

***SARP***  
***REGIONAL SORGHUM***  
***AND***  
***MILLET RESEARCH***  
***PROJECT PAPER***  
***AMENDMENT #3***  
***(690-0224)***

***SEPTEMBER 15, 1993***

PROJECT DATA SHEET

1. TRANSACTION CODE

A = Add  
C = Change  
D = Delete

Amendment Number

3

CODE

3

2. COUNTRY/ENTITY  
SOUTHERN AFRICA REGIONAL

3. PROJECT NUMBER

690-0224

4. BUREAU/OFFICE

AFR/SA

06

5. PROJECT TITLE (maximum 40 characters)

REGIONAL SORGHUM & MILLET RESEARCH

6. PROJECT ASSISTANCE COMPLETION DATE (PACD)

MM DD YY  
09/15/98

7. ESTIMATED DATE OF OBLIGATION

(Under "B" below, enter 1, 2, 3, or 4)

A. Initial FY 8/3

B. Quarter

C. Final FY 9/4

8. COSTS (\$000 OR EQUIVALENT \$1 = )

A. FUNDING SOURCE	FIRST FY 83			LIFE OF PROJECT		
	B. FX	C. L/C	F. Total	E. FX	F. L/C	G. Total
AID Appropriated Total			14,800	42,110		42,110
(Grant)	(6083)	( )	(14,800)	(42,110)	( )	(42,110)
(Loan)	( )	( )	( )	( )	( )	( )
Other U.S.						
1.						
2.						
Host Country						
Other Donor(s)				13,873		13,873
<b>TOTALS</b>			14,800	55,983		55,983

9. SCHEDULE OF AID FUNDING (\$000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	C. PRIMARY TECH. CODE		D. OBLIGATIONS TO DATE		E. AMOUNT APPROVED THIS ACTION FY93		F. LIFE OF PROJECT	
		1. Grant	2. Loan	1. Grant	2. Loan	1. Grant	2. Loan	1. Grant	2. Loan
(1) ESE				14,800				14,800	
(2) SADE				15,150		7,000		26,150	
(3) DEA				1,160				1,160	
(4)									
<b>TOTALS</b>				31,110		7,000		42,110	

10. SECONDARY TECHNICAL CODES (maximum 6 codes of 3 positions each)

11. SECONDARY PURPOSE CODE

12. SPECIAL CONCERNS CODES (maximum 7 codes of 4 positions each)

A. Code

B. Amount

13. PROJECT PURPOSE (maximum 480 characters)

To increase the production of sorghum and millet with good consumer acceptance, local adaptation and pest resistance.

14. SCHEDULED EVALUATIONS

Interim MM /Y MM YY  
06/9/6

Final MM YY  
0/6/9/8

15. SOURCE/ORIGIN OF GOODS AND SERVICES

300  941  Local  Other (Specify) 935

16. AMENDMENTS/NATURE OF CHANGE PROPOSED (This is page 1 of 4 page PP Amendment)

Morse 9/9/93

17. APPROVED BY

Signature

Title Ted D. Morse  
Director, USAID/Zimbabwe

Date Signed

MM DD YY  
0/9/15/9/3

18. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION

MM DD YY

1/1/15/7/3

September 15, 1993

**ACTION MEMORANDUM FOR THE DIRECTOR, USAID/ZIMBABWE**

*Robert E. Armstrong*

**FROM :** Robert E. Armstrong, USAID/Zimbabwe

**SUBJECT :** Regional Sorghum and Millet Research Project 690-0224, Supplement No. 3

**I. ACTIONS REQUIRED:** Your approval is required to:

(A) authorize an increase in the life of project funding for the SMIP project by \$11.0 million from \$31.11 million to \$42.11 million. Ten million dollars of these funds will be for an additional 5 years of activities under the ICRISAT grant from September 15, 1993 to September 15, 1998. The additional \$1.0 million will be utilized by the Mission for the management, monitoring and evaluation activities required by the recently approved Mission CPSP.

(B) sign the ICRISAT Grant Amendment increasing the grant amount by \$7.0 million and extending the grant period through September 15, 1998;

**II. PROJECT BACKGROUND**

The Regional Sorghum and Millet Research Project (also referred to as SADCC/ICRISAT Sorghum and Millet Improvement Project -SMIP), conceived as a 20 year activity, was begun on September 15, 1983 as a response to concerns of the Lusaka Declaration (April 1, 1980) for environmental degradation and food security of poorer people in the marginal rainfall areas of the SADCC countries. USAID project funding for the first ten years of the project totals over \$31 including \$1.162 million for drought emergency seed multiplication. Total donor financing for the initial ten years is summarized as follows:

Donor Assistance to SMIP, 1983-92

<u>Donor</u>	<u>US\$ (millions)</u>
USAID	31.11
CIDA	7.30
GTZ	3.20
	-----
Total	41.61
	=====

Phases I and II have been successful in building capacity and conducting sorghum and millet research; constructing the regional research facilities; developing the regional research farms; assisting several of the National Agricultural Research Systems (NARS) with construction and start up planning; providing short and long term training to NARS staff; collecting and characterizing germplasm; and the collaborative development with the NARS of improved open pollinated and hybrid varieties of sorghum and millet.

The mid-term evaluation of SMIP conducted in 1991 gave the project high marks for accomplishments and made specific recommendations for critical actions

required to keep the project on course towards its objectives<sup>1</sup>. Some of the key actions recommended were a stronger focus on technologies for food production in the semi-arid and drought prone areas, collaborative research with the NARS, field testing of varieties and management practices in the farmers' fields, and greater control over expenditures to assure that costs remain within budget.

SMIP has taken decisive action on the recommendations contained in the mid-term evaluation during the 18 months since that evaluation was completed. The program is now reflected basically as recommended. Rigorous expenditure controls are in place and the tough budget choices have been made -- as is reflected in the project design for Phase III and IV (1998 - 2003) described below.

### III. SUMMARY PROJECT DESCRIPTION

#### A. Project Goal

The project goal is the stabilization of food supplies in the region, leading to improved nutrition and income for poorer people farming in drier areas.

#### B. Project Purpose

The project purpose is to increase the production of sorghum and millets with good consumer acceptance, local adaptation and pest resistance.

#### C. Project Strategy

The strategy of this project is that (a) excellent improved sorghum and millet cultivars have been developed and hold sufficiently promising yield increases for a rapid adoption by farmers and (b) that a combination of public and private input distribution and information dissemination channels exist to extend available technologies to a substantial number of millet and sorghum producers in the region. SMIP can play a catalyst role in moving sorghum and millet technologies to farmers particularly just after a debilitating drought by helping to develop regional networks for millet and sorghum improvement programs and technology transfer. Through its participation in such an effort, SMIP can work with a number of regional and national organizations to establish more formalized networks which will operate more effectively and more efficiently than the present structures existing within the SADC region for technology generation and transfer.

#### D. Project Outputs

1. Sorghum and millet technology transfer
2. Integrated sorghum and millet improvement research programs.
3. Provision of improved sorghum and millet cultivars.
4. Integrated technologies for pest management.
5. Continued appropriate use of Matopos Station facilities and physical plant.

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<sup>1</sup>"Mid-Term Donor review of the SADCC/ICRISAT Sorghum and Millet Improvement Project", USAID/Harare, Oct. 1991

#### D. Project Inputs

The project inputs, provided to ICRISAT, are the funds required to implement Phases III (1993 - 1998) and IV (1998 - 2003) as follows:

USAID	\$10,729,670
CIDA	1,049,373
GTZ	3,122,109
Sub-Total	14,901,151
Others	3,000,000
	-----
Total	\$17,901,151
	=====

The amount of \$729,670 is the balance from USAID Phase I and II. Donor funding will be adequate to cover planned costs in Phase III, but an additional \$3,000,000 will need to be lined up from other sources prior to the start of Phase IV (GTZ funding is a possibility but is provided in three year increments so the GTZ Phase IV can only be listed as proposed). See the section on financial sustainability below for more on this topic.

State Cable 251385 notified USAID/Harare of \$7 million which is now available for obligation against this approval and authorization. The additional \$4 million is subject to the availability of future year funds and authority to extend the project thru phase IV (2003).

On July 21st 1993 USAID received a letter from SACCAR laying out the timetable and rationale for SADC commitment to the sustainability of the project. The grant Amendment contains a paragraph identifying the conditions for disbursement of funds after September 30 1994. This condition precedent requires the submission; by SADC/SACCAR, assisted by ICRISAT; of a sustainability plan which is acceptable to USAID.

#### IV. LEGAL AND REGULATORY REQUIREMENTS AND NEGOTIATING STATUS

The necessary legal and regulatory requirements for this PP amendment have been satisfied and are included as attachments to the project paper supplement:

Attachment I	AID/W Delegation of Authority Cable
Attachment II	AID/W Approval of IEE Categorical Exclusion
Attachment III	Congressional Presentation and Technical Notification Expiration Cable
Attachment IV	Funds Allowance Cable
Attachment V	Statutory Checklist

Under A.I.D. Handbook 13, Chapter 5 (where ICRISAT is listed as a Public International Organization), you, as Director of the cognizant technical office have authority to amend the grant to ICRISAT extending the period of assistance and adding funds non-competitively.

This PP amendment attaches and incorporates the ICRISAT proposal, as a reference document, which is accepted without any substantial changes. In addition, SACCAR request for the assistance is contained in Attachment VI to the Project Paper Supplement. Both ICRISAT and SACCAR are in complete agreement with the terms and conditions of this PP amendment (as described in the attached PP Supplement which is the controlling document) and the attached ICRISAT Grant Amendment.

**V. RECOMMENDATIONS**

A. That you sign (a) this Action Memo below; (b) the attached PP project data sheet and (c) Amendment No. 3 of the Project Authorization thereby approving and authorizing an increase in the life of project funding level from \$31,110,000 by \$11,000,000 to \$42,110,000 for the "Regional Sorghum and Millet Research Project" 690-0224.

B. That you sign the attached Grant Agreement Amendment with ICRISAT, thereby increasing the funding available in the grant from \$31,110,000 by \$7,000,000 to \$38,110,000 and extending the period of the grant by five years to September 15, 1998.

Approved/Disapproved: APPROVED

Signed: [Signature]

Date: Sept. 15, 1993

**ATTACHMENTS:**

- Project Data Sheet for Project Amendment
- Project Authorization Amendment
- ICRISAT Grant Agreement Amendment
- Project Paper Supplement.

**CLEARANCE:**

RLA:MAlexander ML 8/27/93 (DRAFT)

PBuckles PKB9/1/93 (DRAFT)

MLewellen MLL 9/5/93 (Draft)

Drafted by: REDSO/ESA/PDPS:DAAlter/MBaker, REArmstrong/USAID/Harare

AUTHORIZATION AMENDMENT No. 3

Name of Entity: : International Crops Research Institute  
for Semi-Arid Tropics

Name of Project : Regional Sorghum and Millet Research  
Project

Number of Project : 690-0224

1. Pursuant to the Foreign Assistance Act of 1961, as amended, the Foreign Operations, Export Financing and Related Programs Appropriations Acts, the Africa Bureau Delegation of Authority No. 551, as amended, and 93 STATE 241836, the Regional Sorghum and Millet Research Project, which was authorized on September 15, 1983, and subsequently amended on August 16, 1988 and September 29, 1992, is hereby further amended as follows:

a. Delete the second paragraph of Section 1 in its entirety and substitute the following in lieu thereof:

"The Project involves planned obligations of not to exceed \$42,110,000 over a 15 year period from the date of the authorization, subject to availability of funds, in accordance with the AID OYB/allotment process, to help in financing foreign exchange and local currency costs for the project. The life of the project is fifteen years from the date of authorization."

b. Revise Section 2 by adding the following:

"During Phases III and IV, primary emphasis will continue the shift from research to technology transfer, production, and consumption aspects of sorghum and millet in the SADC Region with success judged by the extent to which nutrition and food security of the poor people in the semi-arid and drought prone areas is improved. Phases III and IV will also be marked by a shift from donor financing of regional sorghum and millet activities to an essentially self-financing effort by the SADC member countries."

2. The authorization cited above remains in full force and effect except as hereby amended.

Signature:

  
Ted D. Morse, Director  
USAID/Zimbabwe

Date:

5/15/93

**REGIONAL SORGHUM AND MILLET RESEARCH PROJECT  
SUPPLEMENT No. 3  
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Attachments:

- I. AID/W Delegation of Authority Cable '
- II. AID/W Approval of IEE Categorical Exclusion '
- III. Congressional Presentation and Notification Expiration Cable '
- IV. Funds Allowable Cable '
- V. Statutory Checklist '
- VI. SACCAR Letter to USAID Requesting Project '
- VII. ICRISAT Proposal for Phase III and VI Extension '
- VIII. ICRISAT Grant Agreement Amendment '
- IX. SACCAR Letter on Project Sustainability

#### ACRONYMS AND ABBREVIATIONS

CGIAR	Consultative Group on International Agricultural Research
CIDA	Canadian International Development Agency
DR & SS	Department of Research and Specialist Services
FAO	Food and Agriculture Organization of the United Nations
BMZ/GTZ	Bundesministerium für Wirtschaftliche Zusammenarbeit/Deutsche Gesellschaft für Technische Zusammenarbeit (Germany)
IBPGR	International Board for Plant Genetic Resources
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IEE	Initial Environmental Evaluation
INTSORMIL	International Sorghum and Millet Collaborative Research Support Program (USA)
ISNAR	International Service for National Agricultural Research
NARS	National Agricultural Research Systems
SACCAR	Southern African Center for Cooperation in Agricultural Research
SADC	Southern African Development Community
SARP	Southern African Regional Program
SMIP	Sorghum and Millet Improvement Program
USAID	United States Agency for International Development

## 1. PROJECT DESCRIPTION

Phases III and IV of Sorghum and Millet Improvement Program (SMIP) are described below in LOGFRAME terminology. As this is an extension of an existing project, the goal and the purpose of the project remain unchanged from Phases I and II. Outputs and inputs have been revised to reflect results expected from Phase III efforts and investments.

### 1.1. PROJECT GOAL

The project goal is the stabilization of food supplies in the region, leading to improved nutrition and income for poorer people farming in drier areas.

### 1.2. PROJECT PURPOSE

The project purpose is to increase the production of sorghum and pearl millet with good consumer acceptance, local adaptation and pest resistance.

Over the ten year life of Phases III and IV of the project, the following are performance targets for increasing sorghum and pearl millet productivity within the SADC region. In addition to tracking the relevant changes for the SADC, performance in relation to the country of Zimbabwe will be monitored as this regional effort is closely linked to the strategic objectives defined for the Zimbabwe bilateral program. Hence targets to be achieved by the end of the third phase are defined in absolute terms for Zimbabwe and on a relative basis for the SADC region.

#### 1. Increase in the area planted to improved varieties.

	<u>-For Zimbabwe</u>	<u>-For SADC Region</u>
Sorghum:	38,000 ha.	10-20% of total
Pearl millet:	43,000 ha	area of pearl millet and sorghum.

#### 2. Increase in sorghum and pearl millet yields per hectare.

	<u>-For Zimbabwe</u>	<u>-For SADC Region</u>
Sorghum:	660 kg/ha	10-20% increase on
Pearl millet:	600 kg/ha	three year average.

#### 3. Increases in productivity (decreases in production costs per unit output) of sorghum and pearl millet.

	<u>-For Zimbabwe</u>	<u>-For SADC Region</u>
	20% increase	10-20% increase

### 1.3. PROJECT OUTPUTS

The achievement of the project purpose is expressed in increased sorghum and pearl millet production and productivity. These improvements will require a collaborative effort involving the SMIP regional program, the NARS and other national level institutions. Project outputs, as defined

for Phase III, are those within the management control of SMIP. Activities necessary to increase sorghum and pearl millet productivity at the national level are considered as assumptions since they are outside the management control of this project and receive no project resources directly.

In the attached SADC/ICRISAT proposal reference is made to a number of objectives which have been established by the newly created SMIP Steering Committee made up of the leaders at national sorghum and pearl millet research programs. The outputs defined in this project paper supplement are not intended to replace those set forth by the Steering Committee, but rather to rephrase the objectives in terms that are more easily understood by USAID.

#### OUTPUT 1. Sorghum and Pearl Millet Technology Transfer<sup>2/</sup>.

Phase III of SMIP will give priority attention to transferring technologies developed by SMIP and NARS to development agencies and farmers. SMIP is currently developing detailed plans and making the adjustments in staffing to enable it to work collaboratively with a variety of public and private agencies in member countries toward this end. The staff time and resources devoted to technology transfer are being increased from 10% (Phase I and II) to 50% (Phase III). The shifts in resource allocations for SMIP are illustrated by Figure 1 on page 1 of the Phase III proposal.

SMIP's work with other agencies on technology transfer will focus primarily on following three areas:

- (1) making improved cultivars available to farmers;
- (2) reviewing national extension recommendations for pearl millet and sorghum improvement and updating/revising as needed;
- (3) testing and assessing the performance of new technologies and using such information in planning future research programs;

SMIP will play an entrepreneurial role in assessing problems and opportunities associated with technology transfer efforts. SMIP will commission studies, host workshops and provide advisory assistance to facilitate the dissemination process. Examples include studies of markets and prices; assessments of NARS technology release procedures; and advisory assistance on seed production and distribution. SMIP will give priority attention to supporting the release and dissemination of improved varieties.

SMIP will assist national agencies to locate information and support to address needs in areas which lie beyond SMIP's capacity, but are critical to the progress of technology dissemination efforts. Such activities include advising on the preparation of feasibility studies for private or public financing and research proposals for cross-cutting issues other than breeding and pest management.

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<sup>2/</sup> Output I is based on and relates specifically to objective I in the SMIP proposal

Major milestones in relation to the development of this output include:

- (1) Development of NARS capacities to produce breeder's seed (three countries by 1995, seven countries by 1998);
- (2) Review variety release procedures and propose amendments necessary to speed the availability of improved cultivars to seed producers and farmers (1995);
- (3) Extension aids developed with NARS for promoting improved sorghum and pearl millet cultivars and management practices (1994 and on-going);
- (4) Training in seed production (1994 and 1996);
- (5) Monitor the distribution and adoption of improved varieties with periodic summary status reports (1995 and 1998);
- (6) Impact assessments of sorghum and pearl millet technology adoption patterns and constraints (3 countries by 1995, 6 countries by 1998);
- (7) Collaborative training workshops on impact assessment with SACCAR (1994,1996);
- (8) Verification of farmer's acceptance of improved sorghum and pearl millet cultivars recently released in Namibia, Zambia and Zimbabwe (1994) and of sorghum cultivars about to be released in Malawi (1995);
- (9) Advanced testing of improved cultivars leading to release of new varieties of sorghum and/or pearl millet in Botswana, Lesotho, Mozambique and Tanzania (1994-1997);
- (10) NARS breeding programs for sorghum and pearl millet are better targeted in at least four SADC countries by 1995 and in all SADC countries by 1998;
- (11) Extension recommendations for sorghum and pearl millet reviewed in all SADC countries<sup>3/</sup> (1995);
- (12) Extension recommendations revised in at least four SADC countries (1998);

OUTPUT 2. Integrated sorghum and pearl millet improvement research programs<sup>4/</sup>.

Whereas Phases I and II of SMIP established sound and viable research programs at the regional center, Phase III seeks to devolve substantial responsibility for those research programs to the NARS. The regional program will not continue to have core staff with expertise in agronomy,

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<sup>3/</sup> Except Angola, until the internal conflict is resolved.

<sup>4/</sup> Output 2 is drawn from the overall discussions in the proposal and cuts across all objectives.

food processing and grain quality<sup>5</sup>/. On subjects such as plant breeding and pest management, research operations will be shared between SMIP and the NARS. By the end of Phase III, the regional program will be monitoring the sorghum and pearl millet improvement programs of the ten NARS and providing support functions which are more efficiently conducted at the regional level.

SMIP will be available to assist NARS in reviewing, planning and strengthening the management of pearl millet and sorghum research programs. Activities include i) training workshops on farmer participatory research; ii) monitoring tours of farmer test locations; and iii) analysis of test results. Advisory services, primarily provided by national sorghum and pearl millet research staff with backstopping from SMIP, will assist agencies operating with farmers in modifying the selection of technologies for specific areas in the light of the results from the farmer tests. The involvement of SMIP and NARS staff in this process will help ensure a rapid response in making the adjustments that should be expected in most instances.

SMIP services will strengthen internal NARS linkages between the commodity research programs with farm level adaptive research activities and on-farm testing as it builds information systems for monitoring the performance of shared research programs and technology transfer. The regional program will be available to assist NARS sorghum and pearl millet programs in planning and budgeting exercises to better ensure that priority activities are financed and conducted in a cost efficient manner.

The regional program has played an important role in respect to human resources development for the NARS during Phases I and II. Phase III will emphasize improving performance and creativity among the more than 90 national scientists that received degree training through SMIP. Collaborative activities include the development of research program and project workplans, reviews of research results and analysis, and networking activities within the region.

Major implementation actions:

- (1) Collaborative workplans will be developed with each of the SADC NARS except Angola (1993);
- (2) Special topic seminar in research planning, monitoring and evaluation (1994).
- (3) Special topic seminar in methods of data analysis (1995);
- (4) NARS will gain access to the world database of scientific literature on sorghum and pearl millet (1994);
- (5) Establishment of a collaborative NARS-SMIP working paper series aiming to distribute key research results of regional significance (established in 1994).
- (6) Regional sorghum and pearl millet improvement network coordinated by NARS scientists aiming to exploit complementarities in the research foci of each national program (under NARS guidance by Phase IV).

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<sup>5</sup>/ However, studies and advisory assistance in these areas may be supported by SMIP during Phases III and IV, as needed.

**OUTPUT 3.A. Provision of improved sorghum and pearl millet cultivars and genetic material<sup>6/</sup>.**

This output has been central to the project from its inception and will continue after the end of the project. Continued progress in developing genetic materials is essential for sustainable improvements in productivity. Germplasm improvement received emphasis in Phases I and II and resulted in the production of the current stock of cultivars which are the basis of technology transfer efforts.

In Phase III, decision-making for the breeding program is being progressively shifted to NARS sorghum and pearl millet programs who in turn will be guided by feedback from the technology transfer efforts. SMIP and NARS research program workplans and reports will indicate the effectiveness of these linkages in producing results in station based research that reflect farmer needs.

The ICRIAT will (in collaboration with SADC Regional Gene Bank) complete the collection, analysis and documentation of indigenous cultivars. SMIP will also facilitate the exchange of germplasm within the region and with world germplasm collections as a regional center function.

Major implementation actions:

- (1) Assist NARS with the completion of advanced testing of improved cultivars and the compilation of documentation for release (aiming toward the release of new cultivars in at least four SADC countries by 1998).
- (2) Assist NARS to re-target breeding priorities and develop a genotype base encompassing priority grain and plant traits (re-targeting completed in at least four countries by 1995, seven countries by (1998).
- (3) Breeding lines with drought resistance traits available for testing in Zimbabwe and Botswana (1997).
- (4) Develop breeding lines for long season pearl millet production zones of Tanzania (initial selection completed by 1995).
- (5) ICRIAT Genetic Resources staff will collaborate with the SADC Gene Bank and International Board for Plant Genetic Resources (IBPGR) to complete supplementary germplasm collections in Malawi and Tanzania (1996).
- (6) Striga resistance incorporated into better agronomic material for use by NARS (1997).

**OUTPUT 3.B. Integrated technologies for pest management**

Previous phases of SMIP have provided valuable information in combatting the many diseases and pests which attack sorghum and pearl millet (insects, weeds, diseases and nematodes). Phase III will lead to a more focused, integrated program to be continued at the regional center, but linked to the specific needs of the NARS. The mode of operation is similar to that being followed by the breeding program (OUTPUT 3.A).

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<sup>6/</sup> Outputs 3a and 3b are a translation of objectives 2,3, and 4.

Major implementation actions:

- (1) IPM systems for the control of armoured cricket recommended for adoption in Zambia (1995) and Namibia (1996).
- (2) On-farm testing of IPM packages for Striga in Zimbabwe (1996) and Tanzania (1997).

OUTPUT 4. A Sustainable Regional Sorghum and Pearl Millet Research Program and a Viable Plan for the Future of SMIP Facilities at Matopos Station<sup>7</sup>.

As USAID funding is progressively reduced during Phases III and IV, SMIP and SACCAR are actively exploring options for sustaining the SMIP facilities at the Matopos Station in cooperation with the Department of Research and Special Services (DR&SS) of Zimbabwe. As the size and scope of SMIP operations at the station are reduced and attention shifts more to interactions with national organizations, the facilities required will be less than those developed and utilized during Phases I and II.

Several possibilities are being considered for the future use of the Matopos facilities, including its conversion into a SACCAR training and research center serving the needs of several regional programs, including SMIP. DR&SS is interested in using a portion of the facilities. It is understood that SMIP needs will take precedence in determining the future of the Matopos facilities. These and other possibilities will be assessed through a consultancy mission commissioned by SACCAR for September 1993.

With reference to the future of SMIP itself, the proposal offers two options, notably

- (1) Network staffed by one full time coordinator based at Matopos with a modest budget for meetings and communications. No core research activities, but collaborative research among NARS researchers and the network coordinator.
- (2) Small Core Regional Program with a Network staffed by 3 or 4 scientists based at Matopos who would conduct research in 1 or 2 high priority areas and operate a network.

Either scenario could accommodate a flexible capacity to service public and private institutions concerned with sorghum and pearl millet research and development in the member countries, specifically tailored to the needs and resources of specific clients. The flexible capacity could be expanded and contracted in response to levels and timing of effective demand. In essence, SMIP could be contracted by an institution to carry out services with support from that institution.

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<sup>7</sup>/ Output 4 is based on objectives 2,3,4 and 5, and will in the longer term be greatly influenced by the result, of output I - also see discussion of sustainability in the project proposal.

**Key implementation milestones:**

- (1) Reduction of professional and scientific staff on SMIP funding (1993).
- (2) One or more ICRISAT core staff based at Matopos mid-1995.
- (3) Plan for the longer term use of SMIP-Matopos facilities agreed with SACCAR and the Government of Zimbabwe (1994).
- (4) SACCAR plan for sustaining SMIP with the phase-down of donor support acceptable to AID (Sept. 1994).

**1.4. PROJECT STRATEGY AND MAJOR ASSUMPTIONS**

The central elements of the project strategy are:

- (a) Improved sorghum and pearl millet cultivars have been developed and have sufficient productivity increasing potential for rapid adoption by farmers; and
- (b) Public and private input distribution and information dissemination channels exist to test and extend available technologies to a substantial number of pearl millet and sorghum producers in the region.

SMIP will play a catalytic role in moving sorghum and pearl millet technologies to farmers by making information and cultivars available and assisting a range of national organizations in fulfilling their responsibilities through advisory and backstopping services. SMIP is accountable to see that the necessary arrangements are made to alleviate constraints and exploit opportunities in the technology transfer and adoption processes.

