PD BAW 778

611-0201

# REPORT ON MIDTERM EVALUATION OF AGRICULTURAL DEVELOPMENT RESEARCH AND EXTENSION PROJECT (ZAMARE)

(611-0201)

SUBMITTED TO USAID/ZAMBIA
JUNE 1985

INFORMATION FOR AFR BUREAU EXECUTIVE SUMMARY

(82 STATE 081077)

Q.I. What constraints does this project attempt to overcome and who does it constrain?

This project attempts to address the technical, institutional and methodological constraints affecting the Ministry of Agriculture and Water Development (MAWD) in its ability to conduct research and to extend relevant agricultural technology to small-scale producers (SSPs).

Q.II. What technology does the project promote to relieve this constraint?

The approach used in this project is to couple technical assistance, training (both long- and short-term), procurement of laboratory and field commodities and provision of some operational costs support on a sliding scale to address major biological and agronomic constraints to improve cereal and oilseed production at the national research level and to identify and address applied production constraints (including socio-economic factors) in concert with small-scale producers at the field level.

Q.III. What technology does the project attempt to replace?

Inappropriate cereal and oilseed varieties, and production practices which are not appropriate for increased production by small-scale producers, and ineffective extension methodologies for information dissemination to small-scale producers (SSPs).

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Q.IV. Why do project planners believe that intended beneficiaries will adopt the proposed technology?

The GRZ/MAWD was involved with the project design which emanated from earlier studies/analyses of the Research and Extension Branches of MAWD and the community of SSPs and has continued to use it as a model in other provinces of the country. They are committed to making it succeed as agriculture is becoming more and more important in the total GRZ economy.

Q.V. What characteristics do intended beneficiaries exhibit that have relevance to their adopting the technology?

Individuals in the GRZ/MAWD working with TA personnel are anxious to learn and to adopt the new approaches to research and technology development demonstrated by the project. SSPs willingly cooperate with project staff with applied research and demonstration activities on their farms. They have demonstrated a desire to improve their farming methods so as to increase production and to reduce risk.

Q.VI. What adoption rate has this project or previous projects achieved in transferring the proposed technology?

This project is unique among farming systems projects in that the project design calls for the National Research Branch to be linked with the National Extension Branch through the Research Extension Liaison Officers (RELO) and the Adaptive Research Planning Teams (ARPT). Adoption rate of the new technologies developed is evident through the amount of new seed of maize, sunflower and soybeans that are being utilized by small-scale producers.

Q.VII. Will the project set in motion forces that will induce further exploration of the constraint and improvements to the technological package proposed to overcome it?

This project is making a major contribution to the development and training of human resources in MAWD. These individuals will continue research and development and extension of technologies to solve the major constraints the project is addressing. Because of early success in the program MAWD is already looking for ways to enhance the progress of institutional changes that have helped the project to be successful.

Q.VIII. Do private input suppliers have an incentive to examine the constraint(s) addressed by the project and come up with solutions?

Yes, the project provides some of the basic cereal and oilseed to the only seed suppliers in Zambia. This company, ZAMSEED, is operated on a commercial basis. They have every incentive to work with the project, as their lifeline is new varieties being released by the MAWD research branch. ZAMSEED makes direct and in-kind contributions to the project/program and cooperates in the production, certification, supervision and pricing of seed for national distribution.

Q.IX. What delivery system does the project employ to transfer the new technology to intended beneficiaries?

The project uses the Research and Extension Branches of MAWD and organizations such as ZAMSEED and LINTCO to transfer and deliver the new technology to intended beneficiaries.

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Q.X. What training techniques does the project use to develop the delivery system?

Academic and/or technical, on-the-job training for applied research assistants, applied research trials conducted at the farm level, and demonstration trials and training sessions designed to upgrade capabilities to generate and extend the new technologies.

## PRELIMINARY MATERIAL

ITINERARY FOR THE MID-TERM FORMATIVE EVALUATION OF PROJECT 611-0201 (ZAMARE)

PERSONS CONTACTED

ACRONYMS

PROJECT EVALUATION SUMMARY (PES) - PART 1

EXECUTIVE SUMMARY

## MAIN REPORT

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ITINERARY FOR THE MID-TERM FORMATIVE EVALUATION
OF PROJECT 611-0201 (ZAMARE)
4-22 MARCH 1985

TEAM MEMBERS

John Yohe, Team Leader, FSSP
Earl Kellogg, Economist, UIUC
Eugene Pilgrim, Extension Specialist, FSSP
Loy Crowder, Breeder, FSSP
Eugenio Martinez, Agronomist, FSSP
Dennis Ignasias, UMES, Ex-Officio

SUNDAY - 3 MARCH

All team members will have arrived, met at airport and driven to Inter-Continental Hotel. Each member will be provided with a welcome kit and background documents.

MONDAY - 4 MARCH

| | |
|---|---|
| 0800 hours | Team departs hotel for AID to meet staff. |
| 1000 hours | Courtesy call on DCM, Mr. K. Hill |
| 1030 hours | Department Mr. N. Mumba, Deputy Director for Research Ms. R. Chungu, Deputy Director for Extension Mr. R. Mulele, and National ARPT Coordinator Mr. S. Kean, (If possible courtesy call on PS, MAWD, N. Mukutu). |
| 1200 hours | Lunch |
| 1400 hours | Meet with team leader J. Ragin and staff |

TUESDAY 5 MARCH

| | |
|---|---|
| 0830 hours | Meet with Chief Agricultural Research Officer Ms. B. Patel, ZAMARE Maize Breeder P. Gibson, and other members of maize research team. |

WEDNESDAY - 6 MARCH

| | |
|---|---|
| 0830 hours | LINTCO and CFB |
| 1430 hours | Meet with ZAMARE Sunflower Agronomist V. Eylands and other members of sunflower research team. |
| 1430 hours | Ron Watts, National RELO |



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THURSDAY - 7 MARCH

| | |
|---|---|
| 0830 hours | Extension Subject Matter Specialists |
| 0830 hours | Meet with ZAMARE Soils Microbiologist S. Sanogho, and other members of Microbiology unit. |
| 1430 hours | ZAMARE Administration |
| 1430 hours | Mr. Mhango, RCP |
| 1600 hours | Sutherland/Kean - Mt. Makulu |

FRIDAY - 8 MARCH

| | |
|---|---|
| 0600 hours | Depart for Magoye |
| 0830 hours | Meet with Station J. Joshi, and other members of Soybean Research Team. |

SATURDAY/SUNDAY 9 and 10 MARCH

Choma PAO, and Livingstone

MONDAY, AND TUESDAY - 11 and 12 MARCH

Kabwe to meet with Station OIC, Mr. F. Sikazwe, ZAMARE ARPT members R. Hudgens, Agronomist and R. Dedert, RELO.

WEDNESDAY - 13 MARCH

| | |
|---|---|
| 0900 hours | UNZA |
| 1430 hours | ZAMSEED |
| 1430 hours | PSU |

THURSDAY - 14 MARCH

| | |
|---|---|
| 0830 hours | MAWD Training Office |
| 0930 hours | MAWD Rural Information Services |
| 1430 hours | MAWD Planning Unit |

FRIDAY - 15 MARCH

| | |
|---|---|
| 0830 hours | Meet with AID/Zambia ADO<br>Follow-up meeting with ZAMARE team members (if necessary), organizing of notes, etc. and begin development of Evaluation Report. |



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SATURDAY - 16 MARCH

1600 hours Cocktails at residence of ADO, E. Gibson

SUNDAY - 17 MARCH

Open

MONDAY - 18 MARCH

0830 hours Meet with Ms. R. Chungu, Deputy Director for Research
1030 hours Meet with Mr. R. Mulele, Deputy Director for Extension
1230 hours Lunch with Messrs. Gibson, Perry and Ragin
1430 hours Radio interview on ZAMARE evaluation - John Yohe

TUESDAY - 19 MARCH

1100 hours T.V. interview on ZAMARE evaluation - J. Yohe/E. Kellogg
1430 hours Meet with Mr. N. Mumba, Director of Agriculture
1800 hours Evaluation team reception for ZAMARE

WEDNESDAY - 20 MARCH

1000 hours ZAMARE team briefings on evaluation
1900 hours Reception at residence of Mr. Fred Javaheri

THURSDAY - 21 MARCH

1800 hours Reception at residence of Dr. J. Ragin

FRIDAY - 22 MARCH

1400 hours Representatives of MAWD, ZAMARE and AID/Zambia meet with Evaluation Team at MAWD to review Executive Summary Evaluation team departs. J. Yohe, team leader returns Friday, 3/29/85

MONDAY - 25 MARCH

Prepare report for AID/Zambia ZAMARE, and MAWD review. Provide copies to 1) Director of Agriculture, 2) Deputy Director for Research, 3) Deputy Director for Extension, 4) National ARPT Coordinator, 5) National ARPT Sociologist, 6) CARO, Mr. Makulu, 7) ADO, AID/Zambia, and 8) Team Leader, ZAMARE.



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TUESDAY - 2 APRIL

1400 hours Representatives of MAWD, ZAMARE, AID/Zambia and Evaluation Team Leader J. Yohe meet at MAWD to review report.

NOTES

1) Two vehicles with drivers will be provided by AID/Zambia for the team from 0730 up to 2300 hours each day including weekends.

2) Clerical/Administrative support will be provided by AID/Zambia including use of WANG Word Processor for developing report.

3) E. Gibson and J. Ragin will coordinate team activities and accompany team during visits and meetings with MAWD and ZAMARE representatives.

## PERSONS CONTACTED

GRZ - MAWD

Mr. N. Mumba, Director, DOA

Madame R. Chungu, Deputy Director, DOA (Res)

Mr. R. Mulele, Deputy Director, DOA (Ext)

Dr. B. Patel, Chief Ag. Research Officer, Mt. Makulu

Mr. R. Watts, National RELO Coordinator

Mr. S. Kean, National ARPT Coordinator

Mr. A. Sutherland, National ARPT Sociologist

Mr. W. Chitah, OIC, Magoye, Ag. Research Station

Ms. J. Mulila, Research Associate SIUC

Ms. S. Nkumbula, Soybean Agronomist

Mr. F. Sichone, Agricultural Supervisor

Mr. F. Sikazwe, OIC, Kabwe Ag. Research Station

Mr. K. Chanda, ARPT Agronomist

Mr. Siyoto, PAO

Mr. W. Mwale, Maize Breeder

Ms. R. Mwampole, Sr. Extension Training Officer

Miss. M. Tembo, Home Economics Officer

Mrs. E. Lungu, Sr. Youth Extension Officer

Mr. G. Phiri, Chief Animal Husbandry Officer

Mr. J. Bhullar, Sr. Citrus Officer

Mr. Nkhungulu, Chief Horticultural Officer

Mr. C. Sikanyika, Sr. Home Economics Officer

Planning Division

Dr. M. Warren, Management Speialist

Dr. M. Applegate, Team Leader, ZATPID

Mr. E. Rawson, Economist

Dr. R. Vokes, Sr. Economist

LINTCO

Ms. Mantanyani, General Manager

Mr. D. Haniyama, Sr. Soybean Development Officer

ZAMSEED

Mr. Marcel B. Kanungwe, General Manager

Mr. Winter Chibasa, Production Manager

UNZA

Dr. B. Mweene, Deputy Vice Chancellor

Prof. K. Mwauluka, Principal, UNZA (Lusaka Campus)

Dean Ochetim, Dean School of Agriculture

Dr. K. Gill, Lecturer, Soil Sciences

FAO/UNDP

Mr. F. Javaheri, Soybean Agronomist

ROP

Mr. D. Mhango, General Manager



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AID/Zambia

Mr. Ernest Gibson, Agriculture Development Officer

Dr. Jim Snell, Ag. Economist

Mr. John Patterson, AID Representative

Mr. Fred Perry, General Development Officer

Mr. Michael Ireland, Management Officer

ZAMARE

Dr. James Ragin, Team Leader

Dr. Jagmohan Joshi, Soybean Breeder

Dr. Paul Gibson, Maize Breeder

Dr. Val Eylands, Sunflower Agronomist

Dr. Robert Hudgens, ARPT Agronomist

Mr. Ron Dedert, ARPT RELO

Dr. Oval Myers, Maize Breeder Backstop, SIUC

Mr. Glenn Hartman, Special Studies Graduate Student

Mrs. Bessie Thornicroft, Secretary

Mr. Lighton Chipeta, Admin. Assistant

PSU

Ms. M. Kiremire, Admin. Assistant

## ACRONYMS

| | |
|---|---|
| AA | Agricultural Assistant |
| AD | Agricultural Demonstrator |
| ADB | African Development Bank |
| ADP | Ava Development Projects |
| AFGRAD | African Graduate Program |
| ARET | Adaptive Research Extension Team |
| ARPT | Adaptive Research Planning Team |
| CARO | Chief Agricultural Research Officer |
| CD | Commodity Demonstrator |
| CEW | Camp Extension Workers |
| CIMMYT | International Center for Maize & Wheat Improvement |
| CRT | Commodity Research Team |
| DAO | District Agricultural Officer |
| DOA | Department of Agriculture |
| DVTCS | Veterinary and Tsetse Control Service |
| FSR/E | Farming Systems Research/Extension |
| FOREX | Foreign Exchange |
| GRZ | Government of Zambia |
| ITTA | International Institute of Tropical Agriculture |
| INTSOY | UIUC International Soybean Program |
| IRDP | Integrated Rural Development Program |
| LINTCO | Lint Company of Zambia Ltd. |
| LUP | Land Use Planning |
| MAWD | Ministry of Agriculture and Water Development |
| NAMBoard | National Agricultural Marketing Board |



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CLASSIFICATION

# PROJECT EVALUATION SUMMARY (PES) — PART I

Report Symbol U-44

| 1. PROJECT TITLE | 2. PROJECT NUMBER | 3. MISSION/AID/W OFFICE |
|---|---|---|
| Agricultural Development Research and Extension Project Zambia (ZAMARE) | 611-0201 | ZAMBIA |

4. EVALUATION NUMBER (Enter the number maintained by the reporting unit e.g., Country or AID/W Administrative Code, Fiscal Year, Serial No. beginning with No. 1 each FY) 611-85-

[X] REGULAR EVALUATION [ ] SPECIAL EVALUATION

| 5. KEY PROJECT IMPLEMENTATION DATES | 6. ESTIMATED PROJECT FUNDING | 7. PERIOD COVERED BY EVALUATION |
|---|---|---|
| A. First PRO-AG or Equivalent FY 80 | A. Total $ 16,771 | From (month/yr.) OCT 1983 |
| B. Final Obligation Expected FY 84 | B. U.S. $ 12,515 | To (month/yr.) MAR 1985 |
| C. Final Input Delivery FY 85 | | Date of Evaluation Review MAR 1985 |

8. ACTION DECISIONS APPROVED BY MISSION OR AID/W OFFICE DIRECTOR

| A. List decisions and/or unresolved issues; cite those items needing further study. (NOTE: Mission decisions which anticipate AID/W or regional office action should specify type of document, e.g., airgram, SPAR, PIO, which will present detailed request.) | B. NAME OF OFFICER RESPONSIBLE FOR ACTION * | C. DATE ACTION TO BE COMPLETED |
|---|---|---|
| 1. Fill vacant Central Province ARPT Economist position | E. Kellogg, UIUC<br>J. Ragin, TL ZAMARE<br>N. Mumba, D/DOA<br>E. Gibson, ADO, AID/Zambia | June 1985 |
| 2. Initiate policy for replacing project vehicles every two years or 80,000 km whichever comes first, all vehicles for field use should be heavy duty 4 wheel drive | M. Ireland, MO, AID/Zambia<br>J. Ragin, TL ZAMARE<br>E. Kellogg, UIUC<br>E. Gibson, ADO, AID/Zambia | Immediately |
| 3. Provide home office administrative consultancy for UIUC/ZAMARE field operations | E. Kellogg, UIUC<br>J. Ragin, TL ZAMARE | May 1985 |
| 4. Initiate a new TA position in soybean plant pathology (Mycologist) for the remainder of Phase I | E. Kellogg, UIUC<br>J. Ragin, TL ZAMARE<br>R. Chungu, DD/DOA/RES<br>M. Ireland, MO, AID/Zambia<br>E. Gibson, ADO AID/Zambia | October 198 |

9. INVENTORY OF DOCUMENTS TO BE REVISED PER ABOVE DECISIONS

- [ ] Project Paper
- [X] Financial Plan
- [ ] Logical Framework
- [X] Project Agreement
- [ ] Implementation Plan e.g., CPI Network
- [X] PIO/T
- [X] PIO/C
- [ ] PIO/P
- [X] Other (Specify) Work Plan
- [ ] Other (Specify)

10. ALTERNATIVE DECISIONS ON FUTURE OF PROJECT

- A. [ ] Continue Project Without Change
- B. [X] Change Project Design and/or [X] Change Implementation Plan
- C. [ ] Discontinue Project

11. PROJECT OFFICER AND HOST COUNTRY OR OTHER RANKING PARTICIPANTS AS APPROPRIATE (Names and Titles)

E.F. Gibson, ADO, AID/Zambia
N. Mumba, Director of Agriculture, MAWD
R. Chungu, Deputy Director of Ag. (Research) MAWD
R. Mulele, Deputy Director of Ag. (Extension) MAWD
J.B. Mutelo, Deputy Director of Ag. (LUP) MAWD
J.F. Ragin, Team Leader, ZAMARE

12. Mission/AID/W Office Director Approval

Signature

Typed Name: Fred Perry

Date: 4-12-85

AID 1330-15 (3-78)

| | | |
|---|---|---|
| 5. Link Provincial Subject Matter Specialists to ARPT in Central Province | R. Mulele, DD/DOA/(Ext)<br>J. Ragin, TL ZAMARE | Immediately |
| 6. Extend Microbiology position at least through the remainder of Phase I | E. Kellogg, UIUC<br>J. Ragin, TL ZAMARE<br>R. Chungu, DD/DOA/(Res)<br>E. Gibson, ADO, AID/Zambia | December 1985 |
| 7. Provide Extension Subject Matter short term TA to ARPT and Central Province PAO for guidelines on integration of SMS | R. Mulele, DD/DOA/(Ext)<br>J. Ragin, TL, ZAMARE<br>E. Kellogg,UIUC | Immediately |
| 8. Explore feasibility of transferring inoculum production from MAWD to private sector | N. Mumba, D/DOA<br>R. Chungu, DD/DOA/(Res) | Immediately |
| 9. Review and refine training plan and commodity procurement plan for remainder of Phase I | E. Kellogg, UIUC<br>J. Ragin, TL ZAMARE<br>R. Chungu, DD/DOA/(Ext)<br>J.B. Mutelo DD/DOA/(LUP)<br>R. Mulele, DD/DOA/(Ext)<br>M. Ireland, MO, AID/Zambia<br>E. Gibson, ADO, AID/Zambia | Immediately |
| 10. Draft a Basic Training plan and Commodity Procurement Plan for Phase II, these plans will be refined and elaborated during development of PP for Phase II | J. Ragin, TL ZAMARE<br>R. Chungu, DD/DOA/(Res)<br>R. Mulele, DD/DOA/(Ext)<br>J.B. Mutelo, DD/DOA/(LUP)<br>M. Ireland, MO, AID/Zambia<br>E. Gibson, ADO, AID/Zambia | June 1986 |

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| | | |
|---|---|---|
| 11. Terminal Evaluation Phase I in latter part of year four | E. Gibson, ADO<br>J. Ragin, TL<br>ZAMARE<br>E. Kellogg, UIUC<br>N. Mumba, D/DOA | June 1986 |

# MID TERM EVALUATION OF AGRICULTURAL DEVELOPMENT RESEARCH AND EXTENSION PROJECT (611-0201) (ZAMARE)

## INTRODUCTION AND EXECUTIVE SUMMARY

This evaluation is made after two years seven months of operation by the contract team on a project designed for five years (Phase I) with a Phase II and Phase III being envisaged if preceding activities prove to be successful. The evaluation is dual focussed. The Scope of Work (SOW) for the evaluation called for the team to: (1) Assess progress towards attaining project objectives and (2) To provide preliminary indication on whether a second phase of the project appears justified and, if so, to propose directions for a longer term A.I.D. and contractor role in Zambian Agricultural research and extension development.

The report was prepared by a six member team of John Yohe, Associate Director of the University of Nebraska Title XII Sorghum/Millet Colaborative Research Support Program, Earl Kellogg, Associate Director of the Office of International Agriculture, University of Illinois at Urbana-Champaign (UIUC), Loy Crowder of the University of Florida Farming Systems Project, Eugene Pilgrim of Pilgram & Associates, Watertown, Minnesota, Eugenio Martinez of the University of Florida Farming Systems Project, and Dennis Ignasias, Director of International Programs, University of Maryland-Eastern Shore.

Two Zambian counterpart team members had been requested from the Ministry of Agriculture and Water Developent (MAWD) by UIUC and USAID, but because of unavoidable commitments, MAWD particiaption was not possible. The group was assisted by USAID Agricultural Officer, E.F. Gibson and by the Contractor Team Leader, James Ragin, Mr. N. Mumba, Director of Agriculture, MAWD, Madame R. Chungu, Assistant Director,

Research Branch MAWD and Mr. M.R. Mulele, Assistant Director, Extension Branch. MAWD reviewed drafts of the evaluation paper and contributed in revision.

The evaluation followed the scope of work contained in Telex Lusaka 1059, paragraphs 3,4, and 5. In addition, an Executive summary has been prepared along with an evaluation face sheet indicating actions recommended by the evaluation team and approved by the USAID/Zambia office.

The methodology used, was to review the Project Paper, all documents produced during the first 2 1/2 years operation work plans, annual reports, consultant reports, trip reports, the Government of Zambia (GRZ) strategies for agricultural research and extension presented to the World Bank and many others. These were read prior to the initiation of the review. The team then interviewed team members, counterparts, program leaders in Mawd Research Branch and Extension Branch, MAWD Planning Division, other organizations interfacing with ZAMARE, i.e. the University of Zambia (UNZA), the Zambia Seed Company Limited (ZAMSEED), the Lint Company of Zambia Limited (LINTCO), the Refined Oil Products Limited (ROP), Provincial Agricultural officers in Southern and Central Provinces, Officer in Charge (OIC) of the Magoye Research Station and Kabwe Research Station, and the Chief Agricultural Research Officer (CARO) of the National Research Station at Mt. Makulu and Senior Administrators in MAWD, as well as AID/Zambia officials and staff. The intent was to be thorough in interviewing as well as to encourage respondants to interject their views about items important to the progress of the project and for ideas relating to follow-on activities in a potential Phase II. A list of those contacted is appended.

Executive Summary

This project has made excellent progress toward achieving the objectives of the program. Most notable is training. Thirty four participants were planned for in the project paper. Those have all departed and all will have completed their program during the life of the project. Short term training has equally been as successful and is on schedule.

The project was designed to strengthen the commodity research program on maize, sunflower, and soybeans. The project paper also called for farming systems research efforts through the applied Research Planning Team (ARPT). The ARPT in addition to conducting surveys and designing applied research to resolve constraints to small farmer problems made a direct link to enxtension and central research through the RELO (Research Extension Liaison Officer). This was the first project to attempt this approach through the RELO concept.

Implementation within the first two and a half years has been excellent. The implementing contractor and cooperating institutions have fielded a team professionally qualified and who have as well immersed themselves into the structure of the Ministry of Agriculture and Water Development (MAWD) where they have found outstanding success in working with their host country counterparts. The program has been so successful that logistic problems have occured because of increased activity and involvement over what the design paper envisioned. These have been and continue to be resolved as they occur.

The ARPT concept has been very successful. Problems of small farmers are being identified, research has been designed to investigate solutions

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to those problems and the RELO has been shown to be a viable concept. It has been so successful that this design team has recommended design adjustment to allow extension subject matter specialists (SMS) to work more closely and collaboratively with the ARPT Agronomist, Agricultural economist and the RELO. This is the next step toward integrating research and extension. The SMS's would carry approximately a half time research appointment and a half time extension appointment thus making a permanent bridge between extension and research.

Research: CRTs - Maize, Oilseeds, Soil Microbiology

ZAMARE support of three commodities -- maize breeder, sunflower agronomist, soybean breeder, and soil microbiologist -- have contributed significantly to the forward thrust of research and production. With ZAMARE and GRZ inputs two new early-maturing maize varieties with high yield potential and disease tolerance will move onto farms in 1985/86. Other populations are being rapidly improved.

The discovery of two free-nodulating soybean varieties by the GRZ Agronomist prompted movement of this crop onto small farms, abetted by LINTCO which provides farmer services and a guaranteed market. One such variety, magoye, has been released by the ZAMARE soybean breeder. Another variety, Tunia, which requires Rhizobium inoculation, was released for farmers who use high inputs (commercial and emergent farmers). Soybean inoculum was found to be in short supply and of poor quality. The soil microbiologist successfully purified the local inoculum and introduced two more efficient indigenous strains which will be used in 1985/86. With in-country peat deposits and 1984 TDY support of production

procedures, the country can be self- sufficient in inoculum for the 1985/86 growing season.

Sunfowers are mostly grown by small farmers, 95 percent of whom save their own seeds of locally mixed types which possess low oil content (27 percent). Some Hybrids and composites, were found to have a higher oil content (up to 40 percent). Some maintenance selection with further in-breeding was carried out by ZAMARE staff but seed demand has been low. At present the major constraints found are late planting, broadcast seeding, low plant population, and inadequate production practices are being investigated.

The ZAMARE commodity team members work in close alliance with the Central Province ARPT (supported by ZAMARE), as well as other provincial ARPTs, in design and implementation of on-station verification and on-farm trials. They, in turn, receive beneficial feed-back of farmer problems.

Recommendations

1. The evaluation team recommends continued thrust of the three commodities along the lines of the present research efforts with only minor modifications as noted in the text.
2. In view of the pending review and possible reoganization of the Land Use Planning Branch of the DOA, the position of soil microbiologist will be continued at least through phase I. Short-term technical assistance (TA) support will continue to be needed for monitoring inoculum production.
3. The problem of vehicle deterioration restricts operation of the ZAMARE supported research. For effective and productive program operation

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vehicles should be replaced every two years or an accumulated mileage basis of 80,000 km.

4. GRZ inputs are needed, especially in positioning counterparts and technicians, also in provision of recurrent expense funds, for timely land preparation and tillage, transportation, labor, supplies, equipment, and spare parts.

5. The team strongly endorses the arrangement whereby Zambian staff pursuing advanced degrees return for part of their dissertational research in the country. Whenever feasible this should be expanded.

6. The ZAMARE budget should be reviewed for possible recast of funds to allow an additional training component. ZAMARE staff should have strong input in selection of candidates.

7. Within the time frame of the present contract, short-term TA support should be considered in sunflower agronomy and plant breeding, commercial seed production and processing (assistance to ZAMSEED), and utilization, home, and industrial processing of soybeans.

8. A long term technical assistance position in soybean plant protection should be initiated as soon as possible in phase I. Vehicle and other support by ZAMARE and MAWD (housing) should be increased proportionately to accomodate the new position.

9. A follow-on phase of the ZAMARE project is recommended with consideration given to ZAMARE Team TA positions, within the cereals and oilseeds cluster e.g. cereals cluster leader, maize breeder, maize agronomist, sunflower breeder, sunflower agronomist, and a soybean breeder - subject to MAWD request.

10. Training for long-term and short-term should continue in Phase II for Research and extension activities activities.

Extension

Zambia extension may be characterized as one of relatively large numbers of staff, who are critically short of operating budget, and who could benefit from an improved staff development, supervision and management system plus much more formal and in-service training.

ZAMARE phase I was not designed to place major emphasis on extension. All of the ZAMARE staff however have been involved in extension in some manner.

ZAMARE research, CRTs have participated in some field staff training, trouble shooting, writing of publications and newsletters and station field days.

The ZAMARE RELO, has functioned to liaise between adaptive research and field extension in Central Province. This ZAMARE position has assisted with the ARPT field trial process, has set up training based on the ARPT work for provincial staff; and has worked with staff in getting out considerable numbers of field demonstrations.

We see two areas that need strengthening to impact on the effectiveness of extension in the farming systems process.

a. Need for a strong extension subject matter specialist team at the provincial level. These are to be a part of the ARPT provincial team but to have the leadership responsibility for programing and training in their subject in the province.

b. Programs taken to farmers need to be in the context of the total range of decisions the farm family faces. Thus more of a

complete - farm management extension training and extension program needs to be implented to strengthen the ARPT concept.

Recommendations for remainder of Phase I

1. Designate assignment of SMS - to be close collaborators to ZAMARE RELO, Agronomist and Economist from existing PSMS staff.
2. Initiate a development plan for the training of all SMS specialists and related extension staff - both graduate and in-service. Training to be carried out in Phase II.
3. Strengthen operating budget to support ARPT extension effort in Central Province.
4. Consultant TA to determine extension training needs for Phase II.

Three additional areas need attention for effective extension. These are both at national and provincial level.

1. Integrate Provincial SMS into ARPT and develop and long-term training plan.
2. Strengthen national and provincial communications information capacity.
3. Strengthen the organization management and program development aspects of the extension branch.

Specifically During Phase II

1. Train 15-25 provincial SMS to M.S. level.
2. Take 30 SMS to outside study tours.
3. Provide Consultants in program development, staff development and subject matter for staffing and development
4. Build a communications department.

5. Staff 3 long term ZAMARE experts:

   -Extension Subject Matter Personnel Development Specialist;

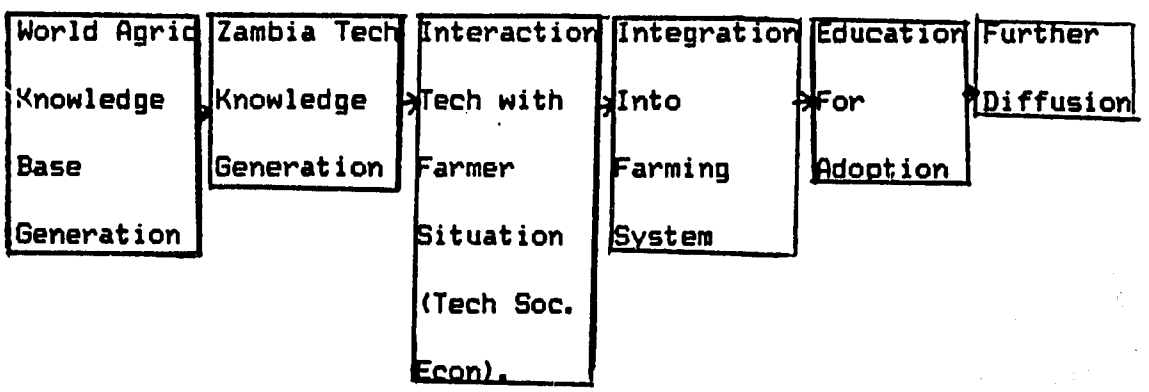
   -National level Communications/Information Specialist;

   -National level Extension organization and Program development Specialist.

6. Provide adequate operating support for 1-5 above.

CRT/ARPT/Extension Integration

For successful research/extension integrations the total organization must be committed to a continum of technology development and application which melts the research/extension function together. The following scheme serves to illustrate this point.




Zambia has in place the traditional research/extension divisions. Recently initiatives by DOA have served to strengthen linkages. In 1975 the LIMA system, 1978 The T&V system, 1980 the ARPT system, and in 1982 the decentralization of extension and research functions. Each had some effect on both research and extension.

A current report of the GRZ supported by the World Bank proposes several changes that should foster integration. Some of these changes are

being implemented. The ARPT is operational in several provinces, this links CRTs, to Adaptive Farming systems research and field extension. National ARPT and RELO Coordinators have been named and are finding their place in the organization. Some effort at provincial planning/coordinating committees are being made.

Much of the present integration and that proposed in the World Bank report is very dependent on coordination and cooperation among units and individual staff. A straight line autocratic structure does not exist. Directors of research and extension will need to be compatible and work jointly with common interests to make the system effective. The same spirit of teamwork must develop between CRT/ARPT staff and ARPT/extension staff. To make this collegial organizational model perform effectively a clear definition of objectives, rules and responsibilities must be understood by all. It is dependent on staff obtaining satisfaction from teamwork, some form of performance appraisal and ample opportunity to interact and communicate to both reduce conflict and to foster teamwork.

At the CRT/ARPT level we feel that the group coordinators can provide for necessary integration. This will however necessitate strong, involved leadership by the present CARO and the proposed Assistant Director Research - Technical Division.

At the ARPT level the local province Agriculture Officer, the team coordinator or leader and the RELO are the key to integration.

For integration to take place we propose providing both time and funding support for frequent meetings of the various teams where linkages and integration is important. For example the ARPT Agronomist should meet frequently with the relevant CRT people. We propose initiating an

annual 3-5 day conference of all key CRT/ARPT/Ext staff to both do program development and to develop a strong team spirit.

The subject matter specialist concept is a major item in our recommendations. We feel this will foster integration and result in impact programs on the farms. Appropriate SMS at the provincial level would be placed on approximately 50/50 ARPT/Ext subject matter training appointment. They would join the ARPT team and assure that that process is working effectively in the field. Also they will be responsible for the program (as a team) in their subject matter special in the provinces, including doing and monitoring the training down to the camp level.

In addition a strong communications-information unit needs to be developed along with a strong program development/staff development capacity.

ZAMARE can initiate several of the above during the remainder of Phase I. We suggest adding 3 SMS counterparts to Central Province, sponsor an annual all-staff conference, and provide an internal staff newsletter.

In Phase 2, subject to MAWD request/concurrence, a ZAMARE staff in country of one communications/information specialist, one program and organization specialist and one Subject Matter staff development specialist at the national level, and 3 provincial subject matter specialists for the ARPT should be considered in context of the MAWD Extension Strategy report. This to be complemented by an aggressive graduate program 25-35 SMS to MS, 30 study tours participants on SMS and consultants and study tours on communications and staff development. This is in addition to the Central Province ARPT which should be augmented by a sociologist.

