginning 3rd quarter 1992 (3 phases complete)
1	1	Develop a payroll program for Accounts Division (complete)
200	200	Train officers and staff in use of software programs (complete. Original target was 100.)

MANAGEMENT AREA 1: CONSTRUCTION AND PROCUREMENT

30	30	Completion of construction on 30 buildings at six sites (complete)
1	1	Delivery of all original project equipment (complete)
1	1	All additional procurement by end of Project (complete)

MANAGEMENT AREA 2: PARTICIPANT TRAINING AND MANAGEMENT TRAINING

65	65	Degrees and non-degree training programs (complete)
90	96	Person-months of short-term training (complete)
10	10	Person-months of local short-term training (complete)

MANAGEMENT AREA 3: COORDINATION, REPORTING, AND EVALUATION

3	3	Life-of-Project Work Plan and annual updates (Original Work Plan and two annual updates completed)
10	10	Quarterly progress reports. (The current report is the last quarterly progress report)
1	1	A final report comparing targets with progress, making recommendations for future projects
1	1	External impact evaluation at end of DAR Project (complete)

TABLE C-3
SEED ENTERPRISES FORMED

Enterprises Involved in Seed Paddy Production

1. Dematamalpelessa Seed Producer Association, Ampara, Eastern Province
 2. Uhana Seed Producer Association, Ampara, Eastern Province.
 3. Saliyapura Seed Producer Group (individual farmers) Anuradhapura North Central Province.
 4. Nintheur Seed Producer Association, Ampara, Eastern Province.
 5. Royal Seeds, Dimbulagala MPCS, Manmpitiya, Polonnaruwa, North Central Province.
 6. Golden Seeds, Palugasdamana MPCS, Palugasdamana, Polonnaruwa,
 7. Southern Pioneer Seeds, Hungama MPCS, Hungama, Ambalantota, Southern Province.
 8. Pan West Seeds, Paduwasnuwara, North Western Province.
 9. CIC Seeds, Malwanagama, Mahaweli H area, North Central Province.
 10. Analytical Instruments, Anuradhapura, North Central Province.
- Paddy Seed Produced by Seed Enterprises

Enterprises Involved in Bean Seed Production

1. DUS Agricultural Company, 4/15 Pitakanda Rd, Aniwatte, Kandy.
2. CIC Seeds, P.O. Box 352, Colombo.
3. Sampath Seeds, No.5, Isurugama Rd, Kaikawala.
4. Ricky Seeds, Galkadilla Elamulla, Central Province.

Enterprises Involved in Chili Seed Production

1. Lanka Dutch Agricultural Company,
2. Sampath Seeds, No. 5, Isurugama, Kaikawela.
3. Akensco Lanka Seed Company, No.26, Kurunagala Rd, Dambulla.
4. CIC Seeds, P.O. Box 352, Colombo..
5. Samarakoon Seeds, Peradeniya Rd, Kandy.