Major assumptions include:

- 1) Technology transfer channels will operate adequately to transfer improved sorghum and pearl millet technologies to farmers with assistance from the project in the provision of breeders seed and on-farm-testing methods. Channels for transferring technology under consideration include the public sector extension service as well as seed companies, farmer's organizations and other NGOs. Existing channels are considered adequate to reach the estimated number of farmers required in order to have the magnitude of impacts expected from this project effort<sup>8/</sup>.
- 2) NARS bilateral programs financed by various donors will improve the management, incentives and performance levels of NARS. Improvements will also take place which will make research agendas more client oriented as a consequence of reforms in extension organizations; liberalization of policies influencing prices and input supplies; and the expanded participation of the private sector in adaptive research and promotional activities. Collectively these changes will increase the effective demand for technologies

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<sup>8/</sup> USAID/SARP has scheduled a special evaluation report and analysis on technology transfer efforts of the project at the end of the second year. This report will be a major input into the mid-term evaluation.

and pressures on NARs to perform.

- 3) Efforts to maintain soil fertility in the drier areas of the SADC region will continue and will result in at least no significant deterioration in soil fertility throughout the region.

The degree of change predicated by the end of this project will be affected by the following factors which are outside the control of project management, USAID, ICRISAT and SADC:

- (a) Major adverse changes in environment (such as the recent drought);
- (b) Progress in settling civil wars (particularly Angola and Mozambique);
- (c) Progress with structural reform and policies toward liberalizing their national economies;
- (d) Peaceful and orderly transition to democracy throughout the region, particularly in South Africa.

#### 1.5. PROJECT INPUTS

The project inputs are the estimated amount of funding required to implement Phases III and IV are indicated in the adjoining box.

Other sources include contributions from the NARS and SADC member states to the core budget and revenue from the provision of materials and services to public and private agencies.

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#### SMIP SOURCES OF SUPPORT 1993 - 2003

USAID	\$10,729,670
CIDA	1,049,372
BMZ/GTZ	<u>3,122,109</u>
Sub-Total	14,901,151
Others	<u>3,000,000</u>
Total	17,901,151

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## 2. PROJECT ANALYSIS

This section considers the technical, economic, social and institutional feasibility of the project supplement. The key questions regarding this extension of SMIP whether -- after ten years and a \$30 million investment by USAID -- it is possible to confirm that the sorghum and pearl millet technologies which the project is developing are feasible, appropriate, and sound; and that the capacity, resources, policies and procedures are in place or are adequately addressed by the proposal to give one confidence that these technologies will be successfully transferred through a variety of organizations to farmers throughout the drier regions of the SADC member states.

The conclusion of the analysis based on a review of the proposal supplemented by other documents and extensive discussions with staff of SMIP and national institutions, confirm that the answer to the above questions is "yes". Specifically, the analysis confirms the following:

- > The range of pearl millet and sorghum cultivars developed by SMIP and NARS, have the desired traits, (e.g. high yields, stover value, grain quality, pest resistance, short duration, drought tolerance, compatibility to the various soil groups in the SADC region, acceptable storage and processing characteristics, and versatility for multiple uses including human food, animal feed, and industrial uses).
- > The crop management practices developed, notably in the area of pest and disease control, will be attractive and useable by the majority of farm families in the drier areas of the region where sorghum and pearl millet are currently produced.
- > SMIP has profoundly shifted its focus away from on-station research to technology transfer in collaboration with a broad range of agencies concerned with agricultural production in the member states (e.g. research, extension, NGOs, seed companies, etc.) in an effort to expose large numbers of farmers to the improved cultivars and management practices.
- > The breadth and magnitude of the response from national institutions to the emphasis being placed on technology transfer give one confidence that there will be extensive coverage by adaptive research and promotional activities during Phase III, in spite of the inevitability of problems and setbacks in specific countries and institutions. Peace-making and policy/institutional reform efforts throughout the region are creating conditions which are conducive to the rapid dissemination of technologies which address farmers' constraints and needs. The sorghum and pearl millet technologies currently available are of this character.
- > Adoption of the innovations will result in improvements in productivity of sorghum and pearl millet production in excess of 20% when rainfall is average to low. In higher rainfall years with improved management practices and cultivars, increases in returns to land and labor could easily exceed 100%.
- > Perhaps most significantly from a food security perspective, the improved short duration cultivars can "escape the drought" and produce a crop in years when the rains are too short for traditional varieties to survive. This latter feature will drive the initial acceptance of the innovations throughout the region more than any other factor. Farmer response to on-farm tests of early maturing varieties to date strongly confirm the interest and

willingness of poor farmers in drought-prone areas to include these cultivars in their cropping systems. The use of these varieties could dramatically reduce shortfalls in food supplies in drought years with substantial savings in foreign exchange and government revenues and improvements in nutrition for the most at risk portions of the rural populations.

The analysis reveals one major area of concern, namely the SMIP staff time requirements associated with i) technology transfer; ii) the development and implementation of integrated research programs with individual NARS which are closely linked to progress in technology transfer through on-farm research and monitoring and evaluation; and iii) mobilizing resources from regional sources as donor funding phases down (sustainability). Sound strategies have been developed to address these three areas which are detailed in the proposal and discussed throughout the analysis section. There is good evidence based on responses from farmers, NARS and other public and private agencies, that cooperation will be forthcoming. However, it is not possible for the SMIP staff to provide the leadership needed to move forward in all these areas simultaneously. In each member state the leadership must be provided by one or more national organizations with SMIP playing a supporting role. The rate of progress depends to an important extent upon the degree of "simultaneous combustion" that takes place, both in the spread of innovations among farmers and through improvements in the performances of national research and development institutions.

SMIP is providing the basic technologies and setting the stage for their adaptation to a range of farming systems and eventual successful dissemination throughout the region. These technologies and framework offer national agencies a special opportunity for productive interaction with each other and SMIP resulting in impacts on agricultural productivity which will reflect credit on the institutions and individuals involved. Not every institution will seize this opportunity with the same enthusiasm and dedication. Some will require extensive "handholding" that SMIP is simply not in a position to sustain for more than a handful of institutions over relatively brief periods of time.

SMIP's comparative advantage is clearly to work with sorghum and pearl millet improvement programs in NARS, and it is appropriate that colleagues in these programs have been selected to play leading roles in the technology transfer activities. However, in the interests of broader participation in the transfer process and expansion of exposure to the new technologies, SMIP is actively seeking to involve other actors, notably extension services, NGOs, agri-business concerns and farmers themselves from the onset in the initial set of planning meetings with national programs on technology transfer. These meetings are already underway and will cover half the member states by mid August. With the possible exception of Angola the remaining countries will have meetings during September and October.

Several of these organizations have solid records of performance and are staffed by individuals who respond quickly to opportunities. It is among this group that a high degree of "simultaneous combustion" must take place for the SMIP strategy to be successful. These organizations must have ready access to materials (notably seed) and information required to test technologies on-farm. They may need access to advisory services on rapid rural appraisal and running simple on-farm trials, where they do not already have experience in these areas. But they must be prepared to pay for these services; take the initiative in arranging for them to be provided in many instances; and then run with them.

Initial success can in turn provide the positive, facilitating environment that is required to move reforms in NARS and extension services forward and strengthen support for an integrated regional research program. SMIP prospects for being sustained rest upon improvements in perceptions by national clients and stakeholders of the value of agricultural research and a greater appreciation by NARS of the extent to which regional approaches to research can be a cost-effective means to enhance their performance and status.

SMIP's role in this process is necessarily limited. Sorghum and pearl millet are commodities of secondary or tertiary importance in research and development plans in most of the countries of the region. However, SMIP can serve as a dramatic illustration of the power of correctly targeted innovations and the potential of regional collaboration in research. The high yielding, early maturing cultivars are the "match" which can ignite the chain of combustion leading to widespread adoption of innovations, positive impacts on food security and incomes, and an integrated set of sorghum and pearl millet research programs which are supported largely from sources within the region.

The mobilization of SMIP resources to focus on technology transfer and the willingness of SMIP to play an "entrepreneurial role" across the range of constraints to successful dissemination of innovations throughout Southern Africa is needed and welcome. However, this is a daunting task by any standard. SMIP may wish to consider allocating an even higher percentage of its resources, up front, in support of technology transfer activities, including studies of constraints, training programs in adaptive research, monitoring of progress and staff travel. Increasingly, it is anticipated that other agencies will cover the costs of these activities, but significant SMIP resources and specifically staff time, will be required just to make the arrangements so that activities can proceed with support from other sources.

An example is the whole area of seed production and distribution which is critical to the success of the entire effort. SMIP can support studies and training in this area in addition to providing breeders seed, but it is anticipated that an impressive range of problems will emerge which are beyond SMIP's capacity to address without additional resources.

SMIP should not revert to being a donor or undertake large scale seed production itself. The program does not have the resources to do so in any event. SMIP can commission studies to assess problem areas and propose solutions. Further, SMIP staff will be called upon to provide the initial follow up on studies and recommendations.

To fill this role, SMIP needs the resources to access additional capacity, as required. A substantial portion of this capacity can come most cost effectively from institutions within region. SMIP can utilize advisory services from organizations such as the Seed Cooperative in Zimbabwe, universities and research institutions, as needed, to assist in addressing the range of technology transfer issues throughout the region. In this fashion, the demands upon SMIP staff time can be kept in reasonable bounds and the core technology generation programs which constitute SMIP's longer term area of comparative advantage can be sustained, albeit at a reduced level.

During the initial years of Phase III, SMIP should explore complimentary sources of support for such advisory services. An effort could be made to contact USAID missions in the SADC region to discuss access to bilateral local currency funds for sorghum and pearl millet technology transfer efforts during Phase III. Priority attention should be given to ensuring adequate supplies of seed.

Increasingly, NARS and other public and private agencies should provide the necessary support, especially where the issues are country-specific in nature (e.g. pricing and trade policies). SMIP's role would be more to initiate interest in such studies and services in the course of reviewing the potential and obstacles to adoption of improved innovations for the sorghum and pearl millet sub-sectors. In the process, a number of common themes will emerge, which might be most effectively addressed at the regional level under the auspices of SMIP or SACCAR.

The concern about demands on SMIP staff time notwithstanding, the project is deserving of support and is strongly recommended for approval. The subsections which follow consider the technical, economic, social soundness and institutional dimensions of the proposal. A final subsection examines the prospects for sustaining a regional sorghum and pearl millet research program as donor funds phase down. The analyses were completed with the participation of the SMIP staff and draw extensively upon documentation prepared by them.

## 2.1. TECHNICAL ANALYSIS

2.1.1. Suitability of Technologies: SMIP and NARS in SADC countries have developed and field tested open pollinated varieties and hybrids with the basic characteristics for successful dissemination to farmers throughout the drier areas of the region. By the end of 1992, 143 sorghum cultivars, 124 pearl millet cultivars and 73 sources of resistance to pests and diseases were made available to national programs. Improved varieties and hybrids that have been formally released for promotion or are in testing on-farm in 9 of the 10 member countries are detailed in Table 1. Special attention has been given to yield stability under stress and pest resistance. Yield differences between improved cultivars and local varieties range from 20% to over 100% under comparable levels of management and rainfall.

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**TECHNOLOGIES, INCLUDING IMPROVED VARIETIES AND CULTURAL PRACTICES, ARE AVAILABLE WHICH ARE SUITABLE FOR USE BY FARMERS ACROSS A RANGE OF FARMING SYSTEMS.**

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No one variety has all of the desired traits. The project is supporting the selection and breeding of varieties for specific climates, soils, pest problems, and uses. Although considerable progress has been made to date, there is a need to continue germplasm improvement efforts, specifically to adapt and select among the available lines to meet the requirements of different areas and client groups. Collectively, these cultivars are designed to fill a broad range of ecological and socio-cultural "niches" in farming systems throughout the region.

Equally important, is the identification of management practices (e.g. planting date, weeding, pest control, fertilization, etc.) necessary to realize the response potentials of the improved varieties. In the area of pest management, simple approaches have been developed for the control of armoured cricket which are being field tested and extended in cooperation with national research and extension organizations in Zambia and Namibia.

**Table 1. Number of sorghum and pearl millet cultivars released, in on-farm or advanced testing in the SADC countries, 1992<sup>a/</sup>.**

Country	Sorghum			Pearl millet		
	Released	In on-farm tests	In advanced tests	In on-farm Released	In advanced tests	tests
Angola	0	0	0	0	0	0
Botswana	8 (0)	7 (100)	22 (77)	1 (0)	1 (100)	12 (100)
Lesotho	3 (0)	2 (100)	10 (60)	0	0	0
Malawi	4 (25)	1 (100)	10 (100)	3 (0)	2 (100)	18 (33)
Mozambique	5 (80)	0	6 (100)	1 (0)	0	0
Namibia	1 (0)	0	24 (79)	2 (50)	5 (100)	56 (100)
Swaziland	4 (75)	0	4 (0)	0	0	0
Tanzania	5 (20)	4 (50)	23 (35)	1 (0)	0	20 (50)
Zambia	7 (71)	7 (75)	100 (0)	2 (100)	1 (100)	100 (0)
Zimbabwe	8 (38)	7 (57)	144 (7)	3 (33)	7 (71)	114 (14)

a/ Figures in parenthesis indicate percentage of cultivars developed by ICRISAT/SMIP.

Evidence in the form of the results of farmer tests in approximately half the member countries during the past few seasons, strongly supports SMIP's contention that this basic set of innovations will prove attractive to large numbers of farmers. However, the targeting of cultivars to fit specific conditions throughout the region will be required. Special emphasis during Phases III and IV will be given to the selection and adaptation of varieties and cultural practices to different farming systems throughout the SADC region through a network of on-farm

testing and demonstrations of innovations involving collaborators from both the public and private agencies. Germplasm will be tested on-farm and "re-targeted", as required, in accordance with farmer responses<sup>9/</sup>.

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**BROAD PARTICIPATION BY RESEARCH AND DEVELOPMENT AGENCIES IN ON-FARM TESTING OF TECHNOLOGIES WILL BETTER ENSURE RAPID ADAPTATION AND DISSEMINATION THROUGHOUT THE SADC REGION.**

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#### **2.1.2. Technology Transfer:**

In July-October, 1993, national programs are organizing in-country workshops, one for each of the member countries to develop programs during which representatives of research, extension and development organizations - both public and private - will meet with representatives of SMIP to work out plans for the on-farm testing and extension of the new technologies. During the initial 2-4 day sessions, participating organizations will review the range of technologies available and be invited to develop individually-tailored programs of testing and dissemination of technologies. Special attention is being given to the development of linkages with a broader range of national research and extension programs, including seed companies and NGOs, in order to speed the process of technology release and adoption.

NARS institutions and particularly the staff of the national sorghum and pearl millet improvement programs will play central roles in this process. Virtually all the current set of national research staff have received either short or long term training offered by SMIP during Phases I and II and over 90 have returned to their institutions with advanced degrees, mostly from US universities. In several instances, cultivars and practices have already undergone on-station testing, selection and adaptation by NARS researchers and have emerged from the national systems as formal releases and extension recommendations (See TABLE 1).

However, weaknesses in both research and extension organizations and the linkages between them have contributed to delays in the process by which new technologies reach farmers in several countries. In order to improve performance, the recently formed SMIP Steering Committee (which is composed of leaders of NARS Sorghum and Pearl Millet Research Programs) has directed SMIP to give priority to technology transfer in Phase III.

Participation in the full range of activities is being extended to encompass a broad range of public and private institutions to better ensure that large numbers of farmers are exposed to the new technologies. These activities which include on-farm testing of technologies, planning of promotional efforts, (notably seed), and monitoring of impacts, will take place within the contexts of collaborative agreements between SMIP and the NARS in each of the member states.

It is anticipated that the bulk of the on-farm testing and subsequent promotional efforts will be implemented by the staff of development agencies, including extension services, NGOs and seed companies in collaboration with farmers. In most instances, the staff of these agencies will not have the training or the interest to systematically address the research or analytical dimensions of the on-farm testing. The central question is clearly whether farmers like what they see in the tests sufficiently to adopt specific technologies. However, information

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<sup>9/</sup> The re-targeting process involves selection of alternate cultivars for farmer testing in specific locations in response to feedback from on-trials during the preceding season.

from these tests is required to guide decisions about promotional efforts, inputs, and research directions.

The quality of the technologies already available combined with a proactive and collaborative approach to the transfer of these technologies to large numbers of farmers in the region, give one confidence that adoption targets and impacts will be attained prior to the conclusion of Phase IV. A recent consultancy report notes "from...discussions with farmers (in Zimbabwe and Namibia), it is apparent that there is very broad and strong interest in the new, early maturing cultivars developed in the region in the last ten years. Spontaneous adoption is already occurring... (with) excellent potential for adoption and impact... over the next 5 years."<sup>10/</sup>

**2.1.3. Backstopping and Feedback:** Backstopping from SMIP and national sorghum and pearl millet research staff will be provided through training workshops on farmer participatory research; monitoring tours of farmer test locations; and simple analysis of test results. Advisory services, primarily provided by national sorghum and pearl millet research staff, will assist agencies operating with farmers in modifying the selection of technologies for specific areas in the light of the results from the farmer tests. The involvement of SMIP and NARS staff in this process will help ensure a rapid response in making the adjustments that should be expected in most instances.

In the process, the demand for technologies should strengthen and the credibility of the research institutions enhanced. Feedback from on-farm testing and promotional efforts will serve to focus research themes and assessment criteria more sharply on alleviating constraints and exploiting areas of flexibility in different farming systems as these are perceived by farm families. This information is needed for the preparation of national sorghum and pearl millet improvement program plans and in turn to refine the divisions of labor between SMIP, NARS and other agencies at the national and local levels which will most efficiently address these needs.

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**FEEDBACK FROM ON-FARM RESEARCH WILL  
GUIDE SMIP AND NATIONAL RESEARCH  
AND PROMOTION PLANS TO SHARPEN  
FOCUS ON FARMER NEEDS**

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SMIP's efforts will extend to assessing constraints to the use of innovations within the sorghum and pearl millet sub-sectors, including inputs, markets, storage and processing, and the performance of research and development agencies. Pricing and marketing policies are being reformed to remove distortions which favor maize in some countries. The current situation with respect to marketing and pricing policies in member states is summarized in Table 2. Possible delays in this process notwithstanding, there are no apparent serious obstacles to successful technology dissemination at the present time, aside from those that are explicitly addressed by this proposal, namely improvements in technology transfer, seed availability and NARS performance.

SMIP's mandate, resources and capacity limit the extent of its ability to address several of the potential areas of difficulty. However, the

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<sup>10/</sup> from "A Review of the SADC/ICRISAT Sorghum and Millet Improvement Program (SMIP) Collaborative On-Farm Research Activities" | G.M. Heinrich, SMIP consultants' report, 5/5/93, p 19.

program can play a key "entrepreneurial role" in the identification of problems and potential solutions and ensuring that this information is brought to the attention of national level decision-makers, donor representatives and NGOs who are in positions to take corrective

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**SMIP WILL PLAY AN ENTREPRENEURIAL  
ROLE IN ASSESSING PROBLEMS AND  
OPPORTUNITIES ASSOCIATED WITH  
TECHNOLOGY TRANSFER EFFORTS**

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measures. In this capacity, SMIP will commission studies, host workshops and provide advisory assistance aimed at facilitating the dissemination of innovations. Examples include studies of markets and prices, a number of which were undertaken during Phase II; assessments of NARS technology release procedures; and advisory assistance on seed production and distribution.

**2.1.4. Future Research Programs:** The current promotion and on-farm testing activities are designed to provide feedback into SMIP and NARS research program plans. It is probable that the feedback will suggest a research agenda for sorghum and pearl millet which is considerably beyond the combined capacities of regional and national sorghum and pearl millet research teams, as currently structured. In order to make the most of the modest resources which it is anticipated will be available for research on these commodities during the coming decade, priorities must be established and divisions of labor worked out such that NARS and SMIP researchers can, in effect, work together on the priority research themes. These themes will change over time as solutions are found and new priorities emerge.

Currently, SMIP's ability to address research themes is delineated by the number of core staff and their areas of specialization. This capacity is some what smaller and narrower in terms of disciplines than during Phases I and II which is consistent with the decisions of SACCAR and the SMIP Steering Committee and with the realities of prospective resource constraints. It was envisaged from the onset that the SMIP core program would get smaller as NARS capacities increased.

Given the resource constraints which virtually all the sorghum and pearl millet improvement programs in the NARS will continue to face, the choice for most is to either work together with each other and SMIP or confine themselves to modest portions of adaptive research and varietal screening. NARS managers will increasingly realize that ambitious research projects requiring a critical mass of researchers and continuity of resources will be difficult or impossible to sustain at the level of the individual NARS and face a high risk of failure at a time when success, results and impact are essential for institutional survival.

**Table 2. Cereal Pricing and Marketing Policies in SADC Member States**

Country	Parastatal	Trade Regulation	Price Regulation	Infrastructure support	Subsidies	Other Comments
Angola	?	?	?	?	?	?
Botswana	BAMB	Import Restriction; Strategic Grain Reserve	Floor producer price	Depots maintained	Implicit on loss making activities	
Lesotho	Coop Lesotho	Import Restriction	Floor prices	Selling off unprofitable (outlying) depots	none?	Stated commitment to liberalize and end subsidies
Malawi	ADMARC	?	Floor prices	Closing unprofitable depots	?	Stated commitment to liberalize and end subsidies
Mozambique	AGRICOM	Deregulation of grain trade	Floor price for maize	Limited finance for grain purchase	?	Stated commitment to liberalize
Namibia	Agronomic Board	Regulation being considered	Establishing Floor Prices	Establishing depots in the north	Implicit on loss making millet trade	Considering firmer system of market support with possible controls
Swaziland	NMC	?	Floor Prices	Limited cooperative support	none?	
Tanzania	NMC	Deregulating trade; except Strategic Grain Reserve	Floor price for maize	Closing some outlying depots; some refuse grain	On strategic grain reserve?	Stated commitment to liberalize and end subsidies
Zambia	Provincial Coops; ZCF	Deregulated trade	Floor price for maize; control status unclear	Closing unprofitable cooperative depots; limited finance for grain purchase	On maize to maize millers	Stated commitment to liberalize and end subsidies
Zimbabwe	GMB	Limited deregulation - of trade in outlying regions and for small grains	Maize prices fully controlled; floor prices for small grains except finger millet	Closing unprofitable depots or collection points	On maize to millers	Stated commitment to partial liberalization and ending of subsidies

SMIP can assist in moving toward a truly integrated regional research program for sorghum and pearl millet during Phase III by having resources to contribute to regional research task forces brought together to address emerging research priorities<sup>11</sup>. SMIP core staff may participate in these task forces which will have a specific time-frame and terms of reference in each instance, but it is essential that the major burden of task force leadership and research fall on others, notably NARS researchers themselves. NARS will contribute, notably in terms of staff time and facilities, but initially SMIP resources may be required for operating expenses of such task forces, to the extent it is problematic or impossible to efficiently access these from national sources. The reforms in planning and financial management for regional and national research programs now in progress will make it increasingly feasible to pool resources in accordance with the results of research plans and priorities.

## 2.2. ECONOMIC ANALYSIS:

**2.2.1. Competitive Advantage of New Technologies:** As discussed in the technical analysis, the use of the new cultivars alone will substantially improve productivity and reduce production costs compared with existing varieties in virtually all weather scenarios, except the most severe drought conditions (where both local and improved varieties fail). The productivity increases range from 10% to over 100% depending on the duration of the cultivar and the weather conditions. Under improved management and fertility levels, the productivity gap widens substantially under normal and high rainfall conditions.

Thus for farmers who are already growing pearl millet and sorghum there is a clear and strong advantage to using the improved technologies. For farmers who are unable to afford fertilizer and/or choose not to invest the additional labor time required for better management, there is still an advantage to using the improved cultivars. This is especially the case with the short duration cultivars which produce a modest crop under low rainfall conditions while the longer duration locals fail as is illustrated by Figure 1. Feedback from on-farm trials of improved germplasm during the past season in Zimbabwe and Namibia strongly confirm this observation and give one considerable confidence that the adoption of early maturing cultivars will proceed very rapidly in drought-prone areas.

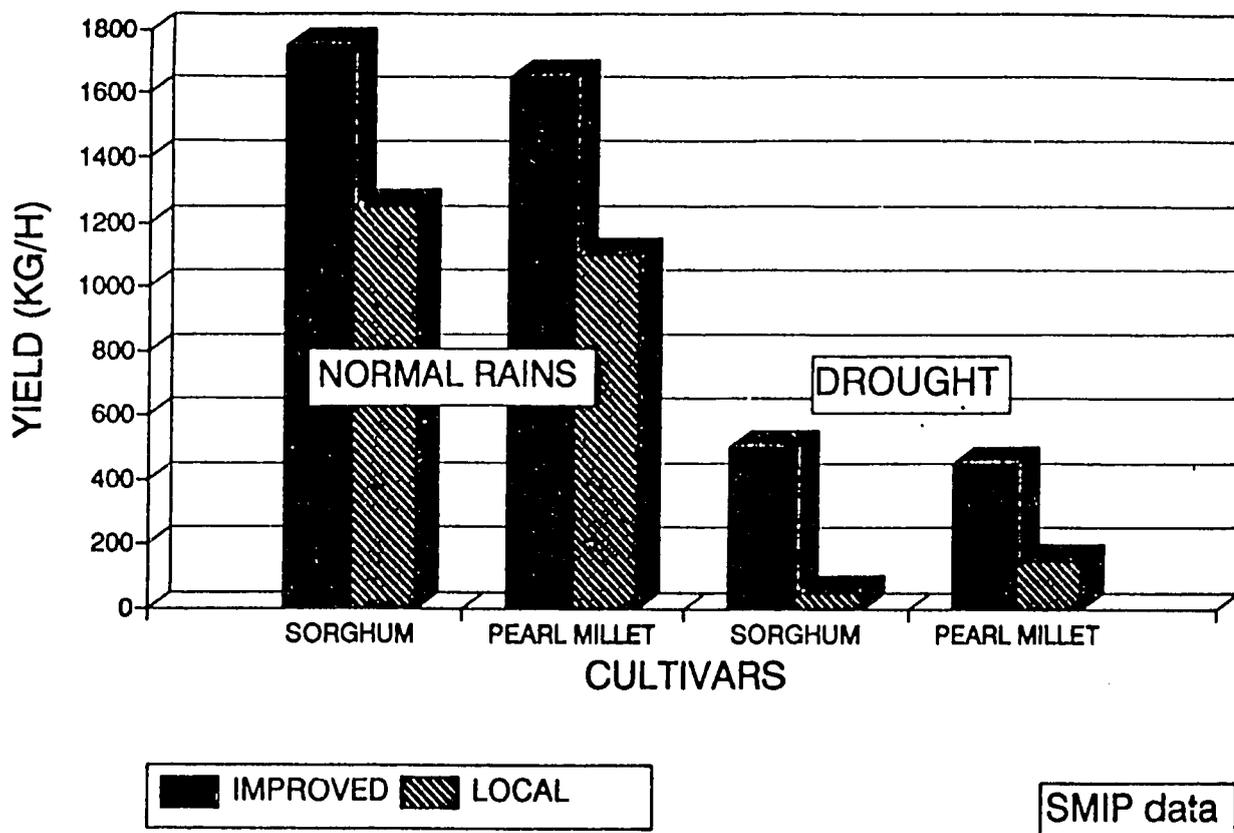
As farmers throughout the semi-arid regions already know and practice, planting a selection of varieties with a range of maturities and other characteristics is a preferable strategy for dealing with uncertain weather conditions, than reliance on a single cultivar. Different maturities allow farmers greater flexibility in the time of planting and other operations, thus giving them the option of expanding area by alleviating seasonal labor bottlenecks. Admittedly, certain of the proposed management practices call for additional labor inputs during the peak labor periods which may limit their acceptability among farmers who do not have the means to engage additional labor or traction, or do not perceive the returns to the improved practices to be great enough to justify diversion of resources from other enterprises.