# Zambia
## Agricultural Research and Extension Project
## Long-term Technical Assistance Needs in Research Branch

```
                    Current     :--------Life of Project--------:
Specialty            Donor      :1985:1986:1987:1988:1989:1990:1991:1992:

 ZAREC Secretariat
Strategic Planner               : 00:0000:0000:0000:0000:0000:0000:0000:

 CEREAL CROPS
Coordinator         ODA         :XX00:0000:0000:0000:0000:0000:0000:0000:
 Maize CRT
Breeder             USAID       :XXXX:XXXX:====:====:====:====:====:0000:
Breeder             SIDA        :XXXX:====:====:0000:0000:
Breedr              SIDA        :XXXX:====:====:
Pathologist         FAO/NORAD   :XXXX:XXXX:XXXX:====:====:
 Wheat/Triticale    CRT
Team Leader         CIDA        :XXXX:XXXX:XXXX:XXXX:XXXX:XXX0:0000:0000:
Breeder             CIDA        :XXXX:XXXX:XXXX:XXXX:XXXX:XXX
Pathologist         Belgium     :XXXX:XXXX:XXX
Soil Scientist      CIDA        :XXXX:XXXX:XXXX:XXXX:XXXX:XXX
Soil Scientist      CIDA        :XXXX:XXXX:XXXX:XXXX:XXXX:XXX
Agronomist          IDA         :XXXX:XXXX:XXXX:XXXX:XXXX:XXX
Engineer            CIDA        :XXXX:XXXX:XXXX:XXXX:XXXX:XXX
Technician          CIDA        :XXXX:XXXX:XXXX:XXXX:XXXX:XXX
 Sorghum/Millet     CRT
Breeder             SIDA        :XXXX:====:====:0000:0000:0000:0000:
Agronomist          SIDA        :XXXX:====:====:
 Rice CRT
Breeder             GRZ         :XXXO:0000:0000:0000:0000:0000:0000:

 OILSEEDS, GRAIN LEGUMES & FIBERS
Coordinator                     : 00:0000:0000:0000:0000:0000:0000:
Soil Microblgy.     USAID       :XXXX:XXXX:====:====:====:====:====:
 Oilseeds CRT
Coordinator         UNDP/FAO    :XX
Groundnut Brdr.     UNDP/FAO    :XX==:
Groundnut Agron     IBRD/IFAD   :XXXX:XXXX:XXXX:
Soybean Breeder     USAID       :XXXX:XXXX:====:====:====:====:====:
Soybean Agron.      UNDP/FAO    :XX==:0000:0000:0000:0000:
Sunflwer Agron.     USAID       :XXXX:XXXX:====:====:====:====:====:
Sunflwer Pathol     Belgium     :XXXX:XXXX:XXX
 Grain Legumes CRT
Breeder             IBRD/IFAD   :XXXX:XXXX:XXXX:0000:0000:0000:0000:
Entomologist        IBRD/IFAD   :XXXX:XXXX:XXXX:0000:0000:0000:0000:
Pathologist         IBRD/IFAD   :XXXX:XXXX:XXXX:0000:0000:
 Cotton CRT
Breeder             France      :XXXX:0000:0000:0000:0000:0000:0000:
Entomologist        France      :XXXX:0000:0000:0000:0000:
Agronomist                          :0000:0000:0000:0000:
```

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```
 ADAPTIVE RESEARCH
ARPT Coordinator  ODA        :XXXX:XXXX:XXXX:====:====:OOOO:OOOO:OOOO:
 Central Province
FSR Agronomist    USAID      :XXXX:XXXX:XXXX:====:====:====:====:====:
FSR Economist     USAID      :XXXX:XXXX:XXXX:====:====:====:====:====:
RELO              USAID      :XXXX:XXXX:XXXX:====:====:====:====:====:
 Western Province
FSR Economist     Netherland :XXXX:XXXX:====:====:====:
 Luapula Province
FSR Agronomist    SIDA       :XXXX:XXXX:XXXX:====:====:
FSR Economist     SIDA       :XXXX:XXXX:XXXX:====:====:
 Eastern Province
FSR Agronomist    IBRD/IFAD  :XXXX:XXXX:XXXX:
 North Western Province
FSR Agronomist    IFAD       :XXXX:XXXX:XXXX:XXXX:
FSR Economist     IFAD       :XXXX:XXXX:XXXX:XXXX:
 Lusaka Province
Rural Sociolgist  ODA/IDI    :XXXX:XXXX:XXXX:====:====:OOOO:OOOO:OOOO:
 Northern Province
FSR Agronomist    NORAD      :  XX:XXXX:XXXX:XXXX:====:====:
FSR Economist     NORAD      :  XX:XXXX:XXXX:XXXX:====:====:
RELO              NORAD      :  XX:XXXX:XXXX:XXXX:====:====:
 Southern Province
FSR Agronomist                    :OOOO:OOOO:OOOO:OOOO:OOOO:OOOO:
FSR Economist                     :OOOO:OOOO:OOOO:OOOO:OOOO:OOOO:
RELO                              :OOOO:OOOO:
 Copperbelt Province
FSR Agronomist                         :OOOO:OOOO:OOOO:OOOO:OOOO:OOOO:
FSR Economist                          :OOOO:OOOO:OOOO:OOOO:
RELO                                   :OOOO:OOOO:OOOO:
 ARPT Backup
Sociologist                       :OOOO:OOOO:OOOO:OOOO:
Sociologist                            :OOOO:OOOO:OOOO:OOOO:
Livestock Specialist              :OOOO:OOOO:OOOO:OOOO:
Livestock Specialist                   :OOOO:OOOO:OOOO:OOOO:

 SUPPORT SERVICES
Maintenance Engineer            OO:OOOO:OOOO:OOOO:OO
 Plant Protection
Virology  Belgium             :XXXX:XXXX:XXX
 Soil-Crop Advisory
Soils Advisory  ODA           :XXOO:OOOO:OOOO:OOOO:OOOO:
Biometrics
Biometritrian  GRZ            :XXXX:XXXX:XOOO:OOOO:
```

---

Donor funding fixed xxxx
Donor funding likely ====
Donor funding needed oooo

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```
 HORTICULTURE & SPECIALTY CROPS
Coordinator                          :0000:0000:0000:0000:0000:0000:0000:
 Roots & Tubers CRT
Breeder                            00:0000:0000:0000:0000:0000:0000:0000:
Agronomist                         00:0000:0000:0000:0000:
 Coffee CRT
Agronomist                         00:0000:0000:0000:0000:0000:0000:
 Vegetables CRT
Physio/Agronomy    SIDA         :XXXX:X000:0000:0000:0000:0000:0000:
Pathologist        SIDA         :XXX=:====:====:0000:0000:0000:0000:
 Tree Crops CRT
Hort/Leader        Arab Fund    :XXXX:XXXX:====:====:
Horticulture       Arab Fund    :XXXX:XXX=:====:====:

 LIVESTOCK/PASTURES
Coordinator: Animal Prod'n/Past    :0000:0000:0000:0000:0000:0000:0000:
Pastures           SIDA         :XXXX:0000:0000:0000:0000:
Pastures           GRZ          :XXXX:XXX
Animal Husbry.     Arab Fund    :XXXX:
Animal Husbry.     Arab Fund    :XXXX:XXXX:
Pasture/Range Mgt                        :0000:0000:0000:0000:
Animal Nutritionist                      :0000:0000:0000:0000:
Dairy Prod'n Specialist                       :0000:0000:0000:0000:

 BASE RESOURCES MANAGEMENT
Coordinator                          :0000:0000:0000:0000:0000:0000:0000:
 Soils CRT
Soil Scientist     NORAD        :XXXX:XXXX:XXXX:XX==:====:====:====:====:
Soil Scientist     NORAD        :XXXX:XXXX:XXXX:XX==:====:====:====:====:
Soil Microblgy.    NORAD        :XXXX:XXXX:====:====:
 Cropping Systems CRT
Agronomist                         00:0000:0000:0000:0000:0000:0000:
Agronomist                           :0000:0000:0000:0000:
Agroforestry                       00:0000:0000:0000:0000:0000:0000:
 Irrigation and Drainage CRT
Irrigation Engineer                  :0000:0000:0000:0000:0000:0000:
Irrigation Agronomist                :0000:0000:0000:0000:
Small-Scale
  Irrigation  UNDP/FAO
 Tillage/Farm Machinery CRT
Agricultural Engineer                :0000:0000:0000:0000:0000:0000:0000:
Engineer/Agronomist                  :0000:0000:0000:0000:0000:
```

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## I. INTRODUCTION AND SUMMARY

Zambia has the highest percentage of its population living in urban centers (some 40-45%) of any African country south of the Sahara. The dominance of copper production in the Zambian economy has overshadowed agricultural development. Because of declining world copper prices and declining copper mining reserves the Government of Zambia (GRZ) has developed new policy initiatives directed toward agricultural development, especially for development of the small farm sector. This is especially critical because in recent years agricultural production has been growing at a rate of about one percent per year while population grew at a rate of 3.13 percent from 1970-75 and is estimated to grow at an annual rate of 3.38% from 1985-90. In order to keep abreast of population growth, it is estimated that agricultural production will need to grow at an annual rate of four percent per year. In the past, the GRZ policy had been directed toward satisfying the food requirements of the urban sector with subsidized food prices which had an additional negative effect on economic growth in rural areas. More recently, the GRZ began removing the subsidies on some food commodities, i.e. maize, and also increasing the producers farm gate prices on major commodities grown (maize, wheat, soybeans, groundnuts and cotton.)

In 1979 AID/Zambia in its first initiative for assistance to Zambian the agricultural sector developed the Project Identification Document (PID) for the Zambia Agricultural Research and Extension Project (ZAMARE). The project moved into the Design stage in July of 1980 and was approved for implementation in Washington, D.C. in September of 1980. A contract was signed with the University of Illinois at Champaign-Urbana (UIUC), lead University, the University of Maryland Eastern Shore, and Southern

Illinois University at Carbondale in December of 1981 for implementation of the program. The Project Paper called for internal evaluations in years 1, 3 and 4. AID/Zambia did hold a first year start up evaluation. It also called for a mid-term external evaluation at the end of year two to address the points which appear in the Scope of Work for this evaluation. (Appendix 1)

This project was well designed and has made significant progress since the arrival of the technical assistance team in August of 1982. There were delays in project start up due to problems beyond the control of the contractor. However, this time was put to good use as AID/Zambia and MAWD identified candidates for long term training under the project training plan and initiated that process. The contracting universities also used this time to implement a thorough departure briefing program. Commodity Procurement, equipment and supplies had also been identified in detail (GRZ/MAWD and the design team drew up the procurement plan) and was implemented by AID/Zambia. These actions resulted in equipment and supplies being available for the Technical Assistance team upon their arrival and the early implementation of training has resulted in trainees beginning to return to their posts as early as January 1984. Most AID development assistance projects don't see equipment and supply purchases until the second to fourth year of a project and often trainees don't return until after a project has terminated. A third major accomplishment during the start up delay was remodelling and refurbishing of houses for the technical assistance team. This is also often not the case.

The sections which follow evaluate in some detail all of the important elements of the project. Implementation within the first two years of

the project has been successful and ahead of schedule, even though there has been a drought affecting the region the past 3 years. The GRZ regards the ZAMARE project as an example of success by which to measure other technical assistance activities. There have been start up problems which mostly have been operational in nature and those associated with establishing adequate communications systems. These mostly have been resolved and they did not detract from progress against project objectives. The first year evaluation indicated that the project design was excellent and that "implementation in the first year was worthy of the design." Leadership of the GRZ Research Branch, accustomed to working with expatriates from a diverse background, has done an excellent job in integrating the human resources into its own program." This fact still holds true at the time of this mid-term evaluation.

The timing of this review is critical in that the GRZ has recently presented a strategy to the World Bank requesting assistance in providing for a greater sense of direction and focus for agricultural research and extension, to improve efficiency in the research and extension branches, to provide a sound basis and rationale for increased financial resources, including continued external donor assistance, and to provide a framework and unifying themes into which various programs and projects may be fitted to achieve common objectives. This evaluation views the ZAMARE project as fitting extremely well into these proposed strategies by recommending continued support with some modification for the Phase I and an expanded role in the Cereals CRT, the Oilseeds CRT, and in the ARPT located in Central Province and a new initiative in Extension for Phase II.

## II. BACKGROUND - Description of Existing Structure of the Department of Agriculture and how ZAMARE fits.

The Department of Agriculture (DOA) headed by a Director, has three branches: a) Research Branch, b) Extension Branch, and c) Land Use Planning Branch. Each Branch is headed by an Assistant Director located at Departmental Headquarters in Lusaka. The Research and Extension Branches will only be described in this discussion.

### A. Research Branch

The existing organizational structure (Chart 1) of the Research Branch is such that virtually all of the Research Team Leaders, administrative and support staff units, and research station heads report directly to the Chief Agricultural Research Officer (CARO) located at the Mt. Makulu Research Station. The research programs are organized on a interdisciplinary basis, by commodities or groups of commodities. The Adaptive Research Planning Teams, which now exist in six of the nine provinces, are coordinated by an ARPT Coordinator who is responsible to the CARO.

### B. Extension Branch

The existing organizational structure (Chart 1) of the Extension Branch is headed by the Assistant Director of Agriculture for Extension. He is assisted by the Chief Subject Matter Specialists (SMS). In the nine provinces of the country, extension services are organized through a Provincial Agricultural Officer (PAO), who is assisted by provincial subject matter specialists and administrative personnel.

Chart 1. Existing Organizational Structure of the Research and Extension Branches

MAWD
PERMANENT
SECRETARY

DEPT. OF AGRICULTURE
DIRECTOR

RESEARCH BRANCH
ASSISTANT DIRECTOR

CHIEF AGRICULTURAL
RESEARCH OFFICER

EXECUTIVE
OFFICER

NATIONAL ARPT
COORDINATOR

| COMMODITY RESEARCH TEAMS | SPECIALIST RESEARCH TEAMS | SERVICE UNITS |
|---|---|---|
| CEREALS | PLANT PROT. | CROP ADVISORY |
| OILSEEDS | WEED CONTROL | SEED CONTROL |
| FIBERS | FARM MCHY/ TILLAGE | LIBRARY |
| TOBACCO | SOIL PRODUCTIVITY | |
| ROOTS & TUBERS | CROPPING SYSTEMS | |
| GRAIN LEGUMES | IRRIGATION | |
| TREE & PLANTATION | FOOD STORAGE/ CONSERVATION | |
| ANIMAL HUSBANDRY AND PASTURES | | |

ARPT's

AGRIC ECONOMIST | AGRONOMIST | RELO

OFFICER IN CHARGE
REGIONAL RESEARCH STATIONS

RESEARCH
SUB STATIONS

EXTENSION BRANCH
ASSISTANT DIRECTOR

SECTIONAL HEADS

ANIMAL HUSBANDRY

CROPS HUSBANDRY
HORTICULTURE
EXTENSION TRAINING

TOBACCO

YOUTH EXTENSION

HOME ECONOMICS

PROVINCIAL AGR
OFFICER

SUBJECT MATTER
SPECIALISTS

LAND USE

DISTRICT AGRICULTURAL
OFFICERS

BLOCK SUPERVISORS

CAMP STAFF

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C. ZAMARE fit in the Research and Extension Branches -ZAMARE functions through the Cereal and Oilseed CRT's located both at Mt. Makulu station and the Magoye Research Stations. This is done by providing a sunflower agronomist and a soybean breeder to the oilseeds CRT, a maize breeder to the Cereal Grains CRT and a soil microbiologist to the Soil Productivity Special Research Team (SRT).

ZAMARE provides the ARPT team for the Central Province. This team consists of an Adaptive Research Agronomist, an Agricultural Economist and Research Extension Liaison Officer (RELO). On the Research side the ARPT team technically works through and with the appropriate CRTs and functions administratively through the ARPT coordinator. The ARPT is linked to the Extension Branch through the RELO who has a functional direct link to the Assistant Director for Extension and works with the PAO and extension personnel in the Central Province.

In addition to the integration of the ZAMARE Team into the Department of Agriculture, the team, as an intergral AID/Zambia technical assistance team, is supported by a Team Leader located within MAWD central headquarters in Lusaka. The Team Leader works with relevant units within MAWD and provides professional assistance to the Assistant Directors for Research and Extension in making the efforts of the Zamare Team more responsive to GRZ needs. He also provides an invaluable communication link between MAWD and USAID. As the Team Leader works within the operational procedures of GRZ, he provides support to both the ZAMARE Team and GRZ in the clearance of personnel, participant trainees and consultants for the ZAMARE project. He provides the backstopping needs

for the team in respect to operational requirements funded under the project.

D. Project Support Unit (PSU)

The PSU was organized by the AID/Zambia office to make contractor-incountry support from the USAID mission more effective. The PSU provides some typing services to ZAMARE team members, occasional transport backstopping for special studies personnel, visitors and TDY consultants. It also does some accounting, purchasing, and clearing of goods purchased for the project. The PSU functions under the guidance of the AID/Zambia Management Officer.

E. AID/Zambia Office

The ZAMARE project is supported by the Government of Zambia and AID/Zambia. As AID/Zambia is the forex supporting donor it has an interest in assuring that the implementing contractor fulfills its contractual obligations and provides the most optimal Technical inputs to the project possible. The AID/Zambia Agricultural Officer and Management Officer provide an active supporting role to the project.

The Agricultural Officer acts as liaison between the Zamare Team and AID/Zambia on matters of program and substance in relation to AID regulations and mission objectives. He is responsible, with the team's help, for conducting the annual Project Evaluation Summary (PES) for years 1, 3 and 4. On the logistical side the AID/ZAMBIA Management Officer through the PSU supports team activities. The AID/ZAMBIA Training Assistant assists in preparations and processing of much of AID's required training documentation such as PIO/P's and bio-data forms.

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## III. ZAMARE PROJECT GOALS AND OBJECTIVES

In evaluating the ZAMARE project, it is important to analyze the extent to which the project's objectives continue to be consistent with GRZ priorities and the recommendations derived from expert analyses regarding actions needed to accelerate economic development. This brief analysis will include investigating expert opinion and priorities regarding; investments in agriculture versus other sectors, emphasis on small-scale producers versus large commercial farmers or State farms, research and extension investments versus other possible agricultural investments, appropriateness of commodities receiving emphasis in ZAMARE versus other commodities, and training of research and extension personnel versus other possible research and extension investments.

It is clear that the GRZ stated policy is to increase the emphasis on agricultural sector development. The World Bank analysis indicates that to support realistic growth rates in the Gross Domestic Product (GDP), agriculture should grow at 4% per year. This will require substantial improvement in the performance of the agriculture sector which has been growing at about 1% per year since 1974 and much of that occurred in the commercial sector. In general, the agriculture sector should be contributing much more than the 14 percent of GDP which was contributed in 1983. Increased agricultural growth will contribute to improved income of rural people, a reduction of the trade deficit by substuting for imports, and assist in reducing substantial rural-urban income disparities. Also, increased agricultural production will moderate the current price inflation index in food, beverage, and tobacco products which reached 329.5 in 1983 from a base of 100 in 1975. Given the

objectives of increased employment and continued reductions in imports, Zambia needs to have a rapidly growing agriculture sector. Therefore, it is clear that the ZAMARE project is consistent the with broad goal and need to increase the performance of the agriculture sector.

The ZAMARE project is oriented toward producing and extending relevant agriculture production technology that can be adopted by small-scale producers (SSP). There seems to be general agreement between expert opinion and GRZ priorities that emphasis in agriculture development should be given to the small scale producer sub-sector at this stage of development. As compared to large commercial farmers or state farms, SSPs can increase agricultural production using less capital intensive and more labor using techniques. It is also apparent that increasing agricultural production through SSPs will require less foreign exchange than through large commercial or state farm structures. Given the extreme shortage of foreign exchange for other than debt-service this SSP strategy seems particularly appropriate.

The ZAMARE project is further focused on research and extension activities and their linkages. The World Bank analysis is that besides spare parts and imports of agricultural inputs for the commercial farm sector, the largest constraint to increased agricultural production is the availability of appropriate technical packages for SSPs due to inadequate adaptive research and inefficient extension services. In other analyses reviewed, immediate needs for agricultural development included two priorities: (1) strengthened agricultural research and extension services; and (2) improved input and output marketing performance. Research extension linkages were also often mentioned as important

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constraints to agricultural development. Improving the economic incentives available to SSPs and improving the policies and performance governing input and output marketing and processing activities are equally important constraints. It must be noted that the ultimate performance of the ZAMARE project and research and extension systems will be dependent on the infrastructure and policy framework governing the distribution of inputs and outputs.

The ZAMARE project focuses on research efforts in maize, sunflower, soybeans, soil microbiology, and adaptive research in the central province. These research concentrations are consonant with GRZ priorities and expert opinion recommendations. Maize is the major staple in Zambia and therefore has a central role in the food self-sufficiency strategy of GRZ. Oilseed production in Zambia is very important to making successful the impact substitution strategy recommended in several studies and adopted by GRZ. The importation of animal and vegetable oils averaged 14 million Kwacha per year between 1976-1980 accounting for 17% of total agricultural imports. The MAWD-IADS report on Zambia - Strategy for Agricultural Research list maize, soybeans and sunflower as priority I commodities in four priority categories. Soil microbiology is a necessary component to increasing soybean and other legume crop production. Zambia has no one trained in soil microbiology at this time. Therefore, the project is filling an important void until Zambians return from graduate programs in soil microbiology. In addition, the ZAMARE project personnel produce the only inoculum in Zambia at the present time. As indicated previously, adaptive research is an area of research badly needed in Zambia in striving to produce technology that will be adopted by SSPs.

The ZAMARE project also concentrates heavily on the training of research and extension personnel. Both the World Bank study on Zambia Policy Options and Strategies for Agricultural Growth and the MAWD-IADS study identified as critical issues the shortage of appropriately qualified and experienced Zambians in research and extension positions. As of June, 1984, there were 2 Ph.D's, 18 MScs and 34 BScs in the Zambian research staff. By 2000, the goal is to have 92 Ph.Ds, and MScs and 62 BScs. Obviously, advanced training will have to be a major activity in Zambia's plan for strengthening agricultural research and extension capacity.

In many dimensions, The ZAMARE project objectives are fully supportive of high priorities of GRZ and recommendations of recent studies on agricultural and economic development in Zambia.

## IV. ECONOMIC AND RESOURCE ANALYSIS OF RESEARCH BRANCH ACTIVITIES

### GRZ Budget Commitment to Agriculture and Research

One test of commitment to agriculture and agricultural research are actual expenditures from local sources in the Government budget. In assessing this commitment and ability to share in the costs of the ZAMARE project as originally planned, one must remember IMF Agreements for example and the stringent controls placed on government expenditures during the past few years to reduce the budget deficit in line with economic policy reform. For example, total current central government expenditures in recurrent and capital categories were about the same in 1983 as in 1980. In real terms, budget expenditures were reduced by over 20% between 1980 and 1983. Therefore, even if agriculture in general or agricultural research in particular were to receive increased priority in government

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expenditures, that might mean slowly increasing budgets in current terms and actual declines in real terms.

From 1975 to 1982, only 6% of total government expenditures was spent on agriculture. However, this proportion may well have increased in 1984. It is reported in the World Bank Zambia Economic Memorandum that agriculture received larger increases in expenditure budgets in nominal and real terms than any other Ministry except Works and Supplies. This amounted to a 24% increase in real terms of the recurrent operating expenditures in agriculture from 1981 to 1984. As a result, in 1984, agriculture will account for 9% of the total government expenditures. Unfortunately, there was not enough time to analyze how these expenditures are distributed within the Ministry of Agriculture and Water Development.

A general rule of thumb is that agricultural research should receive a minimum of 1% and an optimum of 2% of the agriculture GDP. In 1983, the agricultural GDP was 590.9 million Kwacha. Shown below are recurrent and capital expenditures for agricultural research from 1980 - 1983 with 1984 and 1985 estimates.

Actual Recurrent and Capital Expenditures

Agricultural Research 1980-1985

| Year | Recurrent | Capital | Total |
|---|---|---|---|
| | (Kwacha) | | |
| 1980 | 1,896,180 | 1,404,897 | 3,301,077 |
| 1981 | 1,972,048 | 834,453 | 2,806,501 |
| 1982 | 2,498,755 | 2,618,669 | 5,117,424 |
| 1983 | 3,064,392 | 1,015,280 | 4,079,652 |
| 1984 | - | - | 3,557,501* |
| 1985 | - | - | 5,393,501* |

* Estimates

One to two percent of Agriculture GDP in 1983 is 5.9 to 11.8 million Kwacha respectively. Actual expenditures on agricultural research was about 4.8 million Kwacha. Therefore Zambia's Kwacha investment in agricultural research is only 69% of the minimum and 35% of the optimum recommended. The amount of donor support for agricultural research is difficult to obtain but obviously this support makes up a substantial part if not all of the gap between actual and recommended investment levels. It is clear as donor support is reduced, substantial increases in GRZ commitments to agricultural research will have to be made.

The GRZ budget for the ZAMARE project was estimated, in the Project Paper, to be $4,256,000 or 25.4% of overall costs for the five-year period. Much of that support was to be in-kind through provision of personnel, facilities, and services. Housing for the ZAMARE staff has been provided along with office space. Counterparts have been identified for all ZAMARE staff. Housing for Zambian support and counterpart personnel is being furnished except that the lack of housing for the RELO counterpart at Kabwe has constrained the identified counterpart from working at Kabwe. This has, of course, made the RELO counterpart relationship ineffective. Workers to support research at the various locations have generally been available. Also Kwacha contributions by GRZ for salaries of short and long-term trainees have met planned expenditures. Land for research work has also been made available in adequate quantities.

Some difficulties have been experienced in provision of a workable vehicle for the microbiologist, Kwacha contributions for vehicle fuel and maintenance, and purchase of trial requisites.

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The GRZ contributions for vehicle fuel and maintenance and trial requisite were estimated to be about 100,000 Kwacha in year 3 in the project paper. That this amount has not been forthcoming is no surprise when the actual allocations to the various CRTs, and ARPT in which ZAMARE works are noted. In 1984, the MAWD-IADS study on Strategy for Agricultural Research reports that the cereals - CRT received an allocation for recurrent expenditures of 80,000 Kwacha, the oilseed CRT - 30,000 Kwacha and all of the ARPTs - 4,000 Kwacha. These three units, with the exception of the soil-microbiologist, and team leader, are where ZAMARE scientists work. Their total recurrent budget was only 114,000 Kwacha in 1984. This 114,00 Kwacha budget must serve several other scientists and commodities other than the ZAMARE staff working only in maize, sunflower, soybean and one ARPT. Therefore, it appears completely unrealistic to expect matching contributions forecast in the Project Paper of 100,000 Kwacha in 1984, 121,000 in 1985, and approximately 165,00 in 1985 without substantial increases in recurrent budget allocations to CRTs and ARPTs.

In addition to the lack of adequate recurrent budget to provide the requested match, MAWD has at least 10 other donor programs in research which have similar match requirements.

Further evidences of the problem in providing matching funds is the actual budget expenditures released from the approved budget. As indicated above, the 114,000 Kwacha budget for recurrent expenditures of the Cereals and Oilseeds CRTs and ARPTs was the <u>approved</u> budget. No information was available on actual released expenditures in 1984. However, in 1983, the Cereals CRT and Oilseeds CRT were only released 50% and 43% of their approved budgets.

In summary, the matching contributions predicted in the Project Paper are clearly too high for vehicle fuel and maintenance and trial requisites. It is difficult to estimate a reasonable match requirement for fuel and trial requisites but probably no more than 20% of the original estimates could be reasonably expected in the near future.

Research Branch Linkages to Resource Allocations Activities

The procedure for development and submission of budget requests for research activities seems to be clearly defined and understood. Detailed budget requests are prepared by CRTs and ARPTs and sent through channels to the Deputy Director of Agriculture for Research. These requests, usually cast as minimum requests, are sent to the Director of Agriculture who submits them to the Permanent Secretary of MAWD. Some review occurs at each of these levels with the Planning Division of MAWD being involved at the PS level. The revised requests are then taken to higher levels for review, revision, and final decision. Within the Finance Ministry and NCDP some staff who review these and other budget requests do have assignments to work on requests from MAWD units. A recommended procedure and timing is discussed in Chapter IV of the MAWD-IADS study on agricultural research.

The success of receiving what is requested has been limited. In 1984, the budget request for recurrent expenses in research programs was 785,200 Kwacha with 54 percent or 420,600 being approved. For the cereal and oilseeds CRTs, approved budgets were 60% and 33% of requested budgets respectively. However, budget approval has not translated into released expenditures. In 1983, for example, the cereals CRT had an approved budget of 53,000 Kwacha but only 27,000 was released. The oilseeds CRT had an

approved budget of 20,000 Kwacha with only 8,500 Kwacha being released. Therefore, efforts to improve research funding must address the budget approval and the budget release process.

There appears to be a need for development of more detailed justification of research budget requests which outline the substantial benefits recently generated and the likely benefits which would occur if planned activities were supported. An estimation of the likely benefits would need to be developed through use of reasonable assumptions and judgements of senior scientists including ARPT staff and extension personnel. Past benefits derived from research can be estimated using the theory and methodology recently developed to estimate costs and returns to agricultural research. These types of studies have been done in several developing countries. A similar study for Zambia was discussed by ZAMARE staff and Zambian colleagues. A seminar on this topic was given to personnel of the Research Branch at Mt. Makulu in December 1984. Given the new varieties of maize and soybeans being released and cultural practices being developed in sunflower production and through ARPT activities in addition to new Rhizobium strains being identified, the time when research program productivity can be measured in the field is coming near. This kind of evidence could be quite useful to improve budget allocations to research. Some preliminary estimates on the benefits to maize research have already been made.

This kind of information on past achievements and future possibilities could be useful information to planning units in MAWD, Ministry of Finance and NCDP. Closer continual collaboration and information flow to these units is needed regarding research program achievements. Research

personnel, for example, should be more involved in advising the Planning Division in MAWD on the five-year investments plan currently being developed on most commodities. Less than desirable contact with relevant research and extension personnel seems to have been made in developing these plans. To develop the information and evidence needed for high-quality justifications will require considerable time of certain persons and cooperation of CRT and ARPT scientists.

## V. ADAPTIVE RESEARCH PLANNING TEAM: (ARPT)

### A. Description/Organization

The Adaptive Research Planning Team ARPT, was created to improve the generation of agricultural technology by providing feed back information to the CRT (Commodity Research Team) scientists on small farmer production constraints, and to test new technologies at the farm level. In contrast to CRTs which have national responsibilities the ARPTs restrict their activities to specific geographic areas.

The ARPT provides data to help understand the agro-socio-economic problems of small farmers and how this affects their decision-making process. Also, the ARPT look at the small farmer operations from a total system point of view instead of by a single crop related to the total system.

The ARPT has been organized as a team consisting of an Agronomist, an Agricultural Economist and a Research Extension Liaison Officer. At the present time, although to be filled soon, the Agricultural Economist position is vacant. The ZAMARE ARPT is located in the Central Province and has its headquarters at the Kabwe Regional Research Station.

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Throughout the country there are 6 ARPTs each one depending on a different donor, but they all operate under a National Coordinator. Testing of the FSR concept started in 1977-78 with the first surveys under CIMMYT methodology. MAWD chose the districts of Serenje, Mkushi and Kabwe rural for survey and initial research work. The actual ZAMARE ARPT continue that work and orientation.

The main reason for the creation of the ARPT (Adaptive Research and Planning Team) was to have a mechanism for identifying the farmer's real constraints, transmit this information to the CRT to assure that the technology developed by the CRT is relevant and adequate for the farmer's needs, and then test and validate this technology under the Agro-socio-economic conditions of the small farmer.

A further step consists of letting the farmer manage the technology, and monitor the rate of adoption.

In order to have the process functioning properly it is necessary to have a complete integration of the CRT and ARPT as one team working toward the same goals and objectives. The CRT and ARPT should realize that they complement each other and therefore they need each other if the objectives and goals are to be reached. However a team is not formed by wishful thinking, it requires a substantial effort with leadership and authority to adequately coordinate the different disciplines and personalities involved in the process.

B. Objectives

The objectives are to increase national food production through the development and adaptation of relevant technology and to improve the welfare of small farmers. The specific objectives of ARPT is to work in

specific geographical regions to identify small farmer's problems and constraints, to carry these problems to the CRT, to test (adaptive research) new technology at the farm level and to gradually improve the farmer's systems. Another important objective is to link research with extension in an effective manner.

C. Progress

The ZAMARE ARPT has been able to establish trials, demonstrations and field days in the Central Province at the Serenje, Mkushi and Kabwe rural districts. From 1982 to 1985 they have established 29 research trials at 169 farms, and several trials at the Kabwe Regional Research Station. Through their surveys they have reported the following findings:

In Serenje:

1) Most of the hybrid maize was planted too late for maximum yields.
2) Most of the maize planted received only one weeding when the maize was about 60 cm tall.
3) Rates of fertilizer used were less than the recommended rate.

In Mkushi:

1) The average cultivated farm size of the target group was 2-3 hectares and maize was the most important crop with an average of 1-2 hectares.
2) Weeding was the most labor consuming job and sorghum was the most labor consuming crop.
3) A majority of the farmers had access to back-pack sprayers.

In Kabwe Rural:

1) Just over one-fourth of the cobs from maize ears harvested were attacked by insects.
2) Maize is the most important cash crop followed by cotton and sunflower.
3) Oxen are used by 84% of the farmers surveyed.

To seek an answer to those findings the ARPT established the following on-farm trials.

1) Maize varieties, optimum planting dates, and population density.
2) Maize and beans intercropped.
3) Rates of fertilizers and time for weeding of maize.
4) Ground nuts with different rates or levels of limestone.
5) Factors that affect population reduction in maize.
6) Producing maize with zero-tillage and herbicides.