The experiences with the spread of improved maize cultivars suggests that farmers will continue to use local varieties and gradually expand the use of improved cultivars that they find attractive on portions of their land

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<sup>11</sup>/The regional research task force concept is discussed further in section 205 (Project sustainability)

FIGURE 1: COMPARISON OF YIELDS  
NORMAL AND LOW RAINFALL

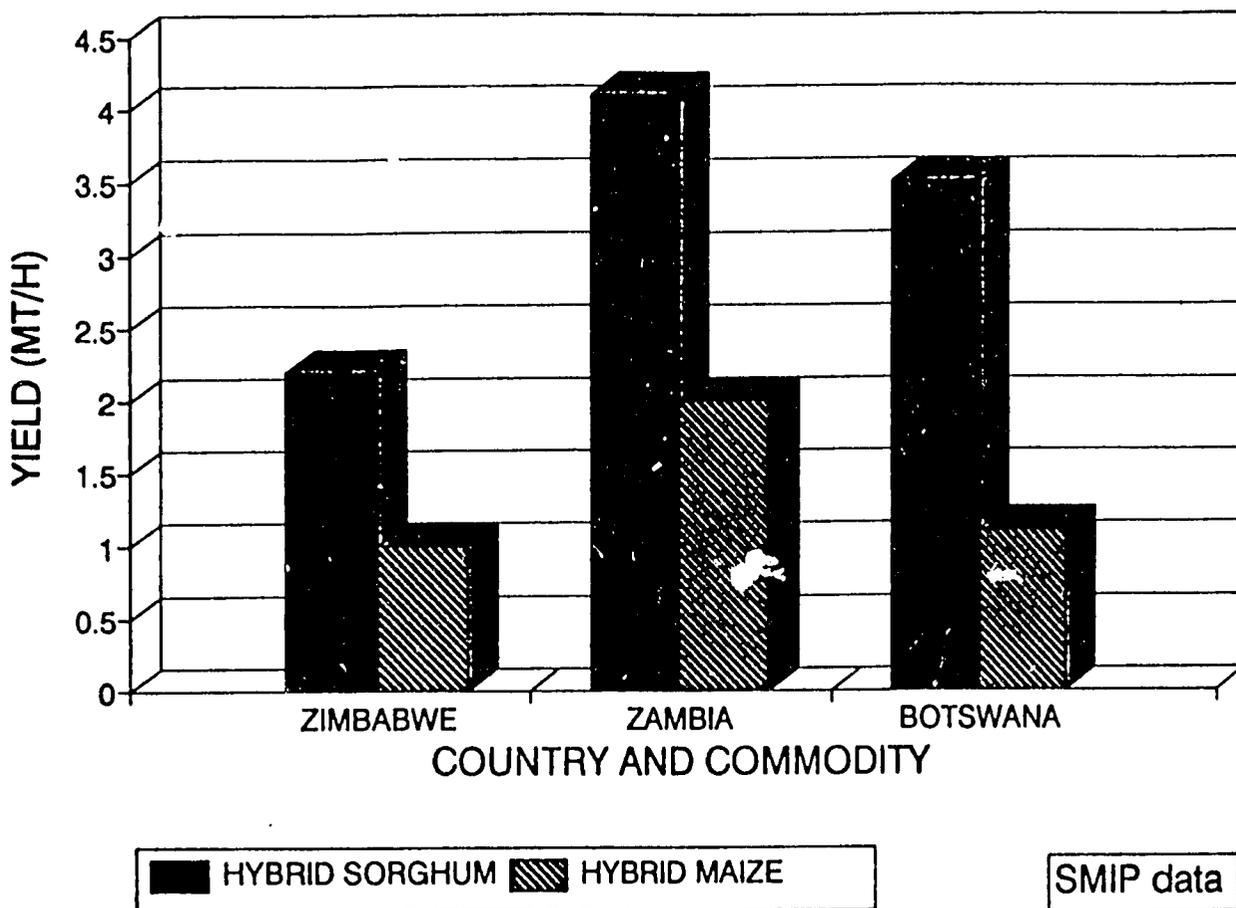


under sorghum and pearl millet. However, the improved cultivars currently available offer producers a broad selection of maturities and other characteristics from which to choose. The precise choices are likely to be guided by resource endowments of specific households as well as by general ecological conditions. This underlines the importance of offering farmers a number of alternatives with respect to cultivars and associated practices. Alternatives are especially important during the on-farm testing, but can also continue in the promotional stage.

Use of improved cultivars improves the competitive position of sorghum and pearl millet vis-a-vis other commodities, notably maize as is illustrated by Figure 2. The improvement is particularly dramatic at the two ends of the spectrum, notably low and high management and rainfall. The use of the improved cultivars makes sorghum competitive with maize under high levels of management. While sorghum may, in fact, make some inroads in the higher potential areas, it is anticipated that maize will continue to dominate in the high rainfall farming systems. However,

small, low resource farmers in more marginal areas, are expected to shift a portion of their land currently under maize to sorghum and pearl millet as a direct response to the improved returns from use of the new technologies. For simplicity, area shifts are not taken into account in the economic rate of return calculations, although their effect will clearly be to improve the rates of return.

FIGURE 2: YIELDS OF SORGHUM AND MAIZE  
AVERAGE FOR 1990/91-91/92 SEASONS



Repeal of policies currently favoring maize in selected countries will further strengthen the competitive position of sorghum and pearl millet. However, the impact of these changes on land allocation decisions is likely to be much greater among commercial producers than with subsistence farmers in marginal areas, many of whom are currently net buyers of staple food. Maize market liberalization will increase the cost of purchasing food by deficit households since maize prices are expected to increase. Increases in maize prices will strengthen incentives for farmers to use short maturity varieties of sorghum and pearl millet to reduce the need to purchase food, especially in low rainfall years.

**2.2.2. Prospective Regional Production and Trade Impacts:** The Phase III proposal includes an assessment of potential impacts of improved varieties of sorghum and pearl millet with an emphasis upon those which have already been developed and are currently being disseminated. The rate of return analysis examines three scenarios which yield rates of return of over 25% and benefit cost ratios of 2.4 to 7.9.<sup>12/</sup> These estimates do not consider the less "visible" impacts, such as reduced dislocations due to malnutrition and poverty and the shifts in resources away from staple food production into other activities which commonly accompany improvements in productivity for commodities such as sorghum and pearl millet.

The adoption of innovations for sorghum and pearl millet will result in significant savings in foreign exchange required for the importation of grain during drought years such as 1991/92. Under the assumptions of the second or moderate rate of adoption scenario in the proposal, the use of improved cultivars on only 25% of the existing area by the year 2004 will result in an additional 75,000 mt worth \$US 15.0 million per annum over what would otherwise be the case<sup>13/</sup>.

In conclusion, the proposal is fully justified in terms of the economic risks. In the light of the results of the on-farm tests of the technologies to date and the emphasis which SMIP and national partners propose to give to technology dissemination from the onset in Phase III, a rapid rate of adoption (40% of the area by the year 2007) is certainly achievable. Under this scenario net economic benefits rise to \$125 million per year at current prices.

The proposal examines the distributional implications associated with the dissemination of innovations for sorghum and pearl millet with specific reference to poor households in the drought-prone areas which have been a principle focus of SMIP research efforts since their inception.

### **2.3. SOCIAL SOUNDNESS ANALYSIS**

**2.3.1. Socio-Cultural Context:** Sorghum and pearl millet account for roughly 25 percent of coarse grain<sup>14/</sup> area in the SADC region (Table 3). Therefore, sorghum and pearl millet remain important in the drier and most drought-prone regions (40% arable areas in SADC.) which are subject to the greatest risks of food insecurity. In Botswana, a country almost entirely characterized by an arid or semi-arid agro-ecology, sorghum and pearl millet account for 85% of cereal grain area. In Namibia, a similar eco-system with more irrigated crop production, sorghum and pearl millet account for almost 50% of coarse grain area. But the largest hectareage of sorghum and pearl millet in the region can be found in Tanzania, Zimbabwe and Mozambique, countries with mixed agro-ecologies, but large pockets of small-scale, semi-arid farming.

The promotion of technology transfer will first and foremost contribute to improving the food security of small farmers in drought prone regions. In addition, this effort will stimulate a re-alignment of the common perception of sorghum and pearl millet as traditional subsistence crops.

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<sup>12/</sup> Assuming a 25% improvement in average yield; adoption covering 25% of the current area devoted to sorghum and pearl millet by the year 2010; and using a 10% discount rate.

<sup>13/</sup> From Scenarios 2 of Appendix 2 of the Phase III and IV proposal.

<sup>14/</sup> Coarse grains=maize, sorghum and millet.

Productivity gains should encourage the recognition of the importance of sorghum and pearl millet as a foundation for household food security in the most drought-prone zones of the SADC region.

**Table 3. Area planted to sorghum and pearl millet as a proportion of total area planted to coarse grains, 1988/90.**

	Sorghum and pearl millet area (000 ha)	Maize area (000 ha)	Sorghum and pearl millet as a proportion of the total area planted to coarse grains (%)
Angola	107	855	11.1
Botswana	200	37	84.4
Lesotho	64	135	32.2
Malawi	49	1 275	3.7
Mozambique	388	650	37.4
Namibia	107	120	47.1
Swaziland	2	77	2.5
Tanzania	707	1 827	27.9
Zambia	99	835	10.6
Zimbabwe	469	1 214	27.9
SADC	2 193	7 026	23.8

Source: AGRISTAT, 1991.

Most SADC countries have concentrated their resources on expanding maize production in their higher rainfall zones. Limited historical investments in the development and dissemination of improved sorghum and pearl millet technologies have reduced the contributions of these small grains to the SADC food system. As a result, sorghum and pearl millet account for only about 15% of coarse grain production in SADC. Persistent dependence on maize imports results in an even lower contribution of sorghum and pearl millet to the average diet.

Concerns about aggregate national food supplies, centralized food stocks and the availability of grain to urban consumers have encouraged a reliance on maize. Priority has been allocated to the development and dissemination of maize technologies, and in many countries, the largest budget subsidies in the agricultural sector have been allocated to support maize trade and consumption. This priority probably contributes to the continuing dependence on cereal grain imports. Farmers in most drought-prone regions have been encouraged by market forces to grow maize, and when this crop fails, encouraged to consume subsidized maize meal or maize grain delivered in the form of drought relief.

One result of this scenario is the paradoxical relationship of aggregate national food supply surplus and household food insecurity. Zimbabwe, for example, has exported grain during most of the last decade. Yet rates of childhood malnutrition in the semi-arid farming regions are commonly more

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than 30 percent. In Tanzania, grain prices in semi-arid regions commonly double or triple between one year's harvest season and the next year's pre-harvest hunger period, because of regional food shortages and high transport costs. Farm households in these drought-prone regions cannot produce adequate quantities of food and the costs for food imports from other parts of Tanzania are high.

Low levels of productivity in the semi-arid cropping systems throughout southern Africa force most small farmers to consistently purchase a portion of their cereal grain supplies. The common image of a farmer as a producer for the market must be replaced with the view of a farmer forced to sell labor into a low value wage market in order to earn enough cash to purchase part of his/her family food supply. Labor that might otherwise be allocated to crop production must be allocated to seeking off-farm jobs.

Unfortunately, most SADC countries face unemployment rates over 30%. At the same time, subsidies on the cheapest food staple in the market, maize meal, are being withdrawn. Structural adjustment policies have brought, at least initially, a decline in real incomes and a rise in unemployment. While the effects have been most difficult in many urban areas, declining real wages and rising food costs have undoubtedly also hurt many rural households at the margins of subsistence.

The most direct means to improve the food security and welfare of small farmers in SADC's semi-arid zones is to increase the productivity of their cropping systems. The foundation for this gain has been laid through the development of improved technologies and training of national scientific staff by the SADC/ICRISAT SMIP. During the third phase of this program, greater effort will be concentrated on the dissemination of these technologies to farmers and the strengthening of the commitment of national scientists to technology transfer.

**2.3.2. Drought:** The drought of the 1991/92 cropping season in southern Africa was the worst failure of rainfall in more than a century. The region had to import more than 5.7 million mt of grain (Table 4). Almost 40 percent of this was brought in as food aid on concessional terms. The total landed cost of these imports was roughly US\$1.0 billion. The severity of this drought was extreme because it affected many areas normally receiving higher and more consistent rains. As a result, aggregate national grain production dropped sharply. But the rainfall levels were not so unusual for many of the semi-arid areas within the SADC region. Southern Zimbabwe, for example, has experienced drought in the form of rainfall levels less than 400 mm during 10 of the last 35 years - roughly every third year. Rains have declined below 500 mm virtually every other year.

Seven of the ten SADC countries have experienced grain supply deficits during each of the last three years (Table 5). Eight of these countries are expected to experience a shortfall following the 1993 cropping season harvests. Again, these deficits tend to be most severe in the semi-arid farming regions. As a result, drought relief programs have become ubiquitous. Where drought relief has not been available, households have been forced to send their most skilled labor away, in search of scarce urban employment. As maize costs sharply rise with the reduction of maize grain and meal subsidies, the poorest farming households residing in these regions are suffering most.

**TABLE 4 SADC FOOD BALANCE, 1991/92**

	Cereal consumption requirements (000 mt)	Cereals deficit in 1992/93 (000 mt) <sup>a</sup>	Percent deficit in 1992/93	Commercial imports in 1992/93 (000 mt)	Food aid in 1992/93 (000 mt)
Angola	988	- 646	65.4	83	60
Botswana	280	- 300	107.1	247	10
Lesotho	389	- 274	70.4	213	42
Malawi	1 873	- 998	53.3	114	407
Mozambique	1 604	-1 400	87.3	70	904
Namibia	165	- 117	70.9	134	31
Swaziland	205	- 167	81.5	90	24
Tanzania	3 680	- 318	8.6	65	20
Zambia	1 587	-1 081	68.1	245	776
Zimbabwe	2 614	-2 580	98.7	2 293	147
SADC	13 385	-7 881	58.9	3 554	2 420

<sup>a</sup>Includes build-up of grain stocks. Actual regional imports were 25% less than this requirement.

**TABLE 5. SADC FOOD BALANCE, 1990/91 TO 1993/94**

	Cereals deficit in 1990/91 <sup>a</sup> (000 mt)	Cereals deficit in 1991/92 <sup>a</sup> (000 mt)	Cereals deficit in 1992/93 <sup>a</sup> (000 mt)	Projected maize deficit in 1993/94 <sup>b</sup> (000 mt)
Angola	- 565	- 620	- 646	- 90
Botswana	- 131	- 155	- 300	- 137
Lesotho	- 179	- 197	- 274	- 242
Malawi	- 172	- 137	- 998	- 43
Mozambique	- 815	- 982	-1 400	-1 100
Namibia	- 59	- 67	- 117	+ 1
Swaziland	- 41	- 31	- 167	- 125
Tanzania	+1 199	- 231	- 318	+ 15
Zambia	+ 413	- 561	-1 081	- 247
Zimbabwe	+ 709	- 427	-2 580	- 630
SADC	- 359	-3 408	-7 881	-2 598

<sup>a</sup>Includes build-up of grain stocks.

<sup>b</sup>Data not yet available on the projected magnitude of the sorghum and pearl millet supply deficit.

The total projected investment required for Phases III and IV equals less than 5% of the costs of concessional food aid shipped to the SADC region following the 1991/92 drought. Similarly this figure represents less than 5% of the cost of maize imports anticipated in 1993/94.

As noted in the Phase III Proposal, a 20% improvement in sorghum and pearl millet yields across the SADC region will increase cereal grain availability by almost 300,000 mt or enough to reduce the region's food import bill by roughly \$US40 million each year. Most importantly, the dominant share of this gain will accrue to the incomes and lives of small farmers in semi-arid regions, many of the poorest in the SADC region.

**2.3.3 Beneficiaries:** Roughly 40% of the SADC region can be classified as semi-arid and prone to drought. These areas encompass an estimated one-third of the population of small farmers in the region: 28 million of the 86 million SADC population. Roughly 20 to 30% of these households are headed by females and are best classified as poor<sup>16/</sup>.

In food surplus Zimbabwe, the combination of low and unstable rainfall and limited technology has contributed to the disenfranchisement of the majority of Zimbabwe's smallholders from the commercial economy. Roughly 60 percent of all small farmers (about 3.5 million people) live in the semi-arid areas (Natural Regions IV and V) (Table 6). Yet these farmers account for only 30 percent of smallholder grain production and less than 20 percent of smallholder grain sales. Most of these sales are on the local market - directly from households with small production surpluses to neighboring households experiencing production deficits. Farmers based in these semi-arid lands account for less than 10 percent of the fertilizer use in the smallholder sector. While over 90 percent of these households use hybrid maize seed, as a result of the post-independence maize promotion efforts, until the drought relief related seed distribution programs of 1992, improved sorghum and pearl millet remained largely unknown.

**2.3.4. Benefits to Women:** Grain crops planted to supply the family with food are primarily the responsibility of women. Men have greater responsibility for cash crops and cattle. Increasing the productivity of sorghum and pearl millet production benefits women in particular.

One concern about women's welfare is the grain processing constraint. Sorghum and pearl millet are more laborious to process (dehull and grind) than maize. This constraint is beginning to be offset through the availability of mechanical dehullers. New varieties with thin pericarps also reduce this constraint.

The larger benefit to women is the increased and/or earlier yield of a food crop at a time and in a location when grain prices are high and food is scarce. This allows women to spend less time hunting for food, increases nutrition and saves scarce cash for other uses. Sorghum and pearl millet are undoubtedly essential food security crops. These will always be grown to offset the risks of food supply shortfalls in the event of drought. These food supply shortfalls affect women and children most severely.

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<sup>16/</sup> In a recent workshop held at the University of Zimbabwe, a survey sample of households in Zimbabwe's semi-arid regions revealed 50-70% of the small farm households live in absolute poverty.

**Table 6. Zimbabwe Agricultural Indicators: Distribution of Participation in the Commercial Grain Economy by Smallholders Across Rainfall Zones, late 1980's<sup>a</sup>**

	High rainfall	Medium rainfall	Low rainfall
Natural regions	I-II	III-IV	V
Percent of smallholder: Population	19.8%	61.0%	19.2%
Grain production	68.4%	18.2%	13.5%
Grain sales	80.2%	16.9%	2.9%
Fertilizer use	91.4%	8.4%	0.3%
Percent of smallholders who:			
Use hybrid maize seed	93.6%	98.6%	77.8%
Use fertilizer	84.6%	14.0%	3.5%
Receive credit	33.5%	3.1% <sup>b/</sup>	4.2% <sup>b/</sup>
Receive extension advice	53.4%	15.8% <sup>b/</sup>	12.5% <sup>b/</sup>

<sup>a</sup>Derived from four sets of detailed farm surveys covering a wide cross-section of smallholder farming areas of Zimbabwe.

<sup>b/</sup>includes households who have received credit or extension advice at any time.

Following the 'normal' 1988 harvest, more than three-quarters of the households in four farming areas growing sorghum or pearl millet had to purchase a significant portion of their grain requirements (Table 7). In two of the four surveyed areas, grain purchases accounted for over 40% of the average household consumption requirements. In a third area purchases were greater than 25 percent of household food supplies. Additional grain was obtained in the form of gifts and food aid.

**Table 7. Zimbabwe: average household coarse grain production, consumption and purchases, 1988.**

	Production (kg)	Consumption (kg)	Purchases (kg)
Ramakwebana	608	1 073	452
Mazvihwa	684	1 128	185
Nata	908	1 275	325
Semukwe	500	1 089	446

These relationships are not uncommon. Surveys in Zambia during the 1990/91 cropping season reveal that 30% of all households in the major sorghum and pearl millet production regions purchased grain and over 60% were reliant on purchases of maize meal. Grain deficits in the principal sorghum and pearl millet growing areas of Southern and Western Provinces averaged over 250 kg per household. This was not a drought year.

Similarly recently completed surveys in Tanzania reveal that over three quarters of sorghum and pearl millet producers are net grain buyers, even when rains are favorable. These households seem to consistently rely on grain purchases for more than 20% of their cereal supplies. The same households desperately aim for a grain production surplus because if they have to buy grain during the hunger period prior to the next harvest, they may have to pay prices rising above Tsh 125 per kilogram or more than US\$250 per mt. In effect, some of the poorest households in the country must pay some of the highest prices for food.

One of the values of SMIP is that the benefits derived from improved technologies are self-targeting. Sorghum and pearl millet are grown primarily by small farmers in drought-prone regions. These are among the poorest and most food insecure farmers in the SADC region. Roughly one-quarter of these households are female-headed. Improvements in sorghum and pearl millet technologies will directly benefit these farmers.

While some farmers may sell additional grain into the market, the primary benefits will be an increase in grain availability to the producing households. Since most households growing sorghum and pearl millet face consistent food deficits, initial production gains will accrue to family food supplies. These households will be able to retain grain longer in stock. They will have to purchase less grain in the local market. Insofar as the additional sorghum and pearl millet enters the local market, this will serve to moderate the rise in local food prices caused by regional food shortages.

By "USAID definition", the second major set of beneficiaries of SMIP will be national research scientists. During Phases III and IV, the educational gains offered through degree education in the United States, Canada and Brazil will be consolidated with in-service support favoring the accumulation of practical research experience. In-service training will focus on the development of research strategies and operational procedures favoring technology transfer and impact. In order for the national sorghum and pearl millet improvement programs to be sustainable in the longer term, they must show impact. They must justify the limited expenditures of national funds by encouraging the adoption of improved technologies showing high payoffs in farmers fields. The next phase of SMIP aims to help national scientists attain this impact.

**2.3.5. Participation:** At its February, 1993 meeting SMIP's Steering Committee established the initial priorities for work in relating to technology transfer, breeding, plant protection and food technology. An initial draft of the proposal was circulated to all national programs and further discussed at a second Steering Committee meeting in May, 1993. The proposal also benefitted from extensive discussions with a range of participants in the sorghum and pearl millet sub-sector and among experienced ICRISAT scientists.

The focus on technology transfer and the associated breeding strategies has been influenced further by discussions with farmers in the context of the 1992/93 season on-farm trials and socio-economic surveys. SMIP is currently reevaluating the preferences of small farmers for alternative grain and plant traits, examining technology access problems and other adoption constraints. Efforts are now being made to test improved cultivars in direct comparisons with the best traditional varieties available to farmers in trials managed by farmers themselves.

SMIP has learned that farmers value early maturity of improved cultivars very highly. Farmers in Zimbabwe, Malawi and Namibia have universally praised this trait. But SMIP has also learned more about the relative value farmers attach to such traits as stover yield, grain hardness and

stem thickness. The structure of demand for improved seed with different characteristics will continue to be monitored in Phase III.

New contacts and relationships are evolving with seed companies in the region. Several seed companies have visited the Matopos research station during the past few months and enquired about the SMIP breeding program. In response, SMIP has encouraged the involvement of these companies in research planning sessions. SMIP will work together with these companies to diagnose seed adoption constraints.

Finally, efforts are being made to include representation from extension services, seed companies, NGO's and grain processing and marketing agencies in the planning meetings designed to establish the research and technology transfer agenda for Phase III. These actors are being invited to comment on the collaborative research plans and participate in the research and technology transfer process. Such participation will improve the accountability of research to the institutions and expand the resources available to achieve the Phase III objectives.

**2.3.6. Socio-Cultural Feasibility:** The most significant socio-cultural constraint historically affecting the development of the semi-arid cropping system has been the limited availability of improved technologies. In most SADC countries, extension visits rise with the availability of rainfall. Available data from Zimbabwe, Zambia and Tanzania indicate that in many sorghum and pearl millet growing areas, less than one-quarter of small farmers are visited by extension workers. In some areas, these rates decline to almost zero.

Correspondingly, local development officials come to view small sorghum and pearl millet producers as backward and subsistence oriented. Periodically, these farmers are castigated for not working hard enough to extend their plantings and grow a surplus. Continuing food deficits and the persisting need for drought relief are blamed on the farmers rather than being attributed to limited resources.

These attitudes are beginning to change with the introduction of improved technologies. When both extension workers and farmers test new cultivars and management practices in the context of on-farm trials, both groups become excited about the potential for cropping system development. Extension workers participating in on-farm research programs in both Zimbabwe and Namibia began to demand more information about new technologies during the recent growing season. As farmers become aware of these technologies, these important channels of development communication can be revitalized.

Development authorities in the health subsector may be able to concentrate on programs other than drought relief. Better nutrition should improve school attendance and educational performance.

**2.3.7. Impact:** Phase III and IV of SMIP are explicitly targeted toward the achievement of impact on farmers' fields and in household food supplies. Correspondingly, the centerpiece of the Phase III program is the transfer of technology from research to farmers. Efforts will be made to help countries streamline seed release procedures and facilitate access to promising cultivars. Technical support will be allocated to backstop public and private seed production enterprises. Technology adoption patterns will be monitored both to more quickly identify constraints and assess impact.

Results from on-farm trials and farm surveys suggest technologies developed during Phase I and II show strong potential for improving food security. Farmers are almost universally pleased with the performance of

the improved cultivars SV-2 and PMV-2, two new varieties released in Zimbabwe. Adoption is expected to be rapid as seed availability improves. Farmers in Namibia have expressed strong interest in the new pearl millet variety, Okashana-1. With the support of SMIP, Okashana-1 has been rapidly disseminated over the past two years. Within two years, more than 50% of small farmers in the main pearl millet growing regions of northern Namibia are expected to be growing this variety. Similarly, in Malawi, small farmers interviewed in a recent reconnaissance survey in the lower Shire Valley expressed strong interest in the new sorghum variety, SPV 351. The Zambian sorghum and millet program has also been making considerable progress in developing and disseminating improved cultivars.

The principal constraints to adoption seem to be limited seed supply and distribution. Recognizing this, SMIP is including technical support for seed production and distribution as a major component of its Phase III strategy. The research program itself has no mandate to produce and distribute seed. Instead, SMIP will help coordinate the efforts of national research programs, seed companies, NGO's and extension services to improve seed production and distribution.

The adoption of improved crop management technologies tends to be a slower process than is the case for new cultivars. This process is particularly problematic in drought-prone regions characterized by limited resources and high risks. Severe poverty limits the cash resources available for investment in the cropping system. Farmers will consistently question whether cash is better invested in school fees and the search for an off-farm job, than agriculture.

Further, the adoption of management practices requiring additional labor is complicated by the preference for household members to search for other sources of income off farm. Workers remaining are sometimes forced to decide whether to work for others in order to earn cash for food purchases or to perform their own farming practices on a timely basis.

Accordingly, many improved crop management practices recommended by extension workers are ignored. In response, Phase III will incorporate a review of extension recommendations and the revision of such advice to better accommodate the resource constraints characterizing most sorghum and pearl millet production systems. Greater emphasis will be placed on the promotion of sustainable fertility management systems, including those making use of manure and crop rotations; and practices which value the risks of crop failure.

**2.3.8. Agro-ecological Sustainability:** A major constraint to the sustainability of semi-arid cropping systems is the low productivity of farm resources. Low productivity leads to extensive production systems. Priority is placed on the exploitation or mining of local resources for immediate benefits rather than the maintenance of these resources as necessary to ensure future benefits. Soil nutrients are extracted and not replaced. Fragile soils are degraded and erosion left uncontrolled.

SMIP contributes to improving resource sustainability in two ways. First, by improving the productivity of the sorghum and pearl millet cropping system, the project encourages farmers to take a longer term view of their resource environment. Farming becomes a more viable source of family livelihood and not simply a means to keep the family fed while searching for alternatives.

Second, on-farm research and associated efforts to review extension recommendations will place emphasis on more efficient use of farm yard manure and crop rotations. Similarly IPM research seeks to place pest management practices in the context of a sustainable farm system.

## **2.4. INSTITUTIONAL ANALYSIS**

Phases III and IV of SMIP will be jointly implemented by ICRISAT and national agricultural research systems (NARS) of the SADC member countries. Secondary implementing agencies are national extension services, seed companies, input distributors, grain processors and associated marketing agents. ICRISAT is the chief implementing agent for Phase III. However, SMIP staff will work closely with the NARS and associated development support institutions in the implementation of specific project objectives. Much of the planned work will be carried out in the context of collaborative national work plans negotiated between ICRISAT and the national research and development institutions. The chief implementing agent for Phase IV remains to be determined.

**2.4.1. SACCAR:** SACCAR was established by SADC to promote cooperative linkages in agricultural research in the SADC region. Regional collaboration is viewed as a cost-effective means of producing improved technologies and adoptable innovations for member countries in the SADC region. Rather than each country conducting the same research, responsibilities can be delegated on a regional basis designed to serve common national objectives. In the process, greater returns can be extracted from limited national research resources and complementarities on research expertise and experience can be better exploited. The rationale for regional cooperation is now stronger than ever with the prospect of South Africa's addition to this community.

SACCAR plays a coordinating role by encouraging the establishment and operation of regional research programs which benefit several SADC countries. In addition, SACCAR programs provide advisory and support services to national programs including support for training, travel, library and bibliographic services and technical assistance.

SACCAR has yet to realize its considerable potential to guide and facilitate the development of a sustainable regional network of research programs designed to complement national research institutions. USAID/Botswana is managing the Southern African Regional Program (SARP) funding operational support and technical assistance to SACCAR to strengthen its capacity to fulfill this role. Special attention is being given to the refinement of regional research priorities. With USAID support, an impact assessment advisor has recently been hired to assist with research priority - setting and the monitoring of impacts.

A critical turning point has been reached as responsibility for supporting regional activities is being shifted from traditional donors to member states and national research institutions. SACCAR's ability to find consensus regarding appropriate priorities for regional enterprises and to encourage national financial commitments in support of regional research efforts remains to be fully tested. The strength of this capacity will strongly effect the future character of regional collaboration in agricultural research.

SMIP has been broadly recognized as one of the stronger regional research activities supported by SACCAR. During Phases III and IV, SACCAR faces a good opportunity to shape this foundation of regional cooperation into a sustainable program. Again, this may be as a regional research facility or a collaborative research network. Whatever the choice, SMIP will stand as a model for regional research cooperation.

**2.4.2. ICRISAT:** ICRISAT has been designated by SACCAR as the implementing agent for SMIP. Correspondingly, ICRISAT is the grantee and principal management agent for the project. ICRISAT is a Public International Organization listed under A.I.D. Handbook 13, Chapter 5

with over 20 years of international research experience in semi-arid cropping systems and sorghum and pearl millet improvement. ICRISAT has a world reputation as an international center of expertise in these crops. ICRISAT's performance in executing Phases I and II of the project confirm this Institute's ability for achieving the project goals and purpose.

The original choice of ICRISAT as a implementing agency is directly traceable to its pre-eminent capabilities in the development of technologies for sorghum and pearl millet. These capabilities have historically been targeted toward improving the welfare of small, low resource farmers in the semi-arid tropics.

ICRISAT is headquartered in India, but maintains a world mandate for research and technology exchange for sorghum and pearl millet. The Institute's presence in Africa extends back almost two decades. ICRISAT maintains significant programs in Niger, Nigeria, and Mali focusing on western Africa, and a smaller program in Kenya, focusing on eastern Africa. ICRISAT also operates groundnut and pigeonpea research programs in Malawi for southern Africa.

ICRISAT's germplasm collections and crop management expertise together with its on-going commitment to assist national programs make this Institute particularly suited to implement this project. Exchanges of information and technology are essential components of ICRISAT's mandate. Collaborative research ties between ICRISAT and national research systems are essential for the successful development and adaptation of improved technologies and their ultimate adoption by small farmers. While ICRISAT generally views its comparative advantage as justifying greater involvement with strategic research, the Institute remains strongly committed to ensuring that its research has practical relevance and to encouraging the adoption of improved sorghum and pearl millet technologies. In this context, a division of labor between a strategically oriented headquarters program in India and a more applied research and development program in Africa has been forged.

ICRISAT's commitment to collaboration with the national agricultural research systems of the region is evidenced by the expected posting of one or more core funded staff members in SMIP to be based in Zimbabwe. The exact number of scientists will depend on the Institute's funding level during the 1994-1998 Medium Term Plan period and agreements on research priorities. Unfortunately, this funding level will not be known until November, 1993. Nonetheless, the ICRISAT core staff are expected to complement the Phase III staffing commitment, further strengthening the projects research and technology transfer capabilities.

**2.4.3. SMIP:** During Phases I and II, foundation was laid for on-going national and regional research in sorghum and pearl millet, and, more importantly, for technology transfer to small farmers<sup>16/</sup>. ICRISAT supported the education of more than 90 NARS scientists from national programs and worked with programs on the development of more than 300 improved cultivars. Fifteen of these have been tested by farmers in various SADC areas, and several have been released and are now in advanced testing for pre-release.

With this foundation, SMIP is well positioned both to continue to backstop national efforts to develop improved sorghum and pearl millet technologies and to facilitate technology transfer. The scientific staff

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<sup>16/</sup> The progress of SMIP during Phases I and II is summarized in Section 3 of the Phase III proposal.

at Matopos has been reduced in size and focused more on collaborative efforts with national programs. The regional program will maintain a capacity for sorghum and pearl millet breeding, plant protection, economics and technology transfer. SMIP has committed itself to hiring a technology transfer specialist in view of the priority attached to this mandate in Phase III. This scientist will have extensive experience with on-farm research, technology verification and technology dissemination. The maintenance of a breeding and plant protection research capacity has been requested by the collaborating national research programs. But these efforts will place greater emphasis on technology exchange and dissemination. Following the mandate of the project, the economist will shift focus from a market policy agenda toward a concern for technology adoption and impact assessment.

**2.4.4. NARS:** During SMIP Phases I and II high priority was attached to the objective of strengthening national research capabilities in sorghum and pearl millet. More than 90 national scientists were provided with post-graduate training and more than 200 scientists and technicians participated in short courses and in-service training. As a result, national programs for sorghum and pearl millet research are undoubtedly much stronger than ten years ago. A larger number of scientists are involved in sorghum and pearl millet research and many of these scientists are better trained.

The greatest advances have been made in strengthening national research capabilities in Zimbabwe, Zambia, Tanzania, Malawi and Botswana. Progress has been slower in Mozambique and Angola and the late admission of Namibia into SADC limited capacity building efforts in that country.

Limitations in national funding for agricultural research remains a significant concern. This restricts the ability of trained scientists to practice their trade. Research priorities need to be more carefully set with greater attention to demonstrating impact. Currently, funding constraints appear to be particularly severe in Tanzania, Zimbabwe and Mozambique, three countries with the largest areas of cropland allocated to sorghum and pearl millet.

SMIP has chosen to respond to these constraints by emphasizing better planning of national research agendas and the exploitation of linkages with complementary national institutions concerned with the welfare of small farmers in drought-prone regions. Collaborative work plans are being formulated which guide national scientists in the re-assessment of their technology development goals and stimulate the evaluation of whether these objectives are congruent with available research resources. During the 1992/93 cropping season, SMIP provided a limited amount of supplementary financial support for collaborative research activities. This support will be reduced and eliminated during Phase III. Collaborative work plans will be formulated such that these remain sustainable on the basis of national resources alone.

The national programs will be encouraged to exploit linkages with other national institutions to extend manpower and financial resources. These agencies can assist in verifying the new technologies with farmers and identifying constraints to technology adoption. Further, efforts will be made to exploit the interests and resources of NGO's interested in promoting the dissemination of improved technologies. Institutions such as Save the Children (UK) in Zimbabwe and Global 2000 in Tanzania will be encouraged to participate. Many such institutions are already involved in the distribution of seed.

SMIP will also collaborate with the efforts of SACCAR's new Impact Assessment Economist to help national research programs monitor impacts.

Impact assessments are most commonly viewed as means to account to sources of support on progress made in achieving program goals and purposes. Correspondingly, most assessments concentrate on success stories and, not surprisingly, reveal high returns to these investments. SMIP will seek to use impact assessments as means to monitor technology adoption and to rapidly identify constraints. Associated efforts to build a sense of impact into national research planning should improve the setting of research priorities and monitoring of research progress.

**2.4.5. NARS Sustainability:** During Phases I and II, extensive investments were made in post-graduate education for sorghum and pearl millet scientists throughout the SADC region. Phase III will be a period of consolidation as national scientists returning from training gather practical research experience. By the end of Phase III, these scientists are expected to take primary responsibility for maintaining a regional network of sorghum and pearl millet research. Yet questions persist about the capability of national programs to attract and maintain qualified manpower and to provide these scientists with operational support. In some countries and some disciplines, rates of staff turnover remain high. The costs of research personnel generally take the dominant share of national financial commitments. Many national programs remain heavily dependent on donor support.

A key assumption, underlying Phase III, is that successful research can stimulate expanded public support for research. Further, technology adoption itself stands as a reward to good scientists, a reward encouraging continuing commitment to research. This assumption reinforces the priority attached to the focus on technology transfer and impact assessment in the project plan.

**2.4.6. Seed Companies:** High priority is placed on the release, multiplication and distribution of improved seed varieties during Phase III. Traditionally, research institutions develop and release new varieties and seed companies multiply and distribute the seed to small farmers. The involvement of research institutions in the multiplication of seed is limited to the production of breeder's seed for use in research or as an initial foundation for commercial multiplication.

During Phase II, farm surveys revealed that most small farmers in drought-prone regions did not have access to improved sorghum and pearl millet seed. Further, inquiries with the national seed companies revealed an apparent misjudgment of the demand for improved varieties. Seed houses in Zimbabwe, Zambia and Tanzania claimed to retain unsold stocks while farmers and extension workers either could not find the improved seed or did not know of its existence. The parastatal seed companies also indicated a pessimism about the profitability of selling improved varieties of sorghum and pearl millet, particularly open-pollinated varieties with variable and difficult to predict levels of demand. Further, since many sorghum and pearl millet growing regions are relatively isolated from major urban areas and the principal marketing points offered by the seed companies, the costs of exploiting this uncertain market appear high.

The payoff to regional and national sorghum and pearl millet breeding programs depends on the resolution of this constraint. SMIP initially responded to this challenge by directly multiplying seed in mid 1992 for distribution following the 1991/92 season drought. This one-time emergency response brought improved varieties to large numbers of farmers in Zimbabwe and Namibia for the first time. During Phase III of the regional program, the seed production and distribution practices of both public and private companies will be more closely monitored and, as necessary, these efforts will be reinforced with technical advice. On-

farm research and adoption studies will provide data to seed companies, assisting them to better evaluate the structure of seed demand.

SMIP expects to work closely with the BMZ\GTZ supported regional smallholder seed production project for sorghum and pearl millet. SMIP's sorghum and pearl millet breeders will provide technical advice necessary to ensure the efficient production of high quality seed. The program's technology transfer specialist will help the BMZ\GTZ project target its efforts to ensure high rates of dissemination and adoption.

**2.4.7. SMIP Steering Committee:** The Phase III proposal was initially based on the recommendations of the Steering Committee. This Committee is made up of representatives of each of the national sorghum and pearl millet improvement programs in the SADC region. The Committee also incorporates representation from SACCAR, ICRISAT and the project donors.

The Steering Committee meets twice each year to allow a steady monitoring of the progress of the project and facilitate accountability to national interests. The Steering Committee first met on a formal basis in February 1993 in order to deliberate on the priorities for regional research during Phase III. The Committee met again in early May to ratify a draft of this project proposal. It is anticipated that the Committee will meet again in early 1994, once the project gets underway.

## 2.5. PROJECT SUSTAINABILITY

The strategy for sustainability (section 7) and the implementation plan (section 5) contained in the Phase III proposal were reviewed by the design team and discussed with the management of SMIP and SACCAR, representatives of CIDA and BMZ\GTZ, and the Director of Research and Specialist Services (DR&SS) of Ministry of Lands, Agriculture and Water Development (MLAWD) of Zimbabwe. The approach outlined in the proposal meets the specific requirements laid out in all relevant sections of the A.I.D. handbook guidelines and appears generally feasible.

Successful implementation of the proposed approach will require a convergence of decision making at the SACCAR, NARS, ICRISAT and donor levels during Phase III. This can be done, but the amount of time to make this happen should not be under-estimated. Further, it is recommended that development and approval of a plan for sustaining a regional sorghum and pearl millet research program by SADC and member states be made a condition for the disbursements of funds after September 1994.<sup>17/</sup>.

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<sup>17/</sup> A recent communication (attached) from SACCAR (July 16, 1993 letter to R. Armstrong from C. Nkwanyawa of the SACCAR secretariat) is very positive in this regard. The letter states:

"SACCAR informed the Sectoral Committee of Ministers of Food Agriculture and Natural Resources in June, 1993 that it was no longer possible to run SMIP by Donors' grants alone. It was necessary therefore to find ways in which SADC could start putting some resources into the programme. Ministers were further informed that a consultancy team was being put in place to look into the future use of the facilities at Matopos. Included in the Consultants' Terms of Reference is the question of sustainability which the team must address in detail. Accordingly, Ministers agreed with SACCAR's recommendations. These recommendations will then be tabled to Council in August, 1993 for endorsement."

Several elements of the project have been designed to improve prospects for sustaining SMIP. First, station operations are being reduced to a minimum level to support on-going research programs. Second, management objectives are being shifted from carrying out research activities on behalf of SADC member states to conducting research and technology transfer with NARS and other national organizations. A significant portion of this activity could take place in member states at NARS facilities. Third, collaborative workplans between SMIP and the NARS and associated national organizations will incorporate greater sharing of research and dissemination costs. These will include contributions from other public and private institutions operating in the member states.

**2.5.1 The Future of SMIP Matopos Facilities:** The reduction in SMIP on-station research activities will create opportunities for the alternate use of a portion of the facilities and land at Matopos. As indicated in the proposal (section 7.2), the inventory of the fixed and movable assets which took place in 1992, is being updated this year in the light of decisions about the scope and scale of SMIP operations for Phase III.

Several options for the facilities not in use by SMIP will be examined as part of a consultancy mission by SACCAR in the near future. ICRISAT's core funded program would be based at Matopos, and it is understood that SMIP requirements will take precedence. Other possibilities include the utilization of the facilities by SACCAR and the Department of Research and Specialist Services (DR&SS) to accommodate other regional and national research and training program activities. SMIP plans to begin charging tuition to recover at least a portion of the variable costs of the courses at Matopos which it will offer during Phases III and IV. Additional sharing and/or rental possibilities will be examined by the consultancy mission.

**2.5.2 Prospects for Financial Support from Sources in the Region:** A key question is whether member states will increasingly find it in their interests to pool resources and work together on emerging research themes as well as access expertise outside of NARS and SMIP as needed to effectively and efficiently find solutions. Admittedly, this is not currently the case. However, in the medium term (e.g. by the end of Phase III), mechanisms could be put in place at the regional (SACCAR/SMIP) and national levels to bring together national resources and research staff into regional problem solving task forces as dictated by research priorities and decisions on divisions of labor. Structural and management reforms currently in progress in more than half the SADC NARS are reorienting these institutions toward service to clients, performance and creativity<sup>18/</sup>.

The movement toward an integrated regional research program for sorghum and pearl millet discussed in the technical analysis provides the

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<sup>18/</sup> Informal discussions with representatives of the World Bank indicate that attention is being given to moving NARS and regional programs toward financial sustainability in the context of NARS proj loans and the Special Program for African Agricultural Research (SPA). The project loan to provide support for DR&SS in Zimbabwe has made development of a plan for cost recovery and sustainability a condition for initial disbursement. It is understood that a consultancy team on this subject has recently completed a draft report which is being reviewed by GOZ. Among the proposals are mechanisms by which DR&SS charge for selected services and share returns from the sales of seed and other materials derived from DR&SS research findings. Similar possibilities should be explored for SMIP.

framework to achieve the sustainability of SMIP. Research task forces are a promising basis by which SMIP can progressively move away from dependence on donor funding and pool their resources to address issues of common concern<sup>19/</sup>. The improvements in research planning and financial management which are the cornerstones of efforts by national governments, ISNAR and donors to improve NARS performance are aimed at diversifying revenue sources, including making research institutions more self-supporting, as well as to bring the scope and scale of operations into line with available resources.

Mechanisms such as contracting for services are already features of some NARS in the region, including Zimbabwe and Malawi, can be used to transfer resources from NARS and other national organizations to SMIP to undertake specific tasks on their behalf<sup>20/</sup>. There is considerable scope for improvements in these mechanisms, but they are unlikely to be improved any faster than NARS management itself is strengthened.

Approval of this PP Amendment will set this decision making process in motion on a clear timetable. The solid funding for Phase III will continue momentum over this critical phase. This will guarantee the integrity of the program and allow adequate time for the national governments to become convinced of the advantages of financially supporting a regional activity.

### **3. REVIEW OF IMPLEMENTATION AND FINANCIAL PLANS.**

The implementation and financial plans contained in the SADC/ICRISAT proposal were reviewed as part of the preparation of the Project Paper Supplement for the Phase III activity. The major conclusions and recommendations of that review are briefly noted below. These have been discussed with the ICRISAT team who prepared the proposal and it has been modified to incorporate these considerations into their proposal.

#### **3.1. IMPLEMENTATION PLAN**

In general, ICRISAT's implementation plans follow the management objectives that have been defined for this project (OUTPUTS) and the objectives of the SMIP Steering Committee. The implementation plans show a logical breakdown of the multiple project activities that result in the achievement of management objectives defined for the project. For example, the implementation plan describes three major types of activities (on-farm testing, the review and revision of extension recommendations and seed production\distribution) required for technology transfer. Lastly, the implementation plans identify key target dates and schedules of performance that seem realistic and correctly sequenced.

As specified and presented, the implementation plans do not focus on several important crosscutting issues or questions which SMIP management

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<sup>19/</sup> The West African Rice Development Association (WARDA) has pioneered the task force approach with NARS in member states with considerable success in recent years.

<sup>20/</sup> The contracting arrangements can work both ways, namely to have NARS contract with other agencies to perform services on its behalf and for NARS staff to work on contract to other agencies (e.g. seed companies, NGOs, SMIP). The latter arrangement provides a potential means for SMIP and NARS to increase revenues (through making charges for indirect costs), reduce costs (through salary savings), and improve conditions of service (incomes) for staff.

will need to consider. These crosscutting issues are important to maintain cohesion between the different management objectives and ensure efficient use of resources (human and financial). For example, each of the management objectives require consistent and efficient information flows about the availability and impact of technology between SMIP and the NARS and ultimately across the various NARS. Further, information flows must assure the effective monitoring of collaborative SMIP-NARS workplans.

A second management concern evident from the workplans will be dealing with trade-offs in allocating available manpower between research activities and technology transfer. It's fully expected that technology transfer will absorb most of the available staff time in the early years of the project; but, as technology performance information filters back to the regional center, more staff resources may need to be reallocated to research. Third, the division of responsibilities between NARS and SMIP as defined through collaborative workplans should be reflected in the SMIP implementation plan.

Given these considerations, it is recommended that SMIP management systematize essential information flows between the regional center and the NARS. This should include a means to track the performance of newly released varieties and associated rates of adoption. It should also include a means to disseminate the results of NARS research of regional significance.

In so doing, SMIP may initially work out a standard procedure for sharing information with individual NARS based on the operational requirements of the collaborative workplans. As these are regularized, SMIP should explore methods for consolidating information flows across all of the NARS. In order for these to be used effectively, the information system should avoid the indiscriminate distribution of information. This creates operational difficulties and would not be sustainable. Instead, the regional information system should target information around the priority needs of users.

The monitoring and evaluation arrangements for the project are expected to ensure that these considerations are adequately taken into account during implementation.

### 3.2 FINANCIAL PLAN:

The proposal contains detailed budgets for the Phase III and projections through Phase IV. Phase III is conservatively estimated to consist entirely of the resources from carryovers of previous funding agreements and new funds from USAID and BMZ\GTZ. Including carry-over funds from Phase II, the total project funding currently planned by the donors is as indicated in Table 8 .

USAID	\$10,792,670
CIDA	1,049,372
BTZ/GTZ	3,122,109
Total	\$14,901,151

Funds required to implement the program through Phases III and IV total \$17,901,151. Available donor funding will be adequate to cover expenditures in the first five years of Phase III, but an additional \$3 million will be needed from other sources during Phase IV. Beyond Phase IV, SMIP activities will be essentially financed by SACCAR, the NARS and governments of member states, and other public and private institutions.

be covered: (a) technology transfer results; (b) the processes being used in interacting, coordinating and linking technology development and transfer institutions (c) the development of information systems which facilitate and document the institutional interaction taking place.

Second, USAID needs to monitor project efforts to integrate sorghum and pearl millet improvement programs and the analytical process that is required to ensure the sustainability of these improvement programs. These analytical steps include (a) a realistic assessment of the NARS sorghum and pearl millet program needs and the existing capacity and funding availabilities; (b) appropriate and clear divisions of responsibilities with respect to the regional center and the NARS in accordance with the directive of the SMIP Steering Committee. With these analytical activities completed, SMIP needs to develop an organizational strategy within the anticipated levels of resources and funding. In monitoring these efforts, USAID should periodically examine progress being made in collaborative research and improvement efforts; processes used in terms of results in the form of obtaining those results (ie planning and budgeting exercises); and the development of information systems that facilitate and document these cooperative research efforts.

The results of SMIP investments are included in the Zimbabwe CPSP Strategic Objective 1 which is to improve household level incomes and food security in the semi-arid regions of Zimbabwe. Several other projects and activities affect families living in these same areas, but in different ways. In an attempt to better understand the nature and magnitude of impacts of multiple interventions upon peoples' livelihoods as well as achieve economies in data collection and analysis, SMIP will contribute to the development of a monitoring methodology which will facilitate collaborative impact studies on behalf of groups of projects operating in given areas. Use will be made of existing statistical information supplemented by reconnaissance and formal surveys designed to examine changes in resource allocations, including labor, land, income and expenditure patterns in a cost effective manner.

These collaborative studies may involve a partial pooling of resources for monitoring, evaluation and impact assessment from more than one project and/or funding source related to Strategic Objective No. 1 which will facilitate greater depth and breadth of coverage than would otherwise be possible. The priority focus of these efforts will be to determine the extent to which various interventions are actually contributing to the realization of the goals of the projects, notably improvements in incomes and food security of poorer households in the drier areas. Area, yield and production statistics for sorghum and pearl millet alone will not answer this question.

Relations and linkages between SMIP and the NARS is a critical albeit complex element of this project. Project implementation plans call for a substantial investment in information and networking activities between the regional center and the NARS. Numerous project activities plan and support the development of such linkages. Yet the details for working out these critical relationships are just now being worked out.

SMIP will benefit from an independent review of monitoring and information systems for sorghum and pearl millet improvement and technology transfer. This review should cover the adequacy and reliability of information; appropriateness of information technologies; uses and benefits of information and networking activities of regional center; and costs. It is expected that this special review will be carried out late in the third operational year of the project and before the mid-term evaluation of the project.

The proposal deals with financial sustainability in a forthright and realistic manner from two perspectives: (1) the future use of the Matopos facilities; and (2) the nature and support for a future SMIP program. The strategy and the key milestones are summarized under Output 4 (A Sustainable Regional Sorghum and Pearl Millet Research Program and a Viable Plan for the Future of the Matopos Station) of the project description. The discussion of this strategy is included in the analysis (section 2.5). Subject to the concerns noted in that discussion, the strategy in the proposal is sound basis for addressing SMIP sustainability and the future of the Matopos station.

### **3.3. PHASING OF EXPENDITURES**

The overall structure of the budget for Phase III is consistent with the priorities as established by the SMIP Steering Committee. As discussed in the analysis section (section 2.5), consideration should be given to increasing the level of resources available for technology transfer activities during the initial two to three years of Phase III. Further, the budget should take account of the staff time and resources that will be needed during Phase III to pursue the strategy for achieving sustainability. These shifts could be accommodated in one of several ways, including accelerating the disbursement of the USAID funds during the initial years. The increase in support for technology transfer would have to be matched by reductions in latter years as far as USAID support is concerned.

### **3.4. FINANCIAL MANAGEMENT**

The USAID grant to ICRISAT provides for funding advances for the next 60 days to be replenished by ICRISAT submission of monthly vouchers. This system has been working well and will be continued.

## **4. MONITORING AND EVALUATION ARRANGEMENTS**

The Logical Framework Matrix attached includes detailed verifiable indicators and means of verification for achieving the project purpose and developing project outputs. The Logframe notes important assumptions which need to be monitored over the life of the project. The SMIP staff will take the lead in data collection and analysis of the progress towards meeting the purpose and output level objectives. As much of the basic information required is for project management, annual workplans and reports prepared by ICRISAT will contain most monitoring information. ICRISAT workplans should describe annual progress increments toward management objectives and proposed annual expenditure of resources toward project management objectives.

Annual SMIP implementation reports should include: (a) progress toward meeting purpose level indicators; (b) summary progress report on management objectives (OUTPUTS) noting problems that may require USAID attention; (c) review of resource expenditures (annual and cumulative); (d) major constraints impeding implementation; (e) review of major assumptions.<sup>21/</sup>

The assumptions noted in the project description and the review of ICRISAT plans raise two points on which USAID needs to focus its monitoring efforts. First, USAID should monitor the interaction between SMIP and the national institutions involved in sorghum and pearl millet technology transfer. Three aspects of this SMIP/NARS interaction need to

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<sup>21</sup> The major assumptions are listed in Section 1.4.

The PP Amendment budget contains funds for a Phase III evaluation in 1996 and a second evaluation in 2000. The first evaluation scheduled for 1996 should review the strategy for the Phase III of the project and the progress being made in terms of meeting specified project outputs. The evaluation should also review the project assumptions related to NARS research capability and the adequacy of existing technology transfer channels. USAID should be substantially involved in this evaluation and be prepared to make substantial revisions to the financial plan in accordance with its findings.

USAID monitoring of the project will include Project Implementation reviews every six months; periodic visits by the A.I.D. Project Manager to the various project sites in the SADC region; and dialogue with SACCAR and the national governments on the progress of the project.

In addition, SACCAR and ICRISAT plan monitoring activities for SMIP. During its annual meetings, the SMIP Steering Committee meeting will review progress for SACCAR. ICRISAT will monitor implementation of the project through SMIP quarterly and annual reports, in-house reviews and Annual Research Planning Meetings.

Diagnostic surveys and impact assessments planned under Objective 1 (Technology Transfer) will provide data for monitoring the farm level impacts of the project and planning new approaches to technology adoption by the farmers.