The results from those trials show that:

1) Maize yields are reduced nearly 50% when planted after mid-December. November 15-December 15 is the optimum time for planting full season hybrid maize.
2) Maize yields are reduced 30-35% when farmers select their own seed from their fields of F1 hybrids.
3) Control of white ants can increase maize yields 25%.
4) Limestone can significantly increase ground nut and soybean yields.
5) Economic yield responses with Nitrogen at 200 kg per ha for early planted maize, i.e. between 15 Nov to 15 Dec when seasonal rains begin.

6) 100 kg of nitrogen per ha gave the greatest net benefit for late planted maize.

7) Maize can be produced in central province economically with no tillage by using herbicides. (ZAMARE REPORT)

D. Constraints

The identification of small farmer's constraints as well as farmers objectives is not an easy task, it can not be accomplished with only a survey, but requires a permanent contact and observation with the farmer's system in order to understand the rationale of his system under the multiple constraints that he must face. He would like to have high yields but he knows that rains vary from year to year so he spreads risk the best he can, by extending his planting season and by interplanting other crops with the main crop.

Once the constraints and objectives of the small farmers are fully understood the next step is to gradually improve his technology. The technology must be packaged as the farmer can understand it in terms of his total farm system. Data to date seems to be so disaggregated (i.e. between districts and domains and factors examined within - planting dates in one area, weeding in another, access to back packs in another) that priorities are impossible to set. Is late planting a problem everywhere or only in Serenje? If so, how do trials on groundnuts with different levels of limestone relate? What do results like control of white ants in increasing maize yields 25% mean to the problem of late planting?

In the case of the ZAMARE project the CRT's on maize, soybeans, sunflower, and the microbiology SRT have done an excellent job, which is even more remarkable, if it is taken into consideration the short time in

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which it occurred. It is evident that this group had very good logistic support. The ARPT team has also made a remarkable progress on the initiation and establishment of the project under especially difficult situations. In order to improve small farmer performance the following constraints need to be considered.

1. Need of direction to integrate CRT and ARPT as a team

In the case of the ZAMARE project some individual efforts have been made to work together between the CRTs and the ARPT, mainly through the Department of Agriculture annual research planning meetings. Some joint projects have resulted. But in order to improve this relationship it is necessary to have a common direction for both the CRTs and the ARPT.

The Deputy Director (under the new rerganization plan) will have the responsibility of helping the team to define concrete goals, and objectives, to establish indicators, to identify discipline needs, to promote team efforts, to develop strategies toward common goals, to establish time frames, and to establish international linkages with the IARC'S. Procedures/recommendations for such are included in the socio-economic report attached as appendix 3.

2. Need of Specific Objectives

One useful mechanism for team building is to have a clear and specific objective, and a reasonable time frame in which that objective has to be reached. Once the specific objectives are set the next question to ask is what is the division of labor, or specifically, what is the role of ARPT and CRT personnel. It may be argued that it is difficult in many cases to take into consideration all of the socio-economic objectives.

This is very true, but to guide agronomic work having a specific goal is an invaluable mechanism.

3. Need of a Pragmatic Approach Commensurate with the Zambia Situation

Often people get more interested in proving a given methodology and in the process they forget about the main objective. It is important to be reminded that methodologies are tools to reach an objective and are not the objective itself.

The team must take a pragmatic approach about what methodology to use in the specific situation, what is the minimum personnel needed to reach the goal, and what blend of disciplines are necessary, all under a given time frame.

4. Need of an Adequate Strategy to cover the different areas

The ideal situation could be to cover all the areas of the country with an ARPT, however this is not possible because trained human resources is a limiting factor.

Another factor that need to be taken into consideration is the logistic support of the ARPT teams. Under the present economic situation it can not be expected to have efficient back-stopping.

It is therefore necessary to develop a strategy for covering geographic target areas, the time frame in which this will happen, and the training of human resources to fill those teams. Training of human resources is a very important component, due to the fact that specific skills need to be developed to cope with specific tasks that need to be performed under the Farming System Research and Extension approach.

The present area covered by the ARPT is considered by this evaluation team to be too big to handle with the present resources, and it is recommended that the area be reduced to what can be handled with the means available. Of course, scope of the work program, number of trials, sites, replications, etc. should be tailored to a manageable geographic area. It is also recommended that the in-service training unit be further developed as part of the ARPT to help develop the future ARPT technical personnel.

5. Need of Specific Back-Stopping Disciplines

In the agricultural development process there are disciplines that are basic. The lack of some of them may constitute a serious constraint. In the case of the ZAMARE Project it is becoming evident that there is a need for a strong support from the soils fertility discipline, in order to have a reference point in all the on-farm and on-station experiments.

This becomes even more important in rain-fed agriculture where the efficiency of fertilizers will depend on the amount and frequency of rains.

It is recommended that more efficient soils fertility support i.e. soil analysis, be made available to the ARPT.

6. Need of a Long-Term Planning Development

The ARPT follows CIMMYT's Farming System Research (FSR) methodology based on four Adaptive Research stages (i) The diagnosis of farming systems, (2) The design of improved system elements, (3) On-station and on-farm testing of these elements and (4) The extension of these elements to the small-scale producers. This is a good methodology to demonstrate the usefulness of the FSR approach at the early stages of an agricultural development project but once the true constraints and problems affecting

the farmers are established as well as his goals, the need for a long-term development planning becomes imperative. This plan should take into consideration the geographic areas to be covered under a determined time frame, and the human and material resources needed, the training required, the logistic for technology transfer and dissemination and the transformation of ARPT's. The appropriate time to do this may be at the end of phase one.

7. Linkages with Extension Early in the Technology Innovation Process

Generally research develops some technology which is given to extension for its dissemination. Unfortunately when that technology is not appropriate for the small farmer it is rejected.

The ARPT was created to assure the appropriateness of the technology being developed. It is important that specialized extension personnel participate as ARPT members since it is critical that they understand the early stage of trial designs, up-to experimentation, testing and validation, in such a way that they thoroughly understand the technology and its limitations. They must follow the process of evaluation and degree of adoption by the farmer in order to determine the possibility of using the innovator farmer as an effective disseminator of that technology.

E. Recommendations

1. Promote several brain-storm sessions with personnel from the CRTs, ARPT, Extension and Planning and together establish specific objectives. Be sure that those objectives coincide with the national objectives.

2. Continue to examine what technologies are already available, and test them under farmers conditions. Determine what problems affecting the

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small farmers need to be solved, what may be the short-term solution and which will require long-term solutions. Establish the alternatives. Make a long-term plan.

3. Continue to look for pragmatic solutions. Follow the farmer system. Try to understand it, and them improve it. The farmer is trying to avoid risks and at the same time provide enough food for his family - under a very limiting environment.

4. Reduce the geographical area to one that can be attended efficiently, with the means that is available.

5. The ARPT agronomist should have adequate soils analysis background so as to be able to interpret soils analysis tests from field plots. This can only be accomplished in light of adequate soils laboaratory back stopping.

6. We recommend an overlap of old staff and new staff of ZAMARE staff to provide for continuity. We also recommend a consultant in Farming Systems RELO be brought in at the time of change in ZAMARE staff. (See recommendation Section IX). The terms of reference of this consultant should be delineated prior to assignment.

F. Socio-Economic Paper Comments

The terms of reference of the ZAMARE mid term evaluation include review and comment on the Socio-economic component evaluation report. The team read the report and visited with Alistair Sutherland and Mike Warren, the authors.

We perceived the report to have two areas of focus:

1. Socio-economic aspects of the farming systems oriented ARPT work with emphasis on survey and analysis data and trial work with farmers.

2. The Central Province ARPT work - its activities effectiveness and efforts to institutionalize the ARPT concept over a two and half year period.

Socio-Economic Comments

Selection of survey and diagnostic sample and carrying out on-farm trials in farm fields.

--Women are not equally represented at all stages. We agree design should be modified toward more involvement of women. The reality appears to be that few women enter the extension/ARPT chain. Also there is reluctance to make intensive contact with women by men technicians and other extension workers. Also women are reluctant to participate in meetings where trial sites are selected. The program needs to continue to work on this important aspect of representative involvement.

-- Farms selected are not truly representative of the small farms of the area. Greater wealth, more outspoken, and politically active farmers are inclined to be selected. This suggests a much more careful design for survey, but in the trial farm site, care must be taken as to the type of farmer who will cooperate and follow through with trial requirements. This person may in fact be more outgoing, of greater means etc. Caution is urged, but allow for trials to be placed where the objectives can be achieved. It must be remembered that one can only do on farm trials with farmers who volunteer. Therefore, one cannot force representative involvement. Secondly, the trials are research trials primarily, and not farmer managed

trials. Therefore, slight deviations from population proportions may not be serious.

-- Data collected poorly and not analyzed in a complete manner. Efforts need to be made to strengthen this aspect but one must recognise the limits to both collection and analysing data that the ARPT faces. The capability in equipment and people is just not available. The task as outlined is too much for the small ARPT group in the current designated geographic area. Thus their geographic area should be more limited to allow more comprehensive coverage.

-- Farmers lack interest and involvement in the ARPT process. We can't expect the small farmer to start with a high level of interest and commitment. This appears to us to be one of the weakness of the extension part of ARPT. The farmer has a holistic approach to life and his farm. The ARPT, surveys, diagnoses, and prioritizes and then conducts trials on only a limited few of the range of problems and decisions the farm family faces during a year. The extension worker (to be effective) should be able to assist the family with their total range of concerns. The ARPT trials fit in the strengthened part of this. Extension must have a farming systems farm manager orientation. Therefore extension efforts must deal with more than ARPT concerns. There is farmer involvement with the trial assistants and ARPT scientists when they visit the on-farm trials. It is agreed that ARPT scientists should spend more time observing the farmer and discussing farm and household operations with him or her. However, at present, the ARPT is required to work in such a large geographic

area that this type of in-depth interaction and observation is difficult.

The Sutherland/Warren report (appendix 3) also comments that some of the demonstrations in place were not derived from the needs assessment survey. There may be some validity to this criticism but there are other reaons to develop demonstrations than to address only the needs found most often mentioned in a survey.

CRT-ARPT-EXTENSION Linkages Comment

Much of this evaluation report, particularly chapters VI-VII-VII-IX discuss these linkages in detail. We refer the reader to those sections and also to appendix 3, Section IV.

In summary we agree with many of the points discussed in the Socio-economic report. To strengthen the ARPT we suggest:

--A renewed look at the recommendation domains. The Anthropologist/Sociologist, economist, agronomist, livestock and soils specialist should be a team to design surveys, analyze and in fact establish the TRD'S. Much more emphasis needs to be given to agro ecological data.

--More staff are needed at the provincial ARPT level if all domains are to be covered. We recommend less geographic area, and adding the PSMS concept as shown in Chapter IX. This issue should be thoroughly discussed with MAWD.

--The basic ARPT farming systems based program needs to be strengthened and continued, we urge those in that program to give much more attention to the extension education program with all

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farmers and using the ARPT research as a part of but not the only aspect of farming systems extension needs.

--We urge more involvement of farmers in the process. Local advisory groups etc. They need to help design the program needs. We propose the establishment of a strong demonstration program to be conducted by extension and headed and by the RELO AND PSMS. We commend the work of the ARPT and urge the system to continue its development, but allow for testing and flexibility at the province level.

--We feel that the LIMA program should be reviewed for each local area, strengthened by CRT-ARPT technical-socio-economic input and used as a major method in the Zambian farming systems program. The ARPT can take leadership here.

The Sutherland/Warren report provides a detailed review of certain parts of the ARPT work for the past two and half years. The report also provides numerous recommendations. In general, we find the report useful as a piece to consider in planning and priority-making. However, care must be taken to not lose the essence of the farming systems approach by expanding into wider and wider geographic areas. The ARPT and farming systems approach is new and not fully tested in Zambia. Instead of pushing ARPT's to do more, this evaluation team believes it is more wise to concentrate on interacting with and observing farmers, understanding their problems and constraints, feeding that information back to CRTs, trying tested research ideas on farmers fields, and linking with the extension service. This is a substantial task in Zambia. Making certain strict representativeness is maintained in all activities and more information is gathered on additional variables, may detract from doing high-quality

work on the essence of the ARPT farming systems objectives. More data and analysis may be like more research-all of it is interesting - some of it may even be important.

## VI. COMMODITY RESEARCH TEAM (MAIZE, OILSEED: SPECIAL RESEARCH TEAM (MICROBIOLOGY)

Maize is the major food crop in urban centers and along the line-of-rail. It is also one of the principle cereals along with sorghum and millet, in rural areas. Thus more attention is given to maize research than any other commodity in Zambia. The principal vegetable oilseeds are sunflower (the most important in volume produced), soybean, cotton seed, and groundnut. Sunflower is mainly produced by smallholders. Soybean is well suited to a commercial system but is rapidly moving onto small farms. Smallholders use fewer inputs, which includes legume inoculant, thus soil microbiology becomes important in soybean production.

Agricultural research within the Department of Agriculture is organized into Commodity Research Teams (CRTs), Special Research Teams (SRTs), and Adaptive Research Team (ARPTs). Maize resides in the Cereals Research Team, sunflower and soybean in the Oilseed Research Team, and soil microbiology in the Soil Productivity Research Team. The project research personnel -- maize breeder, sunflower agronomist, soybean breeder, and soil microbiologist -- operate within these Teams. The Adaptive research agronomist operates in the Central Province.

The program objectives of the project research team members are compatible with those stated in the Logical Framework of the Project Design Summary as well as those of the Ministry of Agriculture and Water

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Development (MAWD). In fact, they are a part of, complement, and extend the objectives set forth by the respective CRTs in which the team members are integrated.

The main research thrust of the three commodities is based on needs within the three agro-ecological regions of the country with major programs located at appropriate regional stations and trials strategically placed at sites to evaluate materials and practices under different environmental conditions. In addition, the maize, sunflower, and soybean team members collaborate with the project ARPT in the Central Province as well as those in other provinces where these crops are important.

1. Maize

a. Description/Organization:

Maize is the dominant staple food crop in Zambia, being grown in every province and almost every district. Approximately 500,000 hectares are planted each year with about 1.0 million metric tons of grain expected in a year of average weather. Of this amount about 65 percent is marketed. Nearly 60 percent of the marketed grain comes from the estimated 600,000 smallholders and emergent farmers in the country with the remainder from the some 500 commercial farmers concentrated in the Central and Southern Provinces.

ZAMARE project support of maize consists of a maize breeder who devotes most of his efforts to research in maize breeding, particularly problems of small scale farmers. Maize breeding resides in the maize Research Unit of the Cereals CRT. Breeding efforts of the ZAMARE Breeder in the Unit are directed at development of open-pollinated varieties.

Hybrid development is handled by another technical assistant sponsored by Swedish aid.

Until recently SR 52, a long season hybrid developed in Southern Rhodesia (now Zimbabwe), constituted the major improved maize type in Zambia, but with many small farmers using locally adapted types. Over years, SR 52 became highly contaminated, causing a decline in yields. Furthermore, small farmers using SR 52 saved seeds of advanced generations which led to genetic deterioration and further reduction in yields (up to 30 percent). The hybrid has now been purified and released as MM 752 with grain yields boosted by more than 10 percent in farmer fields when compared to SR 52. MM 752 is still a long season type. Other hybrids and open-pollinated varieties have been developed for the different agro-climatic areas so as to boost maize production country-wide. A maize suitability map based on the number of growing days, rainfall, temperature, and soil conditions is now available and will benefit the maize breeders in development of more specifically adapted varieties.

b. Objectives

The overall goal of the ZAMARE maize improvement program is in line with the National Maize Programme goals - with principal objectives to evaluate germplasm, conduct varietal trials, develop new varieties and hybrids, and recommend varieties and/or hybrids for release to small farmers. More specifically, the efforts focus on i) developing early maturing and full-season open-pollinated varieties and hybrids for each of the three agro-climatic zones of the country and which give reliable high yields, possess tolerance to the principal diseases and insects, and are adapted to the enviornmental and management conditions under which

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they are grown, ii) refine national maize testing strategy and carry out varietal trials, e.g. National Maize Varietal Trials and CIMMYT collaborative trials, and iii) liaise with ARPTs to assist in design and implementation of adaptive research and demonstrations for trials in farmer fields.

Furthermore, the maize breeder i) provides counterpart training and assists in identification and selection of Zambian researchers for advanced training, ii) prepares research publications and maize reports, iii) ensures proper maintenance and use of equipment provided by the project, and iv) provides liaison between short-term consultants and professional and administrative offices of the cereals CRT and ARPT.

c. Progress

Two open-pollinated varieties, MM 400 and MM 600, were released in 1984 and are under certified seed production. Seed will be available for planting on about 10,000 hectares in the 1985/86 growing season. MM 400 is an early-maturing (90 to 100 days), drought tolerant variety for the southern agro-ecological zone. MM 600 is a longer season (130-140 days), streak (virus disease) resistant variety for the northern high rainfall areas and extending into the central agro-ecological zone. Several other populations are being improved to meet specific needs and two or three will be released before the end of this phase of the project.

The ZAMARE maize breeder has obtained many open-pollinated varieties from numerous sources and established a progressive system of evaluation including observational nurseries, CIMMYT, IITA and SAFGRAD Trials, Preliminary variety trials, advanced variety trials, national variety trials, ARPT trials, and commercial farmer trials (0.1 to 0.5 hectares).

A network of almost 30 trial sites exist, including research stations, extension training centers, mission farms, and development schemes. The multilocational national and advanced variety trials involved varieties and hybrids in the three agro-ecological zones.

Primary sites are the Mansa regional station in the northern agro-ecological zone, Mt. Makulu and Golden Valley in the central zone, Mochipapa and Chirundu in the Southern zone. A croprotation of a bulk legume, e.g. soybean, with the maize experimental fields, has been established at the primary sites in an effort to obtain more uniform testing conditions.

One maize breeder, Mr. W. Mwale trained at the M.Sc level by the project, has returned and will work primarily on the development of hybrids, but will also assist with varietal testing. A counterpart, Ms. C. Mungoma, who left in 1984 for advanced training in the USA, was originally scheduled for ZAMARE support but is now sponsored by another donor. Two other Zambians recently joined the maize project as counterparts -- a UNZA graduate, Mr. J. Kalonda, who completed a special study with the maize breeder, and a five-year graduate from Roumania, Mr. C. Mwambala. Counterpart training occurs in the normal performance of work activities through supervision of the maize breeder. Further short-term training outside of Zambia has been provided for several technical officers with additional candidates selected for future training.

With the development of open-pollinated varieties, interactions with the Seed Control and Certification Agency were necessary for varietal descriptions, certification procedures, and field inspections.

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Furthermore, procedures for projection of seed needs, seed multiplication and marketing have been developed in collaboration with ZAMSEED.

d. Constraints

1. GRZ funding of the maize research continues at an unacceptable low level, despite the notable payoff beginning to occur from the new MM 752 hybrid and other maize hybrids and that expected from the open-pollinated varieties. Actual receipt of recurrent expense funds is much below that allocated. This results in shortages of transport, labor supplies, equipment, repair, timely land preparation and cultivation.

2. The only transport available for open-pollinated variety research is that provided by the ZAMARE project. Thus, heavy demand is placed on the maize vehicle throughout the country where maize research is carried out. This excessive use, coupled with poor roads and unsuitable preventive maintenance, result in rapid vehicle deterioration.

3. Experimental fields on most experiment stations are not sufficiently uniform to provide acceptable evaluation and reliable research information. This results from poor land and tillage management as well as insufficient and/or appropriate equipment for timely land preparation and water control.

4. There is a need for upgrading the winter nursery if it is moved from the National Irrigation Research Station at Nanga to Chirundu. The latter site is frost free and reduces season turn-around by one month.

5. The support staff at Mt. Makulu is inadequate with only two Zambian technicians assigned to the maize section which is comprised of nine professional staff. This derives in part from insufficient GRZ funding, especially for housing.

6. The maize production practices are based on studies carried out with SR 52. An urgent need exists for maize agronomy to refine practices such as date of planting, plant populations. agro-ecological transition of hybrids and varieties, intercropping, and response to applied fertilizers.

7. Extension is not adequately staffed at the national level to cope with the rapidly changing maize hybrid and variety situation. Therefore, the maize section staff must be involved in extension activities. This includes collaboration with provincial staff and the 5 or 6 sections at the national level that deal with various aspects of information dissemination.

e. Recommendations

1. Within the time frame of this phase of the project the maize breeder should continue to implement current research during the absence from Zambia of GRZ maize breeding research officers who are away for graduate training, e.g. germplasm evaluation, varietal testing under various environments, population improvement for development of open-pollinated varieties adapted to specific agro-ecological areas, attention given to drought tolerance and performance under high and low management, collaboration with the ARPTs and extension through the RELO.

2. The maize breeders should work in concert with the maize pathologist who is supported by another donor. This is likely to occur through the arrangement and insistance of the CARO.

3. A personnel change may occur during the time frame of this project phase -- Dr. O. Myers has been identified to replace Dr. P. Gibson as

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maize breeder. The team strongly endorses the anticipated overlap to assure smooth transition without program disruption.

4. A Zambian, (Mr. R. Kamona) with project support, is studying maize agronomy at SIUC and should return during mid-1985. Consideration should be given for his assignment as counterpart to the ARPT agronomist. This person embodies the true subject matter specialist concept. He is an extension professional who has a strong technical background.

5. The time frame of a fourth year vehicle replacement as noted in the PP is inadequate for smooth and productive operation of the project. Vehicles need to be replaced on a two-year cycle or accumulated mileage of about 80,000 km. Additional vehicles are needed for transport of special studies participants.

6. With a view to a second five-year phase the maize breeding program should be continued along the present course of action. Technical Assistants should include a maize breeder and a maize agronomist. This coverage will assure institutionalization of maize research in Zambia and allow time for professional development of Zambians who can assume responsibility for the program.

7. Provision should be made for additional training during the time frame of the project with attention given to training needs in a follow-on phase.

f. Maize CRT Evaluation Summary

ZAMARE support of maize breeding research has rapidly moved toward a significant contribution to increased maize production by release of two high yielding, disease tolerant, early maturing open-pollinated varieties adapted to small farm producers. The agricultural research capability of

the maize unit of the Cereals CRT has been strengthened through long- and short-term training, e.g. one Zambian with project support completed an M.S. and has assumed increased responsibility as a maize breeder. The Maize CRT is making excellent progress.

2. Sunflower

a. Description/Organization

Sunflower is the second most important crop in Zambia on a hectareage basis, following maize. It ranks behind maize and cotton as a cash crop. About 98 percent of the crop is grown by small holders in Eastern, Central, Southern, and Lusaka provinces. Production has recently increased to more than 41 thousand metric tons/year, harvested from 80,000 hectares in 1984. Zambia now produces 75 percent of the country demand for cooking oil. Sunflower is extremely useful as a diversification crop in the traditional farmer subsector, enabling smallholders to expand their efforts over the planting season and use off-season labor for threshing. Late broadcast planting, lack of fresh seed, and few or no inputs result in low grain yields of less than 500 kg/ha (perhaps a high estimate) as compared to 2.0 mt/ha in some countries. Superior varieties, both hybrids and composites, are available but are little used, comprising about 1.0 and 5 to 8 percent, respectively, of the total hectareage. Most farmers save their seeds from year to year, the result being a heterogenous mixture of various types.

Oil content of current types is low (27 percent or below), while the new composites contain 30 to 35 and hybrids 35 to 40 percent. Refined Oilseeds Products (ROP) has the capacity to process 300 mt/day of sunflower seeds but was unable to accept all of the 1984 production because of

equipment breakdown and lack of spare parts. This is being offset in part by small processors located in villages.

ZAMARE project provides support for a sunflower agronomist and advanced training for professional staff--Mr. M. Mwala, Ph.D candidate in plant breeding to return in late 1985 and Mr. B. Chimbwe, B.S. candidate in agronomy to return in mid 1986. A Zambian sunflower breeder, Ms. Habowa is scheduled for Ph.D training in the future.

A turnover in ZAMARE supported staff occurred in 1984 with Dr. V. Eylands replacing Mr. W. Roath as sunflower agronomist. The project team member works directly in the sunflower research unit of the Oilseed CRT located at Mount Makulu.

b. Objectives

The goal of the sunflower portion of the ZAMARE project is to assist the GRZ in increasing production of edible oils through identification of high yielding varieties and appropriate production techniques for use by small farmers. More specific objectives were set forth as follows: i) design and conduct research to overcome constraints to small farmer production of sunflower, as indentified by ARPT, ii) prepare agronomic portions of research publications, iii) assure proper use and maintenance of equipment in the project, iv) liaise between short term consultants and CRT and ARPT, v) provide in-country training for the counterpart and identify Zambian professional staff for advanced training, and vi) maintain close linkage with ARPT agronomists and assist in designing and implementing adaptive research trials and demonstration in farmers fields.

c. Progress

The ZAMARE sunflower agronomist found that composites and hybrids developed by a sunflower breeder (other donor support) over several years had become highly heterogenous and thus spent considerable time in purification of parental lines. In addition, selection for fertility restoration was made within parental male inbred lines of an advanced experimental hybrid.

Several promising hybrids and composites developed by the Belgian AID Breeder have been identified in the National Variety Trials. It is anticipated that they will be recommended for release within the next two years. They represent a significant advance in grain yield, oil content, and disease resistance (especially alternaria) over local types. Maintenance of parental lines and their purity will require continous monitoring and ZAMSEED will need assistance in seed production techniques, especially for hybrids.

Boron deficiency was identified in sunflower though earlier sunflower research. ZAMARE has continued to support varietal and production practice trials. Subsequent studies on the Kabwe Regional Research station gave a positive response in terms of grain yield. This has not been confirmed by on-farm trials nor with local sunflower types.

The LIMA system -- an extension program designed around a farm input package for use on land units of 1/4 hectare -- was used to examine recommendations of seedbed preparation and stand establishment. This approach has been modified to permit study of other components of production practices before suggesting alternative recommendations.

76X

With the arrival of Dr. Eylands (ZAMARE sunflower agronomist) additional constraints to sunflower production on small farms were determined and ranked after consultation with the ARPT, CRT, experienced MAWD researchers, and farmers in the Lusaka Province. The ranking of farmer constraints were noted as follows: i) planting late - generally too late for acceptable and economic yields, ii) plant method - largely broadcast, iii) varietal usage - commercial seed sales less than 10 percent of total hectareage, iv) lack of inputs - 95% of total hectareage not fertilized and a large percentage not weeded, and v) pricing policy - low-farm gate prices, not competitive with other crops.

Based on these farmer constraints the following agronomic trials have been initiated: i) planting date of four varieties in Central, Lusaka, and Southern Provinces, ii) row vs broadcast seeding of three varieties on 32 farms in Central and Lusaka Provinces, iii) planting methods and spacings, e.g. planting to stand and thinning, iv) liming and fertilizer treatments and v) weeding methods and timing.

There is no international program of sunflower improvement, thus acquisition of germplasm is more difficult than with crops such as maize and soybean. Nonetheless, varieties and genetic stocks have been obtained from several sources, screened for adaptation to Zambian conditions, and seeds multiplied of promising materials. These are then placed in national variety trials which were located at 13 sites in the 1984/85 season. These trials are placed under high and low management inputs. It is anticipated that additional germplasm having tolerance to acidic soil conditions and presence of soil aluminium can be obtained from Brazil.

Intercropping is a common practice among smallholders but little is known about this possibility in regard to sunflowers. An exploratory study to examine the feasibility of intercropping sunflower with soybean, lima bean, cowpea, and pigeon pea was initiated in 1984/85.

There has been virtually no linkage between the sunflower research unit and extension. Crop husbandry SMSs, block and camp supervisors, and other extension personnel are not well informed in regard to sunflower production practices. This gap is being narrowed through improved CRT-ARPT relations, CRT-Extension demonstration plots, field days, radio, TV, and farm magazine articles. A sunflower production filmstrip for use by extension and farmer training institutes is being prepared.

d. Constraints

1. The sunflower research unit depends largely on the vehicle belonging to the sunflower agronomist. This is a Datsun 2-wheel drive pick which is entirely inappropriate for the long distance travel over three provinces, carrying 6 or more field workers, seed, fertilizer, and plot equipment. This vehicle has over 110,000 KM and may not survive the 1984-85 season. Certainly it will not be operable for the next season.

2. Considerable time of the sunflower agronomist is devoted to supervision of the national variety trials. A Ph.D is not needed for this activity which could be turned over to a qualified Zambian counterpart. However the Agronomist should continue to acquaint himself with the new lines developed - for which he will have to develop management and agronomic guidelines.

3. In addition, the project sunflower agronomist spends about 10 percent of his time on purification of parental lines and seed

78x

multiplication of pre-basic seed stocks. Doing this during the dry season when he is not conducting agronomic research helps build strong linkage within the team and strengthens the team approach. This responsibility could be shared by Ms. Habowa, a sunflower breeder who recently returned after M.S. training (other donor sponsor). She is inexperienced, however and needs considerable supervision.

4. There is a need for sunflower short-term technical assistance in the area of agronomy and plant breeding. Such expertise apparently does not exist among the three ZAMARE contracting institutions but could be obtained elsewhere.

5. The sunflower agronomist expressed concern that CRT-ARPT relations would suffer because of the complete turnover of the Central Province ARPT ZAMARE staff.

6. GRZ and the Research Branch of MAWD do not have sufficient recurrent funding to pay overtime and per diem for field workers. This could restrict timely and effective operations of sunflower research.

7. ZAMSEED and the sunflower breeding staff need considerable help in maintaining and increasing basic, and certified seeds of new varieties. Furthermore, farmers must be made aware of the benefits derived from purchase and use of improved varieties.

e. Recommendations

1. The present research which is directed towards refinement of production practices should be continued with attention given to rapid technology transfer to small farmers through collaboration with the ARPT agronomist and RELO.

2. A new vehicle, 4-wheel drive Land Cruiser, should be provided to the sunflower agronomist before the 1985/86 growing season. The present fourth year vehicle replacement as noted in the PP should be revised to provide replacement on a two-year or accumulated mileage basis, given the sunflower research travel demands and road conditions in Zambia.

3. Arrangements should be made by the ZAMARE contractors for TDY back-up for the sunflower agronomist and for the Zambian sunflower breeder. It is of national interest that production of edible oils be increased to the point of in-country self-sufficiency. This will require small farmer adoption of new composites having high grain yield potential and improved oil content. The TDY sunflower breeder, in collaboration with the Zambian plant breeder and the ZAMARE agronomist, should provide instruction and supervision of the ZAMSEED production unit regarding seed multiplication of improved composites.

4. The Zambian smallholders who grow sunflower must be convinced of the benefits derived from use of fresh seed and improved production practices. This will call for increased liaison between the sunflower agronomist and the ARPT, especially transfer of technology through the RELO and provincial extensionists.

5. It should be strongly recommended to the Department of Agriculture that new varietal releases of sunflower should be of the composite type for small scale growers until hybrid seed production capability is established and until small farmers are convinced of their value in increasing grain production. A premium paid for high oil content might be an incentive.

80X

6. With a view to a follow-on second phase of this project it is recommended that the sunflower agronomist position be continued and consideration be given to the position of a sunflower breeder. In regard to the latter Technical Assistance, sunflower production in Zambia will be improved by the genetic potential of released varieties, whether composites or hybrids. Refined production practices will undoubtedly lead to some grain yield increase of local types but a yield plateau will soon be reached unless new varieties are available. Furthermore, the Zambians who are trained under the present phase of the ZAMARE project will measurably benefit by the guidance and collaboration of Technical Assistants in a follow-on project.

f. Sunflower Evaluation Summary

ZAMARE support of sunflower production has shown that this is a viable crop for small farmers since it can be planted after maize with minimal inputs and still produce enough seed, although of low yield/ha, to add to the family cash income. Significant yield increase can be obtained by refined production practices such as earlier planting in rows (rather than broadcasting), adequate plant population, timely weeding, and use of lime and fertilizer. By linkage with the ARPT, these practices have moved into farmer field trials and demonstrations. The development of a National Variety Test of introduced material has allowed identification of improved types. Sunflower research will be strengthened by return of an agronomist in mid-1986 with a B.S. through project support. Sunflower breeding support is necessary to support the program. This activity has made significant progress and has even greater potential as the Oilseed CRT develops greater staffing and infrastructure to support it.

3. Soybean

a. Description/Organization

The production of soybean has markedly increased, from about 500 metric tons in 1975 to over 20,000 in 1984/85. Total production is difficult to estimate because of direct farmer sales to private companies. The recent pricing policy made soybean very attractive as a cash crop. Thus, the crop is moving onto small farms, having been largely grown by commercial farmers since it fits into a wheat or maize rotation.

Small farmers show interest in growing soybean because of later planting and earlier harvesting than maize or cotton, therefore not competing directly for labor. Also, at present it does not require spraying since insects and diseases have not become serious problems. Furthermore, the promotion of free-nodulating (promiscous) varieties assures somewhat optimal yields without seed inoculation.

The Lint Company of Zambia (LINTCO) involvement in soybean production contributed significantly to the rapid increase in area planted. This agency provides farmer credit, planting seeds, inputs, production practice recommendations, extension service, and a guaranteed market. In the first year of its activity over 2500 small growers were registered for about 1300 ha of soybean over all nine province in Zambia.

Farmers have a ready market for soybeans with the main buyers being Hybrid Poultry, ROP, National Milling, and private concerns. Soybean is a preferred oilseed for the cake by-product, having a lower hull content and higher cake yield than sunflower. The annual requirement of oilseed cake in Zambia is about 40,000 mt/annum.