**Project Logical Framework for the Sorghum and Millet Improvement Program, Phases III and IV**

Narrative Assumptions	Verifiable Indicators	Means of Verification	Important Assumptions
<p><b>Program Goal: Broader objective to which this project contributes</b></p> <p>(SubGoal): Stabilization of food supplies in the region, leading to (Goal:) improved nutrition and income for poorer people farming in drier areas.</p>	<p><b>Measures of Goal Achievements</b> High per capita consumption of pearl millet &amp; sorghum.</p>	<p>Health surveys and statistics.</p> <p>Macro-economic indicators.</p>	<p>Continued government support of research.</p> <p>Market opportunities for rural producers.</p> <p>Appropriate economic policies including pricing.</p>
<p><b>Project Purpose</b></p> <p>To increase the production of sorghum and pearl millet with good consumer acceptance, local adaptation and pest resistance.</p>	<p><b>Conditions that will indicate purpose has been achieved:</b> <b>End of project status</b></p> <ol style="list-style-type: none"> <li>1. 20 % increase in area planted to new varieties.</li> <li>2. 20% increase in sorghum/pearl millet yields.</li> <li>3. 20 % increase in pearl millet/sorghum productivity.</li> <li>4. Technically and managerially self-sustaining.</li> </ol>	<p>Agricultural surveys and statistics.</p> <p>ICRISAT Annual Reports records.</p>	<p><b>Affecting purpose-to-goal links</b></p> <p>Cessation of hostilities and ensuing peace in Mozambique and Angola.</p> <p>Political stability within the SADC region.</p> <p>Economic growth in SADC region at least equal to population growth.</p>

<p><b>Outputs</b></p> <p>1. Sorghum and pearl millet technology transfer.</p> <p>2. Integrated sorghum and pearl millet improvment research programs.</p> <p>3. SMIP Matopos facilities. Operational</p>	<p><b>Magnitude of outputs necessary and sufficient to achieve purpose</b></p> <p>1.1-On-farm tests. 1.2-Extension recommendations reviews 1.3-Seed distributed.</p> <p>2.1-Program protocols w/ principal SADC pearl millet/sorghum producers. 2.2-Integrated programs covering genetic improvement and cultivar dev.; pest management; farm-level adaptive research.</p> <p>3.1-10 years operations for core SMIP functions.</p>	<p>Annual project reports, project evaluations, project implementation reports.</p>	<p><b>Affecting output-to-purpose links</b></p> <p>1. Technology transfer channels operate adequately to transfer pearl millet/sorghum technologies to farmers.</p> <p>2.SADC NARS productivity for pearl millet/sorghum, adaptive research and technology transfer improves.</p> <p>3.Soil fertility does not deteriorate further.</p> <p>4.Rapid technology adoption rate will increase public support for food crop research within SADC region.</p>
<p><b>Inputs: Activities and Types of Resources</b></p> <p>USAID Funding to ICRISAT grant of \$10,000,000.</p> <p>Other donor funding of \$ \$4,171,481.</p> <p>SADC funding of \$3,000,000.</p>	<p><b>Level of Effort/Expenditure for each activity</b></p> <p>See ICRISAT proposal.</p>	<p>See ICRISAT proposal</p>	<p>See ICRISAT proposal</p>

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ATTACHMENT I

DISTRIBUTION: AID  
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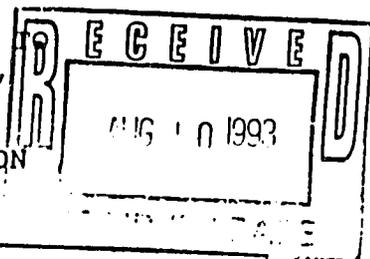
SUBJECT: SARP-SORGHUM AND MILLET RESEARCH AND TRAINING  
PROJECT AMENDMENT (690-0224)--AD HOC DOA

REF: (A) HARARE 001791; (B) STATE 321956 - FY 92

ACTING AA/AFR HEREBY DELEGATES AUTHORITY TO THE DIRECTOR,  
USAID/ZIMBABWE, OR TO THE PERSON ACTING IN THAT CAPACITY,  
TO AUTHORIZE AN AMENDMENT TO THE SUBJECT PROJECT, IN AN  
AMOUNT NOT TO EXCEED DOLLARS 11.162 MILLION, FOR A NEW  
AUTHORIZED LOP NOT TO EXCEED DOLLARS 41.112 MILLION AND  
EXTEND THE PACD FROM SEPTEMBER 15, 1993 TO SEPTEMBER 30,  
1998. THIS AD HOC DOA SHALL BE EXERCISED IN ACCORDANCE  
WITH ALL THE OTHER TERMS AND CONDITIONS OF DOA 551 AND  
SUBJECT TO THE SUBMISSION OF A CONGRESSIONAL NOTIFICATION  
TO CONGRESS AND CLEARANCE WITHOUT OBJECTION.

CHRISTOPHER

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SHIP STEERING COMMITTEE (COMPRISING LEADERS OF
SADC NATIONAL SORGHUM AND MILLET PROGRAMS, AND
REPRESENTATIVES OF SACCAR, ICRISAT AND DONORS)
PLAYED A MAJOR ROLE IN THE FORMULATION OF PHASE
III PROPOSALS. THE COMMITTEE, AT ITS MEETING AT
MATOPOS ON 22 - 23 FEBRUARY 1992 DETERMINED
REGIONAL RESEARCH PRIORITIES (BY BANK) AND
PROVIDED GUIDELINES ON LEVELS OF BUDGET
ALLOCATION (BY 4) AS FOLLOWS: (1) TECHNOLOGY
TRANSFER, 32%; (2) DEVELOPMENT OF IMPROVED
VARIETIES, GERMPLASM COLLECTION AND EXCHANGE,
20%; (3) MANAGEMENT OF DISEASES, PESTS AND THE
WITCHWEED STRIGA, 20%; (4) HUMAN RESOURCES
DEVELOPMENT, 20%; AND (5) EVALUATION OF GRAIN
QUALITY, 10%. THESE FIVE ACTIVITIES HAVE BEEN
TRANSLATED INTO FIVE SPECIFIC OBJECTIVES WITH A
DETAILED BUDGET FOR ACTIVITIES UNDER EACH
OBJECTIVE.

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A/D/W FOR JOHN GAUDIT, BUREAU ENVIRONMENTAL OFFICER,
AFR/ARTS/FAIR

E.O. 12356: 4/A

SUBJECT: LEE FOR SADC ICRISAT SORGHUM AND MILLET
IMPROVEMENT PROGRAM (SHIP) PHASES III & IV
(1993-2003)

THE ICRISAT MEDIUM TERM PLAN 1994-96 INCLUDES
SEVERAL RESEARCH THEMES IN THE SADC REGION WHICH
ARE SIMILAR TO THE REGIONAL RESEARCH PRIORITIES
OF SHIP AS DETERMINED BY THE STEERING COMMITTEE.
DEPENDING UPON THE LEVEL OF FUNDING FROM THE
CGIAR, ICRISAT MAY ESTABLISH CORE-FUNDED RESEARCH
ACTIVITIES IN SORGHUM AND PEARL MILLET FOR
SOUTHERN AFRICA. SUCH ACTIVITIES WOULD

THIS IS AN ACTION CABLE FOR THE AFRICA BUREAU
ENVIRONMENTAL OFFICER REQUESTING CONCURRENCE IN A
NEGATIVE DETERMINATION FOR THE ABOVE REFERENCED
PROJECT EXTENSION.

COMPLEMENT SHIP'S ACTIVITIES AND BE BASED AT
MATOPOS.

I. BACKGROUND:

MAJOR COMPONENTS IN THE IMPLEMENTATION OF PHASE
III ACTIVITIES WILL BE THE FORMULATION OF JOINT
RESEARCH ACTIVITIES BETWEEN NATIONAL PROSPAMS AND
SHIP SCIENTISTS DEFINED IN THE CONTEXT OF ANNUAL
WORK PLANS AND BUDGETS FOR THE FOLLOWING:

THE SACC/ICRISAT REGIONAL SORGHUM AND MILLET

- 1. TO CONDUCT RESEARCH THAT WILL FACILITATE
THE TRANSFER OF TECHNOLOGIES TO SMALL
FARMERS;
2. TO BREED IMPROVED VARIETIES, COLLECT AND
EXCHANGE GERMPLASM;
3. TO DEVELOP
TECHNOLOGIES FOR THE MANAGEMENT
OF DISEASES, PESTS AND THE WITCHWEED STRIGA,
4. TO EVALUATE GRAIN QUALITY FOR VARIOUS
END-USES; AND
5. TO IMPROVE THE PRODUCTIVITY OF NATIONAL
SORGHUM AND PEARL MILLET STAFF

IMPROVEMENT PROGRAM (SHIP) WAS FORMALLY
CONSTITUTED WITH USAID FUNDING ON 15 SEPTEMBER
1983, AND BEGAN OPERATIONS IN MAY 1984. THE
INITIATION OF THIS PROJECT WAS A DIRECT RESPONSE
BY ICRISAT TO THE INVITATION FROM THE GOVERNMENT
OF BOTSWANA, ACTING ON BEHALF OF SADC COUNTRIES,
TO DEVELOP A REGIONAL PROGRAM THAT WOULD ASSIST
NATIONAL SORGHUM AND MILLET PROGRAMS IN RESEARCH
AND HUMAN RESOURCES DEVELOPMENT. THE PROJECT IS
LOCATED AT MATOPOS RESEARCH STATION NEAR
BULAWAYO, ZIMBABWE. USAID, THE MAJOR DONOR, WAS
JOINED BY CIDA IN APRIL 1986 AND BY GTZ IN
JANUARY 1988 AS DONORS TO THE PROJECT. IN PHASE I
(15 SEPT 1983 - 14 SEPT 1988) PROJECT ACTIVITIES
WERE ON SORGHUM AND PEARL MILLET, HOWEVER, IN
PHASE II (1988 - 1993), PINGER MILLET AND
FORAGES, DEVELOPMENT OF NATIONAL PROGRAMS
EXPERIMENT STATIONS, AND FOOD TECHNOLOGY WERE
ADDED TO THE PROJECT ACTIVITIES. IN BOTH PHASE I
AND II, A THEORETICAL COMPONENT OF THE PROJECT
INCLUDED POSTGRADUATE DEGREE EDUCATION OF
NATIONAL PROGRAMS STAFF TO M.SC OR PH.D
LEVELS. THIS COMPONENT OF THE PROJECT WAS
SUB-CONTRACTED TO ICRISAT'S COLLABORATOR IN
SORGHUM AND PEARL MILLET, INTSORMIL, IN THE USA.

III. ENVIRONMENTAL CONSIDERATIONS:

A CATEGORICAL EXCLUSION WAS APPROVED FOR THE
ORIGINAL PROJECT IN SEPTEMBER 1983 AND A NEGATIVE
DETERMINATION FOR THE FIRST PROJECT EXTENSION

FOLLOWING DONOR REVIEW RECOMMENDATIONS IN OCTOBER
1991, SACCAR BOARD'S RESPONSE TO THE DONOR
REVIEW, AND AN ANTICIPATED REDUCTION IN FUNDING
FOR PHASE III, PROJECT ACTIVITIES HAVE BEEN
SCALED DOWN.

(1988 TO 1993) WAS APPROVED 7 JULY 1986 TO
DATE, ALL ACTIVITIES WITH POTENTIAL ENVIRONMENTAL
CONSEQUENCES HAVE BEEN CARRIED OUT UNDER TIGHTLY
CONTROLLED CONDITIONS AND HAVE BEEN THOROUGHLY
MONITORED. AGRICULTURAL CHEMICALS, INCLUDING
PESTICIDES, HERBICIDES AND SEED DRESSINGS, ARE
APPLIED ONLY BY TRAINED ICRISAT OR NATIONAL
PROGRAM RESEARCH STAFF, USING INTERNATIONALLY
ACCEPTED PROCEDURES TO ENSURE THE SAFETY OF ALL
PERSONNEL. THERE IS NO PLAN TO TEST OR USE NEW

II. PROJECT EXTENSION:

UNCLASSIFIED  
 AGENCY FOR INT'L DEV.  
 TELECOMMUNICATIONS CENTER

INCOMING  
 TELEGRAM

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HARARE 06650 00 OF 03 2114062 9310 049830 A106531

PESTICIDES TO SUPPORT RESEARCH ACTIVITIES DURING THE EXTENSION OF THE PROJECT. THE PROVISION INCLUDED IN PILS UNDER THE ORIGINAL GRANT WILL BE MAINTAINED TO ENSURE THAT THE MANUFACTURERS OF ANY PESTICIDE USED IN THE RESEARCH PROGRAM PROVIDE TOXICOLOGICAL AND ENVIRONMENTAL DATA NECESSARY TO SAFEGUARD THE HEALTH OF RESEARCH PERSONNEL AND THE QUALITY OF THE LOCAL ENVIRONMENT IN WHICH THE PESTICIDES WILL BE USED. PILS UNDER THE GRANT AMENDMENT WILL ALSO CONTAIN A PROVISION THAT TREATED CROPS WILL NOT BE USED FOR ANIMAL OR HUMAN CONSUMPTION UNLESS APPROPRIATE TOLERANCES HAVE BEEN ESTABLISHED BY THE USEPA OR RECOMMENDED BY FAO/WHO AND THAT THE FREQUENCY OF APPLICATION, TOGETHER WITH THE PRESCRIBED PRE-HARVEST INTERVALS, DOES NOT RESULT IN RESIDUES EXCEEDING SUCH TOLERANCES.

FUNDING: LOP - 542,110,000  
 THRU FY 03 - 531,110,000  
1983-2003 - 511,000,000

RECOMMENDED ACTION: NEGATIVE DETERMINATION  
 IEE: PREPARED BY CHARLES SCHEIBAL, MEO LANPHER

THE PROJECT ENTAILS THE USE OF APPROXIMATELY 100 HECTARES OF THE NATIONAL (ZIMBABWE) RESEARCH FARM AT MATOPOS. THE SITE IS ADJACENT TO THE MAIN

Concurrence:  
 Bureau Environmental Officer Date: 6/25/93  
*J. G. Gault* Approve ✓  
 Disapprove       

ROAD. IRRIGATION WATER IS TAKEN FROM NEARBY LAKE MATOPOS. ALL CONSTRUCTION AND LAND CLEARING ACTIVITIES HAVE BEEN COMPLETED. ALL SUCH ACTIVITIES ARE MONITORED AND APPROVED BY THE REGIONAL ENGINEER, USAID/ZIMBABWE, INCLUDING PROVISIONS FOR WATER, ELECTRICAL, AND SEWERAGE HOOKUPS.

Clearance:  
 GC/AFR/MAK Date: 7/20/93

ANY NEW LAND BROUGHT INTO CULTIVATION BY FARMERS WILL NOT FALL WITHIN THE PURVIEW OF THIS PROJECT. AFTER RESEARCH RESULTS ARE APPROVED, FURTHER TESTING AT THE NATIONAL LEVEL AND RECOMMENDATION TO FARMERS ARE THE RESPONSIBILITY OF NATIONAL AGRICULTURAL RESEARCH CENTERS.

IV. MITIGATING FEATURE:  
 -----

THE FIVE (5) ACTIVITIES PLANNED UNDER THIS PROJECT EXTENSION, PHASES III & IV ALL QUALIFY FOR CATEGORICAL EXCLUSION UNDER 22 CFR - PART 16.3 C(1)(1), C(2)(1), C(2)(1)(1), C(2)(1)(1)(1). HOWEVER, THERE IS ONE ACTIVITY (43) - TO DEVELOP TECHNOLOGIES FOR THE MANAGEMENT OF DISEASES, PESTS AND THE WITCHWEED-STRIGA - THAT IS EXPECTED TO PROVIDE DEFINITE ENVIRONMENTAL BENEFITS. PART OF THE RESEARCH EFFORT UNDER THIS ACTIVITY WILL BE FOCUSED ON DEVELOPING INTEGRATED PEST MANAGEMENT SYSTEMS, BIOLOGICAL PEST CONTROL METHODS TO REPLACE CHEMICAL PEST CONTROL AND BREEDING FOR DISEASE RESISTANT PLANT STRAINS.

POSITIVE LONG TERM ENVIRONMENTAL BENEFITS WILL RESULT FROM IDENTIFICATION, DISSEMINATION AND USE OF INTEGRATED PEST MANAGEMENT METHODS DEVELOPED FROM THIS RESEARCH.

BASED ON THE INFORMATION AND DETAILS PRESENTED ABOVE, PHASE III AND IV OF THE SORGHUM AND MILLET IMPROVEMENT PROGRAM (SMIP - PROJECT 690-0374) IS RECOMMENDED FOR A NEGATIVE DETERMINATION.

V. IEE PAGESHEET DATA:  
 -----

COUNTRY: SOUTHERN AFRICA REGIONAL PROGRAM  
 TITLE: SORGHUM AND MILLET IMPROVEMENT PROGRAM (SMIP)



UNCLAS AIDAC SECSTATE 217393

ACTION: AID-1  
INFO: ECON-1 DCM-1 AMB-1

DISTRIBUTION: AID  
CHARGE: AID

VZCZCSBO617  
PP RUEHSB  
DE RUEHC #7393 1980435  
ZNR UUUUU ZZH  
P 170437Z JUL 93  
FM SECSTATE WASHDC  
TO AMEMBASSY HARARE PRIORITY 5144  
BT  
UNCLAS STATE 217393

**R E C E I V E D**  
JUL 19 1993

DATE	ACTION	INFO
IE		
DD		
PRM		
CONT		
GDO		
PDIS		
EXO		
LIB		
CHRON		
RF		
DUE DATE		7-20-93
ACTION TAKEN	OFFICIAL FILE LISTED	
INITIALS/DATE		DXC 7/20/93

AIDAC  
E.O. 12356: N/A  
TAGS:  
SUBJECT: SS3 ALLOWANCE - ZIMBABWE-  
(SOUTH AFRICA REGIONAL)

1. APPROPRIATION 72-113/41014, BUDGET PLAN CODE GSS3-93-21613-IG12 ESTABLISHED FOR DOLLARS 27,480,000 FOR PROJECT 690-0256.13, SADC TRANSPORT EFFICIENCY PROJECTS, \$5,500,000. FUNDS FOR PROJECT 690-0270.13, REGIONAL DROUGHT EMERGENCY RECOVERY, \$14,980,000.

~~FUNDS FOR PROJECT 690-0224.13, SORGHUM & MILLET RESEARCH PROJECT (CRISAT), \$7,000,000. FUNDS CANNOT BE OBLIGATED UNTIL EXPIRATION OF CNS WITHOUT OBJECTION. DESK WILL NOTIFY MISSION WHEN CN'S HAVE EXPIRED. TOTAL ALLOWED UNDER THIS BPC IS \$27,480,000.~~

2. ADVICE OF ALLOWANCE FOLLOWS.  
CHRISTOPHER  
BT  
#7393

*DeLund*

6900256.13 - STEP 5,500,000 ✓  
6900270.13 - Reg Drought Emg. Rec. 14,980,000 ✓  
~~6900224.13 - CRISAT 7,000,000 ✓~~  
27,480,000

NNNN

UNCLAS AIDAC SECSTATE 217393

969969

**5C(2) - ASSISTANCE CHECKLIST**

Listed below are statutory criteria applicable to the assistance resources themselves, rather than to the eligibility of a country to receive assistance. This section is divided into three parts. Part A includes criteria applicable to both Development Assistance and Economic Support Fund resources. Part B includes criteria applicable only to Development Assistance resources. Part C includes criteria applicable only to Economic Support Funds.

CROSS REFERENCE: IS COUNTRY CHECKLIST UP TO DATE?

YES

**A. CRITERIA APPLICABLE TO BOTH DEVELOPMENT ASSISTANCE AND ECONOMIC SUPPORT FUNDS**

**1. Host Country Development Efforts**  
(FAA Sec. 601(a)): Information and conclusions on whether assistance will encourage efforts of the country to:  
(a) increase the flow of international trade; (b) foster private initiative and competition; (c) encourage development and use of cooperatives, credit unions, and savings and loan associations; (d) discourage monopolistic practices; (e) improve technical efficiency of industry, agriculture, and commerce; and (f) strengthen free labor unions.

ASSISTANCE WILL  
SUPPORT (e)

**2. U.S. Private Trade and Investment**  
(FAA Sec. 601(b)): Information and conclusions on how assistance will encourage U.S. private trade and investment abroad and encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise).

N/A

### 3. Congressional Notification

a. **General requirement (FY 1993 Appropriations Act Sec. 522; FAA Sec. 634A):** If money is to be obligated for an activity not previously justified to Congress, or for an amount in excess of amount previously justified to Congress, has Congress been properly notified (unless the Appropriations Act notification requirement has been waived because of substantial risk to human health or welfare)?

U.S CONGRESS HAS BEEN PROPERLY NOTIFIED

b. **Notice of new account obligation (FY 1993 Appropriations Act Sec. 514):** If funds are being obligated under an appropriation account to which they were not appropriated, has the President consulted with and provided a written justification to the House and Senate Appropriations Committees and has such obligation been subject to regular notification procedures?

N/A

c. **Cash transfers and nonproject sector assistance (FY 1993 Appropriations Act Sec. 571(b)(3)):** If funds are to be made available in the form of cash transfer or nonproject sector assistance, has the Congressional notice included a detailed description of how the funds will be used, with a discussion of U.S. interests to be served and a description of any economic policy reforms to be promoted?

N/A

4. **Engineering and Financial Plans (FAA Sec. 611(a)):** Prior to an obligation in excess of \$500,000, will there be: (a) engineering, financial or other plans necessary to carry out the assistance; and (b) a reasonably firm estimate of the cost to the U.S. of the assistance?

NO

5. **Legislative Action (FAA Sec. 611(a)(2)):** If legislative action is required within recipient country with respect to an obligation in excess of \$500,000, what is the basis for a reasonable expectation that such action

N/A WITHIN A RECIPIENT. SADC IS EXPECTED TO MEET CONDITION FOR 1994 FY FUNDING AS PLANNED.

96

will be completed in time to permit orderly accomplishment of the purpose of the assistance?

6. **Water Resources** (FAA Sec. 611(b); FY 1993 Appropriations Act Sec. 501): If project is for water or water-related land resource construction, have benefits and costs been computed to the extent practicable in accordance with the principles, standards, and procedures established pursuant to the Water Resources Planning Act (42 U.S.C. 1962, et seq.)? (See A.I.D. Handbook 3 for guidelines.)

N/A

7. **Cash Transfer and Sector Assistance** (FY 1993 Appropriations Act Sec. 571(b)): Will cash transfer or nonproject sector assistance be maintained in a separate account and not commingled with other funds (unless such requirements are waived by Congressional notice for nonproject sector assistance)?

N/A

8. **Capital Assistance** (FAA Sec. 611(e)): If project is capital assistance (e.g., construction), and total U.S. assistance for it will exceed \$1 million, has Mission Director certified and Regional Assistant Administrator taken into consideration the country's capability to maintain and utilize the project effectively?

N/A

9. **Multiple Country Objectives** (FAA Sec. 601(a)): Information and conclusions on whether projects will encourage efforts of the country to: (a) increase the flow of international trade; (b) foster private initiative and competition; (c) encourage development and use of cooperatives, credit unions, and savings and loan associations; (d) discourage monopolistic practices; (e) improve technical efficiency of industry, agriculture and commerce; and (f) strengthen free labor unions.

PROJECT WILL SUPPORT (e)

10. **U.S. Private Trade** (FAA Sec. 601(b)): Information and conclusions on how project will encourage U.S. private trade and investment abroad and encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise).

N/A

11. **Local Currencies**

a. **Recipient Contributions** (FAA Secs. 612(b), 636(h)): Describe steps taken to assure that, to the maximum extent possible, the country is contributing local currencies to meet the cost of contractual and other services, and foreign currencies owned by the U.S. are utilized in lieu of dollars.

N/A

b. **U.S.-Owned Currency** (FAA Sec. 612(d)): Does the U.S. own excess foreign currency of the country and, if so, what arrangements have been made for its release?

N/A

c. **Separate Account** (FY 1993 Appropriations Act Sec. 571). If assistance is furnished to a foreign government under arrangements which result in the generation of local currencies:

N/A

(1) Has A.I.D. (a) required that local currencies be deposited in a separate account established by the recipient government, (b) entered into an agreement with that government providing the amount of local currencies to be generated and the terms and conditions under which the currencies so deposited may be utilized, and (c) established by agreement the responsibilities of A.I.D. and that government to monitor and account for deposits into and disbursements from the separate account?

(2) Will such local currencies, or an equivalent amount of local currencies, be used only to carry out the purposes of the DA or ESF chapters of the FAA (depending on which chapter is the source of the assistance) or for the administrative requirements of the United States Government?

(3) Has A.I.D. taken all appropriate steps to ensure that the equivalent of local currencies disbursed from the separate account are used for the agreed purposes?

(4) If assistance is terminated to a country, will any unencumbered balances of funds remaining in a separate account be disposed of for purposes agreed to by the recipient government and the United States Government?

## 12. Trade Restrictions

a. **Surplus Commodities (FY 1993 Appropriations Act Sec. 520(a)):** If assistance is for the production of any commodity for export, is the commodity likely to be in surplus on world markets at the time the resulting productive capacity becomes operative, and is such assistance likely to cause substantial injury to U.S. producers of the same, similar or competing commodity?

N/A

b. **Textiles (Lautenberg Amendment) (FY 1993 Appropriations Act Sec. 520(c)):** Will the assistance (except for programs in Caribbean Basin Initiative countries under U.S. Tariff Schedule "Section 807," which allows reduced tariffs on articles assembled abroad from U.S.-made components) be used directly to procure feasibility studies, prefeasibility studies, or project profiles of potential investment in, or to assist the establishment of facilities specifically designed for, the manufacture for export to the United States or to third country markets in direct competition with U.S. exports, of

N/A

textiles, apparel, footwear, handbags, flat goods (such as wallets or coin purses worn on the person), work gloves or leather wearing apparel?

13. **Tropical Forests** (FY 1991 Appropriations Act Sec. 533(c)(3) (as referenced in section 532(d) of the FY 1993 Appropriations Act): Will funds be used for any program, project or activity which would (a) result in any significant loss of tropical forests, or (b) involve industrial timber extraction in primary tropical forest areas? NO

14. **PVO Assistance**

a. **Auditing and registration** (FY 1993 Appropriations Act Sec. 536): If assistance is being made available to a PVO, has that organization provided upon timely request any document, file, or record necessary to the auditing requirements of A.I.D., and is the PVO registered with A.I.D.? YES

b. **Funding sources** (FY 1993 Appropriations Act, Title II, under heading "Private and Voluntary Organizations"): If assistance is to be made to a United States PVO (other than a cooperative development organization), does it obtain at least 20 percent of its total annual funding for international activities from sources other than the United States Government? N/A

15. **Project Agreement Documentation** (State Authorization Sec. 139 (as interpreted by conference report)): Has confirmation of the date of signing of the project agreement, including the amount involved, been cabled to State L/T and A.I.D. LEG within 60 days of the agreement's entry into force with respect to the United States, and has the full text of the agreement been pouched to those same offices? (See Handbook 3, Appendix 6G for agreements covered by this provision). REQUIREMENT WILL BE MET AFTER SIGNING GRANT AGREEMENT.

16. **Metric System** (Omnibus Trade and Competitiveness Act of 1988 Sec. 5164, as interpreted by conference report, amending Metric Conversion Act of 1975 Sec. 2, and as implemented through A.I.D. policy):

N/A

Does the assistance activity use the metric system of measurement in its procurements, grants, and other business-related activities, except to the extent that such use is impractical or is likely to cause significant inefficiencies or loss of markets to United States firms? Are bulk purchases usually to be made in metric, and are components, subassemblies, and semi-fabricated materials to be specified in metric units when economically available and technically adequate? Will A.I.D. specifications use metric units of measure from the earliest programmatic stages, and from the earliest documentation of the assistance processes (for example, project papers) involving quantifiable measurements (length, area, volume, capacity, mass and weight), through the implementation stage?

17. **Women in Development** (FY 1993 Appropriations Act, Title II, under heading "Women in Development"): Will assistance be designed so that the percentage of women participants will be demonstrably increased?

YES

18. **Regional and Multilateral Assistance** (FAA Sec. 209): Is assistance more efficiently and effectively provided through regional or multilateral organizations? If so, why is assistance not so provided? Information and conclusions on whether assistance will encourage developing countries to cooperate in regional development programs.

YES - THIS IS A REGIONAL ACTIVITY

19. **Abortions** (FY 1993 Appropriations Act, Title II, under heading "Population, DA," and Sec. 524):

a. Will assistance be made available to any organization or program which, as determined by the President, supports or participates in the management of a program of coercive abortion or involuntary sterilization? NO

b. Will any funds be used to lobby for abortion? NO

20. **Cooperatives** (FAA Sec. 111): Will assistance help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward a better life? N/A

21. **U.S.-Owned Foreign Currencies**

a. **Use of currencies** (FAA Secs. 612(b), 636(h); FY 1993 Appropriations Act Secs. 507, 509): Are steps being taken to assure that, to the maximum extent possible, foreign currencies owned by the U.S. are utilized in lieu of dollars to meet the cost of contractual and other services. N/A

b. **Release of currencies** (FAA Sec. 612(d)): Does the U.S. own excess foreign currency of the country and, if so, what arrangements have been made for its release? N/A

22. **Procurement**

a. **Small business** (FAA Sec. 602(a)): Are there arrangements to permit U.S. small business to participate equitably in the furnishing of commodities and services financed? NO

b. **U.S. procurement** (FAA Sec. 604(a) as amended by section 597 of the FY 1993 Appropriations Act): Will all procurement be from the U.S., the recipient country, or developing countries except as otherwise determined in accordance with the criteria of this section? YES

c. **Marine insurance** (FAA Sec. 604(d)): If the cooperating country discriminates against marine insurance companies authorized to do business in the U.S., will commodities be insured in the United States against marine risk with such a company? N/A

d. **Non-U.S. agricultural procurement** (FAA Sec. 604(e)): If non-U.S. procurement of agricultural commodity or product thereof is to be financed, is there provision against such procurement when the domestic price of such commodity is less than parity? (Exception where commodity financed could not reasonably be procured in U.S.) N/A

e. **Construction or engineering services** (FAA Sec. 604(g)): Will construction or engineering services be procured from firms of advanced developing countries which are otherwise eligible under Code 941 and which have attained a competitive capability in international markets in one of these areas? (Exception for those countries which receive direct economic assistance under the FAA and permit United States firms to compete for construction or engineering services financed from assistance programs of these countries.) N/A

f. **Cargo preference shipping** (FAA Sec. 603): Is the shipping excluded from compliance with the requirement in section 901(b) of the Merchant Marine Act of 1936, as amended, that at least 50 percent of the gross tonnage of commodities (computed separately for dry bulk carriers, dry cargo liners, and tankers) financed shall be transported on privately owned U.S. flag commercial vessels to the extent such vessels are available at fair and reasonable rates? N/A

g. **Technical assistance** (FAA Sec. 621(a)): If technical assistance is financed, will such assistance be furnished by private enterprise on a contract basis to the fullest extent practicable? Will the NO. PROJECT IS A GRANT TO AN INTERNATIONAL RESEARCH ORGANIZATION

facilities and resources of other Federal agencies be utilized, when they are particularly suitable, not competitive with private enterprise, and made available without undue interference with domestic programs?

**h. U.S. air carriers**

(International Air Transportation Fair Competitive Practices Act, 1974): If air transportation of persons or property is financed on grant basis, will U.S. carriers be used to the extent such service is available? **YES**

**i. Termination for convenience of U.S. Government** (FY 1993 Appropriations Act Sec. 504): If the U.S. Government is a party to a contract for procurement, does the contract contain a provision authorizing termination of such contract for the convenience of the United States? **N/A**

**j. Consulting services** (FY 1993 Appropriations Act Sec. 523): If assistance is for consulting service through procurement contract pursuant to 5 U.S.C. 3109, are contract expenditures a matter of public record and available for public inspection (unless otherwise provided by law or Executive order)? **N/A**

**k. Metric conversion** (Omnibus Trade and Competitiveness Act of 1988, as interpreted by conference report, amending Metric Conversion Act of 1975 Sec. 2, and as implemented through A.I.D. policy): Does the assistance program use the metric system of measurement in its procurements, grants, and other business-related activities, except to the extent that such use is impractical or is likely to cause significant inefficiencies or loss of markets to United States firms? Are bulk purchases usually to be made in metric, and are components, subassemblies, and semi-fabricated materials to be specified in metric units when economically available and technically adequate? Will A.I.D. specifications use metric units of measure from the earliest programmatic stages, and from the earliest **N/A**

documentation of the assistance processes (for example, project papers) involving quantifiable measurements (length, area, volume, capacity, mass and weight), through the implementation stage?

**1. Competitive Selection**

**Procedures** (FAA Sec. 601(e)): Will the assistance utilize competitive selection procedures for the awarding of contracts, except where applicable procurement rules allow otherwise? **YES**

**23. Construction**

**a. Capital project** (FAA Sec. 601(d)): If capital (e.g., construction) project, will U.S. engineering and professional services be used? **N/A**

**b. Construction contract** (FAA Sec. 611(c)): If contracts for construction are to be financed, will they be let on a competitive basis to maximum extent practicable? **N/A**

**c. Large projects, Congressional approval** (FAA Sec. 620(k)): If for construction of productive enterprise, will aggregate value of assistance to be furnished by the U.S. not exceed \$100 million (except for productive enterprises in Egypt that were described in the Congressional Presentation), or does assistance have the express approval of Congress? **N/A**

**24. U.S. Audit Rights** (FAA Sec. 301(d)): If fund is established solely by U.S. contributions and administered by an international organization, does Comptroller General have audit rights? **YES**

**25. Communist Assistance** (FAA Sec. 620(h)). Do arrangements exist to insure that United States foreign aid is not used in a manner which, contrary to the best interests of the United States, promotes or assists the foreign aid projects or activities of the Communist-bloc countries? **YES**

**26. Narcotics**

**a. Cash reimbursements (FAA Sec. 483):** Will arrangements preclude use of financing to make reimbursements, in the form of cash payments, to persons whose illicit drug crops are eradicated? **YES**

**b. Assistance to narcotics traffickers (FAA Sec. 487):** Will arrangements take "all reasonable steps" to preclude use of financing to or through individuals or entities which we know or have reason to believe have either: (1) been convicted of a violation of any law or regulation of the United States or a foreign country relating to narcotics (or other controlled substances); or (2) been an illicit trafficker in, or otherwise involved in the illicit trafficking of, any such controlled substance? **YES**

**27. Expropriation and Land Reform (FAA Sec. 620(g)):** Will assistance preclude use of financing to compensate owners for expropriated or nationalized property, except to compensate foreign nationals in accordance with a land reform program certified by the President? **YES**

**28. Police and Prisons (FAA Sec. 660):** Will assistance preclude use of financing to provide training, advice, or any financial support for police, prisons, or other law enforcement forces, except for narcotics programs? **YES**

**29. CIA Activities (FAA Sec. 662):** Will assistance preclude use of financing for CIA activities? **YES**

**30. Motor Vehicles (FAA Sec. 636(i)):** Will assistance preclude use of financing for purchase, sale, long-term lease, exchange or guaranty of the sale of motor vehicles manufactured outside U.S., unless a waiver is obtained? **YES**

31. **Military Personnel** (FY 1993 Appropriations Act Sec. 503): Will assistance preclude use of financing to pay pensions, annuities, retirement pay, or adjusted service compensation for prior or current military personnel? YES

32. **Payment of U.N. Assessments** (FY 1993 Appropriations Act Sec. 505): Will assistance preclude use of financing to pay U.N. assessments, arrearages or dues? YES

33. **Multilateral Organization Lending** (FY 1993 Appropriations Act Sec. 506): Will assistance preclude use of financing to carry out provisions of FAA section 209(d) (transfer of FAA funds to multilateral organizations for lending)? YES

34. **Export of Nuclear Resources** (FY 1993 Appropriations Act Sec. 510): Will assistance preclude use of financing to finance the export of nuclear equipment, fuel, or technology? YES

35. **Repression of Population** (FY 1993 Appropriations Act Sec. 511): Will assistance preclude use of financing for the purpose of aiding the efforts of the government of such country to repress the legitimate rights of the population of such country contrary to the Universal Declaration of Human Rights? YES

36. **Publicity or Propaganda** (FY 1993 Appropriations Act Sec. 516): Will assistance be used for publicity or propaganda purposes designed to support or defeat legislation pending before Congress, to influence in any way the outcome of a political election in the United States, or for any publicity or propaganda purposes not authorized by Congress? NO

37. **Marine Insurance** (FY 1993 Appropriations Act Sec. 560): Will any A.I.D. contract and solicitation, and subcontract entered into under such contract, include a clause requiring that U.S. marine insurance companies have a fair opportunity to bid for marine insurance when such insurance is necessary or appropriate? N/A

38. **Exchange for Prohibited Act** (FY 1993 Appropriations Act Sec. 565): Will any assistance be provided to any foreign government (including any instrumentality or agency thereof), foreign person, or United States person in exchange for that foreign government or person undertaking any action which is, if carried out by the United States Government, a United States official or employee, expressly prohibited by a provision of United States law? NO

39. **Commitment of Funds** (FAA Sec. 635(h)): Does a contract or agreement entail a commitment for the expenditure of funds during a period in excess of 5 years from the date of the contract or agreement? NO

40. **Impact on U.S. Jobs** (FY 1993 Appropriations Act, Sec. 599):

(a) Will any financial incentive be provided to a business located in the U.S. for the purpose of inducing that business to relocate outside the U.S. in a manner that would likely reduce the number of U.S. employees of that business? NO

(b) Will assistance be provided for the purpose of establishing or developing an export processing zone or designated area in which the country's tax, tariff, labor, environment, and safety laws do not apply? If so, has the President determined and certified that such assistance is not likely to cause a loss of jobs within the U.S.? NO

(c) Will assistance be provided for a project or activity that contributes to the violation of internationally recognized workers rights, as defined in section 502(a)(4) of the Trade Act of 1974, of workers in the recipient country?

NO

B. CRITERIA APPLICABLE TO DEVELOPMENT ASSISTANCE ONLY

1. **Agricultural Exports (Bumpers Amendment)** (FY 1993 Appropriations Act Sec. 520(b), as interpreted by conference report for original enactment): If assistance is for agricultural development activities (specifically, any testing or breeding feasibility study, variety improvement or introduction, consultancy, publication, conference, or training), are such activities: (1) specifically and principally designed to increase agricultural exports by the host country to a country other than the United States, where the export would lead to direct competition in that third country with exports of a similar commodity grown or produced in the United States, and can the activities reasonably be expected to cause substantial injury to U.S. exporters of a similar agricultural commodity; or (2) in support of research that is intended primarily to benefit U.S. producers?

NO

2. **Tied Aid Credits** (FY 1993 Appropriations Act, Title II, under heading "Economic Support Fund"): Will DA funds be used for tied aid credits?

N/A

3. **Appropriate Technology** (FAA Sec. 107): Is special emphasis placed on use of appropriate technology (defined as relatively smaller, cost-saving, labor-using technologies that are generally most appropriate for the small farms, small businesses, and small incomes of the poor)?

YES

**4. Indigenous Needs and Resources** (FAA Sec. 281(b)): Describe extent to which the activity recognizes the particular needs, desires, and capacities of the people of the country; utilizes the country's intellectual resources to encourage institutional development; and supports civic education and training in skills required for effective participation in governmental and political processes essential to self-government.

PROJECT STRESSES TECHNOLOG  
TRANSFER OF DIRECT BENEFIT  
TO HOUSEHOLD FOOD SECURITY

**5. Economic Development** (FAA Sec. 101(a)): Does the activity give reasonable promise of contributing to the development of economic resources, or to the increase of productive capacities and self-sustaining economic growth?

YES

**6. Special Development Emphases** (FAA Secs. 102(b), 113, 281(a)): Describe extent to which activity will: (a) effectively involve the poor in development by extending access to economy at local level, increasing labor-intensive production and the use of appropriate technology, dispersing investment from cities to small towns and rural areas, and insuring wide participation of the poor in the benefits of development on a sustained basis, using appropriate U.S. institutions; (b) encourage democratic private and local governmental institutions; (c) support the self-help efforts of developing countries; (d) promote the participation of women in the national economies of developing countries and the improvement of women's status; and (e) utilize and encourage regional cooperation by developing countries.

PROJECT WILL PROVIDE  
PRIMAR<sup>y</sup> BENEFIT TO RURAL  
POOR.

**7. Recipient Country Contribution** (FAA Secs. 110, 124(d)): Will the recipient country provide at least 25 percent of the costs of the program, project, or activity with respect to which the assistance is to be furnished (or is the latter cost-sharing requirement being waived for a "relatively least developed" country)?

N/A - REGIONAL ACTIVITY

1/2

**8. Benefit to Poor Majority (FAA Sec. 128(b)):** If the activity attempts to increase the institutional capabilities of private organizations or the government of the country, or if it attempts to stimulate scientific and technological research, has it been designed and will it be monitored to ensure that the ultimate beneficiaries are the poor majority? **YES**

**9. Abortions (FAA Sec. 104(f); FY 1993 Appropriations Act, Title II, under heading "Population, DA," and Sec. 534):**

a. Are any of the funds to be used for the performance of abortions as a method of family planning or to motivate or coerce any person to practice abortions? **NO**

b. Are any of the funds to be used to pay for the performance of involuntary sterilization as a method of family planning or to coerce or provide any financial incentive to any person to undergo sterilizations? **NO**

c. Are any of the funds to be made available to any organization or program which, as determined by the President, supports or participates in the management of a program of coercive abortion or involuntary sterilization? **NO**

d. Will funds be made available only to voluntary family planning projects which offer, either directly or through referral to, or information about access to, a broad range of family planning methods and services? **N/A**

e. In awarding grants for natural family planning, will any applicant be discriminated against because of such applicant's religious or conscientious commitment to offer only natural family planning? **N/A**

f. Are any of the funds to be used to pay for any biomedical research which relates, in whole or in part, to **NO**

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methods of, or the performance of, abortions or involuntary sterilization as a means of family planning?

g. Are any of the funds to be made available to any organization if the President certifies that the use of these funds by such organization would violate any of the above provisions related to abortions and involuntary sterilization?

N/A

10. **Contract Awards** (FAA Sec. 601(e)): Will the project utilize competitive selection procedures for the awarding of contracts, except where applicable procurement rules allow otherwise?

YES

11. **Disadvantaged Enterprises** (FY 1993 Appropriations Act Sec. 563): What portion of the funds will be available only for activities of economically and socially disadvantaged enterprises, historically black colleges and universities, colleges and universities having a student body in which more than 40 percent of the students are Hispanic Americans, and private and voluntary organizations which are controlled by individuals who are black Americans, Hispanic Americans, or Native Americans, or who are economically or socially disadvantaged (including women)?

N/A -  
A GRANT OF AN INTERNATIONAL  
RESEARCH ORGANIZATION

12. **Biological Diversity** (FAA Sec. 119(g)): Will the assistance: (a) support training and education efforts which improve the capacity of recipient countries to prevent loss of biological diversity; (b) be provided under a long-term agreement in which the recipient country agrees to protect ecosystems or other wildlife habitats; (c) support efforts to identify and survey ecosystems in recipient countries worthy of protection; or (d) by any direct or indirect means significantly degrade national parks or similar protected areas or introduce exotic plants or animals into such areas?

N/A

13. **Tropical Forests** (FAA Sec. 118; FY 1991 Appropriations Act Sec. 533(c) as referenced in section 532(d) of the FY 1993 Appropriations Act):

a. **A.I.D. Regulation 16:** Does the assistance comply with the environmental procedures set forth in A.I.D. Regulation 16? YES

b. **Conservation:** Does the assistance place a high priority on conservation and sustainable management of tropical forests? Specifically, does the assistance, to the fullest extent feasible: (1) stress the importance of conserving and sustainably managing forest resources; (2) support activities which offer employment and income alternatives to those who otherwise would cause destruction and loss of forests, and help countries identify and implement alternatives to colonizing forested areas; (3) support training programs, educational efforts, and the establishment or strengthening of institutions to improve forest management; (4) help end destructive slash-and-burn agriculture by supporting stable and productive farming practices; (5) help conserve forests which have not yet been degraded by helping to increase production on lands already cleared or degraded; (6) conserve forested watersheds and rehabilitate those which have been deforested; (7) support training, research, and other actions which lead to sustainable and more environmentally sound practices for timber harvesting, removal, and processing; (8) support research to expand knowledge of tropical forests and identify alternatives which will prevent forest destruction, loss, or degradation; (9) conserve biological diversity in forest areas by supporting efforts to identify, establish, and maintain a representative network of protected tropical forest ecosystems on a worldwide basis, by making the establishment of protected areas a condition of support for activities involving forest clearance or degradation, N/A

and by helping to identify tropical forest ecosystems and species in need of protection and establish and maintain appropriate protected areas; (10) seek to increase the awareness of U.S. Government agencies and other donors of the immediate and long-term value of tropical forests; (11) utilize the resources and abilities of all relevant U.S. government agencies; (12) be based upon careful analysis of the alternatives available to achieve the best sustainable use of the land; and (13) take full account of the environmental impacts of the proposed activities on biological diversity?

c. **Forest degradation:** Will assistance be used for: (1) the procurement or use of logging equipment, unless an environmental assessment indicates that all timber harvesting operations involved will be conducted in an environmentally sound manner and that the proposed activity will produce positive economic benefits and sustainable forest management systems; (2) actions which will significantly degrade national parks or similar protected areas which contain tropical forests, or introduce exotic plants or animals into such areas; (3) activities which would result in the conversion of forest lands to the rearing of livestock; (4) the construction, upgrading, or maintenance of roads (including temporary haul roads for logging or other extractive industries) which pass through relatively undergraded forest lands; (5) the colonization of forest lands; or (6) the construction of dams or other water control structures which flood relatively undergraded forest lands, unless with respect to each such activity an environmental assessment indicates that the activity will contribute significantly and directly to improving the livelihood of the rural poor and will be conducted in an environmentally sound manner which supports sustainable development?

NO

d. **Sustainable forestry:** If assistance relates to tropical forests, will project assist countries in developing a systematic analysis of the appropriate use of their total tropical forest resources, with the goal of developing a national program for sustainable forestry? N/A

e. **Environmental impact statements:** Will funds be made available in accordance with provisions of FAA Section 117(c) and applicable A.I.D. regulations requiring an environmental impact statement for activities significantly affecting the environment? YES

14. **Energy** (FY 1991 Appropriations Act Sec. 533(c) as referenced in section 532(d) of the FY 1993 Appropriations Act): If assistance relates to energy, will such assistance focus on: (a) end-use energy efficiency, least-cost energy planning, and renewable energy resources, and (b) the key countries where assistance would have the greatest impact on reducing emissions from greenhouse gases? N/A

15. **Debt-for-Nature Exchange** (FAA Sec. 463): If project will finance a debt-for-nature exchange, describe how the exchange will support protection of: (a) the world's oceans and atmosphere, (b) animal and plant species, and (c) parks and reserves; or describe how the exchange will promote: (d) natural resource management, (e) local conservation programs, (f) conservation training programs, (g) public commitment to conservation, (h) land and ecosystem management, and (i) regenerative approaches in farming, forestry, fishing, and watershed management. N/A

16. **Deobligation/Reobligation** (FY 1993 Appropriations Act Sec. 515): If deob/reob authority is sought to be exercised in the provision of DA assistance, are the funds being obligated for the same general purpose, and for countries within the same region as N/A

originally obligated, and have the House and Senate Appropriations Committees been properly notified?

**17. Loans**

a. **Repayment capacity** (FAA Sec. 122(b)): Information and conclusion on capacity of the country to repay the loan at a reasonable rate of interest. N/A

b. **Long-range plans** (FAA Sec. 122(b)): Does the activity give reasonable promise of assisting long-range plans and programs designed to develop economic resources and increase productive capacities? N/A

c. **Interest rate** (FAA Sec. 122(b)): If development loan is repayable in dollars, is interest rate at least 2 percent per annum during a grace period which is not to exceed ten years, and at least 3 percent per annum thereafter? N/A

d. **Exports to United States** (FAA Sec. 620(d)): If assistance is for any productive enterprise which will compete with U.S. enterprises, is there an agreement by the recipient country to prevent export to the U.S. of more than 20 percent of the enterprise's annual production during the life of the loan, or has the requirement to enter into such an agreement been waived by the President because of a national security interest? N/A

**18. Development Objectives** (FAA Secs. 102(a), 111, 113, 281(a)): Extent to which activity will: (1) effectively involve the poor in development, by expanding access to economy at local level, increasing labor-intensive production and the use of appropriate technology, spreading investment out from cities to small towns and rural areas, and insuring wide participation of the poor in the benefits of development on a sustained basis, using the appropriate U.S. institutions; (2) help develop cooperatives, especially by technical

**PRIMARY PROJECT  
BENEFICIARY WILL BE THE  
RURAL POOR**

assistance, to assist rural and urban poor to help themselves toward better life, and otherwise encourage democratic private and local governmental institutions; (3) support the self-help efforts of developing countries; (4) promote the participation of women in the national economies of developing countries and the improvement of women's status; and (5) utilize and encourage regional cooperation by developing countries?

**19. Agriculture, Rural Development and Nutrition, and Agricultural Research (FAA Secs. 103 and 103A):**

**a. Rural poor and small farmers:** If assistance is being made available for agriculture, rural development or nutrition, describe extent to which activity is specifically designed to increase productivity and income of rural poor; or if assistance is being made available for agricultural research, has account been taken of the needs of small farmers, and extensive use of field testing to adapt basic research to local conditions shall be made.

YES

**b. Nutrition:** Describe extent to which assistance is used in coordination with efforts carried out under FAA Section 104 (Population and Health) to help improve nutrition of the people of developing countries through encouragement of increased production of crops with greater nutritional value; improvement of planning, research, and education with respect to nutrition, particularly with reference to improvement and expanded use of indigenously produced foodstuffs; and the undertaking of pilot or demonstration programs explicitly addressing the problem of malnutrition of poor and vulnerable people.

PROGRAM WILL  
>CAL/CAPITA/DAY  
IN GRAIN DEFICIENT AREAS

**c. Food security:** Describe extent to which activity increases national food security by improving food policies and management and by strengthening national food reserves, with particular concern for the needs of the

PROJECT WILL PROVIDE  
IMPROVED SMALL GRAIN  
CULTIVARS FOR RESOURCE POOR  
FARMERS IN RURAL AREAS

poor, through measures encouraging domestic production, building national food reserves, expanding available storage facilities, reducing post harvest food losses, and improving food distribution.

**20. Population and Health** (FAA Secs. 104(b) and (c)): If assistance is being made available for population or health activities, describe extent to which activity emphasizes low-cost, integrated delivery systems for health, nutrition and family planning for the poorest people, with particular attention to the needs of mothers and young children, using paramedical and auxiliary medical personnel, clinics and health posts, commercial distribution systems, and other modes of community outreach.

N/A

**21. Education and Human Resources Development** (FAA Sec. 105): If assistance is being made available for education, public administration, or human resource development, describe (a) extent to which activity strengthens nonformal education, makes formal education more relevant, especially for rural families and urban poor, and strengthens management capability of institutions enabling the poor to participate in development; and (b) extent to which assistance provides advanced education and training of people of developing countries in such disciplines as are required for planning and implementation of public and private development activities.

N/A

**22. Energy, Private Voluntary Organizations, and Selected Development Activities** (FAA Sec. 106): If assistance is being made available for energy, private voluntary organizations, and selected development problems, describe extent to which activity is:

N/A

a. concerned with data collection and analysis, the training of skilled personnel, research on and development of suitable energy sources, and pilot projects to test new methods of energy production; and facilitative of

research on and development and use of small-scale, decentralized, renewable energy sources for rural areas, emphasizing development of energy resources which are environmentally acceptable and require minimum capital investment;

b. concerned with technical cooperation and development, especially with U.S. private and voluntary, or regional and international development, organizations;

c. research into, and evaluation of, economic development processes and techniques;

d. reconstruction after natural or manmade disaster and programs of disaster preparedness;

e. for special development problems, and to enable proper utilization of infrastructure and related projects funded with earlier U.S. assistance;

f. for urban development, especially small, labor-intensive enterprises, marketing systems for small producers, and financial or other institutions to help urban poor participate in economic and social development.

23. **Capital Projects** (Jobs Through Export Act of 1992, Secs. 303 and 306(d)): If assistance is being provided for a capital project, is the project developmentally sound and will the project measurably alleviate the worst manifestations of poverty or directly promote environmental safety and sustainability at the community level?

N/A

C. **CRITERIA APPLICABLE TO ECONOMIC SUPPORT FUNDS ONLY**

1. **Economic and Political Stability** (FAA Sec. 531(a)): Will this assistance promote economic and political stability?

N/A

To the maximum extent feasible, is this assistance consistent with the policy directions, purposes, and programs of Part I of the FAA?

2. **Military Purposes** (FAA Sec. 531(e)): Will this assistance be used for military or paramilitary purposes?

3. **Commodity Grants/Separate Accounts** (FAA Sec. 609): If commodities are to be granted so that sale proceeds will accrue to the recipient country, have Special Account (counterpart) arrangements been made? (For FY 1993, this provision is superseded by the separate account requirements of FY 1993 Appropriations Act Sec. 571(a), see Sec. 571(a)(5).)

4. **Generation and Use of Local Currencies** (FAA Sec. 531(d)): Will ESF funds made available for commodity import programs or other program assistance be used to generate local currencies? If so, will at least 50 percent of such local currencies be available to support activities consistent with the objectives of FAA sections 103 through 106? (For FY 1993, this provision is superseded by the separate account requirements of FY 1993 Appropriations Act Sec. 571(a), see Sec. 571(a)(5).)

5. **Cash Transfer Requirements** (FY 1993 Appropriations Act, Title II, under heading "Economic Support Fund," and Sec. 571(b)). If assistance is in the form of a cash transfer:

a. **Separate account:** Are all such cash payments to be maintained by the country in a separate account and not to be commingled with any other funds?

b. **Local currencies:** Will all local currencies that may be generated with funds provided as a cash transfer to such a country also be deposited in a special account, and has A.I.D. entered into an agreement with that government setting forth the amount of the local currencies to be generated, the terms and

conditions under which they are to be used, and the responsibilities of A.I.D. and that government to monitor and account for deposits and disbursements?

c. **U.S. Government use of local currencies:** Will all such local currencies also be made available to the U.S. government as the U.S. determines necessary for the requirements of the U.S. Government, or to carry out development assistance (including DFA) or ESF purposes?

d. **Congressional notice:** Has Congress received prior notification providing in detail how the funds will be used, including the U.S. interests that will be served by the assistance, and, as appropriate, the economic policy reforms that will be promoted by the cash transfer assistance?