82x

ZAMARE project supports a soybean breeder, Dr. J. Joshi, and provides for long - and short-term training of Zambian professionals. Soybean breeding is an integral part of the soybean research unit of the oilseed CRT. The main thrust of the research is at the Magoye Regional Research station with research trials located at other stations and sites in the three agro-ecological zones of the country. The main research effort will be moved to Lusaka West when the proposed reorganization of research is instituted. This change will place the soybean breeder more nearly in the center of the soybean production area. The soybean breeder benefits from close working relationships with an extension soybean agronomist, Mr. F. Javaheri and a Zambian agronomist, the latter acting as a counterpart while one Zambian is out for advanced training-- Ms. J. Mulila pursuing a Ph.D. in plant breeding at SIUC.

b. Objectives

The GRZ policy on oilseed crops is i) self-sufficiency in edible oils, ii) a continuous supply of raw materials to oilseed processing plants, and iii) through increased oilseed production, improved income of small scale farmers to raise their standard of living.

The soybean breeder is developing and testing varieties which will contribute to attainment of this goal. More specific objectives are i) promote involvement of small scale farmers in soybean production by introducing free-nodulating varieties that possess competitive advantage against weeds, resistance or tolerance to prevalent diseases and insects, shattering, drought and acid conditions, ii) develop varieties responsive to high management inputs such as applied fertilizer, chemical weed control, and Rhizobium inoculation, iii) produce breeder seed for release

to ZAMSEED, iv) provide information and materials for dissemination to the farming community, and v) assist in training and development of Zambian personnel involved in the soybean program.

c. Progress

The ZAMARE supported soybean research has focused on introduction and evaluation of diverse germplasm and varieties in the selection of promising material for further testing. The inclusion of materials from INTSOY, IITA, AVRDC, Zimbabwe and other neighboring countries, as well as cooperation with the University of Queensland, has resulted in a substantial thrust in improvement of this crop. Varieties and lines have been grouped according to maturity, namely I - early (75-95 days), II-medium (96-132 days), and III-late (133-160 days).

Of particular significance has been the identification of free-nodulating varieties. Two varieties have been released, Magoye since initiation of the project and Hernon 147, and both are popular among small scale farmers because they can be successfully grown, with an acceptable yield (2.0 mt/ha or more) without seed inoculation. Magoye has also been identified as having drought tolerance. Other varieties and lines have been identified in trials planted on virgin land, seeds with and without inoculation. Some of these outyielded Magoye under both treatments. They will be further tested in other localities. The development of free-nodulating varieties holds greater promise for small farmers who frequently do not have access to inoculum. Under conditions of higher inputs, other varieties which require seed inoculation will be higher yielding. Farmers who grow free-nodulating types can inoculate their seeds and may expect a positive yield response.

84-X

Evaluation of introduced germplasm revealed that plants of two lines from Zimbabwe held their pods for 30 days after 95 percent maturity. This contrasts to most varieties which begin to shatter shortly after this stage of maturity. The late-shattering characteristic is of critical importance for small farmers who hand harvest soybeans and will also benefit commercial growers.

Tunia, a recent release by the soybean breeder, possesses some shatter resistance (10 days after 95 percent maturity) which exceeds that of other recommended varieties. It is also somewhat more disease tolerant than other varieties. Pods are set slightly higher on the plant (nearly 12 cm from ground level) which is important to assure harvest of all pods. Ideally, the height should be about 15 cm. This trait exists among other lower yielding varieties. Other promising varieties have been identified in the National Soybean Variety Trials placed in 14 locations in the low, medium, and high rainfall areas occurring from south to north.

A winter soybean nursery under irrigation was established at the Magoye Research Station. A crossing block of selected parental lines was planted in late May, 1984. The parental stocks contained such genetic traits as free-nodulation, late-shattering, disease resistance, height of pod set, and weed competitive ability. A small quantity of breeder seed of Tunia was planted for seed increase to provide planting material for the 1984/85 season.

F1 plants and their parents are being evaluated in the 1984/85 growing season. Those with favorable characteristics will be increased for further testing. In the development of breeding materials, segregating populations (F2 through F6) have been obtained from Zimbabwe for evaluation under

Zambian conditions. In addition, two North Carolina populations segregating for male sterility were crossed by Dr. O. Myers at SIUC with F2 seeds being sent to Zambia. They carry resistance to the major foliar diseases, rootknot nematode, soybean cyst nematode, and Phytopthora root rot. The male sterility chararter will now be incorporated into locally adapted material. This should accelerate the breeding program since the number of F1 seeds obtained from hand crossing often drops below 50 percent.

As soybean production increases in Zambia it is likely that the disease problem, especially leaf spot caused by Pyrenochaeta glycine will increase. A ZAMARE special studies research associate, Mr. L. Datnoff, from UIUC, spent one year in Zambia and found that no lines of 958 entries were resistant but showed degrees of tolerance, rate of infection tended to increase as growth stage changed from vegetative to reproductive, the disease caused yield losses which averaged 22 percent, and other less severe diseases were identified. He was replaced by MR. G. Hartman who will continue plant pathology research on pyrenochaeta.

The ZAMARE soybean breeder works closely with the agronomists in regard to evaluation of varieties which respond more competitively to weed stress, for example early maturing varieties since they are exposed to weed competition for a shorter period of time.

The Zambia Ph.D. plant breeding candidate, Ms. J. Mulila, is conducting a portion of her dissertational research at Magoye under the supervision of Dr. Joshi. Her research involves screening varieties for drought tolerance and response to different rhizobia strains. She will return to SIUC for completion of the degree later this year.

86X

Other activities of the soybean breeder include production of breeder seed of recommended varieties released to ZAMSEED, assist in preparation of guidelines for soybean production by small farmers, a monthly soybean newsletter and a film strip on soybean production for small farmers, participate in training courses, seminars and field days, and assist in selection of national staff who attend short-term training courses.

d. Constraints

1. The full impact of the ZAMARE soybean program is hampered to some extent by not being more centrally located in the soybean growing region. This could eventually be corrected when or if the program is moved to the Mt. Makulu/Lusaka West Research Center.

2. The lack of transport plagues and severely restricts the breeding and overall soybean program. The project vehicle assigned to Dr. Joshi must be used for on-and off-station trials. Consequently, greater mileage and depreciation has occurred than was anticipated when the PP was prepared.

3. Coupled with the transport constraint is the shortage of GRZ recurrent funds, thus a scarcity of all supplies, equipment, spare parts, fuel labor, etc.

4. The soybean breeder spends much time in preparing planting materials, harvesting and supervising National Variety Trials. This takes time away from his breeding responsibilities. This is further compounded by lack of sufficient numbers of well trained technicians to carry out experimental trials in the outlying research stations.

5. The quality of planting seeds received from some outside sources and from ZAMSEED is low probably due to deterioration in storage. This has

not occurred for seeds stored on the Magoye Research Station. Viability of soybean seeds declines rapidly when stored under unfavorable conditions such as high temperature and humidity . There is no seed physiologist in the Research Branch to study such problems.

6. Undoubtedly, the prevalence of pests and diseases will increase as the area planted to soybean increases. At present there is no plant pathologist nor entomologist assigned to work on these problems. One entomologist is away for Ph.D. training but is assigned to Food Preservation and Conservation.

e. Recommendations

1. The soybean breeding program should be continued along its present research thrust, with particular attention given to utilization of the male sterility character now available in genetic material. This will greatly enhance crossing of promising parental material and more rapidly build-up segregating populations. More attention should focus on late-shattering and tolerance to drought, soil acidity, and presence of soil aluminium.

2. A rotation of the soybean breeder may occur during the time frame of the project. If so, the replacement should be identified as soon as possible and arrangements made for an overlap with Dr. Joshi.

3. The project vehicle assigned to the soybean breeder should be replaced for the 1985/86 growing season. If a follow-on phase were to be negotiated the vehicle(s) should be replaced on a two-year interval or mileage accumulation basis.

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4. The project should consider providing funds to supplement the GRZ recurrent budget for office equipment and supplies at the Magoye Research Station.

5. With ZAMARE interim support of the extension soybean agronomist, Mr. F. Javaheri, it is recommended that he assume a greater responsibility for the National Soybean Variety Tests and work more closely with the ARPTs, particularly in the Central Province, in regard to on-farm trials and demonstrations of refined production practices.

6. To assist the GRZ soybean expansion program the project should consider providing short-term Technical Assistance for consultation in seed processing and storage, especially to work with ZAMSEED. The same TA could review aspects of the Seed Control and Certification Institute and provide suggestions and guidance to the seed technologists trained by project support.

7. The evaluation team strongly endorses the plan whereby Zambian research staff pursuing advanced degrees return for a part of their research within the country. Whenever feasible this should be extended to other candidates.

8. The special studies program in which research associates from the contracting universities carry out research in Zambia has benefitted the soybean breeding project. Their efforts point to the need for additional research in this discipline. It is recommended that Mr. Hartman's time be extended and arrangements made with his major professor to develop dissertational research in Zambia. Furthermore, this person could serve as short-term TA in plant pathology.

9. Assign long-term Soybean Pathologist during Phase I to address soybean pyrenochaeta problems.

10. There is an interest and a need for development of a soybean utilization industry in Zambia. The project should arrange for INTSOY input in this area.

11. In regard to a possible follow-on phase of the ZAMARE project, the soybean breeder position should be continued.

12. In the second phase negotiation, consideration should be given to Technical Assistance in the fields of plant pathology and entomology, perhaps long-term and short-term, respectively.

f. Soybean Evaluation Summary

ZAMARE support of a soybean breeder accelerated the release of a free-nodulating variety (identified by other GRZ soybean scientists) specifically adapted to small farmers who seldom have access to seed inoculant. This had a notably impact on movement of this crop into the traditional farm sector and overall country production. Agricultural research capability of MAWD is already being strengthened by a project supported Ph.D candidate who is confucting a part of her dissertational research in the country. The soybean activity is making excellent progress toward adapting soybean cultivars to small farm conditions. Farmers are responding to this technology.

4. Soil Microbiology

a. Description/Organization

The production of soybean inoculant based on Rhizobium japonicum has been completely turned around since the start of the ZAMARE project. The country could soon be self-sufficient in supply of this product.

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Previously, it was in short supply and poor quality (viability of bacteria). Furthermore, the inoculant was highly contaminated with non-effective bacteria. This too has been rectified.

Inoculum is widely used by commercial farmers in Zambia, when it is available. On occasion, they made import arrangements from a neighboring country. Otherwise, they relied on bacteria in the soil and counted on their numbers increasing where soybean was repeated in rotation with wheat or maize. Only recently have small farmers begun to grow soybean and they frequently do not use inoculant. The introduction of free-nodulating soybean varieties has significantly benefited the small scale grower.

The ZAMARE project supports a soil microbiologist, Dr. S. Sanogho, under contract with NifTAL for a 30 month period. He is attached to the Soil Microbiology Unit which is a part of Soil Research and Productivity Team located at Mt. Makulu. The soil microbiology laboratory serves a dual purpose of research and production of soybean inoculum. This is the only source of inoculant in Zambia. There are two Zambian soil microbiologists on study leave in the USA, Mr. R. Nyemba and Mr. M. Sakala, both are project supported M.S. candidates, and scheduled for return in mid-1986 and mid-1987, respectively.

b. Objectives

The major emphasis of the project supported soil microbiology program is based on legume/rhizobia symbiosis and involves i) implementing and developing procedures for improving quality and increasing quantity of inoculum in amounts to meet farmer needs, ii) assemble and screen lines of commercial and indigenous lines of rhizobia to determine their nitrogen fixing efficiency, iii) conduct field experiments to evaluate the benefits

of inoculation under local soil and climatic conditions, and iv) investigate the effect of cultural practices on the efficiency of soybean/Rhizobium association.

c. Progress

Renovation and improvement of the soil microbiology laboratory was facilitated by early arrival of equipment previously ordered by AID/Zambia for the project. The inoculum production part of the laboratory supplied 60 percent of the demand for the 1984/85 growing season. The country supply (30,000-40,000, 80-gram bags) could be adequate for the coming year if peat moss and plastic bags are available. Peat deposits of high quality exist within the country.

It was found that the carrier of inoculum being used, namely finely ground soil and charcoal, was unacceptable and responsible in part for poor quality. An effort was made to use filter-mud from a sugar mill but this was not fully reliable for quality control. Peat was then imported from the USA. Mr.J. Rourke of NifTAL joined the project on a short-term consultancy and set up the laboratory for and began inoculum production and training of Mr.Sakala and laboratory staff. However, utilization of an indigenous peat carrier and monitored procedures resulted in a high quality product equal to that of any country and has a shelf-life of at least three months provided the temperature remains below 30 degrees C. Even before test results of Zambian peat, the soil microbiologist successfully purified the existing Rhizobium being used for inoculum production. Furthermore, he identified two local strains, SS-2 and SS-3, which are more effective "than the US-110, used as a standard for efficiency comparison and widely included in commercial inoculants. These

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have been increased and will be mixed with US-110 for the 1985/86 production of inoculum. They have not been identified as to species and strain.

The soil microbiologist assisted the soybean breeder in field testing of free-nodulating soybean varieties and lines planted on virgin soil at the Magoye Research station, seeds with and without inoculant. He also collaborated with members of the Soil Productivity Research Team in studies at Mt. Makulu which investigated the use of N-15 to quantify the amount of nitrogen fixed by soybean varieties inoculated with different Rhizobium strains and at various levels of applied fertilizer.

The soil microbiologist noted additional research on rhizobia used for production of inoculum for dry beans and ground nuts.

d. Constraints

1. A major restriction for production of soybean inoculum is transport of peat from Western Zambia. Another is the availability of plastic bags for packaging. These must be imported from Zimbabwe.

2. At present there is no organized distribution system for soybean inoculum. Therefore, personnel in the soil microbiology unit at Mt. Makulu become involved in marketing and distribution.

3. With the departure of two Zambian professional staff the soil microbiologist has no professional counterpart - although he has been assigned two lab assistants to help produce the inoculum.

e. Recommendations

1. With the pending review, evaluation, and possible reorganization of the Soil Research and Productivity Team as noted in the Department of Agriculture document proposal to the World Bank, the team recommends that the soil microbiologist position be extended at least through Phase I.

2. The production of inoculum should be moved from the Research Branch of the Department of Agriculture as soon as feasible and convenient. It should be taken over by a commercial entity--perhaps ZAMSEED. The TA noted above could provide guidance to ZAMSEED in planning for this operation. This move should help in solving the marketing and distribution of inoculant.

3. The soil microbiologist should aggressively pursue identification and characterization of the two Rhizobia strains, SS-2 and SS-3, and give support to other grain legume rhizobia research.

4. The project has assisted and should continue help in organizing for transport of peat.

f. Evaluation Summary

With project support, procedures and techniques for production of soybean inoculum will help the country to be self-sufficient, or nearly so, for the 1985/86 growing season. Identification of two highly efficient Rhizobium strains will lead to a notable increase in production of varieties grown under improved management conditions. With training of two Zambian microbiologist at the M.S. level and their return before the end of this phase of the project, the soil microbiology research capability will be measurably increased. The contribution of the soil microbiologist toward purifying R. japonicum strain has been excellent and the Niftal contribution to determining superiority of local peat sources as an excellent inoculum carrier has been an outstanding contribution toward the success of this activity.

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## VII. EXTENSION

### A. Description/organization

Presently Extension is one of three branches (Research, Extension, Land Use Planning) in the Department of Agriculture (DOA) of the Ministry of Agriculture and Water Development (MAWD). There are extension activities in the Department of Veterinary and Tsetse Control (DVTCS) but it is largely in DOA. A number of special extension services (i.e. LINTCO, IRDP, ADP, VAP) utilize existing seconded DOA extension staff to carry out more specialized extension efforts.

The function of Extension is to assist farm families toward their goal of improved agricultural productivity through production technology - education/information efforts. In reality additional functions are being performed such as assisting with farm inputs, collecting registry information etc. The overall objective of Extension is to assist GRZ in its policy of helping farmers increase food production resulting in improved family welfare, to move toward food self sufficiency and to reduce the food import currency drain.

The Extension branch is headed by an Assistant Director with a Lusaka headquarters subject matter specialist staff (SMS) of 7 positions. These include Crops , Livestock, Horticulture, Tobacco, Youth, Home Economics and Extension Training. In the 9 provinces a decentralized structure since 1982 is in place. The Provincial Agricultural Officer (PAO) has a staff of SMS, often more specific (i.e. dairy within livestock).
At the district level a DAO supervises a district specialist staff. There are then blocks within the district and camps within each block. Training institute sites are used for both staff and farmer training. Field staff

consist of: Senior Agricultural Assistants, (SAA), Agricultural Assistants (AA), Agricultural Demonstrators, (AD) and Commodity Demonstrators (CD) For example Southern Province has a PAO, 13 SMS, 7 DAO, 5 blocks with 4-5 camps in each. The total Southern Province staff is 316. The camp is where most individual farmer contact is made by Camp Extension Workers (CEW). Trial assistants who work in The Provincial Adaptive Research and Planning Team (ARPT) program are seconded from the district or local extension staff.

Extension employs about 2416 people in Zambia, excluding administrative and clerical personnel. About 2,000 of these are civil service established positions and 400, such as the Commodity Demonstrators are contracted daily workers. Approximately 1300 staff are based at the block and camp level. These are the extension workers who have direct contact with Zambia's 600,000 plus farm families. Of these 1300 block/camp staff there are 864 with a certificate or diploma from an agricultural college (Monze, Mpika). At the SMS level, training may be; University B.S., some out of country M.S., or the 3 year NRDC Zambian Natural Resources College. Extension is obligated to employ graduates from these 3 Zambian colleges, e.g. Monze, Mpika and NRDC, thus new staff are added each year. In central province a net of 31 new positions were added in 1983 according to the February 1984 annual reports. Also in Central Province there are 510 extension staff of which 29 are professionals, 372 agricultural college trained, certificate or diploma, and 109 were contracted with no formal agricultural training.

Organizationally, subject matter technology is introduced into the system from Lusaka headquarters by SMSs and likewise in the Province by

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Provincial SMS staff. At the field level extension staff are "generalists" dealing with all commodities and farmers questions. Theoretically research information flows from the researchers to SMS down through the organization. In reality some direct contact with field extension staff and Farmers is done by researchers. Recent ARPT work is generating local farmer adapted research results for extension program support.

In 1978 the Training and Visit system was introduced by the Department of Agriculture. This involves a programmed, disciplined approach, delivering key impact technologies. To date the system has not been effectively implemented. In 1979 the LIMA system was introduced. This comprises a recommended set of production technologies for geographic areas carefully prescribed and extension assistance given with appropriate inputs. In many instances original (1979) LIMA recommendations, though outdated, are the main source of information in the hands of local camp extension workers. In 1980 the ARPT program was initiated. This farming systems based research effort strengthens the input into the extension information flow. As yet the linkage and integration of ARPT to the extension field delivery system is incomplete.

Various information dissemination methods are used in Zambian extension; newspapers, radio and T.V.: (National level); meetings, demonstrations and field days. The principal method however is the individual farm or camp visit. The rural information unit of MAWD presently reports directly to the Permanent Secretary (P.S.) and has both Public Relations and agriculture technology delivery functions through the public information media, e.g. TV, radio, news reports. It is not

however well integrated into the technology generation and delivery system of the DOA.

Budget estimates for 1985 for the DOA (Extension, Land Use Planning) but excluding research was K20.8 million. Allotments usually fall short of approved budgets. While budgets have increased in recent years, actual appropriations have not risen and inflation has severely reduced the real budget for extension. Estimates are that over 90% of the Extension Annual budget is in personnel. The actual capital and operating budget is very low relative to both numbers of staff in place and actual program needs. Equipment, particularly transport, is in short supply or non-existent or in need of repair - replacement. Publications and teaching materials are woefully short of the needs. Petrol for vehicles is very limited. Extension, so dependent on mobility, is hampered by the vehicle situation. For example as of Jan 1, 1985 in Southern Province there were 4 Land Rovers operating and 8 non repairable and 18 being repaired. Thus the total staff had 4 vehicles for long distance travel. Motorcycles and bicycles had similar shortages and out of service levels.

There are general reports of poor morale among staff. Factors influencing this have been identified as poor housing or lack of housing, inadequate transport, inadequate incentives and recognition of performance, poor promotion prospects, lack of supervision and a lack of needed technical and program development training.

A recent World Bank Report (1985) indicated a wide range of problems associated with extension. The Training and Visit system is not being effectively implemented, SMSs are not optimizing their opportunities in training, inadequate institutional setting and management and supervision,

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lack of funds for transport, housing and extension basic teaching supplies. While recognizing the organization structure as adequate the major constraints are in operating budget, transport, staff training, program development and management supervision. There is opportunity to strengthen these areas as well as to shift to a farming systems - farm management organizational emphasis.

Positively speaking, the government of Zambia has, as national policy, a high priority position for agricultural development. The organization structure, while in need of some modification is in place. Within the large number of staff there are very capable people. The research branch is being strengthened and in a position to provide farmer adapted recommendations for extension programs. Finally Zambian farm families appear very receptive to an extension service that meets their individual situation needs.

B. Objectives

The majority of Zambia's population live in the rural areas. These people both depend on agriculture for their own family food needs but are also the potential for food needs of the country and for export commodities. Farmers have been categorized into estimated; commercial 500, emerging commercial 5000, and small farmer 600,000. While all are important in agricultural development, GRZ extension policy places priority on the small farmer group in their programs.

Broad objectives of extension are geared toward achieving the following:

1. Self sufficiency and/or self reliance in all food and cash crops.

2. The export of surplus food and industrial crops for earning of foreign exchange.
3. The use of locally produced food crop by products and raw materials in Zambia's industries.
4. To improve the living standards of rural people and, thereby encouraging those in rural areas to remain and to attract new people into agriculture.

Specific extension objectives might be stated as follows:

1. Identify constraints and opportunities for individual farm families in relation to their agricultural production enterprises.
2. To provide educational and information inputs to farm families assisting them with technical and family living management decisions under their specific conditions.
3. Through individual farm application of improved technology in a farming systems context, impact on the output of agricultural products, thus contributing to national goals listed above.

ZAMARE objectives relating to extension thus far have emphasized the ARPT on-farm trials and farmer and extension worker contact through that process. Specifically the RELO member of that team has the objective of liaison and getting appropriate research out to the Provincial staff/farmers through extension.

C. Progress

1. Overall Extension

There appears to be general agreement in Zambia agricultural circles that progress in effective application of research through extension is

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far short of what is possible and what is expected. While a relatively large field staff is in place they are limited by three major factors:

a. Lack of appropriate training

b. Lack of an effective Program development system emphasizing program management and staff supervision

c. Lack of support to do their work (transport, teaching materials, housing etc.)

Individual situations where special funded projects have been introduced do evidence some effective work. LINTCO is making an impact in the oilseeds extension effort through a donor funded soybean agronomist (Fred Javaheri) working with a LINTCO soybean specialist and seconded extension staff who have been provided work incentives. The ARPT in several provinces is showing some results. ZAMARE ARPT in central province is having an extension impact under the leadership of Ron Dedert, the RELO member of the ARPT team. This program has brought training in the FSR/E to the province and especially at the camp level. Other efforts such as the Netherlands support project in the Rural Information Services Unit is assisting in mass media and publication work at the national level. These and other special extension project efforts visibly demonstrate the potential that exists for extension work in Zambia.

Considerable in-service and some external training of staff has taken place but nationally a major task of organization, training and providing adequate support resources remains to be done.

2. ZAMARE Extension

The ZAMARE project design was almost entirely in the conventional and adaptive research areas. The Project paper identified activities in which

ZAMARE would assist in the Farming Systems oriented ARPT work in Central Province. This took the form of work of the ARPT but its extension activity related principally to the role of the RELO member of that team. Conceptually extension is to interpret CRT research findings to small farmers and provide improved communication on farmers problems to researchers. Project funding is directed toward:

a. In-service training for extension workers on research recommendations and organizing farm trials.

b. Engage extension workers in the diagnostic, testing and dissemination phases of the F.S. program.

c. Facilitate contacts between research and farmers, administer trials and test technologies.

d. Training for AA and CD staff.

e. Indirect information to large numbers of farmers.

f. Providing transport - cycles - for local workers.

The ARPT-RELO had major responsibility for developing the extension component of this project. Examples of progress over 3 years are:

a. A close working liaison has been developed between ARPT and the Provincial staff and the provincial advisory - coordinating group is functioning.

b. Four Trial Assistants have been selected, trained and are proving very effective.

c. Studies and surveys by CIMMYT and ARPT have assisted in defining TRD and relating to actual farmer problems i.e. (Date of planting, weed control, fertilizer rates, insects, source of power,).

d. Twenty one on farm research trials on a total of 106 farms over three years.

e. A bi-monthly newsletter going to all provincial staff of DOA and others.

f. Supplementary economic analysis reports.

g. Extension training workshops for lecturers of future extension workers.

h. Long term LIMA demonstration plots at each farm center and experiment stations.

i. Extension demonstrations on effects of using farmer selected seed from F1, Hybrid maize.

j. During 3 years ARPT Central Province has:

-Involved 107 farmers in 22 different trials.

-Involved additional 17 farmers in demonstrations where 700 farmers attended.

-Additional 320 farmers (M&F) attended field days.

-150 farmers visited LIMA field trials.

-350 farmers involved in ARPT surveys.

-635 farmers directly involved in ARPT on farm trials and demonstrations.

-Conducted technical training sessions for all province extension officers.

-During 1984 there were 2370 reached in extension training programs.

The ARPT through the Extension - research linkage has been able to contact farmers, help diagnose their technical constraints, secure

cooperation for on-farm trials and extension work and demonstrated the program to both extension staff and farmers.

ARPT team work has identified tremendous potential for extension education programs. Examples are:

1. Maize yields can be increased by early planting.
2. Maize yields are reduced by 30% using farmer selected seed from F1 Hybrid fields.
3. White ant control can increase yields 25%.
4. Limestone increased groundnut yields.
5. Economic yield increases for 200 kg N on maize.
6. Farmers are receptive and eager for <u>appropriate</u> farming systems technology.
7. Extension workers are cooperative and willing to work but in dire need of support.
8. Researchers, extension and farmers working cooperatively through FSR/E can improve agriculture productivity.

The RELO has given leadership to extension worker involvement in on-farm trials, training in crop husbandry and communication and teaching skills, large numbers of farm demonstrations, a research-extension newsletter, and farmer field days at ARPT sites. The RELO has had major responsibility to help the Provincial staff understand farming systems in extension.

D. Constraints

While some very positive steps have been taken by GRZ and the DOA this section will dwell on areas needing improvement, and where Zamare may help. (Annex I gives rationale for evaluating constraints.) Reviewing

reports and in interviews with central and field staff the following pervasive limitations were identified. These are areas which need to be addressed for a more effective and dynamic extension program.

1. Inadequate resources to support a relatively large extension staff.

   --Number and quantity of houses.

   --Number and conditions of transport (vehicles, cycles and bicyles).

   --Technical information base materials.

   --Materials for extension teaching: Paper, bulletins, visual aids, demonstration supplies.

2. National requirement to accept additional staff each year (graduates of Monze, Mpika, NRDC) with inadequate support as listed above.

3. Inadequacies in providing appropriate subject matter and extension education training for staff at all levels.

4. An effective extension program development process (planning, implementing evaluation) not in place.

5. Need for more effective management and leadership throughout the extension organization.

6. Performance appraisal system not conducive to improving individual staff effectiveness.

7. Lack of understanding of farming systems/extension methodology in the DOA.

8. T & V System not fully implemented.

9. Excessive time of present extension staff in administrative and non-educational activities.

10. Subject matter specialists both national and at the province not being utilized most effectively.

11. Lack of a "whole farm" or farm family approach to extension work, including farm management and systems analysis of farmers problems by extension workers.

12. Provincial ARPT doing effective adaptive research, but in limited problem areas, while extension farming system programs must deal with the farm family in the total decision making framework they face.

Constraints listed above are not unique to Zambia. Many of these are related to a new country coping with complex problems and limited resources. However many of these can be worked on and alleviated. GRZ and DOA have this responsibility, and challenge. In many of these areas experience and resources of outside support such as ZAMARE can, working as colleagues with local extension and DOA professionals, create an impact for positive change.

We concur with Zambian and other observers that the extension service is not reaching needed potential in effectively imparting or achieving increased agricultural productivity on a long term sustained basis.

Inadequate funding, shortage of sufficiently qualified and trained personnel, lack of direction and management has characterized MAWD extension in recent years. While these are problems they are also opportunities to greatly strengthen the application of appropriate technologies by attacking some of the constraints listed here.

E. Recommendations

1. For the national program (Phase II):

a. Follow the general outline of the World Bank Review report in relation to structure. We propose modifying this with a lifting of the place of the SMS throughout the organization, beginning at the provincial level. Also communications-information capcity needs to be integrated into the technial part of the structure.

b. In Phase II, an aggressive donor supported training program to form effective provincial subject matter specialists is proposed. Bringing 2-3 experienced technical subject matter specialists to work on colleague-counterpart teams is appropriate. Selecting key SMS for M.S. and some Ph.D training is essential. This effort must be integrated into the adaptive research chain in the FSR/E in Zambia. The PSMS should be looked to as the Subject Matter leaders and will develop the training and action program for the district SMS, and ultimate block and camp workers.

c. Communication-information services strengthening at both national and provincial level is proposed. A well trained communications specialist is needed at the national level and in each province. Move in that direction via donor assistance and as Zambian resources permit.

d. Organization, management and program development processes are in need of immediate attention. Clear organizational lines, job descriptions, supervisory responsibilities,

performance development processes need to be developed and implemented. This could involve outside assistance by a team of experts.

e. A specific proposal for the above would be to incorporate a donor support team of 3 experts; one in Extension organization and program development, one in Extension communications, and one in extension subject matter personnel development. These should be on site for at least five years and preferably ten. They might work at the national level but use one to three provinces as their priority, to demonstrate impact.

f. Continue efforts to allocate adequate budget for program support.

g. Shift budget where possible by having less personnel, not hiring new staff and using salary savings for support of a core staff.

h. Give strong support to the ARPT concept but strengthen with addition of split appointment SMSs at the provincial level, and make the provincial program truly a farming systems approach assisting farm families with the total set of management decisions they face. Further amplification may be provided by referring to appendix 3, Section IV.

2. For present and proposed phase II ZAMARE:

a. Strengthen ARPT by shifting concept to ARET (Applied Research Extension Team) and adding SMS at the province level (shown in section IX). Do this by staffing three positions with

that team - (note: Propose working in Central Province) with possibly limited testing in one other area.

1 - RELO Counterpart - Strong extension organization type person

1 - ARET Counterpart - Extension specialist - crops/soils to (lead the PSMS concept.)

1. ARET Counterpart - Communications/Sociologist/Economist

b. Provide an extension communication staff person at the national level to help develop an information-communications program. Use ZAMARE provincial work as demonstration and model of an effective communication program.

c. Provide an organization development/staff development person at the national level.

d. Assign immediately (Phase 1) one of the returning BS or MS extension trainees to the Kabwe ARPT as counterpart to RELO to initiate the PSMS - strengthening concept. Also assign Central Province Crops SMS counterpart to ARPT Agronomist as soon as possible, (see 2.a. above).

e. Build in graduate training for 15-25 PSMS positions in priority speciality areas to staff some key provincial ARPT units. Have this ready to launch early in a second phase.

f. Graduate training for 1 Program Development/Staff Develpment - Ph.D.

g. Provide for necessary transport and extension teaching support materials to fully demonstrate what an effective extension program can be using 2 provinces.

h. Short term consultants in program development communications and organization management.

i. Training tours to U.S., Chile, Guatemala or other countries for PSMS. Up to 25 PSMS to study role of Subject Matter Specialists.

j. Training tours for Communications Specialist.

k. Visual aids, communications unit - facilities and supplies for two provinces with ARET program.

Phase II, subject to MAWD request/concurrence, would continue the present ARPT in Central Province, augmented by a rural sociologist, in addition to the above recommendations.

## VIII. CRT/ARPT/EXTENSION INTEGRATION

### A. Description/Organization

Relative to research and extension the DOA has the responsibility for: Assessment of the world body of agricultural knowledge; local technology generation; adaptation to on-farm conditions and ultimate application by farm unit decision makers. This implies two main functions - investigation and education. A continuum of technology development and application is suggested for discussion.

World Agric. Knowledge Base → Zambia Tech. Knowledge Generation → Interaction of Tech. with Farmer Conditions (Tech. Soc. Econ.) →

→ Integration Into .F.S. → Education for Adoption → Diffusion

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The two extremes of this continuum, traditional research and extension, have been quite well defined and institutionalized in Zambia. While collaboration is taking place between extension and research, the linkages and integration necessary for effective determination of research directions and dissemination of research need to strengthened. The GRZ in 1980 initiated the ARPT concept as a measure to strengthen these linkages and to make research more relevant to the farming systems of the country. Through FSR/E methodology and specialized ARPT staff, farm oriented problem solving/research was initiated and an attempt is being made to strengthen the extension technology package making it more relevant to the range of constraints farmers are facing. Presently the 1985 Zambia proposal to the World Bank for review and reorganization of Research/Extension is being utilized to make some major changes to integrate research and extension.

Work in the area of strengthening CRT/ARPT/EXTENSION linkages is in response to the generally recognized need to effectively achieve an increase in Zambia's agricultural production on a sustained basis. This attacks the constraint of lack of appropriate information for small farmers as a result of inadequate adaptive research and an aggressive effective extension system.

Sections VI, VII, VIII of this report detail the CRT, ARPT and extension situation.

The present structure as shown in figure 1 allows for points of integration at the AD Extension, AD Research level. The ARPT Coordinator and Liaison Officer at the national level are in position to facilitate integration between extension/research. Other aspects of linkages or

integration must be on an informal, staff contact basis. Presently there is not a strong line relationship in the organization providing for linkage and interaction, rather individuals are expected to cooperate voluntarily. Figure 1 shows integrating the ARPT concept. The ARPT National Coordinator position is relatively new and ARPT's are not fully staffed in all provinces. The National RELO position is very new and the role is as yet not totally defined as to how he/she will relate to CRT and Extension as well as ARPT.