6. **Capital Projects** (Jobs Through Exports Act of 1992, Sec. 306, FY 1993 Appropriations Act, Sec. 595): If assistance is being provided for a capital project, will the project be developmentally-sound and sustainable, i.e., one that is (a) environmentally sustainable, (b) within the financial capacity of the government or recipient to maintain from its own resources, and (c) responsive to a significant development priority initiated by the country to which assistance is being provided. (Please note the definition of "capital project" contained in section 595 of the FY 1993 Appropriations Act.)



ATTACHMENT VI

# SACCAR

Southern African Centre for Cooperation  
in

Agricultural Research

Private Bag 00108 Gaborone Botswana  
Telephone: 373847/8 Telex: 2752 SACAR BD Fax: 375204



REF: SAR/2/6

7th April, 1993

The Director  
USAID  
P.O. Box 6988  
Belgravia  
HARARE  
Zimbabwe

Dear Sir,

A REQUEST TO YOU AND YOUR COUNTRY THAT YOU CONTINUE TO SUPPORT THE IMPROVEMENT OF SORGHUM AND MILLET IN SADC REGION

You will recall Sir, that your country, the United States of America through its Agency for International Development (USAID) has together with Canada and Germany been in the forefront to support SADC in an attempt to improve the food security situation of the resource poor communities living in the drier areas that are prone to drought. You have contributed more than any other country in ensuring that SADC develops improved germplasm in sorghum and millet, better technologies and increased capacity to undertake research in these crops and that information on germplasm enhancement and crop management connected with them is readily available to extension agents and farmers. The contributions of US\$29.95 million from your Agency, US\$7.30million from Canada, US\$3.20million from Germans and US\$0.30million from SADC during the period 1983-1991 have led to unprecedented achievements within a relatively short time. These achievements have included:

1. (a) Generation of 143 improved varieties and hybrids of sorghum;
- (b) Generation of 124 improved varieties of pearl millet;
2. One hundred and ten (110) SADC scientists have been trained at B.Sc., M.Sc. and PhD levels in various specialisations of research on these crops. Twenty (20) of these have been women.

3. Two hundred and six (206) technicians have been trained in various sorghum and millet research specialisations.
4. Technologies on management of the resources of soils and water for increased and sustained production of these crops have been produced.
5. Technologies to reduce the pest and disease menace of these crops have been produced.

Because of the above achievements you and your donor colleagues have been asking us whether the National Research Systems (NARS) are now ready to take over the research on sorghum and millet and therefore reduce the research activities at regional level. The Technical Advisory Panel for the Program, the Steering Committee and the Donor Review have recommended that the scale of research operation can be reduced but that emphasis should be directed into consolidation of the achievements that have already been made. More specifically, this means showing impact through a wide adoption of improved germplasm and technologies by the resource poor farmers and the SADC member states to increase their resource contributions to the improvement of these crops.

We wish to record at this juncture your generous support in terms of the deployment of your senior staff to work with us in reviewing the program and in designing its future phases. As a result of this partnership it has been felt that phase III of five years will require about US\$11.2million. The tentative budget is as follows:

USAID	US\$7.40million	including carryover
Canada	US\$1.05million	mainly carryover
Germany	US\$2.80million	including carryover
Total	US\$11.25million	

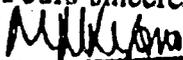
We are therefore getting back to you and your donor colleagues to request that you continue to support us during phase III in the following priority areas identified by SADC's Sorghum and Millet Commodity Improvement Program Leaders (Steering Committee members),

1. Technology transfer
2. Germplasm enhancement
3. Management of crop pests and disease including striga control,
4. Human resources development
5. Evaluation of Grain Quality.

ICRISAT as an Executing Agency has made an attempt to translate the above priority areas into a project document. We are happy with the first attempt but there are a few refinements that will have to be made on the document.

Hoping very much that you will continue to assist us,

Yours sincerely,



M.L. Kyomo  
DIRECTOR

- cc: The Permanent Secretary  
Ministry of Agriculture, Gaborone, Botswana
- : The Executive Secretary, SADC Secretariat  
Harare, Zimbabwe
- : The Director, USAID, Gaborone, Botswana
- : The Chairman, Board of SACCAR
- : Dr. J.G. Ryan  
Director General ICRISAT, Patancheru, India
- : Dr. L.K. Mughogho  
Executive Director, SMIP, Bulawayo, Zimbabwe

**SADC / ICRISAT**  
**Sorghum and Millet**  
**Improvement Program**

**Phases III and IV**

15 September 1993 - 15 September 2003



**ICRISAT**

International Crops Research Institute for the Semi-Arid Tropics  
Patancheru, Andhra Pradesh 502 324, India

## **ACRONYMS AND ABBREVIATIONS**

<b>CGIAR</b>	Consultative Group on International Agricultural Research
<b>CIDA</b>	Canadian International Development Agency
<b>FAO</b>	Food and Agriculture Organization of the United Nations
<b>FPPS</b>	Farm and Physical Plant Services
<b>BMZ/GTZ</b>	Bundesministerium für Wirtschaftliche Zusammenarbeit/Deutsche Gesellschaft für Technische Zusammenarbeit (Germany)
<b>IBPGR</b>	International Board for Plant Genetic Resources
<b>IITA</b>	International Institute of Tropical Agriculture
<b>ICRISAT</b>	International Crops Research Institute for the Semi-Arid Tropics
<b>INTSORMIL</b>	International Sorghum and Millet Collaborative Research Support Program (USA)
<b>NARS</b>	National Agricultural Research Systems
<b>SACCAR</b>	Southern African Center for Cooperation in Agricultural Research
<b>SADC</b>	Southern African Development Community
<b>SATCRIS</b>	Semi-Arid Tropical Crops Research Information Service (ICRISAT)
<b>SMIP</b>	Sorghum and Millet Improvement Program
<b>USAID</b>	United States Agency for International Development

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# 1 INTRODUCTION

The SADC<sup>a</sup>/ICRISAT Regional Sorghum and Millet Improvement Program (SMIP) for SADC countries was formally constituted with USAID funding on 15 Sep 1983 and began operations in May 1984. The initiation of this project was a direct response by ICRISAT to the invitation from the Government of Botswana, acting on behalf of SADC countries, to develop a regional program that would assist national sorghum and pearl millet programs in research and human resources development. The project is located at Matopos Research Station near Bulawayo, Zimbabwe, and is currently funded by USAID, CIDA and BMZ/GTZ.

Major accomplishments in Phases I (1983-88) and II (1988-93) include (a) the development of physical facilities and infrastructure for research and training at the regional center at Matopos and at selected NARS experiment stations, (b) introduction, adaptation and development of improved sorghum and pearl millet technologies, and (c) human resources development (particularly degree education) of NARS staff. Emphasis in SMIP Phase III will shift from these activities to the transfer of the improved sorghum and pearl millet technologies to small farmers in drought-prone regions (Figure 1). This activity will include efforts to promote greater in-country inter-institutional collaboration for delivery of technology to farmers.

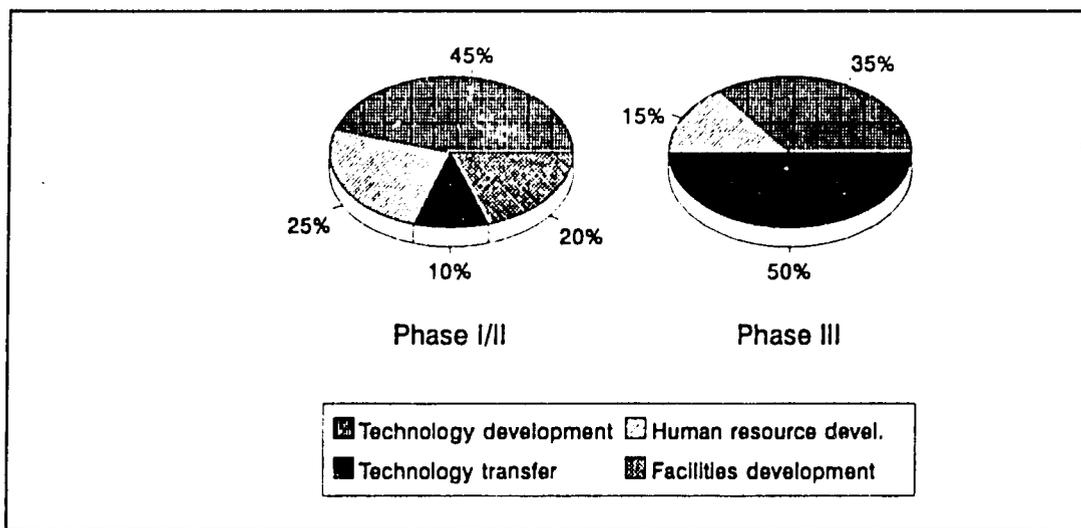


Figure 1. Shift in the allocation of SMIP resources.

In addition, SMIP assistance to the NARS will shift to a collaborative partnership designed to strengthen the quality of technology development, verification and delivery to small farmers. NARS scientists will lead in the planning and implementation of collaborative activities which will be embodied in agreed annual work plans.

SMIP Phase III will also work towards strengthening of a regional, self-sustaining sorghum and pearl millet network for sharing ideas and new technologies between SADC countries.

This proposal reiterates the importance of sorghum and pearl millet for food security in drought-prone regions, reviews progress in Phases I and II, and describes the activities, implementation plan and budget for Phase III. The important issue of sustainability or funding of the regional program is also addressed.

<sup>a</sup> Southern African Development Community member countries are Angola, Botswana, Lesotho, Malawi, Mozambique, Namibia, Swaziland, Tanzania, Zambia and Zimbabwe.

## **2 OVERVIEW AND STRATEGY**

### **2.1 Nature and Magnitude of the Problem**

Improving the productivity of sorghum and pearl millet is essential for the attainment of food security and for the establishment of sustainable production systems in the semi-arid regions of southern Africa. These regions, marginal to the production of maize, account for roughly one-third of the SADC landbase and one-quarter of the farm families, including the poorest segments of the rural populations of southern Africa. Farmers in these areas face frequent droughts and shortfalls in food availability. Even when rains are favorable and aggregate national cereal stocks are ample, many of these households still do not produce enough grain to meet their full consumption requirements. Severe poverty limits the capacity of these households to purchase adequate amounts of food, particularly in drought years such as 1991/92.

The semi-arid regions of southern Africa are also among the most highly prone to environmental degradation. The limited productivity of traditional production systems encourages the mining of soil resources. So long as food supplies remain severely limited, smallholder farmers will continue to place higher priority on the exploitation of limited land and water resources for immediate gains than on the preservation of these resources for future production. Strategies for sustainable resource use must be built into technologies designed to improve production and productivity.

The special needs of semi-arid agricultural systems have not been broadly recognized in national agricultural policies and development strategies historically pursued by governments in southern Africa. In 1980, the SADC Council of Ministers of Agriculture, and subsequently, the SADC Heads of State sought to redress this gap by requesting the establishment of a research institute responsive to the difficulties of drought-prone zones. SMIP was born out of this recommendation.

At the time of its establishment in late 1983, SMIP recognized the difficulties of offsetting the region's maize bias. Historical improvements in maize technologies and broadly focused national efforts to promote the production of maize had encouraged farmers to grow this crop, even in drought-prone areas. Market systems, processing technologies, and policy support, often in the form of massive crop subsidies, had promoted the view that grain production was equivalent with the promotion of maize. But many resource-poor farmers persisted in growing sorghum and pearl millet because of the importance of these grains for household food security. In most SADC countries, the area planted to sorghum and pearl millet continued to expand.

### **2.2 Progress during Phases I and II**

During the initial years, priority attention was given to the development of facilities at the SMIP center at Matopos which today possesses a physical plant which is adequate and provides an environment which is conducive to high research performance. After eight years of regional and collaborative national research efforts, the technical advantages of improved sorghum and pearl millet technologies can no longer be doubted. In direct comparisons with hybrid maize, improved cultivars of sorghum and pearl millet have offered grain yield advantages of 50 to 200%, especially in years of poorer rainfall. These gains are traceable in large part to the scientific collaboration between ICRISAT and national program scientists. SMIP was able to exploit the relative adaptability of cultivars from ICRISAT Center and other parts of Africa.

Phases I and II were also marked by major investments in human resource development including the provision of long term degree training to over 90 national scientists concerned with sorghum and pearl millet in a range of disciplines. Many more scientists and technicians have received in-service training. Workshops, regional trials, and monitoring tours have created a regional sorghum and pearl millet research

community linked to an international germplasm base. This network is capable of sharing research ideas and technologies across national boundaries.

The region now possesses one of the largest single concentrations of scientists with special expertise in these commodities in the world. SMIP forms part of a community of sorghum and pearl millet research and development efforts with the collective capacity to make major progress in the future.

The technological advances achieved are now beginning to reach the small farmers of southern Africa on a significant scale. SMIP support has facilitated the release of 20 new cultivars including 15 sorghums and 5 pearl millets in recent years. These include many direct introductions from ICRISAT Center in India that are beginning to benefit farmers in Malawi, Mozambique, Namibia, Tanzania, Zambia, and Zimbabwe. Many additional cultivars are in advanced stages of national testing in virtually every SADC country.

### **2.3 Strategy for Phase III - Technology Transfer and Transition**

During Phases I and II, technologies were generated and scientists were trained. The Phase III plan maps a strategy to exploit this foundation by getting technologies to farmers and ensuring that national programs' capacities to conduct sorghum and pearl millet research will be sustained. In accordance with the directives of SMIP's Steering Committee, which is composed of leaders of national sorghum and pearl millet research programs, priority is being given to a broad program of on-farm cultivar testing and related measures to facilitate the distribution and adoption of improved cultivars. Past investments in postgraduate education will be reinforced with a set of collaborative workplans that aim to nurture the growth of a community of scientists. The regional research effort will be increasingly defined through the process of dialogue with national program scientists. A proportionately larger component of SMIP's research effort will be conducted on national stations within the context of national programs.

Throughout this process, operational strategies will be guided by the mission of ensuring research impact - -- most particularly, the adoption of improved technologies by resource-poor farmers in drought-prone regions.

The specific objectives for Phase III as defined by the SMIP Steering Committee are:

- > To conduct research that will facilitate the transfer of technologies to small farmers.
- > To breed improved varieties, collect and exchange germplasm.
- > To develop technologies for the management of diseases, pests and the witchweed *Striga*.
- > To evaluate grain quality for various end-uses.
- > To improve productivity of national sorghum and pearl millet staff.

### **2.4 Prospective Impacts**

In 1992, SADC requested over US\$850 million in short-term donor support in response to regional drought. Grain imports into the region are estimated to be about 6 million metric tonnes, more than 50% of the total domestic grain consumption. The dislocation caused by the 1991/92 drought was most severe in farming communities. Many farmers were forced to sell off critically important farm assets to purchase food. Livestock, the principal source of draft power in much of the SADC region, died in large numbers. The poorest of the small-farm communities in semi-arid areas became even poorer.

SMIP offers the prospect of a long-term response to these difficulties. While national grain stocks, cereal grain imports, and special feeding programs can mitigate the worst effects of these droughts, such emergency measures cannot fully offset the malnutrition and impoverishment caused by inadequate family food supplies. Further, such solutions represent costly short-term responses to a long-term problem. Longer term responses must be technology based.

With a projected 20 to 25 year time frame, SMIP is charged with the responsibility of developing improved sorghum and pearl millet technologies for resource-poor, smallholder farmers and with strengthening the capacity of national agricultural research programs in the SADC region. Improved technologies for these commodities will enhance food security, raise income levels, and provide a firmer basis for sustainable production systems for the drier areas of the SADC region.

The willingness of the farmers in this region to adopt improved technologies is without question. Improved maize technologies, particularly improved cultivars, have been widely adopted even in the most drought-prone regions. As improved cultivars of sorghum and pearl millet become available, resource-poor farmers are being offered a choice. This choice is likely to lead to an expansion of the sorghum and pearl millet area and to a reduction in the dependence on maize. Correspondingly, household food security and incomes, particularly among poorer households should increase.

## **2.5 Sustainability**

During Phase III alternatives for the long term future of SMIP will be explored by SACCAR and the SADC member states to identify a set of activities which can be sustained on a continuing basis without dependence on external donor funding. ICRISAT intends to post one or more scientists to the region supported by its core budget. SMIP is confident that member countries will, at a minimum, support the maintenance of a network linking sorghum and pearl millet scientists across the NARS in the region. A preferred alternative is a small core research program staffed by 3 or 4 scientists based at Matopos who would conduct research in 1 or 2 high priority areas and who would help maintain the regional network. Either of these alternatives could accommodate a flexible capacity for servicing the needs of public and private institutions concerned with sorghum and pearl millet research and development through collaborative research contracts.

SMIP will examine the full range of possibilities for sharing and recovering costs for the services it provides. A SACCAR study is planned for 1993 on the future prospects for efficiently utilizing SMIP Matopos facilities on a self-sustaining basis.

### **3 PROGRESS DURING PHASES I AND II**

#### **3.1 Physical Infrastructure and Facilities for Research**

Good, well-maintained research support physical facilities are a prerequisite for quality, resource-efficient, and productive agricultural research. Following the location of SMIP at Matopos, a livestock research-station of the Department of Research and Specialist Services in Zimbabwe, it was necessary to establish the infrastructure for a crop research base. The facilities had to adequately support SMIP activities, and complement the research facilities on the station for use by the SADC national programs and other collaborating partners in SADC countries. Facilities include land, farm service buildings, laboratories, greenhouses, offices, seed stores, crop and data processing facilities, and a dormitory and catering facility.

The land developed for SMIP field experiments at Matopos and Muzarabani includes the three soil types (vertisols, alfisols, and granite sands) representative of the region.

Soon after the inception of SMIP, its Technical Advisory Panel (TAP) in its 1985 report indicated that the lack of adequate research support facilities in the national programs hampered progress in crop research. This was even more noticeable for sorghum and pearl millet crops that had previously received little research attention. SMIP responded by participating and collaborating with national programs in upgrading the research support facilities at selected regional test locations where collaborative trials were conducted. This assistance included land development and improvement, procurement of machinery and equipment, construction of farm service buildings, and seed stores, and establishment of crop and data processing facilities. The locations that benefitted from this input include Pandamatenga and Sebele in Botswana; Kasinthula and Ngabu in Malawi, Ogongo and Mashari in Namibia; Golden Valley in Zambia; and Panmure and Henderson in Zimbabwe.

The quality and adequacy of facilities and services available at Matopos and at several improved national programs' stations contributed significantly to the rapid advancement in sorghum and pearl millet research in the region during SMIP's formative years. These station-improvement activities have helped to stimulate some governments and donor agencies to invest in research station development and rehabilitation. The Governments of Botswana and Namibia have allocated substantial funds to research station development over the past 2 years, while the Swedish International Development Agency (SIDA) has provided funds for the development of Golden Valley Research Station in Zambia. Tanzania has included station rehabilitation and maintenance in its research master plan.

#### **3.2 Human Resources Development of National Programs**

When SMIP started in 1983, a major limitation faced by national programs in their efforts to improve sorghum and pearl millet was lack of trained scientific personnel.

In 1983, 35 scientists (Angola 1, Botswana 7, Lesotho 3, Malawi 4, Mozambique 2, Namibia 1, Swaziland 2, Tanzania 4, Zimbabwe 6 and Zambia 5) were involved in sorghum and pearl millet research (Table 1). Most of them had additional responsibilities beyond these crops. It was realized by ICRISAT and the donors that if research on sorghum and pearl millet were to be improved, improvements in staff training were necessary. SMIP's mandate, from the beginning, included a strong postgraduate educational component executed by INTSORMIL in the USA. A master plan was established to identify the training needs for each SADC country.

By the end of Phase II, 94 scientists (Table 1) will have been trained mostly up to M.Sc. and Ph.D. levels. Most of these will have studied in the USA, some from Angola and Mozambique in Brazil, and others in SADC universities. It is expected that most of these scientists will be involved full time, or at least part

time, in sorghum and pearl millet research in their home countries. A few will be absorbed by universities, other scientific institutes, or the commercial sector.

**Table 1. Staff (scientists) strength of national sorghum and pearl millet programs in SADC countries 1983 - 1993**

Country	Before Phase I (1983)	By end of Phase II (1993)	% trained by SMIP	% time spent on sorghum and pearl millet
Angola	1	4	80	51
Botswana	7	11	61	52
Lesotho	3	10	77	46
Malawi	4	10	71	40
Mozambique	2	7	78	50
Namibia	1	4	0	75
Swaziland	2	6	75	14
Tanzania	4	16	80	73
Zambia	5	15	75	86
Zimbabwe	6	11	65	44
Total/Average	35	94	74	53

Before 1984, national programs' technical support staff was fairly strong in numbers but lacked experience. In some countries, they were the backbone of the sorghum and pearl millet improvement programs. To improve their skills, in-service training was provided for 148 of them at ICRISAT Center in India.

SMIP also realized the need for specific training courses. Research station management was a specific area which needed attention to improve the standard of field research. Most of the experiment station managers from stations involved in sorghum and pearl millet research have attended the experiment station management training courses at Matopos. Other training workshops were held in the areas of breeding, plant protection, agronomy, economics, and food technology that were aimed at improving the technical skills of scientists and technicians in the region. This has been supplemented with short-term technical training for individual scientists who spent periods ranging from a few days to a few months learning methodologies, data analysis, etc. at Matopos.

Based on all these activities SMIP has created a solid scientific personnel base for long-term sorghum and pearl millet research in the SADC countries except Angola (because of security problems) and Namibia (which joined SADC only in 1990).

### 3.3 Catalytic Role of the Regional Program

When SMIP was established in 1983, most of the sorghum and pearl millet produced in the SADC region was used for home consumption as food or beer; very little was traded. Only four of the 10 SADC countries had national programs to improve these crops, and these were not very sophisticated. There were fewer than 20 scientists working on sorghum and pearl millet, and most of them were also responsible for research on several other crops. Less than six improved local selections and only three high-yielding crossbred cultivars were available as releases. Extension recommendations for crop management were poorly developed, and because these were based largely on maize experimentation in higher-rainfall areas, they were not appropriate for sorghum and pearl millet. Market policies specifically formulated for the two crops were non-existent, those available were simple extensions of policies originally constructed for maize and therefore lacked relevance.

While it was recognized that greater priority should be placed on the improvement of the two crops and the development of their cropping systems, the capacity to generate appropriate technologies and facilitate their adoption was limited in the region. Correspondingly, four strategic elements were identified to accomplish the defined objectives that underlaid the creation of SMIP whose main goal was the attainment of food security for resource-poor farmers of the region.

The four elements of the strategy were: (a) the rapid development of improved technologies through conservation of local landraces and exploitation of the world germplasm; (b) expansion of an agronomic knowledge base on sorghum and pearl millet; (c) the strengthening of national scientific capacities to ensure both a continuing process of technology generation and adequate linkages between national programs and the world knowledge base; and (d) the building of institutions and human resources development so that improvements achieved and technologies developed would be sustained by the national programs.

Over time it was anticipated that the regional scientific program would evolve into a regional research network managed by the national programs.

During Phases I and II of the regional project, several improved cultivars were developed for use throughout the region. Many of these are now beginning to be adopted by farmers. By the end of Phase II it is anticipated that over 250 000 farm families will be growing varieties developed through the efforts of SMIP and associated linkages with ICRISAT Center. More than 15 000 germplasm accessions will have been evaluated for their grain and stover yields, the quality of their products, and for pest and disease resistance. Major advances have been generated in crop management practices for stand establishment, water-use efficiency, disease, witchweed, *Striga*, and insect pest control. The importance of crop product quality traits has become more broadly recognized both in national breeding programs and market systems. Policy makers have gained a better appreciation of the potential contributions of sorghum and pearl millet to national economic growth and regional food security. In effect, a foundation has been laid for the development of the sorghum and pearl millet subsector which simply did not exist in 1983.

Due to the combined efforts of regional and national sorghum and pearl millet programs, policy pronouncements about the importance of growing drought-resistant crops can be backed by specific recommendations on appropriate technologies. Crop packs distributed in the context of drought relief can contain appropriate sets of improved cultivars and production inputs. Maize is no longer perceived as the only cereal grain offering prospects for commercialization. Sorghum and pearl millet are becoming accepted as both food and cash crops.

Finally, the regional program has encouraged the evolution of national sorghum and pearl millet efforts into an interdisciplinary scientific community. Regional workshops have stimulated the publication of scientific results. The regional linkages through a series of training and development activities have prompted recognition of the importance and value of the diverse contributions of such specialists as economists, food scientists, plant protectionists, and agronomists to the crop improvement process in addition to those of the breeders.

### **3.4 Elements of a Network Established for Technology Exchange among National Programs and other Organizations**

SMIP has contributed to the establishment of an effective networking system for technology development and dissemination in the region.

Germplasm exchange has been developed over the years as evidenced by the 20 cultivars of sorghum and pearl millet that have been released with ICRISAT involvement, and 20 genotypes that are presently in the advanced stages of evaluation.

Networking activities have already been initiated in the form of annual reporting and planning meetings, workshops, group consultative meetings, monitoring tours, conferences, meetings, visits, and continued exchange of germplasm.

Such network activities will have impact on: (a) strengthening the applied research capability of SADC national programs; (b) generating appropriate technology; (c) ensuring sustainability of agricultural production through a responsive research capability, and (d) providing the support needed to facilitate the coordination of regional research activities.

### **3.5 Production Technology and Information**

Steady progress has been made towards strengthening national agronomic research capabilities and identifying solutions to major crop management problems. The research agenda has highlighted efforts to improve the capacity of sorghum and pearl millet to withstand the effects of drought. This research has also focused on problems of stand establishment, nematode control, improving water-use efficiency, superiority of hybrids over varieties, yield stability, and the responsiveness of improved cultivars to good management.

**3.5.1 Yield Gap Assessments:** Strengthening national programs' agronomic research capacity has been undertaken by establishing collaborative agronomic research efforts which focus on relevant site-specific aspects of production. These aim to help national scientists to set their agronomic research priorities and carry out a systematic research program designed to revise extension recommendations.

Professional development and technical interactions have been simultaneously provided while conducting experiments, collecting data, and conducting statistical and economic analyses, interpretation of results, and drawing conclusions. Most national programs are in a position to take primary responsibility for these activities.

**3.5.2 Stand Establishment:** Sorghum production in the sandy soils of the SADC region has been adversely affected by poor stand establishment, seedling mortality and growth variability. Each of these problems severely reduces grain and stover yields. Results of a series of experiments indicate that nematodes (e.g. *Pratylenchus* spp) are a major contributor to yield losses on sandy soils. Several possible means of alleviating nematode effects have been identified. A carbofuran seed treatment provides a cheap and efficient means to control nematode infestation. A greenhouse-screening technique has been

refined to identify sources of resistance. Significant differences among cultivars for the plant parameters associated with resistance to nematodes have been found.

**3.5.3 Drought and Efficient use of Rainfall for Crop Production:** Drought and erratic rainfall are major yield-limiting factors in the low rainfall areas where sorghum and pearl millet are grown. Farmers consistently face the challenge of how to make the most efficient use of limited water for crop production.