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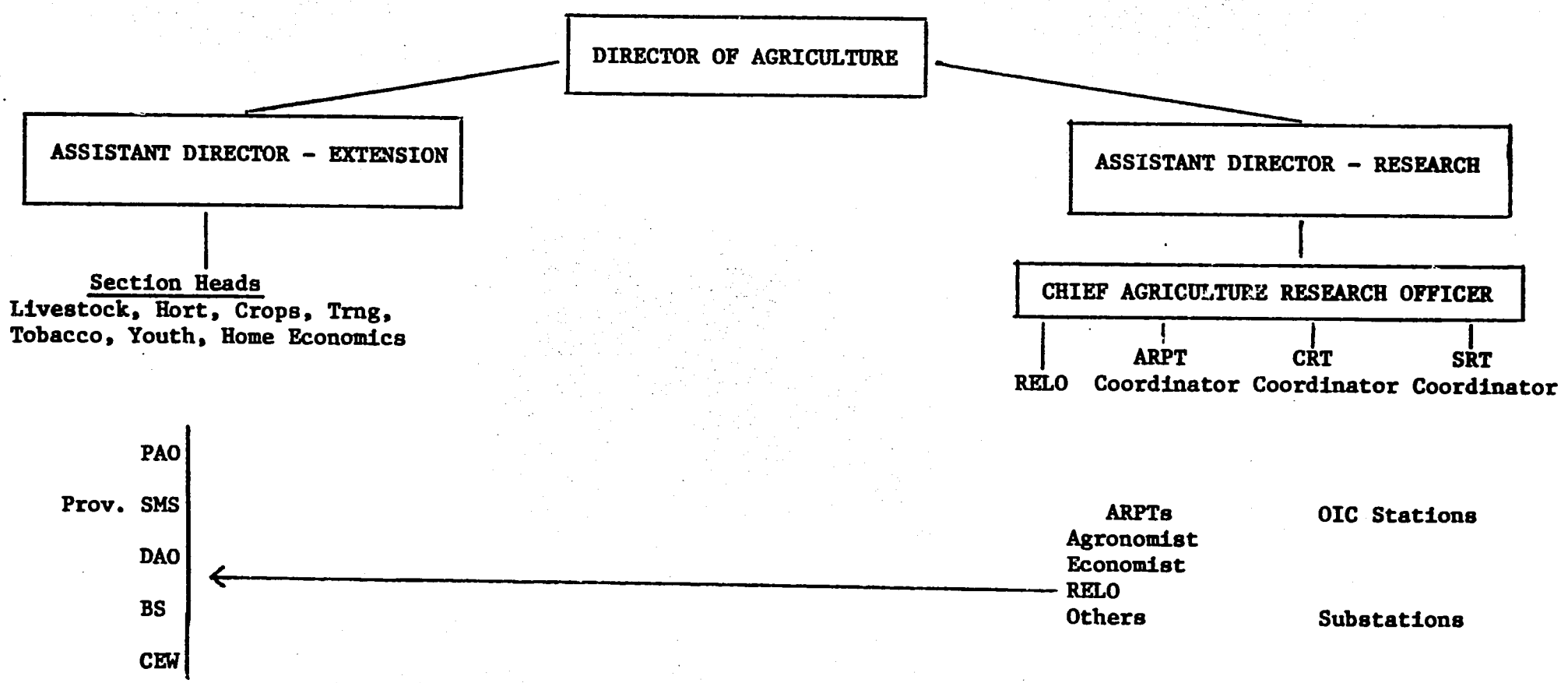
Figure 1: Present Structure and Linkages



B. World Bank Recommendations: Team comments

Annex 11 of the Zambia World Bank review report discusses linkages between research and extension. A major point is stated "If research and extension are to provide the farming community with useful recommendations, they must look at the whole farming system within which the farmer makes his decisions".

Extension is challenged to create a demand for the information or research farmers need for decision making and researchers are likewise challenged to observe and analyze problems at the farmer level.

The ARPT-RELO plan is facilitating a two way flow. Through target grouping, survey, testing, on-farm experimention and dissemination, the research-extension linkage is developed. In this, the ARPT team, its leadership and the RELO positions are the key to integration and effective working relationships.

The World Bank proposal supports strengthening the ARPT and the RELO aspects of research/extension planning committees, and fostering team efforts as recommended. A well defined work plan with objectives and defined roles and responsibilities is proposed.

Proposed Structure and Linkages

This brief sketch (figure 2) of the proposal in the World Bank Sponsored Review report serves to illustrate the points of needed integration and linkages. It should be noted that at the time of this ZAMARE evaluation, some aspects of the proposal have in fact been implemented. Others are TBD (to be decided).

There has been an apparent overload on the Assistant Director positions in DOA. This is corrected in the DOA document to the World

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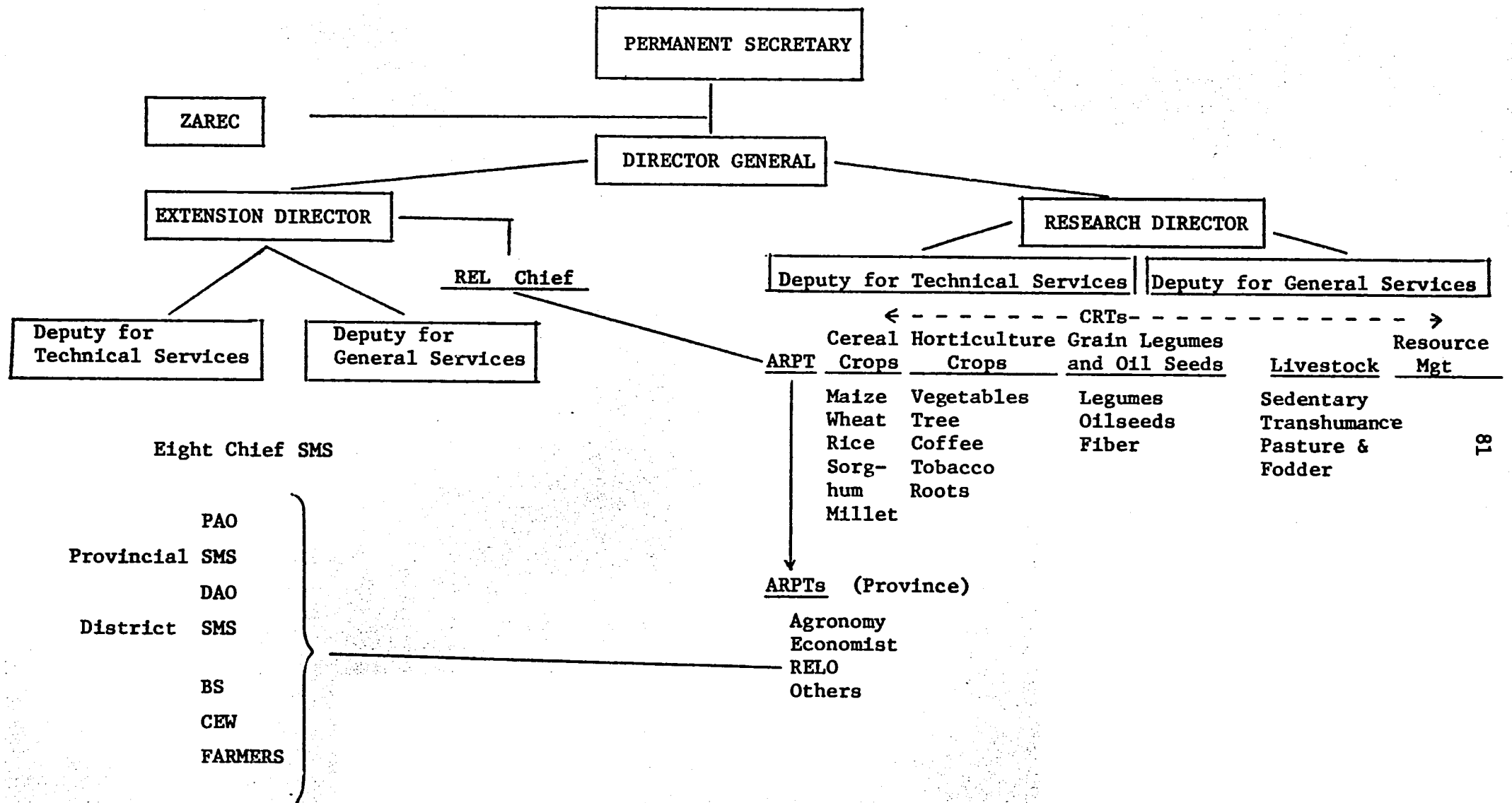
Bank proposal by naming the AD to Director and providing two deputies, one for technical and one for administrative matters. The role of the ARPT Coordinator and national level RELO, as relates to effective integration and linkages, is not well defined in the structure. The RELO Coordinator reports to the extension system but must be a part of the ARPT research branch. The RELO on the ARPT team has a dual function as ARPT team member and as provincial extension training and program development leader. This dual role is not reftlected in the administrative and reporting structure, and will need further clarification.

The World Bank Review report treats extension/research, linkages by: Providing technical directors (new) in both branches, naming section heads and coordinators, establishing national and regional coordinating committees and strengthening communications by research/extension interaction opportunities. There is not a strong adminstrative line bringing both functions together at all levels. In this report it appears that ultimate responsibility for effective integration and linkages rests with the two A.D. positions.

We discussed the lack of strong administrative structure to integrate research/extension with DOA officials. There appears to be a strong feeling of cooperation at the AD level. Both feel that fostering teamwork and collegial relationship will be effective.

Figure 2: Proposed Structure and Linkages
(Zambia-World Bank Review Report)



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General Recommendations (Extension) Relative to the World Bank Review Report

The evaluation team did not make a thorough evaluation of the World Bank Research/Extension review as relates to ZAMARE. Some major points were however identified which should guide future ZAMARE directions.

1. The reports are a very comprehensive reference of the research/extension situation in Zambia.
2. Some structural changes should strengthen the DAO
   a. Directors for research and extension, and division of technical from administrative functions under an assistant director in each.
   b. Providing for ZAREC, national and strengthening provincial coordinating committees.
   c. Naming heads of CRT units and Head of ARPT on equal basis to aid in linkages in basis and adaptive research.

In relation to integrations and linkages, the emphasis is on coordination and team work. For this to function it is essential that a strong viable organization be developed at all levels.

We feel the report did not sufficiently address some major issues which could strengthen the extension effectiveness and integration with research and with the farming community.

1. The CRT/ARPT process identifies major constraints of farmers by TRD. Then the process of testing, trial, etc is directed at key technical research needs. This is excellent, but from the viewpoint of the farm and the local extension worker it does not give a complete Farming Systems integrated set of production

information to assist farmers in their total range of questions on: What to produce? how much to produce? and how to produce it. In short, the emphasis is on adaptive research on a limited set of problems (by necessity) but somewhere the extension staff needs more of a farming systems/farm management backup to do effective extension work. Research and extension branches must strive to be one dynamic unit if DAO is to respond to the needs of farmers and the developing technology in meeting food production goals. The CRT-ARPT-Extension continuum of necessity is structured in two Branches thus both integration of staff and linkages among units is critical to successful programs.

2. The opportunity to provide strong subject matter technical leadership for training of staff and implementing of field programs is not addressed in the report.

   We feel that a well trained team of SMS at the provincial level can provide this important link in the research/extension continuum. A split appointment is proposed; 50% on the ARET team to tie closely to the FSR/program and 50% in a training, subject matter leadership - backup role for district and camp staff to assume delivery of his/her subject matter. This is done in a provincial ARET team setting and assures that extension programs are interdisciplinary and respond to the total farm decision making needs.

3. For effective research/extension application a communications unit directly integrated into the technical branch of extension is

essential. We feel that the report did not deal sufficiently with this.

We believe a communications-information section needs to be established at the national level to provide for a continous flow of information from the CRT/ARPT groups to extension field staff. This includes technical information plus teaching aids and including training on effective communictions with farmers. The technical unit of the Rural Information Services Bureau (RSIB) will soon move to the Extension Branch and will be responsible for agricultural information/communication/dissemination. The Central and Lusaka provinces provide an ideal field workshop to launch this national effort. Adequate operational as well as capital funding is essential for success.

4. The program development/staff development aspects of extension could have been more specific in the report. For effective extension work a definite long term and annual work plan is needed as well as clear definition of roles, criteria and measures of performance, and opportunity for staff to receive individualized training as they develop their career.

Specificic ZAMARE Opportunities Relative to World Bank Review Report

In relation to these suggestions we feel that ZAMARE can fit both in the present phase and in any future directions.

In Phase I, providing of an Economist - Farm Management to the ARET team plus encouraging DAO to assign counterparts to each team member; agronomy, economics and RELO. One or more of these could be from present

Central Province SMS, to test the split appointment concept being proposed by this evaluation team.

In Phase II a definite emphasis on strengthening the extension end of the research/extension process is proposed. Providing a team of ZAMARE at the provincial level which are in fact Extension Specialists; Agronomist, Economist, Communications/Staff development, RELO. Providing for strengthening the communications - information unit at national level with a Communications specialist, providing for a national program development/staff development position. Finally providing an ambitious graduate, short term and consultant program to develop the provincial subject matter specialist concept. Utlimately 25-35 MS people trained.

C. Progress

Progress of ZAMARE in fostering effective integration and linkages has been discussed throughout this section and in various places in the report. In summary the ZAMARE project has demonstrated their part in effective integration - linkages by:

1. ZAMARE staff serving on CRT and ARPT teams.
2. Participation in pre-research planning conferences.
3. Participating in various coordinating meetings such as Central Province planning committee.
4. Cooperation on field days, extension publications selecting trial sites etc. by all team members.
5. ZAMARE team leader serving effectively in developing good working relationship in MAWD and other GRZ circles.

It appears that ZAMARE team members are looked on as professionals who are willing to fit into the local system and work to reach organization goals.

D. Constraints

Many perceived constraints are identified in the discussion section above. They may be summarized as follows in relation to developing effective research/extension linkages in the DOA:

1. Need to develop strong leadership and direction at the AD level as well as with coordinators, team leaders and supervisory staff throughout the system.
2. The organization is built on a decentralized structure, with two branches. The smooth operation of these is dependent on; effective communications, development on teams, effective leadership - both organization and subject matter. This is a constraint in that leadership and team - level trust is not yet fully developed.
3. The linkage to the farmer is in place, but programs are not fully developed to meet farm famly needs.
4. Transport and other restrictions may reducce the amount of interactions necessary for research/extension people to develop teams and effective working relations.
5. A great burden is placed on the two Assistant Directors - technical in the new proposal. They will need to be strong leaders and develop a productive working relationship built on competence and trust. The constraint is in locating and developing this leadership.

E. Recommendations - general

Research and extension branches must strive to be one dynamic unit if the Department of Agriculture is to respond to the needs of farmers in

developing technology to meet food production goals. The CRT-ARPT-EXTENSION continuum of necessity is structured in two Branches thus both integration of staff and linkages among units is critical to successful programs.

A scheme is presented for consideration:

| Basic Commodity Research | Adaptive F.S. Research | Field Extension |
|---|---|---|
| CRT | ARET | EXTENSION |
| | (Areas of Integration) | |

In the above all DOA-Research/Extension staff have obligations and responsibility to the system. Teams exist at the CRT-ARET level and the ARET-Extension level. CRT can do applied research, as well as extension staff. ARET's can do both CRT work and extension work. The key is that team and colleague - professional relationships must be developed and fostered.

The framework of figure 2 separates out the service type functions from both research and extension. The technical and educational aspects are then interrelated, from basic research through ultimate technology adoption. The farming systems and ARPT concepts go a long way to strengthen these relationships. Effective linkages and integration in a complex organization are dependent on two factors.

1. Willingness of staff to work jointly as Professional colleagues and on multiple teams.

2. A high level of supervisory/managerial skills on the part of administrators and coordinators using strong but objective leadership.

While the organization charts must define administrative lines the program calls for several levels of teamwork. These teams may be interdisciplinary, inter CRT-ARPT, inter ARPT-Extension etc. The team effort needs to be provided for administratively and the necessary interaction and communications take place to make them effective. The farming systems approach is a major step in this direction through: ARPT work, target grouping, diagnostic surveys, on farm testing, farmer response, analysis, etc.

1. Subject Matter Specialists (ARPT)

The evaluation team feels strongly that a major opportunity exists to strengthen the research-extension linkage and impact on technology adoption. We place emphasis at the level of the ARPT and the Provincial Subject Matter Specialists (SMS). ARPT teams are spread thin and must restrict the TRD's they can handle or the amount of research within each domain. With DOA emphasis on decentralization we feel the weak link in provincial programs and effective integration of ARPT - Extension is in the area of Subject Matter Specialists (SMS).

a. We propose renaming ARPT to ARET (Adaptive Research Extension Team) to more nearly reflect the integrated team approach, and to allow for split (50-50) appointments to the ARPT teams. The subject matter specialist has been shown to be a key component of adaptive research-extension programs in many countries of the

world. This position must be a well trained subject matter person but oriented to and trained in extension program development.

b. We propose elevating selected (based on ARPT priority programs) Provincial SMS staff to joint appointment status with the ARET teams. They should be relieved of their provincial administrative duties and have two major functions:

1. As member of the ARPT team assist in the farming systems process with emphasis in his/her subject matter area;
2. Provide strong leadership for the total extension program as relates to their subject matter in the province.

In the above the PSMS (Provincial SMS) relates to the relevant ARPT (Agronomist, Farm Management, economics, etc.) team member. He/she also relates to the RELO for the total extension training and educational program in his/her subject matter area.

The provincial ARPT advisory or planning committee is important in identifying program priorities and in providing for integration, linkages and effective staff working relations. The SMS, to be on split appointment research-extension, is in a strong leadership position in facilitating the farming systems research and the training program for all District, block and camp officers. The ARPT-SMS will assist in developing the technical and extension teaching capabilities of the district SMS staff.

In the above discussion a commitment of the organization is essential and the SMS person assigned to the Provincial ARPT must have equal or superior training particularly in extension program development. He/she must be selected for demonstrated leadership skills.

With careful selection, on-site training, outside country training to M.S. level they can form a key link in the technology adoption chain.

The strengthening of SMS at the provincial level is in accord with decentralization and with bringing farming systems direct to farm families. As this is tested and implemented in the province the District SMS will be beneficiaries of the training and work of PSMS. To make for total program impact and as resources become available the National Subject Matter Specialist staff need to be strengthened. Transport and Communication-information materials support is essential to make the most of Subject Matter Specialists.

The basic process of linkages and integration based on PSMS are:

1. PSMS become part of ARPT team, responsible to ARPT for adaptive research component. Responsible to PAO (through ARPT Coordinator) for extension training program in province.
2. PSMS team develops an annual work plan for the province including: training for District SMS and block and camp staff, information dissemination program, comprehensive demonstration program tied to adaptive research of the TRD's. Assist in getting out adapted research trials and using them for training.
3. Serve as province planning and provide input to other planning, coordinating committees.

The specialist subject matter provincial team adds the critical component in linking research to extension at the local level. They are giving the impetus to the needed adaptive research, but as a team are providing for the broad training needs and back up support of field staff.

They should be readily accepted by both ends of the research-extension continuum.

The structure for the proposed ARET-SMS modification is as follows:

PAO

ARET - NATIONAL

ARET - Coordinator - TBD - Split Appointment SMS

| | |
|---|---|
| ARET - Agronomist - | Agronomy |
| ARET - Economist - | Economics |
| ARET - Livestock - | Livestock |
| ARET - etc. | |
| ARET - RELO | Communications/training officers |

In future directions for ZAMARE there is a timely opportunity to develop this concept. We recommend that DOA consider assigning one of the returning B.S. extension trained persons to a position of counterpart RELO in the Central Province ARPT. This can set the stage for the future, starting immediately. In a phase two a strong RELO extension specialist type should be assigned to this program and an extensive graduate in service training set up for the proposed ARET-SMS staff.

2. Facilitating through Coordination

   a. The national and provincial planning or coordinating committees are significant in integration and linkages and should be encouraged and developed.

   b. Provision needs to be made (travel, time etc.) for the various teams or groups to interact in a formal setting in research/extension program development.

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c. The ARPT team leader or coordinator position and role needs to be articulated. He should have frequent interaction with both branch directors.

3. Facilitating through Communication

A communications unit within the DOA will not only provide for technical information support but can assist in internal organizational communications i.e. staff newsletter, conferences etc.

4. Annual Staff Conference

One well planned Annual Conference of all CRT/ARPT/EXTENSION staff should be instituted. The purpose to provide for integration, some opportunity for team meetings and most important to develop an esprit de corps among all. We suggest all CRT people, all ARET including new SMS on that team, Provincial Agricultural officers and control administrative bodies staff should participate.

F. Recommendations - ZAMARE

1. Encourage assignment of 3 SMS to Central Province team.
2. Encourage an annual Research/Extension conference, and assist in funding.
3. Assist in establishing an integrated CRT/ARET/EXTENSION staff newsletter, provide critical funding and provide guidance in publishing.

<u>Phase I</u>

The evaluation team proposes that the replacement for the present RELO be in country for a one month overlap to assure continuity. That during this one month overlap, Dr. Robert Soza Director of Extension in Chile and former CIMMYT Outreach Specialist be contracted to spend one month in

training on implementing the concept of Provincial Subject Matter Specialists being assigned as collaborators to the ARPT.

Phase II

1. Develop the Subject Matter Specialist concepts in Central Province. Staff 3-4 positions.
2. Provide one national Program Development and one staff development - 2 persons and support for the programme.
3. Provide national communiations-information unit - 1 person and support for unit.
4. Provide 25 SMS - MS training support.
5. Provide consultants to assist with PSMS development, extension program development, extension staff development and communications-information support

## IX. LINKAGE BETWEEN RESEARCH BRANCH AND OTHER ORGANIZATIONS

### A. UNZA

The ZAMARE project has provisions for students and faculty at UNZA to carry out special studies relevant to the objectives of the project. A special projects' selection committee has been established which consists of UNZA faculty, MAWD officials, and ZAMARE personnel. This committee is chaired by the Principal of the Lusaka campus of UNZA. To further facilitate this linkage, School of Agriculture faculty have been invited to participate in the ZAMARE staff meetings. That the Chief Agricultural Research Officer sits on the Board of Studies for the School of Agriculture at UNZA is further evidence of the linkage between research and UNZA.

At this point in the project, UNZA personnel have conducted a study on the interactions of SSPs and extension agents in terms of the

effectiveness of agents delivering information and how farmers use it. Further evidence of developing linkages is that three UNZA students are working with ZAMARE personnel in maize and sunflower research. ZAMARE personnel have also been active in helping to recruit outstanding School of Agriculture graduates into the Research Branch.

UNZA faculty will also be invited to participate in an upcoming workshop on research/extension linkages sponsored by on of the ZAMARE cooperating universities. UNZA faculty also participated in an inservice training course on extension communications and methodology. In addition, the Head of the Soil Science Department in UNZA's School of Agriculture will have a six month Post-Doctorate research program (not funded by ZAMARE) at one of the cooperating Universities.

Further participation by UNZA personnel with ZAMARE activities is somewhat constrained by the limited availability of transport for students or faculty doing research. Perhaps further linkages between the ZAMARE project and UNZA could be developed by arranging small group trips for UNZA personnel to ZAMARE research and extension locations.

B. ZAMSEED

The Zambia Seed Company is a corporate entity and the only agency in Zambia which produces seeds for commercial sale. The ZAMARE research team members--maize, sunflower, and soybean have direct association with ZAMSEED since they are responsible for production of breeder (pre-basic) seed which is handed over to ZAMSEED for production of basic and certified seed. In some instances, they have been called upon to produce basic seed. They are consulted in regard to isolation needs for seed production fields and are often familiar with the location of such fields. They

offer suggestions for production practices and are consulted in regard to projection of seed needs. ZAMSEED is informed about potential varietal releases and discussions are held regarding ZAMSEED's capability to handle new varieties and the need to anticipate variety replacement.

In turn, ZAMSEED provides about K400,000 per annum for research support, mostly in kind, e.g. fertilizer, seeds for varietal tests, chemicals, etc. Since ZAMSEED benefits directly (financially) from plant breeding research by having a monopoly on breeder seed it should, in fact, contribute more substantially to research. This might be derived from a levy on sale of certified seed. Such funds, however, should be specifically ear-marked for research, perhaps by a memorandum of understanding, and not be placed in the Ministry of Finance where they will be lost to the Research Branch. It is recommended that ZAMARE give consideration to supporting long- and/or short-term training in seed production and processing for ZAMSEED personnel, along with TDY for in-service training and consultations.

C. REFINED OIL PRODUCTS (ROP)

ROP is a wholly owned parastatal organization by the parent parastatal INDECO. Its function is to purchase and process nationally grown oilseed for edible oil consumption in Zambia. Historically it has purchased on international markets the difference between local oil produced and what the national requirement may be. ROP has two plants, one at Ndola, the Parastatal Headquarters and one at Lusaka. It has the capability to process cottonseed, sunflower, groundnuts and soybeans. The soybean processing rated capacity at the Lusaka solvent extraction plant is 250 MT/day and the sunflower rated capacity is 300 MT/day. The Soybeans are

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the only oilseed crop requiring the solvent extraction process. Both cottonseed and sunflower seed can be processed through expeller extraction which is a much less technological intensive procedure. There is a ready market for soybeans with the main buyers being Hybrid Poultry, ROP and a private concern. Soybean cake is the preferred oilseed cake by product as it has a lower hull (fiber) content, higher cake yield, and higher percentage of protein than sunflower or cottonseed. It is ideal for poultry and swine feeds. The annual requirement for soybean cake is about 40,000 MT/yr. The disadvantage of soybeans vs sunflowers is the lower oil content, 20% for soybeans vs 27% for the current predominant sunflower varieties/hybrids (there are sunflower varieties which run up to 35-40% oil content).

ROP has estimated edible oil demand currently to be 20,000 MT annually and rising to 40,000 MT in 5 years. MAWD estimates current demand to be 30,000 MT and that it will rise by 3-5% annually as population levels go up.

Table 1 illustrates current oil production potential from soybeans and sunflower. Table 2 illustrates estimated total production of edible oil versus demand. At the present time, at best, Zambia is producing about one half of its edible oil needs. In addition about 40,000 MT of soybean cake is imported annually. This is in addition to the potential production of 16,320 MT produced in Zambia.

At a working capacity of 300 days and an average of 250MT/day, if equal days were devoted to soybean and sunflower, ROP can process 75,000MT annually.

Table 1. Estimated Total Production and Oil and Protein Cake in Zambia, 1982/83

| Crop | Year | Hectares Grown | Yield MT/HA | Total Produced MT | Avg % Oil Content | Total Potential oil MT | Total Potential cake MT |
|---|---|---|---|---|---|---|---|
| Soybean | 1982/83 | 12,000 | 1.7 | 20,400 | 20% | 4,080MT | 16,320 |
| Snflwer | 1982/83 | 60,000 | .525 | 31,500 | 27% | 8,505MT | 22,995 |

Table 2. Estimated Production of Edible Oils, 1982/83 vs Demand

1982/83

| Total Demand for Edible Oil | Oil Produced from Soybean | Oil Produced from Sunflower | Net to be imported or produced from cotton-seed, ground-nuts, etc. |
|---|---|---|---|

This probably is enough capacity to handle the total current production of sunflower, soybean, and cotton seed. However, ROP has never been able to run over 50% capacity. It has difficulty in getting spares because of foreign exchange restrictions and when one component of the plant breaks down, the whole plant may be down for several months. This is a major constraint.

There appears to be little communication between the research branch and ROP. Research has the capability to produce significantly higher yielding varieties of sunflower, however ROP does not offer any price incentive to farmer producers to grow improved varieties. This is also a major constraint to increased production of edible oil.

The Research Branch, through ZAMARE has access to technical assistance in oil processing plant management consultants. ROP may be interested in this kind of assistance. It is recommended by this evaluation team that ZAMARE contact INDECO, the parent parastatal of ROP regarding ZAMARE support for an oilseed processing, utilization and marketing study from the UIUC International Soybean Program (INTSOY).

There are many uses that soybean cake, e.g. can be used for in human food product development. ROP should be interested in this potential. The above mentioned consultancy could provide information on new potential market opportunities that ROP could develop.

D. LINTCO

The Lint Company of Zambia (LINTCO) has recently been given responsibility for increasing soybean production of SSPs in Zambia. The results of these efforts have been encouraging. Over 2000 SSPs are now growing soybeans and 3,500 are being projected for the 1985/86 season.

Cooperation between LINTCO and ZAMARE and FAO sponsored soybean scientists in the Research Branch has been especially productive. New promiscuous varieties of soybeans have been released for use by LINTCO for extending to SSPs. LINTCO extension workers have been trained by Research Branch scientists in agronomic practices. Extension material and a soybean newsletter have been produced and used by LINTCO workers, as well. A complete set of relevant publications from the International Soybean Program (INTSOY) at the University of Illinois were sent to LINTCO for their use. In addition, the General Manager of LINTCO will visit the University of Illinois to gain further information about INTSOY, and soybean research/and production, in general. Future cooperation is being planned in the area of processing of soybeans for human food at the farm and village level.

The major constraints to further soybean development appears to be the processing capability of the Refined Oilseeds Products parastatal organization. Coordination between ZAMARE and the upcoming African Development Bank sponsored project on oilseeds will need to be achieved. INTSOY expertise on soybean industry development especially in food utilization and processing may be helpful.

E. NAMBOARD

NAMBOARD is an important institution in the supply of inputs to SSPs and as a purchaser of farm output. The ARPT economist has done some research on these sales and purchases by NAMBOARD in the Central Province with respect to fertilizer and maize purchases. The results of this study were shared with NAMBOARD as well as other agencies. As agricultural production and input useage increases in the Central Province, the ARPT

economist will need to continue to analyze NAMBOARD performance and report results back to various agencies including the Planning Division of MAWD.

## X. PARTICIPANT TRAINING

### A. Background

The implementation rate of participant training for the project is ahead of schedule in timing. Although a total of 34 individuals were suggested in the original project design for training, as of January, 1985, 31 have been placed in long-term degree training at U.S. Universities. Forethought on the part of AID/Zambia and MAWD, the Contractor and ZAMARE and rebudgeting of another $450,000 in the contract for training assured success of placing nearly 100% of the originally proposed trainees within the first three years of the project. The team leader along with MAWD and AID/Zambia training officers have been instrumental in working with MAWD in expediting personnel reviews, processing of paperwork and handling of arrangements for the participant trainees.

UIUC data as of January 1985 show 3 at the PhD level, 11 at the Masters level and 20 B.S. (three students had dual degree programs). By discipline/subject matter, 75% were focusing on agronomy, agricultural economics, agricultural extension, seed physiology, breeding and horticulture. As of January, 1985 eight trainees have completed their academic programs and returned to their posts in Zambia. Another twelve are expected to complete the training by December, 1985. The last eleven will finish by mid-1987.

The first group of trainees who returned as early as December, 1983 have remained with MAWD. There is one example of advancement within this

group, as one trainee was named head of the Seeds Storage and Protection Section.

Short term courses offered in the U.S. have been the opportunity for 51 Zambians to participate in the project by the end of 1984. Twenty such short courses were attended in 1984, ranging from topics of agricultural organization, management and research methodologies to commodity production and processing, seeds, soils and technology transfer. Before the end of 1985 another 19 Zambians are scheduled to participate in short-term training at USDA, U.S. Universities and international agricultural research centers. In country, in-service workshops organized by the contractor for training extension workers will be continued.

The MAWD National Extension Training Office (Rita Mudenda Mwampole) stated that provincial training officers made initial recommendations on staff for additional training in research and extension based on their skills/experience level and needs for strengthening. She reported that the ZAMARE project had been very helpful to Zambia in meeting both long- and short-term training needs. Training conducted outside the country was viewed as desirable for cross fertilization purposes, but in-country, short-term courses were being examined as an approach to reaching a larger audience of extension and research workers without dislocation of their time and duties necessitated by external travel and as being most related to the African setting. In-country, short-term courses were also seen within the Department of Agriculture as being useful to private commercial companies and other organizations in the agricultural sector such as ZAMSEED and ROP.

B. Assessment

The perspective of MAWD for the remainder of the project and a Phase II is that staff development remains a high priority if the Department of Agriculture is to have the caliber of degreed scientists, professional and technical staff performing at optimal levels in the system to meet country long-term strategies for agricultural research and extension. The training needs are in technical specialities, with the exception of managerial skills improvement for administrators. The MAWD document "Strategy for Agricultural Research " (Nov. 1984) acknowledges about a 20 year period to get " the number of degree-trained scientists up-graded to the level of training and experience that is desired," i.e. a goal of 32 Ph.D., 60 M.Sc. and 62 B.Sc. degrees by the year 2000, from the June 1984 figure of 20 Zambians with advanced degrees in the Research Branch (2 Ph.D, 18 M.Sc. and 34 B.Sc.). The program dislocation MAWD is willing to make to achieve this goal is to send an upper limit of 37 personnel away for training at any one time, which is 20% of the total Zambian staff of professional and technical personnel in the Research Branch. A limitation of this plan is the absence of replacement staff to the trainee posts which would allow expatriates to continually have counterparts in training. Most staff requiring graduate degree training will likely be sent abroad. The Extension Branch with 11 M.Sc. and 34 B.Sc. is expected to obtain B.Sc. degree holders from UNZA and meet other extension workers' certification through NRDC and related institutions.

Since only eight trainees have returned to their posts during the 1984 calendar year, it is premature to determine an attrition rate to the private sector or farming after the required service period has been

completed. MAWD is considering a system of incentives for retention. When newly trained personnel return to their posts, they are briefed by their supervisor but there is no formal orientation or short internship provided for them to gain on-the-job experience. Feedback on effectiveness of long- or short-term training is apparently limited to descriptive comments from the Provincial Agricultural Officer or other officials as to whether or not the trainee is performing satisfactory in his/her post. The premise is, if the trainee performs well, the training is presumed to have been adequate. The only other known documentation of feedback is the self critique questionnaire given by the team leader to each returning trainee. AID/Zambia and ZAMARE, however, are already exploring ways to improve tracking, evaluation, follow up and monitoring of returned participants. There are no formal evaluation procedures as yet to test skills, applications and techniques learned and productivity over time within the in-country environment.

Expatriates are expected to be used through the 1990's. In June, 1984 there were 62 expatriate degree holders (majority donor-financed) in the Research Branch. The projection for 1990 is 36, and barring more than a 3% attrition rate per year, the Research Branch could be Zambianized by the year 2000. The strategy presumes some build up of staff to establish capability to carry out planned research programs before expatriate replacement is completed. As the number of Zambian degree holders increases over the next several years, there will be better opportunities for expatriates to provide the on-the-job-training for their Zambian counterparts.

C. Recommendations

1. Given the success of the participant training program, the contractor in conjunction with MAWD should immediately devise a plan for additional degree trainees in the remainder of the project life and for Phase II so that the momentum of training is sustained. The contractor will need to work with AID to realign the budget for the additional monies.
2. Short courses abroad and in-country should each be continued and considered to meet Zambian needs of staff development.
3. A performance evaluation of trainees after return to duty will provide better feedback for the contractor on effectiveness of the training program and for MAWD on the need for further on-the-job experience for trainees prior to their resumption of regular duties.
4. Returning trainees should be interviewed six months after their return, to obtain their views on how their training background could be more usefully utilized.

## XI. COMMODITY PROCUREMENT

In most AID financed development assistance projects, responsibility for procurement of equipment and supplies is given to the AID contractor. This in many cases becomes a problem because identification of equipment, obtaining host government clearances, cutting of purchase orders and international shipping consumes a great part of the project life. The design team of the ZAMARE project was concerned about the equipment and supplies not being a limiting factor in early implementation and progress

by the technical assistance team. The design team with MAWD input had the knowledge and expertise to prepare an equipment and supply list for early procurement in the life of the project. It was understood that there might be differences of opinion by the technical assistance team due to personal preferences, however, it was decided that the benefits of early procurement outweighed the option of letting the contractor making the purchase after the project began. AID/Lusaka then retained funds from the project contract to make the equipment acquisition.

The ZAMARE project was anticipated to start in February 1981. Due to unavoidable circumstances the project did not start until August, 1982. However, because the design team chose the option of preparing the list for equipment purchases, AID/Zambia, using the AID retained funds, initiated procurement of all equipment in October, 1980. All equipment was purchased and available for use by the project technical assistance team upon their arrival in country. There are very few examples of this happening with AID Development Assistance programs. It has been a positive plus for early and successful implmentation of this project. The disadvantage of the procedure was that upon arrival in country, eight pieces of farm machinery valued at $48,432 was determined to be inappropriate for project use. This amount is estimated to be 11-16% of the total list of commodities purchased.

The evaluation team feels that this was a desirable procedure to follow.

Recommendations

1. AID/Zambia was able to sell the inappropriate equipment locally for Kwacha and covert that to U.S. dollars. This amount of money should

be returned to the equipment line item for additional high priority equipment purchases.

2. It is recommended that the funds remaining in the equipment line item of the budget for AID retained funds be made available for purchases to fill in necessary gaps as identified by the technical assistance investigators and their Zambian counterparts.

3. ZAMARE/MAWD should proceed to develop a draft equipment list for Phase II in preparation for Phase II Design activities.

## XII. PROJECT MANAGEMENT AND ANALYSIS

The following questions were used as terms of reference:

1. Does the present project organization and management facilitate the flow of project activities to accomplish and complete project objectives in an orderly and expeditious manner, given in-country constraints?

2. What is the organizational climate in which CRT/ARPT team members are expected to conduct research? What are administrative areas of responsibilities of the Team Leader and support staff?

3. Are procedures and processes established to provide accountability by the contractor in expenditure of funds and compliance with contract terms?

4. Can economy and efficiency measures be suggested toward more effective functioning of project management?

5. Have there been improvements in interactions between the AID Mission, the project and MAWD?

Section One: Team Leader's Office

Interview with Team Leader (TL), James Ragin, Administrative Assistant, Lighton Chipeta and Secretary, Bessie Thornicroft.

A. Background

Interviews were held with the above in their assigned office within MAWD at Mulungushi House.

Mrs Thornicroft reported performance of the following duties: a) receptionist; b) clerical; c) maintaining all paper work on participant trainees (long-and short-term); d) ordering supplies; e) operating office equipment (typewriter and copier). These tasks corresponded to duties specified in the secretary's position description. She reports to and works 100 percent time for the TL.

Mr. Chipeta reported performance of the following duties: a) maintaining operational forms such as project vehicle usage log sheets, team leave records, supplies requested and received per station by quantity and description, b) distribution of supplies to stations, c) working with AID training officer on detail processing of the project's participant trainees, d) verifying accuracy of the project's imprest account expenditure forms from the stations and preparation of payment vouchers, and confirming accuracy of claims for subsistence allowance and mileage on official travel, e) reviews preventive maintenance needs on project office equipment and vehicles; f) supervises secretary and driver assigned to the team leader.

The tasks performed correspond to the position description. He reports to and works 100 percent time for the TL.

Dr. James Ragin, TL, reports in the Department of Agriculture in MAWD to the Director and works closely with two Deputy Directors for Research and Extension. His position description is defined in the project paper and contract award. The following were areas of discussion:

1. Planning and Coordination

The TL requires a quarterly report from the team (including himself). The TL reviews the progress report and projections from team members as related to general project goals and specific objectives of the team member, time schedule, problems, needs, constraints, etc. The quarterly report is discussed in a quarterly meeting of the team (in the first two years such meetings were monthly). The TL provides quarterly progress reports, annual progress reports and annual work plans to the ADO/AID/Zambia. The TL has not consistently filed copies of the quarterly reports with UIUC, SIUC and UMES; annual progress reports and annual work plans are being received by them. The quarterly reports of each team member are apparently circulated in MAWD through their counterparts or other channels of communication. The team participates in the annual MAWD strategic program planning meetings held in August/September. The TL has a formal meeting of his office staff at least monthly. The TL reports considerable time spent in policy meetings with the Director of Agriculture and on technical matters with the Deputy Directors for Research and for Extension.

2. Communications

The TL states that he has easy access to the Director of Agriculture and his staff as well as to the ADO/AID/Zambia. The TL reports no outstaning delay in information flow/paperwork processing with either

MAWD or AID/Zambia. The TL and office staff have contact usually weekly with most team members as they pick up mail, run errands, etc. in Lusaka. Trips by the TL to the stations are made regularly and on an as needed basis.

3. Internal Controls

The TL stated that he has signature authority over and approval of in-country project expenditures, and approval of those directly processed through the Project Support Unit (PSU) in the AID/Zambia office under AID retained contract funds. The TL stated that he was conversant with AID general Provisions and related contract terms and conditions and allowable costs. If AID prior approvals were required under contract terms, these were obtained through channels. If the TL was uncertain of an allowable cost, he sought opinion of the AID Mission and/or UIUC. MAWD input and/or approval of an activity (as an agreed - to policy early-on in the project), e.g. staff travel, was also obtained. A procedure had been established whereby one of the team members was appointed acting TL in Dr. Ragin's short- and long- term absence to permit continuity of project operations.

4. Performance Evaluation

Both the ZAMARE and MAWD, as on-site parties, have undertaken to develop an annual performance evaluation of the team. The MAWD evaluations will carry weight in determining ZAMARE personnel decisions such as in MAWD recommendations of staff for a second tour of duty. Regular scheduled visits by the three cooperating universities provide for annual performance evaluation of the team for promotion, tenure, and annual salary increases for host institution administrative requirements.

B. Assessment

Concern was expressed in the first year AID evaluation of the project on acceptance of responsibility by the contractor for management of the project. This concern has since been properly addressed and corrected. There is a viable management structure in place with a well organized two person office staff capable to assist the TL on day-to-day activities so that the TL may devote more time in leadership direction to effect implementation of project objectives.

The TL has a difficult dual responsibility, first to cooordinate the staff located at three different sites to work on their specific tasks while simultaneously maintaining a "team" (unit) perspective, and secondly to accomodate project staff interaction within the MAWD structure, with assigned counterparts, with GRZ staff at the research stations and province level. The TL has direct lines of communication within MAWD and to AID in decision-making. Policy statements have been developed and agreed to by MAWD and AID on functioning of the project and role of the TL. The approval process for major programmatic decisions and clearances affecting project personnel, travel, commodities, etc. is a lengthy one, which involves routing through the TL, MAWD and AID. Authority of the contractor to perform as a project manager, to provide accountability for in-country funds, and capacity of team members to meet daily operational needs have all been established and implemented.

Section Two: Team Overview of Project Management

A. Background

An overview of project management was obtained from a majority of the team members. Their reactions, though brief, fell into two categories:

AID involvement in the project and the team leader. Examples concerning AID were delays in responses and/or inaction on perceived needs such as fencing and wells at Kabwe, install fencing at Magoye, and travel to professional meetings approved by MAWD.

On the TL, there surfaced two concerns, one of perception of duties, the other of communications. Team members generally perceived the team leader to be less a motivator for them than an administrator; lacked specific understanding of the dynamics surrounding his time spent in MAWD; were confused by unclear lines of authority and the decision-making process vis-a-vis MAWD, AID, home campuses. The team overall expressed a desire to have the team leader make more field visits to observe and appreciate their needs and directions. It is important to note that frustrations appeared to be expressed at a group level of achievement rather than with their own individual productivity.

B. Assessment

The AID involvement is treated in Section Five

Daily communication and interaction by the TL with the staff in the field are difficult, complicated by distance for Magoye and Kabwe and dysfunctional telecommunications. Telephones are installed at all research stations and in MAWD, but work intermittently. Short wave radios for field sites have likewise become inoperative. Sustaining a team identity and avoiding a fragmentation of the team into institutional loyalties and self-interest is a herculean task. The team leader reports bimonthly trips to the stations, to on-farm trials, in listening to needs and in providing guidance. If the frustrations are attitudinal, the team may have been negatively conditioned over the past two years by start-up

problems and delays. The response is to generate a climate for this and successive teams which is positive, forward-looking and provides adequate recognition.

Section Three: Recommendations: (for Sections One and Two)

1. The ZAMARE project does not yet have a formal internal organizational chart. In the start-up stages of the project there was some confusion and uncertainly over the role of the team leader and of MAWD, the lead institution in project management, and the involvement of AID/Zambia. These differences have since been set aside to put the project on target. An organizational chart should depict linkages, flow of communications and the decision-making process between the ZAMARE team, MAWD and AID/Zambia.

2. A set of administrative guidelines for the project should be compiled which incorporates previously agreed upon policy and procedures between the team leader, UIUC, MAWD, and AID/Zambia, the official channels of communications, the decision/approval processes and turn-around time as established between the parties. The guidelines should include personnel evaluation procedures as well as operational procedures governing personnel, travel, capital expenditures, supplies, etc. The guidelines will be beneficial in orientation of future personnel coming onto the project and serve as guidance to the team leader and the administrative assistant in the TL's office. The guidelines should be viewed as addressing the concerns on project management as found in the AID evaluation of 1983 and the Executive Team Visit in 1984. The intent of the Project Paper will likewise be served, i.e. to have day-to-day management of the project residing with the TL and support staff.

3. The administrative assistant may be more effectively utilized (as suggested in recommendations under PSU) in handling of project details. This might include training as needed for specialized tasks. The TL's office staff and the PSU in AID should be viewed organizationally as one service unit in support of the project. The administrative assistant's status needs to be better communicated to both team members and PSU if he is to be effective. His salary level should be commensurate with duties performed and vis-a-vis his PSU counterpart.

4. A short-term TDY consultant in management/administration should be requested to assist the Team Leader in devising appropriate response to recommendations one through three which are acceptable to and can be approved by all parties.

5. The location of the team in-country and distance between some of them combined with dysfunctional telephone service create a communications problem and a sense of isolation from peers. There is a social benefit to the project, i.e., in morale and loyalty, by having the TL visit the research stations on a regular basis and to continue to have visitors meet with the team members at the stations. The TL should maintain a brief trip report on discussions, with copy to the team member.

6. Because of non-functional telephone services, there should be working radios appropriate to transmission needs between the TL's office and PSU, and between the TL's residence and each team member. The purposes are, for example, to reduce lack of effective communications between the TL's office and PSU (See Section Four), to handle transport and supplies needs, emergencies related to health and safety, etc.

7. To keep the three cooperating institutions abreast of project activities, the TL should regularly transmit a copy of quarterly reports to UIUC, which in turn is responsible for their timely dissemination to SIUC and UMES.

8. The team leader's office space in MAWD is too small to accomodate three individuals and adequate seating for visitors and business appointments. While the secretary and administrative assistant may reside in one room which is also a reception area, the team leader should have a seperate office.

9. The project at the Kabwe station has a medium capacity reproduction machine and electric typewriter. With the productivity being generated at Magoye, the same type of equipment at that station is an investment in research output and not duplicative of other support services.

Section Four: Project Support Unit (PSU)

Interview with AID/Zambia Management Officer (M.O.), Michael Ireland, PSU Administrative Assistant, Mrs Merab Kiremire.

A. Background

The M.O. stated that the Project Support Unit was a concept adopted from implementation in another AID country funded project and was premised on freeing the Team Leader of assorted administrative tasks for time devoted to technical needs of the project. The PSU was set up as a seperately budgeted office within the AID Mission to be a service unit to the two coinciding funded projects in Zambia, ZAMARE and ZATPID, and the Mission itself. The PSU staff consists of an administrative assistant

and two clerical personnel. The costs of operating the PSU are derived from AID retained in-country project funds and from the Mission.

For all AID/Zambia projects the PSU was responsible for one-time, large scale project start-up needs, such as renovation of housing, purchase of household furniture, appliances, vehicles. Under a set-aside of in-country project funds, the PSU handles recurrent costs such as contractual services for security guards, house rentals and utilities, vehicle maintenance and repair. Interim services by the PSU have included assistance in registration of ZAMARE staff's personal vehicles and obtaining of driver licences and vehicle plates, securing import clearances, and visas, in addition to general typing, reproduction and collating of materials. Following the initial heavy start-up outlays in the first year of the project, recurrent costs are being budgeted at a steady-state level of approximately $200,000/yr. The M.O expected that at this rate of spending there would be uncommitted line item monies (from the 20% AID retained ZAMARE project funds) by the fifth year of the project which could be redirected to direct project needs.

On capital equipment and volume order of consumable supplies approved by the team leader, the M.O. acted as a buyer and issued a pro forma invoice to obtain the item(s) locally if available and if the fastest turn-around delivery time. Items requiring detailed scientific specificity were generally sent to UIUC for processing.

Two AID station wagons retired to the PSU were available for project usage, one for ZAMARE, the other for ZATPID. The priority order for usage of the vehicles was given as a) the projects, b) PSU, c) AID. PSU

maintains a schedule sheet in which team members of both projects are asked to forecast their need for these vehicles.

Office automation equipment in the PSU includes two large capacity reproduction machines, one with collator, a stencil cutting machine, and a word processor and a telex machine.

Examples of services provided in part to the Zamare project by PSU since January 1, 1985 were cited as:

1. Payment of monthly rentals, utilities, contract services.
2. Transmitting and receiving telexes.
3. Lab supplies obtained for Magoye.
4. Office supplies obtained for Mt. Makulu.
5. Vehicle maintenance and repair.
6. Typing of papers for the March, 1985 maize conference and team member's handouts for the evaluation team.
7. Photocopying.
8. Transportation needs for the maize conference.
9. Travel arrangements for Val Eylands trip to Argentina.
10. Purchasing of new vehicles.
11. Payment of Support staff salaries including the team leader's administrative assistant, secretary and driver.
12. Issuing checks against the team leader's checking account for reimbursement purchases by project personnel.
13. Preparing the monthly reports to UIUC on expenditures obligated under the team leader's bank account for replenishment of local operating funds.

The M.O. foresees continuance of the PSU in support of the ZAMARE and ZATPID projects and with the addition of the coming HIRD project.

B. Assessment

The PSU concept as an administrative service center is a valuable asset to project management, particularly for the type of outlays required for a research-oriented project. This service center is consistent with a management operational objective of facilitating the flow of project activities to allow accomplishment and completion of project objectives in an orderly and timely manner. Acting as a "Accounting Office" for a project it can provide a central audit trail or accountability of expended funds. PSU can effect economy and efficiency measures such as in pricing purchases of commodities, equipment and services and reducing the need to provide extensive office automation equipment at each research station where team members are located. ZAMARE team members report reliance on the PSU for support typing, photocopying, services and some supplies and materials.

The PSU caused consternation for the contractor since it was alluded to but not expressely stated in the contract. AID retained about 20% of contract funds for purposes including basic administrative support. Because of confusion early-on in the project over role of the team leader housed in MAWD vis-a-vis functioning of the PSU in the AID Mission, an agreement was reached by the contractor in February 1983 on division of responsibilities for in-country support funds between PSU and the TL. Procedures were developed for approving, processing and payment of support items (outlined by category "A" for AID and "B" for contractor). All requests for support services were to be reviewed by the TL who referred

items in Category A to the AID/Zambia Project Officer for approval and action through PSU, and in Category B took action directly or upon his approval referred them to PSU for processing. PSU was to maintain account records on both categories of support items, and for UIUC prepare monthly reports for reimbursement of the TL's local bank account (at this time the head of PSU was a CPA). Later in 1983 an administrative assistant was provided to the TL to help with processing of category B support items and other procedural details. For audit purposes AID remains responsible for items paid through PSU, the contractor for items paid through the TL.

Given in-country operation constraints, the overall technical success of the project to date demonstrate that project support has been and is available and functioning. There are snafus, examples cited below, which illustrate logistical problems for project management planning and coordination under a dual organizational structure. Ideally that portion of PSU providing service to the ZAMARE project should be adjunct to and located in the TL's office since the TL is supposed to review all expenditure requests from team members. As currently structured, the PSU reports to the Management Officer of the AID Mission. The 1983 agreement between UIUC and AID Mission reflects a dual system of in-country project operation with seperate reporting and accountability mechanisms under the umbrella of the ZAMARE contract award. Complicating factors for project management are the distance of about 5 kms between the TL's office in MAWD and the PSU at the AID Mission and generally inoperative telephone service.

Examples of snafus affecting planning, coordination, use of time and scarce petrol are:

1. Advance scheduling of the PSU vehicle for ZAMARE will not allow for unanticipated daily changes. Without functioning telephone service between MAWD and AID, coordination of the use of the vehicle is handicapped, with frustration at being driven from MAWD to AID to discover that the vehicle is out.
2. Inoperative telephone service leads to frequent trips between MAWD and AID to learn whether services were/were not completed by PSU, e.g. visas, work permits, supplies ordered and received.
3. A computer part for Mt. Makulu sent from UIUC and not received by the scientist after two months, had been presumed lost and was replaced by UIUC about the time as the original package was discovered sitting in the PSU office. This could have been prevented by PSU keeping the AID/Zambia project officer informed.
4. Because of personal leave taken by the PSU Administrative Assistant, the monthly expenditure reports to UIUC were delayed in completion and submission to UIUC, such that three consecutive months' reports submitted at one time caused a breakdown in timely reimbursement of funds from UIUC to the TL's rapidly depleting account.

Section Five: AID Mission and MAWD

Assessment

Members of the evaluation team met in scheduled sessions with AID Mission and Department of Agriculture officials. The consensus derived from these sessions was the marked improvement in thinking about the project and those management concerns expressed in previous evaluation

reports. The project has a positive image and very high visibility in both AID and MAWD. Channels of communications are open and utilized.

One lingering problem remains to be addressed. It was learned that Mission review and approval of all telexes for the project is an internal policy directive, not a statutory provision or AID Handbook policy legally binding under usual contract terms. The continued practice fuels sensitivities toward problems of the past which are best put to rest.

Requests cited by team members e.g. on fencing and walls were referred to the AID Project Officer for review as these would come under the AID retained in-country funds.

Section Six: Recommendations:(for Sections Four and Five)

1. Given unreliability of telephone service and probable continuance of the PSU concept in the AID Mission, continued interaction between the TL's office and the AID Mission are essential in their jointly searching for alternative solutions to project support problems and needs and in minimizing conflicts and delays encouraged by physical separation of offices by distance and different reporting mechanisms. This could be examined by the short-term TDY consultant.

2. The strengths of PSU are known, there is an underlying but inaccurate notion between PSU and the TL'S office of duplication of some support services by one or the other. Both administrative assistants claim background and/or experience in accounting.The work each one does seperately on expenditures processing is probably closer to an accounts clerk than strictly accounting. The monthly UIUC expenditure report can be prepared by either administrative assistant*, since a second level administrative review of field expenditures/internal auditing function is

performed by UIUC, not the PSU. Closer cooperation and collaboration by PSU would have prevented the aforementioned several months' delay in transmission of UIUC expenditure reports.

3. Given the physical constraints to easy communications and vehicle usage, a streamlining of selected functions to either the PSU or TL's office is suggested. An example is that since a good part of the TL's duties are to handle the participant trainees (long- and short-term) and research associates and special studies under the project, it makes sense to let the TL's office be responsible for handling of all their services such as visas, work permits, travel arrangements, etc.
*This activity is listed in the Team Leader's Administrative Assistant's position description, Oct. 1983.

4. For consumable supplies and materials and travel, team members present receipts for reimbursement against the TL's account. The checkbook is currently retained at PSU where a pre-signed blank check by the TL is completed by the PSU administrative assistant. PSU stated that only 3-4 pre-signed checks are usually kept on hand, intended for early usage. The procedure of pre-signed checks, though for convenience, may be a questionable one in an audit. An opinion should be sought on this procedure. Since the TL has to initially approve the reimbursement for payment, his completion and signing of the check on the spot may be as efficient as having the team member go to PSU and having the check filled in. If the TL and his designee or PSU administrative assistant are both absent, there is delay anyway in immediate reimbursement.

5. There are inadequate vehicles to presently handle ZAMARE project needs. Consideration should be given, in the replacement of project

vehicles, to assigning more retired AID/Zambia vehicles to PSU and then assigning more than one PSU vehicle to ZAMARE with one on direct loan to the TL's office for handling research associates, and related transport project needs in addition to the vehicle being purchased for the special studies student in Kabwe.

6. The AID Mission internal policy of approving telex and is not a statutory provision and contained in the contract terms and conditions. The AID Mission should review repeal of this internal policy.

7. Oustanding capital expenditure requests from team members for AID determination and action should be reviewed and efforts made to implement these requests as practicable and in a timely manner.

XIII. FUTURE DIRECTIONS: (Subject to MAWD request/concurrence)

USAID and MAWD should continue and increase support to the team leader through out Phase I and Phase II of the ZAMARE project. During the second phase, it is recommended that the team leader and his office receive the services of an additional assistant and be assigned one additional vehicle.

CRT

USAID and MAWD should continue to strengthen the Research Branch through expanded support to the Commodity Research Teams, the ARPT in Central Province and consider extension development activity for the Central Province. This would include technical assistance (long-term and short-term). Long- and short- term training, in country workshops, commodity purchases, (equipment and supplies), recurrent budget operational support and the special studies program. The matrix of staffing recommended is as follows:

| CRTs | Ist PHASE | II PHASE |
|---|---|---|
| Maize | Breeder | Breeder<br>Agronomist<br>Cereal CRT Leader |
| Sunflower | Agronomist | Agronomist<br>Breeder |
| Soybean | Breeder<br>*Pathologist<br>*Microbiologist | Breeder<br>Pathologist |

* Recommended that project add soybean pathologist in Phase I.
** The Microbiologist position is recommended to be extended at least through Phase I

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EXTENSION

| ARPT | I PHASE | II PHASE |
|---|---|---|
| ARPT/Extension | Agronomist | 1. ARPT Agronomist |
| | Economist | 2. ARPT Economist |
| | RELO | 3. ARPT RELO/Communications |
| | | 4. ARPT Livestock specialist |
| | | 5. National level extension organization and program development specialist |
| | | 6. National level Communications /Information specialist |
| | | 7. National level extension subject matter personnel development specialist |
| | | 8. Consultants on extension subject matter specialists role |
| | | 9. Consultants in program development/staff development |
| | | 10. Consultants in communications |

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Extension: Future Direction Narrative for New Activity

Phase one of ZAMARE placed emphasis on the research component of technology development and adoptions. We propose that phase two shifts emphasis to strengthen the extension component of the process. Project planners must recognize that extension is an educational institution and any strengthening of extension must be long term, no less than ten years.

Some initiatives can be taken in phase I to facilitate an expanded extension effort in phase 2. Background and supporting estimate for these recommendations may be found in Chapters VIII and IX, and in APPENDIX I.

Phase I.

1. Continue support of the Central Province ARPT. Staff the Economist-Farm management position, provide 1 month overlap in changes in the RELO and agronomist positions.
2. Bring two consultants, one extension organization program and staff development, one extension subject matter specialist development person. They are to work with ZAMARE Team and DOA leaders to outline strategy for phase 2 extension strengthening/i.e. staffing, training, equipment etc.
3. Encourage and secure counterparts for ZAMARE staff in Central province, transfer SMS specialists from Province.

Phase II.

1. Staff 3-4 ZAMARE positions at Central Province ARPT level. To be accompanied by counterparts and SMS specialists from Zambia extension.
2. Implement a national training plan (from phase I) for development of provincial ARPT-PSMS specialists. Suggest 25-35 be considered

to the U.S. level. PSMS and ARPT team gives leadership to the provincial program in his subject area.

3. Continue to strengthen the ARPT concept nationally attempting to make it more farm family- decision making or farming systems oriented as relates to extension work.

4. Staff a ZAMARE communications/information specialist at the national level to initiate a program of technical support for field extension programs through ARET-PSMS. Use Central Province as pilot area of work and provide project support for supplies and equipment for communications unit.

5. Provide a ZAMARE top level staff person to work at the national level on extension program development, staff development and supervision management of programs. Again use Central, Southern and other provinces as testing areas.

6. Provide for consultants to strengthen each of the above aspects in addition to full time ZAMARE staff.

   a. In subject matter specialization:

      -Extension agronomy specialist 3-4 months.

      -Extension Economist-farm management/farming systems, 3-4 months

      -3-4 months

      -Extension Livestock specialist - 3-4 months

      -Extension Communication specialist - 3-4 months

These specialized consultants would work both at national level and with ZAMARE ARPT-PSMS to develop action programs. They should be top level extension people - with expertise both in subject

matter and in extension program development. Suggest each come 2 times during the life of project.

b. In Communications-information:

-Extension information seminars, institutions

-Building specialist - 3-4 months.

-Extension visial aids specialist 3-4 months

-Extension Editor, publications specialist 3-4 months.

-Extension teaching methods specialist 3-4 months.

c. In organization, program development, management and supervision.

-Program development specialist 3-4 months.

-Staff and personnel development specialist 3-4 months.

-Program/personnel development, management and supervision - 3-4 months.

7. Study tours - SMS, communications, program management.

-Provide for up to 25 short term study tours of the-key staff to implement program outlined above.

8. Program support - Extension:

-Provide adequate vehicles and associated expert items.

-Provide for field demonstration materials.

-Provide for equipment and supplies for training in Central Province.

-Provide for facilities and equipment for communications unit.

APPENDIX 1

# TERMS OF REFERENCE FOR THE MID-TERM FORMATIVE EVALUATION OF AGRICULTURAL DEVELOPMENT RESEARCH AND EXTENSION PROJECT NO. 611-0201

## PURPOSE

The evaluation will be dual focussed. The team is asked to:

1) Assess progress towards attaining project objectives and;

2) To give preliminary indication of whether a second phase of the project appears justified and, if so, propose directions for a longer term AID and Contractor role in Zambian agriculture. The team will also make recommendations for modification of the project over the remaining years of Phase I, if appropriate.

## I. ASSESSMENT OF PROGRESS

A.

1. Assess and identify any problem areas and make recommendations for possible design adjustments;
2. Appraise the capacity of the Zambian Government to bear cost-sharing, particularly where sliding scales are concerned, and recommend any adjustments that may be necessary;
3. In particular, the evaluation should assess the implementation rate of the participant training program and the appropriateness of professionals employed by the US Contractor will also be considered;
4. The evaluation should also assess MAWD's counterpart situation and make recommendations to address any issues.

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5. What is the current status of collaboration between the Research and Extension branches?
6. What are the specific constraints to more effective linkages?
7. What modifications can be made within current resource limits to increase effectiveness of linkage?
8. What realistic program opportunities can be identified? What opportunities exist for collaborating with other donor programs in developing extension and extension research linkage?

B.

1. What accomplishments can be identified in the development of the ARPT structure and processes?
2. To what extent are the ARPT's and CRT's integrated into a single research service?
3. To what extent has there developed a productive division of labor between ARPT's and CRT's.
4. What alternatives are there for improvement?
5. What technology has been produced or modified by the ARPT's or what is likely to be available within the near future?
6. Characterize the ARPT extension collaboration and suggest alternatives for increasing its effectiveness.

C.

1. Consider the findings of the Zambia Agricultural Research and Extension World Bank review and indicate how ZAMARE fits into it;
2. Consider the findings and recommendations of the socio-economic evaluation of the ZAMARE CP ARPT and comment.

D. Analyze and comment on the institutional development status of the Research Branch. This should note these items:

1. Linkages with extension, with UNZA, with Zamseed, Namboard and other elements of GRZ important to the performance of the agricultural sector.

2. Personnel. Looking at the Research Branch's ability to retain trained persons, academic training, need for training, providing of experience to the newly trained personnel, needs for expatriates, and utilization of expatriates in a strategy to develop expatriate replacement.

3. a. To what extent are the ARPT's covering the Province? The country?

   b. What is the expansion strategy to complete the coverage?

   c. Describe the Zambia model of agricultural research organization when ARPT coverage is fairly complete.

4. If there are substantive areas in which either the project or the Research Branch are critically weak, identify. Be fairly severe in defining what is really critical.

5. a. A second linkage issue deals with the linkage to those GRZ institutions that allocate resources. Note Research Branch activities in those areas.

   b. To what extent have returns to investment in research been calculated?

   c. If so how have these calculations been used in the competition for funds?

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E. Examine the relationship between the Research Branch and Zamseed (the entity responsible for maintaining genetic purity and production/distribution of adequate quantity and quality of crop) seeds and address the implications of Zamseed) functions on the operations of the Research Branch.

II. FUTURE DIRECTIONS

A. Examine the need for additional capacity in the Department of Agriculture for research management and analysis particularly with respect to a quote priority unquote analysis of economic returns to possible research directions and quote ex post unquote analysis of economic pay-off of research and extension activities.

B. Anticipating the termination date of the project, what will be the program needs of research and/or extension that an AID project could address?

1. Will a new project be needed or would it be better to modify and extend the current project?
2. If the latter, what modifications seems to be needed?
3. If a second phase of the project appears justified, propose directions for a longer term AID and Contractor role in Zambian agriculture.

APPENDIX 2

## ANALYSIS OF EXTENSION CONSTRAINTS

We feel that constraints in extension should be listed in reference to known elements of program success. These elements are known from experiences both in Zambia and other countries and from a large body of extension education research.

1. In relation to the farmers or farm family audience, programs must -

   --be consistent with felt needs.

   --have involvement of target groups in their development.

   --be understood, not pose a threat or undue risk and not be forced.

   --be presented as part of the whole in which audience decisions are made.

   --be presented at the level of comprehension appropriate.

Extension staff must -

--have a positive human relations orientation with genuine interest and ability to work with people.

--have appropriate level of subject matter training.

--know communication and educational skills.

--know their individual roles, responsibilities and the goals and objectives of the organization.

--have a definite work plan with objectives.

--be in a system where performance is recognized.

--have adequate logistical support.

--have adequate, helpful supervision.

--be capable of working on a team.

--have transport to carry out the field work.

--have a strong base of research support.

In relation to the above the following constraints are apparent in Zambia:

1. Staff not adequately trained in extension program development and working with people.
2. Management, supervisory functions not facilitating organizational effectiveness.
3. Drastic shortages of means to implement program i.e. transport, supplies, facilities.
4. Lack of strong leadership at the subject matter specialist level.
5. Little emphasis on the whole farm and family approach to extension programming (i.e. farm management).
6. Objectives - at all levels not clearly defined.
7. Inadequate personnel and staff performance development system in place.
8. Annual increase in staff but without needed support.
9. The T & V system and FSR/E not internalized by most staff in extension.
10. Educational and service (registry etc) functions in conflict for staff time and effectiveness.
11. The communications - information system is weak due to inadequate resources. It should be integrated into the technical branch of extension.

APPENDIX 3

# SOCIO-ECONOMIC COMPONENT OF THE USAID MID-TERM EVALUATION OF THE ZAMBIA AGRICULTURAL RESEARCH AND EXTENSION (ZAMARE PROJECT NO. 611-0201)

BY: ALISTAIR SUTHERLAND AND MIKE WARREN

FEBRUARY 1985

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# I. INTRODUCTION

This report represents the social impact component of USAID's mid-term project evaluation of the ZAMARE-sponsored Adaptive Research Planning Team's (ARPT) involvement in Farming Systems Research (FSR) in Central Province, (CP) Zambia. The terms of reference (Annex A) for this component were developed by the evaluation team (Sutherland and Warren) in collaboration with USAID/Lusaka. The principal documents consulted are listed in Annex E. Two field trips were made by the team to Central Province; in December 1984 and in January 1985. All of the ZAMARE team members based in Kabwe were interviewed, as were a variety of provincial and district level agricultural officers and a number of cooperating small-scale producers (SSPs). Members of various C.R.Ts. at Mt. Makulu were also interviewed during December and January (see Annex B). The evaluation Team was received in a very cooperative manner by all individuals concerned with the evaluation.

Considerable effort and achievement has already been recorded by the CP/ARPT. As one of the first ARPTs to be organized in Zambia, its experience is of considerable value to the newer ARPTs. The evaluation team found a very healthy attitude of self-appraisal and self-criticism in many individuals interviewed. There is commitment to the project by both GRZ and the ZAMARE team and a strong desire to strengthen and improve the efforts of ARPT. The recommendations presented in this report - many provided by interviewees - are given in the same positive perspective as they were given to us, to make current efforts even better. We feel that while local conditions vary across Zambia, many of the constraints identified and recommendations made in this report will be useful to the

national system of ARPTs as they grapple with the complex activities designed to improve agricultural productivity by the small-scale producers (SSPS).

## II. THE ZAMARE ARPT

ZAMARE provides technical expertise and capital and operational funds for the CP/ARPT. The team consists of a Farming Systems Agronomist, a Farming Systems Economist (both of whom arrived in Zambia in August 1982), and a Research-Extension Liaison Officer (RELO), who arrived in Zambia in October 1982. The agronomist and economist have formal Zambian counterparts. The RELO whose position is established in the Extension Branch works most closely with the Provincial Extension Training Officer (ETO). In addition to carrying out farming systems research and research - extension liaison in the province, the ZAMARE ARPT component provides resources for in-service and overseas training for Zambian counterparts and trial assistants. The training component is not covered in this part of the evaluation.

FSR survey work was begun by a team under the leadership of CIMMYT in 1978 (See CIMMYT, 1978). The first on-farm trials were established in 1981-82 season by Zambian ARPT staff in the Serenje District of Central Province. The ZAMARE team arrived in August 1982. Their initial activities included survey work in Mkushi District and on-farm trials in both Serenje and Mkushi Districts during the 1982-83 cropping season. Since then the Central Province ARPT program has expanded to incorporate the three largest traditional recommendation domains (TRD's) in the province. What follows is a summary of the team's work, point to strengths

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and weaknesses in the socio-economic aspects of work to date, and making suggestions for operation improvements.

## III. THE SOCIO-ECONOMIC IMPACT OF THE ZAMARE ARPT

### A. Diagnostic Surveys and On-Farm Research

In 1978 CIMMYT's East African Economics Program demonstrated low-cost farm survey techniques in the Serenje District of Central Province. The following year CMMMYT 'zoned' the entire province into eight recommendation domains (RD's); one 'commercial' one 'emergent'; and six 'traditional' (See CIMMYT, 1979). The six traditional recommendation domains (TRDs) - with an estimated 46,000 farm families were the primary target group identified in the social analysis section of the ZAMARE Project Paper (USAID, 1980). This section emphasized that 'women are central to agricultural production in Zambia' (p.38) and that 'women are over-represented among the poorest stratum of traditional farmers' (p.39), concluding that, with its focus on multiple target groups, ARPT 'should take care not to exclude female headed households' (ibid). The Project Paper also recommended that ARPT 'move beyond the existing CIMMYT methodology by including sex of household head as one criteria in discerning recommendation domains' (ibid).

One objective in this section of the evaluation is to establish the reasons why CP/ARPT has been unable to consider gender as a factor in its program of diagnostic surveys, on-farm trials and research extension liaison, and to make recommendations for the situation to be rectified. A further, related, objective is to assess the extent to which the ARPT program has been targeted to reach the larger numbers of poorer

'traditional' farmers than the smaller numbers of relatively richer 'emergent' farmers.

In order to address these objectives it is necessary to consider the ARPT program of diagnostic survey and on-farm research in the three traditional domains where it is operating: TRD2, TRD3, and TRD5 (See Annex C).

Each TRD will be covered seperately before general comments are made regarding the collaborative aspects of on-farm research.

1. Traditional Recommendation Domain 2

TRD2 lies in the northern high rainfall area incorporating most of Serenje District. Its estimated population of 13,000 'traditional' farmers makes it the largest domain, and the first to be exposed to farm surveys and on-farm trials. A formal survey was completed by CIMMYT in 1978, (prior to the zoning of the province), and on-farm research began in the 1981-82 season which addressed farmers' problems identified and prioritised during the formal survey. This was continued after the ZAMARE component of CP ARPT arrived in August 1982 (See USAID, 1983). No more socio-economic survey work has been conducted in this domain since 1978, although farm level agronomic data was collected in the 1983-84 season. As the initial survey work carried out by CIMMYT was based on a sample drawn from the farm register, it is highly likely that both female headed households and poorer households were under represented. Survey data was not disaggregated by gender as the sex of household head was not required on the CIMMYT questionnaire and labour data was not collected and analysed by gender or age. However, detailed labour and other household data was being collected in TRD2 by the Mpika IRDP which the CP/ARPT economists

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could have made use of, and which incoming economists must use in the economic analysis of trials.

The selection of farmer cooperators in TRD2 over the four seasons of on-farm trials has shown a bias towards relatively more wealthy household heads who are predominately male. Two (10%) out of the 20 farmer cooperators listed by the TA are female, and both are larger farmers (one with 21 HA. and one with 4 HA). While zoning reported farms in TRD2 in the range of .8 to 2 HA., and cultivated area in one formal survey averages 2.2 HA., nine (45%) of the farmer cooperators had 3 or more HAs., and only three (15%) less than 2 HAS. Partly due to an attempt to integrate with the T and V system there was also a 'politico-economic' bias; three (15%) held party positions, one (5%) was a tractor operator, three (15%) were ox owners, and three (15%) others hired either oxen or tractors. This bias towards male and more wealthy farmers is of concern given the nature of the on-farm trials which address cash and labour constraints which are most acute in poorer and female-headed households.

2. Traditional Recommendation Domain 3.

Diagnostic survey work in TRD3 (Mkushi District) began in August 1982 with an informal survey. This domain, with an estimated 8,000 small farmers, is the third largest in the province. According to the zoning reports, sorghum is often dominant over maize as a staple and 1-2 HA is the average area cultivated with hand hoe as the dominant method of tillage (see CIMMYT, 1979). Later survey work did not confirm this. In the informal survey of 1982 (covering 24 farmers in 3 wards), maize was found to be the dominant starch staple in all households, 92% of the sample surveyed had access to oxen or tractor power, and the average cultivated

area as 2.6 HA. Gender of household was not indicated in this survey, but the average household size of 8.7 suggests that large monogamous or polygamous households were selected. An extension bias towards more progressive farmers with better than average resource endowments is a likely explanation for some of the discrepancy between the zoning done in 1979 and the survey work conducted in 1982.

While labour and cash were the main constraints considered in designing the 82-83 trial program in TRD3, few data were collected on labour in the informal survey. However, a detailed labour data study using a modified version of the Mpika IRDP format was initiated in the same season and continued into the 83-84 season. This promised much useful data but suffered several major drawbacks. Firstly, although the study was conducted over two seasons covering 26 households (9 in 82-83 and 17 in 83-84), only one household (5%) was female-headed. Secondly, different households were sampled in each season so that consistency across seasons and reliability checks couldn't be made. Thirdly, the richness of the data has not, so far, been analysed in a way that allows any modification or conclusive endorsement of the on-farm trial program. Fourthly, the survey did not start until December, 1982, and so missed important operations in the first season. Fifthly, in the second season, the ZAMARE economist reported that the data was dubious as the enumerator was not doing a thorough job. Finally, much valuable data on off-farm activities was excluded, thereby weakening the systems aspect of the study. Despite the under-representation of female-headed households in the labour survey, the average size of households was small (6) as was the average cultivated area (1.7 HA). In comparison to the informal and formal survey

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sample, the labour survey data should therefore be more relevant in regard to the labour constraints experienced by smaller farmers in TDR3. The labour data has been used in the economic analysis of trials in the domain. It should be borne in mind that the main objective of collecting labour data is to explore further hypotheses being worked on in the trial program. Therefore this data should be of high quality, and used extensively and sensitively both in the economic analysis of trials and in the pre-screening of technical solutions. The analysis of the labour data is being continued by the outgoing ARPT economist at Illinois, where there is access to a computer. The analysed data should be made available to CP/ARPT for planning on-farm research, analysing trial results, and in the extension of recommendations in the forthcoming cropping season. However, we caution that such economic analysis should never substitute for increased farmer participation in the evaluation of trials and the pre-screening of technical options.

Similar data analysis constraints apply to the formal survey of TRD3 which was not carried until July 1984, following the seasons of trials. As yet, the data collected have only been broken into frequencies; cross-tabulations and correlations to test hypotheses developed in the informal survey are the next step in analysis in order to improve on-farm research in TRD3. Frequencies presented in the annual report suggest that the sample for the formal survey, like that of the informal survey, over-represented more wealthy male-household heads. For example, the average cultivated area of 3.3 HA was larger than the 1-2 HA reported during zoning and most were either oxen owners (44%) or able to hire oxen or tractors (42%). All reported maize as the main staple crop.

Eighty-eight percent were male-headed households, more than the 70% estimated for the population as a whole (See Annex E), but it was encouraging that gender of household head was included as a factor in the survey. The smaller size of households (6.5), compared with 8.7 in the informal survey, was also encouraging given the importance of labour constraints in the system. However, the fact that the average number of household working members was larger, suggests that different kinds of households were selected or that young children were not all recorded).

In short, the collection of socio-economic data in TRD3 has involved considerable resources and effort but the benefits are not yet fully apparent. Thus while the informal survey and prognosis identified 12 major production constraints, this list has not yet been increased or refined as a result of the labour survey and formal survey in TRD3.

After constraints were identified during the informal survey, on-farm trials for TRD3 were designed and implemented in the 1982-83 season. The ZAMARE agronomist noted the following prioritisation of agronomic problems; maize is most important crop with problems of late planting, poor soil fertility and crop establishment. Sorghum is secondary to maize and problems need further exploration. From the socio-economic perspective constraints were very similar to those identified in 1978 for TRD2; labour and cash shortages at critical periods. But socio-economic constraints were not prioritised in relation to agronomic ones. The 12 types of constraint were matched against 59 possible technical solutions. Of these 59, 14 have been tried in trial programs, some over three seasons.

The selection of farmer cooperators to host on-farm trials showed a bias similar to that in the surveys. Only one (7%) of 15 cooperators was

a female, and she was married. More than half (60%) owned oxen and only one (7%) relied on hand hoe cultivation. The relatively small size of most cooperator's farms suggested that they were not using their draft power to the fullest extent, perhaps due to cash shortages (for fertilizer and labour hire) or labour shortages (for planting and weeding), perhaps to alternative income sources, or perhaps to more intensive than average management. Five (33%) of the cooperators held positions of leadership responsibility in the local community which might affect their farming activity. Lack of more basic socio-economic data on the cooperators precludes firmer conclusions (see recommendation B.7).

3. Traditional Recommendation Domain 5

TRD5, located primarily in Kabwe Rural District, has the second largest target group in the province with an estimated 11,000 'traditional' farmers who grow maize as their major staple and cash crop. Tillage is mainly by oxen or tractor ploughing and hybrid seed and fertilizer are widely used. Diagnostic surveys for this target group were undertaken as part of the CIMMYT "in-country" training program involving ARPTs from all provinces. The informal survey was completed in March 1983 and the formal survey three months later in June.

The surveys covered 2 agricultural camps within a single ward. Local extension workers (EWs) identified farmer informants during the informal survey, and acted as enumerators and helped with tabulation of data during the formal survey. Sampling for the formal survey was done by the ARPT rural sociologist together with the CP/ARPT economist. Purposive sampling ensured that the farm size and access to draft power were within the expected range (Av 2.7 HA)., and just under half in the sample not owning

oxen). Female-headed households (about 20%) were selected for interview but unfortunately gender of HH head was not on the questionnaire and data were not broken down by gender. Analysis of survey results produced a set of production constraints similar to those identified in TRDs 2 and 3. Apart from infrastructural constraints, (credit, labour payments, untimely arrival of inputs, etc.) labour shortage during land preparation, planting, and weeding was identified as the primary production constraint. This constraint resulted in a series of compromises leading to poor management of cash crops, especially maize and sunflower. Constraints were prioritised during the training workshop when a trial program was outlined. No checks were made to ensure the prioritized constraints identified in the survey area were applicable to the domain as a whole.

The trial program in TRD 5 related to technologies which would help the smaller farmers by increasing the efficiency of labour in weeding maize and applying fertilizer, and by moving their demand for labour and draft power out of the peak period to permit growing of later planted crops such as short-season maize and soybeans and sunflower. In the light of these objectives it is regrettable that similar biases towards better endowed male headed households took place in the selection farmer cooperators. 13 (93%) of the 14 cooperators were male, 4 (27%) own tractors, 8 (53%) own oxen, while only 3 (20%) hire oxen or tractors. The average cultivated area of 9.5 HA, is nearly four times greater than the 2.7 reported in the formal survey.

B. Collaboration with SSPS and Extension in Research Trials

CP/ARPT has built up and sustained a large and impressive program of on-farm research trials spread over three domains. All of these trials

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fall into the category of 'research managed - research implemented' (RM/RI and the farmers have not been closely involved with the design or running of the trials. This, unfortunately, has resulted in a low level of dialogue between the farmers and the ARPT officers and minimal collaboration. In some cases the complexity of experimental design has precluded such collaboration. However, there was nothing in the basic problems being experimented which precluded more farmer involvement. Moreover, in many cases trials have been sufficiently simple to enable the kind of collaboration between farmer and researcher which FSR is designed to promote.

Language has been a major obstacle, and ZAMARE staff may have benefitted considerably from a more intensive introductory course in Chibemba with a short follow up course. In addition, the size of the on-farm trial program greatly reduces the researcher-farmer contact, and level of places heavy dependence on the trial assistant (TA). This aspect suggests the need to intensify current attention being paid to training, especially sensitising TAs to the importance of farmer feedback. As TA training is currently under national review, and CP/ARPT have recently conducted a TA training program which emphasised both technical and practical skills, there is need to consolidate further by training TAs how to more fully involve SSPs and local EWs in the on-farm research process.

The selection and design of on-farm research trials has followed diagnostic survey work in all domains largely according to the CIMMYT sequence for on-farm research (the exception being a late formal survey in TRD3). Yet in spite of some efforts SSPs and EWs have not been closely

involved in the identification of research priorities and the design of trials for farmers' fields. There are logistical problems, but closer involvement of SSPs should be a primary objective, especially as the on-farm research becomes less exploratory, and more verification-oriented in the three domains. At present farmers are only involved at meetings used to recruit volunteers and in field days. The discussion of existing research priorities should also be attempted at meetings with farmers, which can be organized through local EWs. Similar meetings could be used to discuss the design of on-farm trials. Farmer field days can also be further developed and monitored, with cooperating farmers explaining the nature of the trials on their fields, rather than agronomists or TAs taking the leading role. Now the task of organising field days has been handed to TAs the language problem has eased. Yet now the task of recording farmer feedback should be discussed in greater detail with TAs who should keep a detailed record of farmer comments made during field days. In particular, TAs should be trained to record all comments, and be cautioned against selecting those which reinforce their own, or the agronomist's, ideas about which are the best treatments.

The extension service has been involved with on farm trials and the ARPT trial assistants are agricultural assistants seconded from the extension service. This arrangement is intended to allow for a rotation of EWs through ARPT to help inject a FSR perspective into extension. The heavy reliance on capable and motivated TAs who have been trained over 2 or more seasons means that a biannual rotation would probably adversely influence the scale and quality of on-farm research. A proportion of extension workers are clearly not suitable for training as trial assistants

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while others might require close supervision. For these reasons a rotation of 3-4 years is favoured. A one year period for handing over to a successor who would work simultaneously as a local field EW in that year would provide continuity when experienced TA's decide to go back into regular extension work or change jobs.

At the same time, further steps could be made to involve field EW's more in the on-farm research program. Involvement in survey work, farmer selection, and field days are current practices which familiarise EWs with the on-farm research in their local area. Involvement of field EWs in TA training programs, would be one way to increase extension involvement in the monitoring of trials. Another way would be more job sharing. TAs could assist field EWs with their work strictly on a voluntary basis during the slack season (tasks such as farm registration, advice on post-harvest practises, etc), and request help from field EWs during the planting and monitoring of ARPT trials the following season. At the same time, TAs should not forget their primary responsibility to ARPT, and would not be able to give much assistance to EWs if they had dry season trials in their areas.

Farmer selection for cooperation in trials is an important part of collaborative on-farm research. This is particularly so when great value is placed on farmer response in the evaluation process, and FSR is viewed as an 'iterative process' (Tripp, 1984), rather than as applying conventional scientific methods in an on-farm situation. CP/ARPT employs a strategy of farmer selection which is also common to other ARPTs. Meetings are held at which farmers are asked to host trials. Farmers who fall outside of the target group may be rejected, but this does not always

happen as the reliability and receptiveness of more progressive farmers is seen as a valuable attribute. The main criterion of selection is therefore willingness to host trials, and representativeness of the target group is secondary. The danger of this approach, as the above findings suggest, is the risk of selecting farmers who are not very representative of the target group. If this happens the social impact of the program is reduced because target group farmers are not well integrated into the on-farm research program.

C. Research-Extension Liaison

The historically weak linkage between agricultural research and extension in Zambia has been strengthened, at the provincial level, through the new positions of 'Research-Extension Liaison Officer' (RELO). Central Province is the first to have an RELO (who started work in October 1982). The value of a professional officer linking research with extension, in general terms, is to facilitate better two way communication between these two branches of the Dept. of Agriculture, with the aim of more closely integrating their activities and also avoiding duplication of effort. In relation to small scale farming activities, this involves instilling the FSR component of research into extension, so that the on-farm research can be effectively transformed into technical recommendations which local extension workers can communicate effectively to farmers. In practice this involves short and long-term strategies for training and re-orienting extension workers.

Activities relating to research-extension liaison have been at three levels: (1) the provincial level, incorporating block-level staff in the districts through the extension administrative hierarchy; (2) the

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recommendation domain-level, incorporating camp-level staff operating in ARPT's target areas for on-farm research (See Annex C); and (3) the National level, involving training institutions and specialist researchers at Mount Makulu.

1. Liaison through the provincial hierarchy

The thrust of the RELO's program so far has been at the first level, working with the provincial extension hierarchy, and concentrating on the upper end of this hierarchy. The RELO began his work with a 6-month familiarisation program during the 1982-83 season, visiting provincial and national agricultural training institutes and district officers, assisting with survey work and on-farm trials, and helping to organise field days to explain to extension personnel and farmers the on-farm research program. Provincial training work began in May 1983 with the production of a monthly newsletter which was distributed to Camp EWs. In October 1983, a series of one-day training meetings were held at the district level throughout the province. These were intended to explain to field EWs the work of ARPT and to show them how to set up a demonstration which showed the benefits of using new (F1) hybrid maize seed over saved (F2) hybrid seed. This training exercise was followed by a three-day workshop in April 1984 which focussed on teaching district and block level staff crop husbandry recommendations. The workshop had a broad focus, covering soil classification, animal draft power, farming systems research/extension, and work planning.

The Provincial Training Program continued later in 1984, when following on from the April workshop district level extension staff, under direction from the provincial extension training officer (ETO), organised

their own training workshop to provide in-service training for field EWs. Materials presented at these workshops were based on the earlier workshop for block supervisors and DAOs containing a mix of specialist and farming systems material. They were not closely monitored and so far only one report on district level workshops has been submitted. This program of training is scheduled to continue into 1985, with provincial level officers training block supervisors and district level staff who, in turn, train field EWs. The proposal is to provide more of a farming systems focus by implementing the handbook 'Agricultural Extension for Small Scale Farming Families', and by giving training on animal husbandry recommendations. The newsletter will continue, re-enforcing the content of the training programs, and hopefully re-enforcing the farming systems perspective at the camp level.

2. Liaison in traditional recommendation domains

At the recommendation domain level, organised field days in target areas have been the primary mode of research-extension liaison, and in this the RELO has worked in cooperation with other ARPT staff. After the first season, when the audience was combined, separate field days have been held for farmers on the one hand and extension and research officers on the other. The reason was that during the first season it was felt that farmers were intimidated by the present of senior officials. This season, field days for farmers have been organised by the TAs in conjunction with the local field EWs. Delegation of responsibility is encouraging, but as yet the outcome of these farmer meetings have not been closely monitored, and the RELO has requested assistance with developing a uniform monitoring system. To date ARPT field days have

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functioned effectively as public relations and education exercises, but priority has not been placed on obtaining feedback from farmers or extension and research officers visiting the trials. Thus the impact of farmers and extension staff on CP/ARPT trial programs through field days has been minimal, while in target areas the ARPT public relations impact on local farmers and extension staff has been quite considerable.

Farmer surveys and on-farm research has also involved field EWs within RDs 2,3, and 5. This involvement has been perhaps the most constructive in introducing an FSR perspective to EWs at the field level. However, as it has involved only field EWs working in target areas in each domain, the majority working elsewhere still need to be reached through more formal training programs and by strengthening the FSR perspective in the monthly newlsetter.

Another kind of research-extension liaison in TRDS is the demonstration used during the on-farm testing stage of FSR. Demonstrations began in the 83-84 season with a comparison of F1 and F2 hybrid maize. These served a double function; being both large-scale research plots and demonstrations for small farmers. Unfortunately, follow-up proved difficult and feedback was poor so that the research and demonstration effects were not conclusive. This season (84-85) the RELO has assisted in repeating demonstrations of the 'improved' Lima at the province's farm training centres and at Kabwe Research Station. This is a long-term 'improved Lima' demonstration/research test, which looks at the benefits of intensive management (liming, crop rotation, hand planting, fertilisation, and the application of dieldrin) for maize. The RELO's involvement serves, potentially, to link the soil productivity research

team at Mount Makulu more closely with ARPT and extension in Central Province. However, the demonstration is more cropping systems than farming systems in orientation, and did not arise explicitly out of priorities identified during diagnostic survey and conclusively tested in on-farm trials in the province. This season, Lima plots (.25 HA) of rainfed wheat have been added to the demonstration program. Like the previous demonstrations, these do not arise from diagnosis and on-farm research in the province.

After three years of on-farm experimentation in TRD2, on-farm testing was planned for the 84-85 season to demonstrate the value of early weeding in conjunction with a single application of mixed basal and top dressing fertilisers. As testing in the target area is the final step before the release of recommendations across the domain, great emphasis needs to be placed on delivering the message to farmers this season, and monitoring adoption in subsequent seasons. Moreover, as these management recommendations are primarily labour-saving devices, the RELO should take care to demonstrate them on farms experiencing labour shortages, particularly female-headed households and households with few children.

3. Liaison at the national level

In addition to activites at the levels of the provincial extension hierarchy and recommendation domains, the RELO has worked at the national level. In June 1984, the RELO organised an 'Effective Teaching and Training Workshop' along with the visiting 'INTERPAKS' team from the University of Illinois. This aimed at improving communication skills in national level and identifying insect pests in maize. Also, dieldrin treatments have been superimposed on on-farm trials and demonstrations in

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order to assess its effectiveness for insect control in maize. The above activities reflect a direction somewhat adrift from the main focus of ARPT in the province, and concern for national level problems has the danger of weakening the impact of the RELO's program relating to local EWs and SSPs at the provincial level.

D. Communications of Farmers' Problems to CSRT's and Local Institutions and Projects

1. Background

Inadequate communication between ARPTs and CSRTs was recognised as a potential problem almost since the time that ARPTs started to function in 1981. The re-organisation of the research branch included with it the mandate for ARPTs, as the spokesmen of the small farmers, in the longer term, to determine about two-thirds of the content of CSRT research programs (Kean and Chibasa/GRZ, 1981). The logic was that small farmers produced at least this proportion of the national food supply and therefore should receive a proportionate amount of national research resources. This much quoted mandate has been the cause of some misunderstanding, as it is not clear exactly how this could take place. Perhaps it could be more appropriately said that through close cooperation between CRTs and ARPT staff, the research branch should work towards ensuring that a large proportion of CRT research relates to appropriate small farmer problems. The statement was made at a time when the bulk of agricultural research was oriented to technology suited primarily to commercial farmers and high levels of management. Moreover, many of the CRT programs were long standing breeding and varietal selection programs under the direction of experienced expatriates who had spent a long time in Zambia. These

breeders sometimes lacked a farming systems perspective, and in some instances were skeptical about the value of breeding for the low management and late planting conditions which prevail in most of Zambia's small-scale farming systems; the attitude being to change the small farmer rather than adjust breeding priorities. It was partly due to pressure from the CIMMYT demonstration in 1978, that the maize team intensified work on shorter season maize varieties, and to the arrival of the ZAMARE maize breeder that the maize section began to look more closely at higher yielding open-pollinated varieties as an alternation to hybrids for subsistence farmers. Other specialists, largely in response to government pressure in the later 1970s, were involved in putting out crop recommendations for small farmers based on research station trials, and promoting storage technologies which had not been tested under farmers' conditions, and compared with farmers' practices under experimental conditions.

The reactions of new ARPT staff (from all provinces) to these earlier attempts to assist the small farmer were sometimes critical and this attitude did not assist in developing a good working relationship with CSRTs. Moreover, the financial support given to ARPT created some jealousy among other CSRT sections which were grounded due to lack of operations funds. Things were not helped by an attitude, described as 'arrogant' by CRT staff, of some new graduates from UNZA who formed the Zambian component of ARPT, and of some incoming expatriate staff. Both ARPT staff and CRTs sometimes saw FSR as a panacea to the small farmer' problems offering a new king of technology, rather than as the initial missing link between the technical expert and the small farmer. Such misconceptions are

regrettable, but common during times of innovation when expectations vary, and established researchers may feel threatened. It has taken time for researchers from CSRTs and ARPTs to realise the complementary nature of their work.

Various steps have been taken by the national ARPT co-ordinator to improve ARPT-CSRT linkages (See Annex F). Agronomists from ARPT were encouraged to liaise with CSRT specialists in the planning of their trial programs. In 1983, "pre-research committee meetings" were instituted to bring ARPT agronomists and CSRT specialists together to discuss research findings, and ways in which CSRTs could work more closely with ARPTs. Provincial teams were encouraged to invite CSRTs to visit their trial programs. ARPTs have been given a format for reporting farmers problems to CSRTs and CRTs have been provided with a format for presenting crop profiles on new varieties for ARPTs. More recently a formal program of visits by CSRTs to ARPT trial programs has been arranged.

CP/ARPT has an advantage over most other ARPTs to further improve ARPT-CSRT linkages in at least three ways:

1. It is physically closer to Mount Makulu and so communications are relatively easier.
2. It is part of the ZAMARE project which is explicitly designed to more closely integrate the work of farming systems with commodity research; the ZAMARE CSRT agronomists and breeders have an explicit mandate to assist small farmers and are keen to learn about small farmers' problems (USAID, 1980); and
3. The team has an RELO who can use his position to ensure better feedback of farmers' problems to CSRT's and receive guidance from

experienced CSRT experts at Mount Makulu on the formulation of crop recommendations.

In spite of these advantages the record of contact and cooperation has room for improvement.

2. Crop Breeders

Crop breeders are probably the scientists who can most assist SSPs. In order to develop relevant programs they need to have full information about small farmers' preferences for particular crops, preferred varietal characteristics, production problems (under low management), taste and cooking preferences, etc. CP/ARPT has had contact with breeders in the maize, grain-legume, sorghum and millets, wheat and soybean programs. They have also had contact with oilseed breeders through the ZAMARE sunflower agronomist.

a. MAIZE: Contact with the maize program began well, and has been sustained but not without some clashes of priorities. The ARPT agronomist felt unable to continue to test maize varieties, especially after those tested were not released, while a released variety was not given for testing. Perhaps over-concerned with public relations at the farmer level, this attitude has not helped to improve cooperation with maize breeding program. The maize CRT has also been criticised by the ARPT for not always ensuring varieties were tested on farmers fields before being put forward for release. However, the ZAMARE breeder feels that they take a lot of trouble to select the best varieties to give ARPT for testing. Part of the problem arises from the large number of hybrid lines being tested, some of which have very similar parent stock, and a line closely

affiliated with, but not identical to, the one being tested by ARPT performs better in CRT trials and so is selected for release. The situation should improve considerably when the maize CRTs completes the crop profiles for ARPT's information (See Annex F). Yet the rapidly changing situation in the breeding program will necessitate good communication and a tolerant attitude on both sides. Farmers' production problems and preferences for maize have been discussed and the maize CRT has explicitly asked for information on varietal characteristics favoured by the small farmer in the domains. This has been provided and there has been agreement on the kinds of problems requiring attention. As maize is the main cash and staple crop in the province this dialogue clearly needs to be strengthened further. The ZAMARE breeder feels there is a need for more quantified prioritisation of farmers' problems with maize. The ZAMARE linkage provides a good opportunity for this dialogue to grow, but contact should always be through the appropriate GRZ channels and non-ZAMARE maize breeders and agronomists are equally important to the success of the program. A further point is that the maize section is extremely busy, and often time restricts the level of contact. The ZAMARE breeder feels that most constructive contact has been during his visits to field days in CP, and when ARPT agronomists have called into his office to discuss trial designs on maize.

b. Grain-Legumes: Contact with the grain-legume team has been limited (including an improved bean variety in an inter-cropping trial). Geographical distance is an obstacle (as the breeders are mostly in Chipata), and in one instance CP/ARPT agronomists were not supplied

with bean varieties requested for testing. More efforts should be made to feed upwards farmers' problems and preferences for beans, and even to request what kinds of information the breeders require, in order to encourage better co-operation from the breeders.

c. Sorghum and millets: Varietal testing of sorghum has now gone into a second season and linkage here is strong with a good working relationship with breeders. The sorghum team still requires more information on farmers' preferences and the valued characteristics of the local varieties in the province. Like the ZAMARE maize breeder, the sorghum breeders value the opportunity to visit ARPT trials and appreciate being called in promptly to help with the identification of problems in trials and farmers field. Also, they see cooperation is most constructive when an ARPT agronomist calls in to discuss trial priorities and trial designs for sorghum and millets.

d. Wheat: Contact with the wheat team began this season when in response to a request for the wheat CRT, CP/ARPT expressed an interest in trying out rainfed wheat. It is not clear why such an ambitious demonstration program has gone ahead in an area where no farmers have grown wheat before, and the justification from a farming systems perspective is not clear (planting of wheat competes with weeding and fertilizer application in maize and seems most likely to be adopted by ox-cultivators who can use mechanised planting and weeding). Nevertheless, the spirit of cooperation is a healthy sign.

e. Soybeans: Work with soybeans began this season in response to the introduction of a LINTCO soybean package. The FAO soybean expert

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might have been more closely involved in the trial design, as he has a wealth of experience to draw on, and should be invited to visit the trials before harvest. The ZAMARE soybean breeder has visited the CP trials.

f. Oilseeds: Cooperation with the oilseeds team began with on-farm trials for sunflower last season, which have been expanded this season. The arrival of the ZAMARE sunflower agronomist with a farming systems training in 1984 has done a lot to develop a strong working relationship which has resulted in a collaborative on-farm trials this season. Attention should be paid to ensure that this is not seen simply as good ZAMARE co-operation and that the sunflower breeders are also more closely involved. A very effective system of information exchange and discussion of project outlines and trial results has been developed between the ZAMARE agronomists; this could be adopted more widely by other ARPT agronomists when co-operating with agronomists in other CSRTs. This level of cooperation demonstrates the value and potential of the ZAMARE project in improving the linkage between FSR and CSRT work in Zambia.

3. Soil Scientists

Soil and pest problems identified during survey work rank high in the biological problems which SSPs face in CP. Soil acidity and poor structure (sandy soils and 'hard pan') limit production particularly in the higher rainfall areas. These have been reported in surveys and annual reports and the head of soil productivity was involved in prioritising farmer problems in TDR5, and invited to participate in the extension worker training program.

A low level of cooperation between CP/ARPT and the soils advisory officer at Mount Makulu has led to some bad feelings, both in relation to trial content, and the release of crop recommendations through the monthly newsletter. The RELO needs to get together with the soils advisory officer before releasing recommendations, especially those relating to fertilizer. It is encouraging that the soils advisory officer is visiting the CP/ARPT trials this season and that the team is also looking forward to monitoring his involvement with small farmers in the Serenje District.

4. Plant Protection

There has been contact between CP/APRT and the plant protection section, both in relation to nematodes and insect pests in maize. The RELO has been the prime mover in this, sending soil samples for nematode analysis and referring the consultant entomologists from Illinois to inspect the collection of insects and slides for identification purposes. The plant protection head is expecting that the findings of the entomologist consultants will have general use in Zambia, and looks forward to feedback.

5. Local Institutions and Projects

A range of institutional problems were encountered during survey work. Late delivery of inputs, shortage and non-availability of inputs, late payment for crops, shortage of credit and late arrival of credit, poor transport infrastructure in some areas, limited contact with extension workers, and inappropriate extension advice were all identified as production constraints. These problems were encountered in varying degrees in all target groups. It seems that few steps have been taken to inform the local co-operative unions and credit institutions of the situation

(although they are probably aware of it anyway). The inclusion of representatives of these organizations in the pre-research committee meetings, while increasing the size of the committee, might help to open a dialogue which could prove very useful in the longer term.

There has been some liaison with the EEC maize improvement project based in Kabwe and are operating in parts of TDRS; mainly exchange of reports and assistance received for the purchase of soil analysis kits. A change of personnel, together with the inclusion of a social scientist evaluation officer and an extension expert on the EEC team, provides the opportunity for increasing the level of cooperation. Close attention should be paid to exploring the possibility for co-operating in measuring the impact of ARPT work in TDRS, and in training EWs at the camp level in this domain.

In view of the fact that Mpika IRDP are moving into Mkushi district, closer links should be developed with them, to consolidate the cooperation begun during the labour data survey. Finally, as the liaison with related institutions is one of the ARPT economist's responsibilities, the incoming ZAMARE economist should ensure that he or she improves on the performance of the outgoing one in this respect.

## IV. RECOMMENDATIONS

### A. Survey and Diagnosis

1. Review the 1978 zoning of the province using the latest farmer categories, and with specific attention to testing the representativeness of target areas for on-farm research;
2. Make more use of existing data in the reviewing of research priorities and the design of on-farm trials, and make a CP/ARPT

library containing all references in the ARPT bibliography on rural studies;

3. In future survey work pay more attention to off-farm activities and subsistence crops, especially those involving women;
4. In all data collection ensure 1 in 3 households in the sample is female headed;
5. In recruiting a new social scientist for the team ensure that he or she has more of a farming systems orientation, a more anthropological perspective and a sensitivity to the importance of the role of women, and the ability to work as a member of a team;
6. Involve the ARPT sociology section more in survey work, particularly in sampling for surveys, framing of questions and fuller incorporation of indigenous knowledge into data collection and problem definition;
7. In collecting data ensure the sample is within the range of resource endowments of the target group and not above average;
8. Give more attention to economic analysis in the pre-screening of technical options and, the evaluation of on-farm trials. The sociology section should be be invited to comment on the suitability of trials and treatments;
9. Follow the suggestion of the national coordinator, and prepare, as part of a provincial handbook, annual information on crop sales, inputs purchases and loans based on figures for CPCMU/NAMBoard and giving averages/farmer; and
10. Prepare for use by CSRTs using on agronomic summary sheet format;

B. Collaboration in On-Farm Research

1. Develop a more systematic and rigorous method of selecting farmer cooperators, paying special attention to gender and to the labour and cash resources of the farmer; we recommend that a minimum of one in three farmer cooperators be female heads of households, and that wives of farmers are also more involved in trial evaluation. As far as possible, farmers with larger than average cultivated areas, cash resources and family labour should be excluded;
2. Train trial assistants to collect and record farmer reactions in a systematic way which avoids technical bias in their own training. If necessary seek assistance with this;
3. As trials become more farmer implemented, farmers should be made even more aware of their role in the trials, and also be made to feel they are community representatives;
4. Where possible reduce the complexity of on-farm trials, and also the number, so that more attention can be made to recording farmer responses and to observations during the growing season, and less reliance is placed on making predicitions and drawing conclusions on the basis of statistical results;
5. In relation to the above, consider using a 'farmer panel' in the review of trial results and the design of the program for the next season;
6. Consider using farmers fields as 'control plots' and collect more agronomic data from the fields of farmer cooperators;

7. Keep a full record of the socio-economic characteristics of farmer cooperators, recording changes over time; and
8. Make the selection and design of on-farm trials less the prime responsibility of the agronomists, and more of a team responsibility.

C. Research-Extension Liaison

1. Intensify training of EWs at the field level to differentiate between different categories of farmers (in relation to resource endowment) and to deliver advice on crops and livestock relevant to the different categories. This involves using the handbook 'Agricultural Extension for Small Scale Farming Families', testing the handbook for its suitability for training different levels of extension workers. There is a need for closer monitoring of district level training programs for field EWs, followed up through camp visits. This work is best carried out on a pilot basis due to its innovative nature;
2. Continue writing, collecting, and editing materials for the newsletter, but more specifically, with a farming systems perspective in mind. This implies even greater involvement of the CP/ARPT agronomists in preparing materials, and also other ARPT agronomists and social scientists.
3. Materials prepared for the newsletter and presented during training programs could be incorporated into the EW training manual for use at the district level and to provide guidance to RELO's in other provinces.

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4. Give added attention to the organization of farmer field days, within the framework of T and V, to improve interaction between farmers, and EWs and researchers in the assessment of on-farm trials, and demonstrations. This means using contract farmers to assist with farmers field days, demonstrations and monitoring adoption.

5. Liaise with research and extension in such as way as to ensure that the demonstration program follows on from the verification stages of on-farm research trials, or at least problems identified during diagnostic surveys and verified through observations and feedback from field EWs. Care should be taken to ensure that EWs do not confuse demonstrations with on-farm experiments.

6. Assist other ARPT staff in liaising with institutions and projects offering infrastructural support to ensure that successful on-farm testing of new recommendations is matched by any necessary changes in input supply and marketing arrangements.

7. Continue to ensure that new recommendations are widely distributed through the monthly newsletter and continue to check if this reaches field EWs. This also involves continuation of the close liaison with other authorities responsible for formulating crop recommendations.

8. Continue to work through training programs, and through the monthly newsletter, to improve the quality of reporting by field EWs of farmers' production problems and continue to develop mechanisms to ensure that these are passed on to other ARPT staff and appropriate CSRT staff at Mount Makulu and elsewhere.

9. Consult with the ARPT Rural Sociology Section to look at areas of work deserving specialist consideration. These include: (i) Ways of involving women in general, and female-headed households in particular, in the assessment of on-farm trials and demonstrations; (ii) Heightening the awareness of field EWs to the necessity of more effectively involving women in the extension process; (iii) Devising and testing methodologies for measuring adoption of new recommendations; (iv) Making use of local indigenous knowledge and terminology both in the reporting of farmers' problems and in the delivery of new recommendations; and (v) Training EWs how to group farmers into homogenous categories, and how to define farm households.

10. Ensure that the RELO's activities are more closely integrated with those of other members of the team, particularly during on-farm testing and demonstration work;

11. RELO to participate fully in the review of RDs in order to co-ordinate an in-service training program which will ensure that local EWs deliver the appropriate message for each domain; and

12. Renew efforts to secure a full Zambian counterpart.

D. Links with CSRTs

1. Improve the reporting format in Annual Reports so that ARPT findings and suggestions relating to CSRT work are easily accessible and vice versa. List contents of annual reports, indicating sections relevant to individual CSRTs. Send heads of CSRT sections relevant extracts from these reports for comments.

2. Involve CSRTs more in the design of trials and the analysis of results by sending trial results wherever possible before the ARPT-CSRT pre-research committee meetings, and by discussing project outlines at least a month before a trial is due to be planted.

3. Pay special attention to communicating with plant breeders the kinds of characteristics valued and problems faced by farmers in the different domains of the province. Request CSRTs to specify, preferably in writing, the kind of data most valuable to them, and efforts should be made to standardize the measurements of problems.

4. Follow procedures outlined in Annex F, including involvement of CSRT specialists in exploratory surveys, preparation of agronomic data sheets based on survey data, and presentation of problems and trial proposals at pre-research committee meetings.

5. Continue the good progress made in informal interaction with CSRT scientists, even in the face of personality differences which inevitably arise.

E. General

1. Continue developing strong links with other local institutions (e.g., the Provincial Planning Unit) and projects to avoid duplication of effort and co-ordinate infrastructural development and change along with technical change at the farm level; assure that ARPT is represented on the Provincial Agricultural Planning Committee.

2. Re-think and expand the role of the social scientists to include more work on technology transfer mechanisms and monitoring of farmer response and better farmer collaboration in the FSR process.

3. Improve the team dynamics through a training program, and by revising terms of reference which spell out clearly areas where a team effort and input is especially important. National and provincial coordinators should emphasize the need to develop a team situation which allows for more coordination of efforts between ARPT, CSRTs, TAs, EWs, and SSPs; this would reduce the necessity to be directive in management style.

4. To ensure improved understanding of ARPT activities at the district level, where logistics permit follow the approach taken by Serenje District Council which made the ARPT Trial Assistant a full-time members of the Council Agricultural Development Committee; where logistics do not permit have TAs send monthly reports to DAOs so the Committee can be kept current regarding ARPT activities.

5. Since the Newsletter is clearly regarded as highly useful and the only regular communication device down to the camp level, it should be considered for implementation by other ARPTs which lack such a device; more efforts should be made to include news/notes and views from all provincial agricultural officers, to add more FSR materials, and to solicit more material from the district, Block and Camp levels; more support must be provided through ZAMARE to institutionalize the Newsletter production

in Kabwe; the PETO should be trained as a co-editor to later assume the editorship role.

6. Given the large volume of socio-economic and agronomic data collected by the ARPT and the critical need for rapid tabulation and analyses of data, pressure should be increased for the installation of microcomputers at Kabwe RRS. Zambian counterparts and support staff especially should be provided with training in their uses. This would assure that field results could be provided in time for inclusion in the DAOs' annual reports, Newsletters could be produced far more easily and quickly, and the reporting process would be speeded up generally

7. CP/ARPT staff, like provincial coordinators and ARPT staff elsewhere must be fully knowledgeable about FSR; standardized approaches to ARPT must be understood and followed; staff should have the ability to collaborate across disciplines and cultures, to interact fully with EWs and SSPs, be strongly 'people oriented' by willing to extend knowledge and skills to counterparts in order to institutionalize the ARPT approach in Zambian colleagues; and staff should be willing to learn skills from SSPs as well as work to teach them improved skills.

8. Although ARPT is established within the Research Branch and has its primary responsibility to improving agricultural research as an integral part of the Research Branch, it was felt by some interviewees from the Extension Branch that the collaborative approach between research and extension would be enhanced by

changing the name ARPT to ARET (Adaptive Research and Extension Team).

9. Where appropriate in specific systems, consider more trials involving minimal purchased inputs and using local varieties and traditional crops.

10. Assure that Zambian counterparts have appropriate housing and rationalize use of ARPT vehicles so counterparts have appropriate access to them; develop training possibilities so counterparts can learn to drive vehicles; develop maintenance training for TAs and EWs provided with Honda motorbikes. Provide more adequate supply of spare parts for motorbikes.

11. Assume that the Central Ministry includes the PAO in decisions taken to hire and terminate expatriate ARPT members operating under the jurisdiction of the PAO.

12. The reason for establishing ARPT was to focus on the technological problems of traditional and small-scale commercial procedures and thus it is expected that these 2 categories form the target groups for ARPT. The ZAMARE Project Papers also identifies these as the ARPT target groups. As the vincial ARPT is expected to identify the different farming systems in a province, the Provincial ARPT committee must decide which of the systems ARPT will work in given its resource constraints.

13. Where appropriate in specific systems, work to expand CP/ARPTs program to include agricultural mechanization, animal husbandry, forage and agro-forestry efforts, and youth and home economics extension.

14. Provide soil ample analysis facilities at Kabwe RRS.

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## V. CONCLUSION

The CP/ARPT was the first Adaptive Research Planning Team in Zambia to become fully operationalized. It has experienced the full range of new project start-up constraints. Despite these, considerable progress has been achieved in less than 3 years. Many issues have been thoughtfully discussed and presented for consideration, not only by the Central Ministry but by CIMMYT/Nairobi itself (see e.g., Hudgens, R.E., 1984). some of these issues have equal impact on all ARPTs and include the following: (1) the fact that TRDs cut across agroecological zones and political divisions, with MAWD personnel expected to operate within political divisions; (2) the fact that TRDs are dynamic systems sometimes undergoing dramatic change - e.g., rapid adoption of sunflower as a cash crop - requiring rapid rural appraisal techniques to keep on top of such changes; and (3) the fact that over time the ARPT reaches the outer limit of the current FSR methodologies - requiring additional guidance when the farmer managed/farmer implemented stage is completed and the on-farm test stage begins, the sequence to monitor adoption of the new technology under 'real world' conditions when close supervision and free inputs are no longer provided.

It is clear that there is a growing understanding of the principles and philosophy upon which FSR and ARPTs are based. Members of both ARPTs and CSRTs are beginning to develop the avenues for improved collaboration. Sensitivity by MAWD personnel down to the camp level has improved regarding the important role of the SSP in the ARPT process. One small-scale cooperating farmer in Serenje even designed his own research trial

intercropping maize and sunflower in rows - and determined that the mix was not one he would recommend.

The impact has been substantial in terms of contact - through the Newsletter; by training courses at national, provincial, district and camp levels; by demonstrations at FTCs and the Kabwe Regional Research Station; by district field days for both EWs and SSPs. The pay-off in terms of an improved and energized research-extension system capable of operating in a two-way dialogue with SSPs, and the potential high adoption and diffusion rates of improved cropping methodologies and practices by SSPs should become evident within another year or two. Hopefully the recommendations provided in this evaluation study will assist the ARPTs to achieve these important objectives.

## VI. ABBREVIATIONS

| | |
|---|---|
| ARPT | Adaptive Research Planning Team |
| CIMMYT | International Maize and Wheat Improvement Centre |
| CP | Central Province |
| CRT | Commodity Research Team |
| CSRT | Commodity Specialist Research Team |
| DAO | District Agricultural Officer |
| ETO | Extension Training Officer |
| EW | Extension Worker |
| FSR | Farming Systems Research |
| FTC | Farmer Training Centre |
| HH | Household |
| IRDP | Integrated Rural Development Program |

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| | |
|---|---|
| NRDC | Natural Resources Development College |
| PAO | Provincial Agricultural Officer |
| RD | Recommendation Domain |
| RELO | Research-Extension Liaison Officer |
| RM/RI | Research Manager/Research Implemented |
| SMS | Subject Matter Specialist |
| SSP | Small-Scale Producer |
| TA | Trial Assistant |
| TRD | Traditional Recommendation Domain |
| T and V | Train and Visit System of Extension |
| UNZA | University of Zambia |
| ZAMARE | Zambia Agricultural Research and Extension Project |

## VII. ANNEXES

A. Scope of Work

B. Individuals Interviewed

C. Recommendation Domains for Traditional Farmers in Central Province

D. Female Headed Households

E. Bibliography

F. ARPT National Coordinator's program for CRT-ARPT linkage.

ANNEX A. SCOPE OF WORK

7th December, 1984

SCOPE OF WORK

EVALUATION OF SOCIO-ECONOMIC ELEMENT

OF ZAMARE PROJECT'S FSR (ARPT) COMPONENT

By Alistair Sutherland and Mike Warren

## I. INTRODUCTION - ZAMARE PROJECT

The Zambia Agricultural Research and Extension Project (ZAMARE), funded by USAID as a five-year grant to GRZ, is designed to assist MAWD "in strengthening its agricultural research capacity and to increase the effectiveness of the extension service in transferring relevant new agricultural technology to the farmers of Zambia, with special emphasis on small producers and the cereal grains Commodity Research Teams (CRTs) and the Central Province Adaptive Research Planning Team (ARPT) based in Kabwe.

The ARPT at Kabwe plays an important linkage role in the ZAMARE Project. The provincially-based ARPTs follow CIMMYT's Farming Systems Research (FSR) methodology based on four adaptive research stages, (1) the diagnosis of farming systems, (2) the design of improved system elements, (3) on-station and on-farm testing of these elements, and (4) the extension of these elements to the small-scale producers (SSPs). The ARPT acts in a primary liaison role to facilitate linkages and communications between the CRTs, extension personnel, and the SSPs. ARPTs work <u>with</u> SSPs to jointly identify needs and constraints of the SSP as a client group. ARPTs then translate these findings into research

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priorities, some of which can be handled by CRTs, some by the ARPT itself. Adaptive testing of new technologies is conducted and successful innovations are packaged with extension staff for transmission to the SSPs.

## II. EVALUATION OF THE SOCI-ECONOMIC IMPACT OF THE ARPT COMPONENT OF ZAMARE

USAID has requested that an evaluation of the socio-economic impact of the Central Province ARPT (CP/ARPT) be completed for use by the team contracted to conduct the ZAMARE mid-project evaluation. The terms of reference include the following:

1. To determine the extent to which CP/ARPT, in conjunction with SSPs and extension personnel has conducted diagnostic research to establish recommendation domains with different resource mixes, to prioritize these target groups as beneficiaries of ARPT resources, and identify and prioritize SSP production constraints;
2. To determine mechanisms developed through ARPT to refer priority constraints for action research by appropriate CRTs resulting in the design of improved agricultural technologies relevant to SSPs;
3. To determine the extent to which ARPT has conducted on-station and on-farm trials of improved technologies in a collaborative mode with SSPs and extension staff;
4. To determine the appropriateness and effectiveness of ARPT strategies for disseminating improved technologies through the extension system to SSPs in different recommendation domains (target groups)
5. To determine the actual beneficiaries of ARPT to date.

The ZAMARE Project Paper stressesthat ARPT "should take care not to exclude female-headed households" and should move beyond CIMMYT methodologies to include the gender of the head of household to help discern recommendation domains. A key question to address in this evaluation is the appropriateness of the recommendation domains which have been stratified according to area cultivated and type of production technology utilized (hoe, oxen, or tractor).

The effectiveness of ARPT in facilitating a collaborative and participatory approach to problem identification with SSPs, to prioritizing research activities with extension staff is a key area for evaluation. A CIMMYT study of Central Province prior to the organization of its ARPT identified 8 recommendation domains (6 traditional, 1 emergent and 1 commercial). An important evaluation question will center on the criteria used by ARPT to prioritize these target groups to assure that ARPT resources would research the largest beneficiary group with the greatest possibility for a rapid spread (adoption-diffusion) effect of appropriate improved technologies.

## III. APPROACH TO EVALUATION

The socio-economic impact of CP/ARPT will be evaluated through several mechanisms as follows:

1. A review of relevant studies and reports produced by CP/ARPT and collaborative groups such as CRTs and extension staff;
2. A review of survey and other data collected by ARPT appropriate to each of the 4 stages in the FSR methodology;

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3. Interviews with ARPT members and with members of collaborating groups, i.e., a sample of SSPs. CRTs, extension staff, provincial and district agricultural staff, (e.g., PAO, DAOs), and Rural Informational Services Staff.

## IV. TIME LINE FOR EVALUATION

The evaluation will be conducted by Sutherland and Warren. Since both officers have other work commitments, the different evaluation activities will be conducted at different times as follows. Report writing will be completed January 29 - February 3, 1985.

| ACTIVITY | TIME PERIOD | SITE |
|---|---|---|
| III.I | Dec. 18-22 | Kabwe |
| III.2 | Jan. 2-3 | Kabwe |
| III.3 | Jan. 21-26 | Central Prov. |

## V. ASSUMPTIONS

1. Clearance has been given by the Director of Planning, the ZATPID Team Coordinator, and USAID for Warren to participate.
2. Clearance is given for provision of transportation by the Kabwe team for field surveys, and evaluation report preparation by the ZAMARE/ZATPID Project Support Unit.

# VI. ANNEX - CLIENT FOCUSED EVALUATION INPUTS

## A. SSPs

1. Examine the diagnostic survey work;
2. Examine the on-farm research programme
   a. By geographical location;
   b. By relative size of target group;
   c. By gender;
   d. By resource base.

## B. EXTENSION BRANCH

1. Involvement in on-farm research;
2. Information sharing with ARPT;
3. Progress with preparation and dissemination of recommendations to SSPs.

## C. CRTs

1. Research priorities submitted by ARPT;
   a. Suggestions to crop breeders;
   b. Suggestions to Soil Productivity Research Team;
   c. Suggestions to Plant Protection Section regarding chemical and biological control of pests and weeds;
   d. Suggestions for farm machinery and tillage.

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## ANNEX B. INDIVIDUALS INTERVIEWED

* Indicates interviewed by Warren

** Indicates interviewed by Sutherland

*** Indicates interviewed jointly by Warren and Sutherland

19 Dec - Al Harms*** - ARPT Economist - Kabwe

Mary Chulu*** - Prov. Asst. Ext. Tr. Officer Kabwe

20 Ron Dedert*** - RELO - Kabwe

22 J.M. Sinkonde*** - Farm Manager, Keembe Farm Institute, Keembe

Simushi Nomai* - Commodity Demonstration - Muswishi

A. Katelele*** - SSP - Muswishi

H. Mwanza* - Block Supervisor - Muswishi

K. Zulu* - Agric. Assistant - Muswishi

M. Bwalya** - Trial Assistant - Muswishi

Bob Hudgens*** - ARPT Agronomist - Kabwe

23. J.K.B. Nshindano* - Trial Assistant - Serenje

J. Tembo* - District Agriculture Officer - Serenje

Evans Mphande * - RETO - Serenje

K.G. Maka* - DES - Serenje

J. Chisha* - DPO - Serenje

K.C. Chime* - District Governor - Serenje

C.I. Imbula* - Commercial Secretary - Serenje

G. Chitenta* SSP - Serenje

Munshya* - SSP - Serenje

Jessie Fise* - SSP - Serenje

A. Simwanza** - Trial Assistant, Nkole Agric. Camp Mkushi

Harold Simuzia** - Labour Enumerator, Nkole Agri. Camp Mkushi

_____** - Agricultural Assistant, Nkole Agric. Camp, Mkushi

W. Falanga** - SSP, Nkole Agric. Camp, Mkushi

L. Malata** - SSP, Nkole Agric. Camp, Mkushi

24. Aida Musonda** - SSP, Nkole Agric. Camp, Mkushi

Aaron Njovu** - SSP, Nkole Agric. Camp, Mkushi

Joe Chilomba* - District Agricultural Officer, Mkushi

P. Mutale* - Officer In Charge (Incoming), Mkushi FTC

M. Mwambwa* - Officer In Charge (Outgoing), Mkushi FTC

E.K. Musonda* - Farm Manager, Mkushi FTC

I. Chileshe* - Project Coordinator, Mkushi FTC

25. Lingston Singogo* - Provincial Agricultural Officer, Kabwe

Evans Mphande* - Prov. Crop Husbandry Officer, Kabwe

Grace Mwangala* - Prov. Planning Officer, Kabwe

D.S. MANDA* - Prov. Planning^E^@ Officer, Kabwe

Jan 85 - Mt. Makulu

Dr. P. Gibson** - ZAMARE, Maize Breeder, Mt. Makulu

Dr. V. Eylands** - ZAMARE, Sunflower Agronomist, Mt. Makulu

Dr. B. Patel** - Chief Agricultural Research Officer, and Head of Plant Protection

Mr. K. McPhilips** - Soils Advisory Officer

Dr. D. Roose** - Plant Protection (Legumes)

Dr. Little** - Head ZAMCAN Wheat Program

Dr. B. Vermer** - Head of Sorghum and Millets

Mr. M. Chis;** - Sorghum Breeder

Ms. B. Habowa** - Sunflower Breeder

Mr. J. Munyinda** - Soil Scientists

## ANNEX C. FEMALE HEADED HOUSEHOLDS

### FEMALE HEADED HOUSEHOLDS BY DISTRICT, 1980, CENSUS

| | Proportion of FHH 1/ | Adjusted as proportion of SSPs |
|---|---|---|
| Kabwe Rural and Mumbwa (TRD5) | 22% | 29% |
| Mkushi District (TRD3 mainly) | 21% | 25% |
| Serenje District (TRD2 mainly | 30% | 30% |

* Adjusted figure based on assumption that there are twice as many female headed households in the 'traditional' farmer category as in the 'emergent' category. As there are very few emergent farmers in Serenje District no adjustment has been made for TRD2.

1/ Source, Sophilios - Rothschild (1984)

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FEMALE HEADED HOUSEHOLDS BY DISTRICT, 1969, CENSUS 1/

Kabwe Rural 21%

Mumbwa 27%

Mkushi 24%

Serenje 47%*

Source: 1969 Census, Final Report

*This very high figure of 47% contrasts with the 30% recorded 11 years later in 1980. The difference may be due to a difference in definition of a FHH, and/or to an increase in the popularity of virilocal (wife going to live in husband's village) marriages due to possibly increased oxenization and cash cropping in the district.

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# ANNEX E. ARPT NATIONAL COORDINATORS PROGRAM FOR CRT-ARPT LINKAGE

## 1. INTERACTION BETWEEN ARPT AND THE COMMODITY AND SPECIALIST RESEARCH TEAMS

An important preoccupation during the early stages of institutionalising farming systems research within the Research Branch has been to avoid appearing as a threat to the scientists with the CSRTs. This has been necessary firstly, to avoid any animosity developing on the part of CSRT scientists which could inhibit the development of good working relationships between ARPT and the CSRTs which is essential if the new structure of the Research Branch is to work effectively.

Secondly, with considerable attention, as well as support in terms of manpower and finance being given to ARPT, both from the government and from outside agencies, there has been a danger that technical component research would be overlooked. This is due in part to the tendency to see farming systems research as pancea. However, it has become very obvious to those with ARPT that it is not, and that whilst it does have several unique and important features it must be seen as an integral part of the Research Branch complementing the work of the CSRTs. For, when no technical component research has been undertaken, as is most obvious in the case of farm machinery and tillage research, then ARPT is not able to test any possible technological situations. However, efforts are being made to ensure that when technology is from analagous situations in other countries that it can be tested in Zambia.

There is a two-way flow of information between ARPT and CSRTs, with ARPT providing information on farmers' problems requiring technical

component research, which will form 60% of the CSRT work programme, and also providing feedback on the performance of such research when conducted under farmers conditions. The CSRTs, in turn, provide information on possible technological solutions available for on-farm experimentation.

In order to achieve this two-way flow of information several mechanisms have been established:

a. Involvement by CSRT scientists in the exploratory survey

In order to benefit from specialist knowledge on particular crops or specialist issues, scientists from relevant CSRTs are invited to participate in the last few days of the exploratory survey. Such participation helps to guide the questionnaire development for the verification survey by clarifying factors related to identified technical problems and also enables ARPT to obtain a better understanding of those areas where technological solutions may already exist and could be tested with confidence in on-farm experiments.

b. Pre-Research Committee Meetings

Prior to the annual Research Committee Meetings, held to review the previous season's result and to discuss the forthcoming season's programme, a series of meetings are now held between scientists from each CSRT and from ARPT. These Pre-Research Committee Meetings are small meetings in which ARPT scientists from all provinces are able to present the problems that have arisen in the different domains either during the surveys or trials undertake, and then present proposals for both technical component and on-farm experimentation. CSRT scientists are able to learn of these problems and contribute to the formulation of the research programme. Following the approval of ARPT's proposed research programme by the main

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Research Committee Meeting the CSRT scientists are again asked to comment on the project outlines in which the details of each trial are specified.

c. Agronomic data sheets

In order that CSRT scientists can make use of agronomic data collected by ARPT, data sheets are prepared after each survey has been completed. These sheets simply present quantified data, without interpretation, on the agronomic practices and problems found on farmers' fields in different domains, e.g. percentage of maize plantings affected by streak virus, percentage of farmers using retained or purchased seed, etc. These data do not entail conducting new surveys but only require printing data which might never otherwise have been seen. Such data provide a much needed quantified data base for the CSRTs.

d. Crop research strategies

It is proposed that when sufficient numbers of farming systems have been surveyed, that a crop research strategy will be drawn up using the quantified data collected from across the country by ARPT, together with CSRT knowledge of what research is feasible over a given time period

2. ADAPTIVE RESEARCH PLANNING TEAM

FORMAT FOR USE WHEN PRESENTING IDENTIFIED PROBLEMS TO COMMODITY AND SPECIALIST RESEARCH TEAMS IN RESEARCH COMMITTEE MEETINGS

1. Commodity specialist team to be involved.
2. Province (s).
3. Location of farming system (s)
4. Crop.
5. Technical description of the problem.
6. Description of the problem in terms of the system.

7. Benefits of successful research; Number of farmers who could benefit, importance of the crop to these farmers, market potential, increased output anticipated if solution was successful.

8. Research programme required-short and long term.

9. Key constraints within which a solution would have to work

EXAMPLE

1. Farm machinery and tillage research team.

2. Lusaka Province (also probably southern and parts of Central)

3. Ox-based farming systems with (900mm rainfall.)

4. Maize

5. Late planting, which reduce yield potential, increases weed problems, and limits the returns to inputs such as fertilizer and weeding. A high proportion of the planting (commonly more than 50%) is done after 15th December

6. The system is limited by the speed of the planting operation, and the need to minimize risks. The risk of complete failure due to lack of moisture at critical stages in the growth cycle (emergence, pollination) is reduced by planting over a number of weeks, and only planting when moisture conditions are good. This is likely to occur on only a dew days before mid-December. The draft power (manpower equipment) cannot cover sufficient ground before the potential yield starts declining rapidly.

7. A reduction in this problem would significantly affect a lot of farmers. If 20% of the area currently planted after 15th December was planted before 15th December, an increase in output of 10% be expected. The greatest beneficiaries would be the ox-hiring members

of the community, who currently have to wait until the ox-owners have finished their fields. If potential for high yield exists in the emerged crop, farmers will be more willing to invest in inputs such as fertilizer weeding.

8. Research must establish more rapid ways to prepare and plant fields in order that a higher proportion of the crop can be planted early. It must also establish ways to provide a better environment for the planted seed to increase the rate of emergency, and to extend the number of days on which planting can be done.

   Short term research should concentrate on testing planters (or other methods) for plant establishment under different moisture conditions, and on different soils. Successful methods should be tested in farmers hands.

   Other approaches might be to look at winter ploughing or ploughing with the first rains to allow the planting operation to occur earlier; and investigation of reduced tillage techniques, etc. Other specialists such as plant breeders, may simultaneously approach the problem by different means.

9. The research programme tackles on operation which is constraining the system; however, at the same time there is severe cash constraint and very high returns would be needed for a new piece of equipment to be purchased. A low-cost planter would be much more likely to be adopted. Secondly, it is worth noting that the idea of winter ploughing has been pushed by extension for a long time without a great deal of uptake. Even if it is shown to be a solution

technically, it seems unlikely that it will be taken up unless some other change occurs which make it appear more favorable to farmers.

3. CROP PROFILES FOR A.R.P.T.

INTRODUCTION

Farming systems research involves identifying constraints, both agronomic and socio-economic, in a given farming system. Ways are then sought to overcome these constraints and exploit the potentials identified. This often involves matching a particular crop or variety to the existing farming system. In some cases varieties with appropriate characteristics will already be in existence, but where a breeding programme needs to be undertaken, the farming systems perspective can give a fine focus to the criteria for breeding.

In order that a general agronomist can assess the potential for a crop in a system, he must have an accurate idea of the environmental and management requirements of the cop. We are therefore asking C.R.T. co-ordinators to draw up 'crop profile's for the major small-farmer crops in Zambia.

For a given crop, it may be easier to make one profile to the crop showing the genetic potential of the cop (e.g. germplasm known with tolerance to pH 4.2) and separate profiles for varieties currently available in Zambia. Alternatively, potential and existing varieties could be combined in profile.

Emphasis should be given to points that are likely to be of most importance in the small-scale farming sector. Where genetic potential could be relatively easily realized in the breeding programme, this should be indicated.

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Comparisons with other crops (eg sorghum with maize) may be the best way to illustrate the relative merits of a crop.

PROFILE FORMAT

1. Name Common name, genetic name, and any known Zambian names.

2. Soils
   a) pH The pH range for optimum growth should be indicated, and an indication given of the way in which yield decline at pH levels below this. Often the yield potential at sub-optional pH is very important for farmers who can afford to apply lime.
   b) Texture. Indicate preference for clay or sandy soils, etc.
   c) Structure. How prone is crop to drought, waterlogging, compacted soil etc.?
   d) Depth. Does it require a deep soil, or can it perform well on relatively shallow ones?
   e) Nutrients. Response to macro-nutrients give some idea of actual response rather than an economically or biologically optimal level
   f) Any other important requirements of the soil environment.

3. Temperature
   a) Maximum and minimum air temperatures. If the sensitivity varies with growth stage, indicate this. Give optimum temperatures.
   b) Sensitivity to soil temperatures at different stages.

c) Any other aspect of temperature directly or indirectly affecting the crop.

4. Rainfall
   a) Duration of moisture required
   b) Mean monthly requirement, and most sensitive stages.

5. Altitude Limitations

6. Daylength sensitivity

7. Botany
   a) What is the range of plant forms? Stress particularly those features of agronomic importance (e.g. weed suppression, need for support).
   b) Nodulation - What conditions are condusive to natural nodulation? (Where appropriate).
   c) Any other botanical features considered to be important.

8. Management
   a) Planting date. This should be related to rainfall, or other environmental features which determine it.
   b) Seed bed preparation: how critical is this operation?
   c) Depth of planting?
   d) Plant population and plant response to changing population would be of more use than a recommendation.
   e) Time and method of fertilizer applications
   f) Days to harvest
   g) Ability to intercrop
   h) Crop weed competition and critical weeding periods.

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i) Pest and disease problems, potential for resistance. Relate attack to environmental factors.

j) Storage problems

k) Any other important management aspects (e.g. irrigation for vegetables).

## 4. PROJECT OUTLINE FORMAT FOR ADAPTIVE RESEARCH TRIALS

### INTRODUCTION

The standard format which is supposed to be followed when drawing up project outlines for trials has been found somewhat inappropriate for on-farm trials concerned with problems identified through farming systems research methodology. We need a greater emphasis on the systems context in which the problem occurs, and to provide information on the hypothesis proposed as to how the problem can realistically be reduced, and the criteria necessary for disproving the hypothesis. The traditional format designed to serve as instructions for the agronomist carrying out the trials; as it is necessary to produce a separate set of instructions for the Trials Assistants, it is felt that for an on-farm adaptive trial, the project outline should specify the overall management level, rather than the full detail.

To make this outline more comprehensive, it is also proposed that some of the headings, such as 'initiated by', 'authorised by' and 'to commence on' could easily be omitted without any great loss.

<u>Proposed Format</u>:

1. Master Number
2. Title
3. Location Number of farms, recommendation domain, (district) province

4. Agricultural System: Salient agro-ecological and socio-economic features of the system which are important for an understanding of the trial (Reference to survey reports)
5. Hypothesis. The key constraint, and how the proposed technology will relieve it
6. Treatment
7. Design (Including the phase of trialing)
8. Criteria for evaluation: The hypothesis may state that the benefits of treatments will come indirectly through increased time available for another crop, rotational benefit, nutritional benefit, etc.
   (a) These criteria must be stated, and
   (b) further data which needs to be collected to evaluate the treatments should be outlined
9. Literature (on technology)
10. Duration: This should include what the duration will depend on.
11. Management and Implementation: An overview of the management to be followed, highlighting the most important points. Emphasis on which management decisions are made by research and which by the farmer
12. Staff involved