A drought-screening method has been developed that induces or relieves stress enabling the evaluation of cultivar response to drought. Drought intensity and drought susceptibility indices for 30 sorghum cultivars have been quantified. Traits associated with yield under stress have been identified for possible use in breeding.

Research on genotypes by date of sowing interactions provides options in the choice of cultivars depending on the start of the season, the availability of the resources at sowing and the farmers' level of risk aversion.

Research has quantified the contributions of alternative tillage practices, stubble mulch, nitrogen and weeding on sorghum and pearl millet yields. Assessments of alternative soil surface configurations have confirmed the value of catching rainwater early in the cropping season.

The superiority of sorghum hybrids over varieties under different management systems that mimic farmers' production practices have been quantified. Hybrids produced an average of 16 - 30% more grain yield than varieties in experimental plots.

This groundwork has laid a basis for the promotion of improved management practices on farmers' fields during Phase III. Strengthened national agronomic research programs can continue some of the water and fertilizer use efficiency work initiated at the regional level.

### **3.6 Germplasm Enhancement**

Before 1983 the status of germplasm of sorghum and pearl millet and their enhancement were rudimentary in most SADC countries. Only Botswana, Malawi, Tanzania and Zimbabwe had programs on sorghum and pearl millet breeding. Some landrace accessions had been collected but very few were used. However, some exotic germplasm had been introduced, evaluated and selected, resulting in their release as varieties.

Between 1988 and 1992, progress was made in strengthening the capabilities of the national programs to conduct research on sorghum and pearl millet in the following areas: (a) collection, introduction, evaluation, preservation and exploitation of relevant local and exotic germplasm and breeding material from various sources; (b) development of improved varieties, hybrids and random mating populations with drought resistance, good grain quality, and high stover yield; (c) establishment of regional crossing activities including country crossing blocks that resulted in genetic stock used by the NARS breeders; and (d) dissemination of selected cultivars into national programs' breeding programs through regional collaborative trials and nurseries.

**3.6.1** SMIP has increased the genetic diversity of the region's working collections. A total of 12,500 sorghum germplasm accessions and 7,948 pearl millet accessions have been introduced from outside the region or collected from farmers' fields in the region. Of these, 1,500 sorghum and 1,785 pearl millet local collections have been characterized and described. Catalogs of this information are being prepared.

Crossing activities to increase productivity, resistance to diseases, drought and *Striga* have resulted in enhanced genetic variability. This has already been exploited, and will continue to be used by national programs.

**3.6.2** Achievements in cultivar development through the collaborative work of national programs and SMIP will facilitate the movement of higher-yielding varieties and hybrids into national programs' multilocational trials and ultimately into farmers' fields. To further develop breeding in national programs, four random-mating sorghum populations and nine pearl millet populations have been developed for use as genetic stocks.

By the end of 1992, across the whole region, 143 sorghum varieties and hybrids, 124 pearl millet cultivars (Table 2) and 73 sources of resistance to diseases, insect pests, and *Striga* were made available to national programs. Major accomplishments include: (a) 15 sorghum cultivars have been released with ICRISAT and/or SMIP involvement. These include SV 1, SV 2 and ZWSH 1 in Zimbabwe; Kuyuma, Sima, WSH 287, MMSH 375 and MMSH 413 in Zambia; Macia and Mamonhe in Mozambique; SPV 351 in Malawi, Tegemeo in Tanzania; and MRS 13, MRS 12 and MRS 94 in Swaziland. (b) Pearl millet cultivars released include; PMV 2 in Zimbabwe; Kaufela and WC-C75 in Zambia; and Okashana 1 in Namibia.

The released sorghum and pearl millet varieties are already moving into farmers' fields. The drought relief emergency seed production project produced 654 metric tonnes of seed of the released cultivars in September 1992. This seed was distributed as free seed with inputs to farmers by the Ministries of Agriculture in Malawi, Namibia, Zambia, and Zimbabwe. It is estimated that 100 070 ha were sown to improved sorghum and pearl millet varieties in the 1992/93 season. This will have a tangible impact on sorghum and pearl millet production in these countries. Sixteen sorghum and 10 pearl millet varieties, developed in collaboration with national programs, are in on-farm tests.

No cultivar has been released or is in advanced testing stage in Angola because of security problems there. It is hoped that this situation will improve during Phase III.

**Table 2. Number of sorghum and pearl millet cultivars released, in on-farm or advanced testing in the SADC countries, 1992.**

Country	Sorghum			Pearl millet		
	Released	In on-farm tests	In advanced tests	Released	In on-farm tests	In advanced tests
Angola	0	0	0	0	0	0
Botswana	8 (0) <sup>a</sup>	7 (100)	22 (77)	1 (0)	1 (100)	12 (100)
Lesotho	3 (0)	2 (100)	10 (60)	0	0	0
Malawi	4 (25)	1 (100)	10 (100)	3 (0)	2 (100)	18 (33)
Mozambique	5 (80)	0	6 (100)	1 (0)	0	0
Namibia	1 (0)	0	24 (79)	2 (50)	5 (100)	56 (100)
Swaziland	4 (75)	0	4 (0)	0	0	0
Tanzania	5 (20)	4 (50)	23 (35)	1 (0)	0	20 (50)
Zambia	7 (71)	7 (75)	100 (0)	2 (100)	1 (100)	100 (0)
Zimbabwe	8 (38)	7 (57)	144 (7)	3 (33)	7 (71)	114 (14)

a Percentage of cultivars developed by ICRISAT/SMIP.

**3.6.3 Identification of Resistance to Pests and Diseases:** During Phases I and II several sources of resistance were identified for economically important diseases and *Striga*, and to a lesser extent for insect pests.

Several high-yielding sorghum varieties and hybrids were identified with resistance to downy mildew (20 cultivars), leaf blight (18 cultivars), and anthracnose (17 cultivars).

Five *Striga*-resistant varieties were identified from several accessions introduced into the region: SAR 19, SAR 16, SAR 33, SAR 35 and SDS 2729 (all from ICRISAT Center). They were identified as resistant in Botswana and Zimbabwe. Two others, SAR 29 and its hybrid SPL 38A x SAR 29 were found resistant to the two *Striga* species, *S. asiatica* and *S. hermonthica* in Tanzania. These resistant sources are now being used in the evaluation of integrated control packages for *Striga* in Tanzania and Zimbabwe.

Important insect pests (shoot fly, stem borer, aphids, armoured cricket, grain weevil and grain moth) and diseases (downy mildew, leaf blight, sooty stripe, anthracnose, grain mould in sorghum, and ergot in pearl millet) have been identified. Seven sorghum cultivars (IS 22039, ICSV - 234, PS 31388, SV-1, PB 12891-1, ICSV-1 and ICSV 708) were identified as tolerant to stem borer and 8 advanced varieties and hybrids (SDSH-514, SDSH 61, SDSH 18, SDSH 47, SPV 351, SPV 475, SDSL 87029, SDSL 89473) were resistant to grain weevil. Some of these sources of resistance also carry useful grain quality traits making them valuable to national programs.

During Phases I and II screening methods were developed or adapted for the major insects and diseases. For insects, artificial rearing and infestation techniques, and greenhouse screening were developed for stem borer and aphids. Adult and egg infestation techniques were developed for grain weevil and grain moth. For diseases, seedling inoculation techniques were used in downy mildew resistance screening and conidial inoculation was used for leaf blight. For downy mildew screening, disease pressure is augmented by using infector rows. Lines resistant to sooty stripe and anthracnose were selected based on natural infestation. So far only a few national programs have been able to adopt these technologies. The main reasons for the poor adoption of these technologies by national programs are: lack of research facilities, financial constraints, work overload for research scientists and in some cases low motivation which may have resulted from the constraints mentioned above.

### **3.7 Evaluation of Crop Product Quality for Various End-Uses**

A database has been compiled on the grain quality of varieties and hybrids that are released, in on-farm testing, and at different stages of advanced testing.

Grain quality data have been compiled for 67 SMIP-bred sorghum cultivars and 9 bred by national programs. All cultivars were tested for 13 grain quality traits. Milling (flour) yields in this group of cultivars range from very low 55.3% (among the brown-seeded soft types) to very high 84.6% (among the white-seeded corneous types).

Malting estimates using sorghum diastatic units (SDUs) from 75 brown hybrids from SMIP and the Zambia national program have been made. In all instances the red (without testa) hybrids are intermediate between the white and brown types for both milling quality and malting characteristics. Like the white types, red hybrids contain little or no tannin and could possibly be used as human food.

Pearl millet has been assessed for grain and flour fraction, and malting qualities. It has been confirmed that dehulling of pearl millet results in lower yield of flour and lower nutritional quality.

### **3.8 Market Policy and Utilization Prospects**

Collaborative analyses of the market and utilization prospects for sorghum and pearl millet began in Phase II with the appointment of an economist. Detailed assessments of the competitive position of sorghum and pearl millet in national grain markets were conducted in Botswana, Tanzania, Zimbabwe and Zambia. A corresponding study is presently in progress in Namibia. Reconnaissance assessments of the market positions of these crops were conducted in Swaziland and Lesotho. The investigations examined national market policies relating to these small grains, the potential for greater industrial utilization of sorghum and pearl millet, and the relationships between public market interventions and private sector grain flows.

The studies directly contributed to the formulation of national market policies in Botswana, Zambia and Zimbabwe. A workshop intended to redefine national sorghum and pearl millet policies will be sponsored in Tanzania in May 1993. The results of the Namibia study will feed directly into the process of constructing grain market policies in this newly independent country.

These studies have generally indicated that efforts to encourage expanded sorghum and pearl millet production and commercial grain flows through the establishment of relatively high official producer prices have resulted in uncompetitive consumer prices and the build-up of parastatal grain stocks. In Zimbabwe and Botswana, for example, sorghum and pearl millet stocks held by national market parastatals were extraordinarily large, relative to demand during the mid to late 1980s. Even in Zambia, the closely regulated cooperative system could not dispose of even limited quantities of sorghum. The principal reason for such stocks was, in each case, that maize was a much cheaper industrial input. Industries refused to purchase sorghum or pearl millet if substitution was possible and maize was readily available.

The price supports offered by governments in the region were meant to encourage production and provide income support to small farmers. But such policies primarily benefitted the small minority of sorghum and pearl millet farmers with larger grain surpluses. Price supports and market controls have not benefitted the larger majority of small-holder farmers based in drought-prone zones who tend to be net grain purchasers.

Sorghum and pearl millet will not compete with other raw material as industrial inputs without significant improvements in production and productivity allowing the establishment of more competitive buying and selling prices. Sorghum will continue to be purchased in small quantities for the specialized requirements of opaque beer industries. But the principal source of demand for these grains will remain in the rural market --- for food security and for the production of traditional beer, an important source of petty cash income for many poorer rural households.

The economic studies carried out under the regional program have encouraged the construction of pricing policies that account for the competitive position of these grains as industrial inputs and market policies that encourage (or at least do not discourage) the direct movement of grain from surplus to deficit rural households.

Market studies will be limited during Phase III to the limited assessments needed to evaluate the adoption of improved technologies.

Farm-level studies by the economics program have measured the competitive position of sorghum and millet in the small-scale production system. Starting with the question "**Why is land allocated to maize in drought - prone regions?**", these studies have examined the range of reasons smallholder farmers choose to plant less drought-resistant crops. The analyses pursued in these studies evaluate the returns to land and labor gained through the cultivation of alternative coarse grains, the significance of processing constraints, taste preferences, and the structure of incentives associated with shifting grain market opportunities.

Such studies have concluded that improved maize hybrids often offer higher yields than the unimproved landrace cultivars of sorghum and pearl millet commonly available to small farmers -- even in drought-prone regions. Labor returns to maize are also favorable. Further, maize is highly valued for the food it offers when harvested green, well in advance of the main harvest. But most farmers facing high risks of drought will continue to plant a portion of their land to sorghum or pearl millet. This portion may increase or decrease depending on the taste preferences of the household and the relative availability of cheap maize meal.

Such results suggest that farmers will respond favorably to significant gains in the productivity of sorghum and pearl millet. Land will be reallocated from maize to sorghum or pearl millet with the largest gains in areas most prone to mid-season dry spells and drought.

As improved sorghum and pearl millet cultivars and new management practices become available, this research agenda will shift toward monitoring the response to the new technologies and assessing adoption. Work during Phase III will emphasize participation in on-farm research activities with the assessment of adoption constraints and research impact.

Finally, the economics program has initiated a networking and training program offering support designed to strengthen the reporting of research results of economists in national programs and the consideration of the policy implications of micro-level work. National program economists have historically concentrated on the diagnosis of farm constraints and economic review of agronomic trial results. Many analyses have been more descriptive than analytical, and more critical than constructive. The Policy Analysis initiative, run with the assistance of Centro Internacional de Mejoramiento de Maiz y Trigo (CIMMYT), has encouraged the consideration of how analyses of survey and trial data can be extended to consider alternative measures of research impact. Options are currently being considered for the continuation of this effort through other local institutions.

## **4 PROJECT DESCRIPTION**

### **4.1 Goal and Purpose**

The principal goal of SMIP Phases III and IV is to improve food security through increasing productivity of sorghum and pearl millet grown by resource-poor farmers in drought-prone regions. This goal reflects the primary objective of the SADC Regional Policy Statement to "increase agricultural production, productivity and food security at [the] household, national and regional levels."

This goal will be pursued through efforts to promote the adoption of improved cropping technologies. During SMIP Phases I and II, national research staff were trained, new cultivars were developed and experimentation was conducted on crop management practices. During Phase III, higher priority will be placed on promoting the transfer of improved technologies to small farmers.

The second goal cited in the SADC Regional Policy Statement is to "foster the efficient development, utilization, and conservation of natural resources.....Natural resource development is defined as the rational utilization and management of natural resources necessary to achieve acceptable production levels without threatening the long-term sustainability of such resources."

Adequate production levels are viewed as an essential component of effective resource management. But production gains must be sought within the framework of a sustainable production system. Cultivar improvement must be linked with attention to the opportunities for more efficiently using available soil and water resources.

These objectives can only be pursued through the maintenance of a consistent effort to monitor the needs of resource poor farmers and to develop technologies designed to resolve particular resource constraints. This is best accomplished through continued strengthening of national research capabilities. During Phase III, much of the regional research agenda of SMIP will be shifted into the hands of a cooperative network of national scientists.

### **4.2 Outputs**

The SMIP Steering Committee met at Matopos on 22 - 23 February 1993 to determine regional research priorities for SMIP Phase III. Regional research priorities were ranked as (1) technology transfer, (2) development of improved varieties, germplasm collection and exchange, (3) management of diseases, pests and the witchweed *Striga*, (4) human resources development, and (5) evaluation of grain quality. The following objectives are based on these research priorities.

#### **4.2.1 Objective 1: To promote the transfer of technologies to small farmers**

The payoff to the building of institutional capabilities to conduct sorghum and pearl millet research derives from the development and ultimate adoption of improved cropping technologies designed to increase household food security and farm incomes. The level of this payoff depends partly on the productivity gains offered by improved technologies, partly on how these technologies fit the resource allocation decisions of established farm systems and partly on the institutional matrix affecting access to these technologies and the costs and returns of their application.

In recent years, an increasing number of sorghum and pearl millet technologies - both improved cultivars and improved management practices - have become available to small farmers. But the adoption of improved seed technologies has been variable. In most of the SADC countries, adoption rates on improved cultivars stand at less than 5 percent, and in many, adoption rates are less than one percent.

Nonetheless, the prospects for technology exchange, dissemination and adoption are now better. Greater interest is being expressed in the production of sorghum and pearl millet seed. Seed adoption has been stimulated by the distribution of improved seed in Zimbabwe, Zambia, Malawi and Namibia following the 1991/92 drought.

Few farmers in the SADC region apply the management practices for sorghum and pearl millet that are recommended by national extension agencies. Fertilizer use on sorghum and pearl millet is rare, though many farmers use farm yard manure. It is even more rare for farmers to use field insecticides. Recommended plant populations and planting practices are commonly far different from the practices commonly applied by small farmers. New efforts are needed to ensure extension recommendations are relevant to the farming circumstances of most small farmers. In many countries, extension recommendations need direct re-evaluation and revision.

National research programs are becoming increasingly concerned with research impact. SMIP aims to encourage a strategic response to these concerns. During Phase II, SMIP will seek to instill a sense of stewardship for improved technologies. Collaborative workplans between the regional and national programs will lay emphasis on the involvement of scientists in technology transfer. This includes the movement of technologies through advanced testing and release into farmers' fields. It also incorporates the monitoring of adoption determinants and research impact.

A key component of these efforts will be to promote stronger linkages between research scientists and the range of actors and institutions involved with technology dissemination. SMIP will facilitate the participation of representatives from extension agencies, seed companies, non-governmental organizations with an interest in new cropping technologies in the planning meetings organized to develop collaborative workplans between the regional program and the NARS. As appropriate, representatives of grain processing agencies and marketing institutions may also be invited.

An increasing number of these institutions are already involved with technology transfer activities relating to sorghum and pearl millet. In Zimbabwe, for example, the NGO Environment and Development Activities (ENDA), has recently started multiplying both traditional and improved varieties of sorghum and pearl millet. The Seed Cooperative has been producing the seed of several improved varieties for sale through drought relief programs in Mozambique and has expressed increasing interest in expanded sales in Zimbabwe. The Zimbabwe Farmers Union has expressed an interest in supporting demonstration trials of new technologies and organizing farmer field days. In Namibia, the Rossing Foundation has initiated the production of a newly released pearl millet variety. In Malawi, another NGO, Christian Care, has expressed an interest in the sorghum and pearl millet seed production. In Tanzania, Global 2000 has extended its demonstration programs for sorghum through much of the country. BMZ/GTZ has recently developed a regional project in southern Africa for the multiplication and distribution of improved sorghum and pearl millet seed. SMIP will encourage these and many similar organizations to improve their linkages with national research and extension programs in a common effort to achieve a more rapid dissemination of improved technologies.

In general, the pursuit of technology transfer will be sought through a strategy of:

- technology verification under farmers' conditions,
- backstop support for national seed production and distribution,
- the review and revision of extension recommendations,

- the evaluation and resolution of constraints to technology adoption, and
- the evaluation of research and technology impact.

This strategy will verify the value of the best available technologies under farmers' conditions, diagnose adoption constraints, and promote the more rapid release and adoption of promising cultivars and management practices. Highly favorable results from station based experiments and some initially favorable results from on-farm trials suggest this strategy will yield high rates of technology adoption.

The monitoring of adoption constraints and impact will facilitate the fine tuning of on-going station based research. Impact assessments should facilitate more efficient setting of research priorities and begin to systematize the evaluation of the payoff to research investments. This helps ensure greater accountability of research scientists as regards rates of adoption.

We expect the full technology transfer program will encourage a stronger sense of responsibility for technology adoption among crop scientists while speeding the process of technology adoption and impact.

**On-Farm Research for Technology Verification.** Cropping technologies developed on the experiment station commonly perform well under farmers' circumstances, but sometimes offer smaller gains under the limited resources characterizing smallholder agriculture in the semi-arid regions. Further, the value of productivity gains may be offset by problems of cultivar acceptability due to plant characteristics other than grain yield - e.g. taste, stem strength or processing ease. Different groups of farmers place value on different plant traits - e.g. grain yield vs stover yield. Recommended management practices may not adequately account for the strategies farmers employ to offset the risks of drought and food insecurity.

Each of these factors justifies the need for technology verification on the fields of small farmers and under their management. This verification helps diagnose potential adoption constraints. In addition, verification trials serve as an initial stimulus to technology adoption. Such trials have a direct demonstration effect in the communities of participating farmers. The results of on-farm trials also help confirm the level of demand for new technologies and thus guide the wider dissemination of improved cultivars and management practices by market and extension institutions.

SMIP will support the implementation of national on-farm trial programs designed to verify the value of improved cultivars and management practices for sorghum and pearl millet. These trials will test technologies targeted for release under improved management and under the traditional practices of small farmers residing in semi-arid regions. The trials will allow SMIP to assess the constituent elements of the yield gap between experiment station results and the productivity levels farmers commonly achieve with traditional cropping practices. In addition, farmers will be asked to characterize the value placed on alternative plant and grain traits including taste parameters and ease of processing. Finally, the biological, institutional and market constraints to technology application will be evaluated.

As technologies are verified, national scientists and extension workers will be encouraged to develop a larger and broader set of on-farm technology demonstrations. Social scientists based with national research programs will also begin to work with extension workers to diagnose adoption constraints.

Training will be provided on trial implementation and methods of interpreting the trial results. This will incorporate seminars on technology release and distribution procedures.

**Seed Release Procedures.** In some SADC countries, the procedures for advanced testing and release of new sorghum and pearl millet cultivars are amorphous, ambiguous and subject to delay. Advanced cultivar testing may extend for long periods without a cultivar release. In some circumstances, release has

not been followed by notification of cultivar availability to seed companies and farmers. Released seeds have not been multiplied and distributed.

Concerns have also been raised about the importation and distribution of seed unsuited for particular countries or regions. In some instances, grain has been imported as seed and varieties of unclear origin have offered low rates of germination. These problems have led to moves to tighten, and possibly further delay, the distribution of improved seed to farmers. Procedures for monitoring seed imports remain poorly developed.

To begin resolving these problems, SMIP will conduct a review of national seed release procedures and associated seed laws in each SADC country. The review will seek to identify how seed release can be speeded in each country. The assessment will examine strategies for monitoring the import of new seed and examine how multiplication and distribution following release can be both speeded up and monitored.

This workplan will be conducted with consultative expertise from the international seed industry. Specific recommendations will be developed for countries with the most serious problems. The results of the review will also be discussed in a regional planning meeting.

**Seed Production.** SMIP will provide technical support for the production of breeder seed required for research, including research on farmers' fields. SMIP may provide an initial allocation of breeder seed of ICRISAT cultivars. Thereafter, this production is expected to take place almost entirely within the national research programs. SMIP support will primarily take the form of advisory assistance to the NARS.

SMIP will also work with national research programs to provide advisory support for the production of seed for direct distribution to farmers. These activities are discussed further under Objective 2 below.

**Revising Extension Recommendations.** In recognition of the fact that most farmers currently ignore national extension recommendations for sorghum and pearl millet, assistance will be provided in diagnosing constraints to the adoption of this advice. These diagnoses will highlight opportunities for revising extension recommendations in order to make them more acceptable to farmers. If more research is needed, a specific time-table for the completion of these investigations and a target period for the release of revised extension recommendations will be created. Otherwise, research and extension agencies will be encouraged to better publicize available recommendations - e.g. in the context of the delivery of improved seed.

In some countries, extension recommendations for sorghum and pearl millet were developed more than a decade ago. No efforts have been made to monitor adoption or to adjust these recommendations in the context of shifting input and product prices. In some cases, these recommendations are simply products of agronomic research originally conducted for maize in high rainfall zones. In some cases, the origin of current recommendations remains simply unknown. Where needed, SMIP will encourage the development of a more regular set of procedures for establishing, monitoring and modifying extension recommendations for sorghum and pearl millet.

**Institutional and Policy Related Constraints to Adoption.** Crop scientists often blame poor policies and inefficient market institutions for the failure to provide agricultural inputs to farmers on a timely and consistent basis. This argument suggests, in effect, that technologies are available and appropriate but the institutional environment needs repair. Yet one could similarly argue that extension recommendations need to fit policy and institutional constraints within which they are offered.

In line with an effort to promote a sense of stewardship for released technologies, SMIP will encourage research, extension and input suppliers to work together to resolve modifiable policy and institutional

constraints. Collaborative workplans will incorporate a review of adoption constraints and the identification of strategies necessary for their resolution. Short reconnaissance type surveys can provide guidance for re-setting of research priorities. Follow-up targeted constraint assessment surveys will provide a basis for quantifying the justification for policy changes and institutional reforms. These surveys will be conducted jointly by biological and social scientists.

Reference continues to be drawn to the limited absorptive capacity of national markets in the circumstance that individual farmers are able to produce a significant surplus of sorghum and pearl millet. During Phase II, the boundaries for the competitive use of sorghum and pearl millet on the industrial market were calculated. During Phase III, opportunities for promoting greater intra-rural trade will be considered. As national grain markets are liberalized and as maize subsidies are lifted, sorghum and pearl millet become increasingly competitive on the rural market. SMIP will provide technical backstop support for investigations leading to policy advice on how to better exploit the rural market for small grains.

**Impact Assessment.** Measures of potential (*ex ante*) impact are useful for the delineation of research priorities. *Ex poste* measures of the impact of adopted technologies are useful for the reassessment of these priorities and for justifying continuing financial and human resources investments. Both sets of measures assure greater accountability of research scientists for the ultimate adoption of technologies being developed. The consistent conduct of impact assessments should help reduce the possibility that improved cultivars are released but not adopted or extension recommendations are proposed but widely ignored by small farmers.

Methods for incorporating assessments of potential impact will be transferred to the national programs for use in research planning. Several case studies of *ex poste* impact will be collaboratively conducted with economists in the national programs. These will incorporate an effort to establish a research monitoring system into the sorghum and pearl millet programs of the region's NARS.

SMIP will consult and collaborate with the SACCAR supported impact assessment economist in regional training in methods of impact assessment. This collaboration may also extend to joint involvement in impact assessments. SMIP will also draw upon the expertise in impact assessment methodology available at ICRISAT Center in India.

**Contributing Disciplines: Farming Systems, Economics, Breeding, Pathology, Entomology**

**Implementation Schedule**

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Activity	1993/94	1994/95	1995/96	1996/97	1997/98
On-Farm Research and Technology Verification	<hr/>				
Review of Seed Release Procedures	<hr/>				
Seed Production	<hr/>				
Revise Extension Recommendations	<hr/>				
Evaluate Policy Constraints to Adoption	<hr/>				
Impact Assessment	<hr/>				

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**Expected Outputs**

On-farm research and demonstration trials support will be concentrated in countries with technologies suitable for final verification.

Collaborative research and technology transfer planning will incorporate linkages with institutions important for technology dissemination and adoption.

On-the-job training in on-farm verification trial design and interpretation. Associated planning seminars in technology dissemination.

Review of seed release procedures and recommendations for adjustments to speed access of farmers to improved varieties.

A review of seed production and distribution constraints for sorghum and pearl millet will be conducted and a summary report for the SADC region will be drafted.

Summary of current extension recommendations and associated adoption patterns (if data immediately available) for sorghum and pearl millet in each country in the SADC region. Suggested improvements to be developed with appropriate agencies.

Diagnostic surveys assessing constraints to the adoption of recommended technologies and resource management issues affecting strategic research priorities.

Data from collaborative on-farm research will be used to support release of new cultivars and to revise extension recommendations.

Impact assessments with results integrated into research planning.

#### **4.2.2 Objective 2: To breed improved varieties, collect and exchange germplasm**

Considerable progress has been made in Phases I and II in strengthening the capabilities of national crop improvement programs. Following the theme of technology transfer, SMIP will shift emphasis in Phase III toward facilitating the exchange of technology and the movement of improved varieties through advanced testing to release and into farmers' fields.

The regional breeding program will serve to sustain the access of the national research programs to the world and regional germplasm base. Breeding for the region will be limited to the generation of variability for use by the national programs. This variability will include the maintenance of nurseries with adaptation to drought stress, good grain and fodder yield and disease and pest resistance.

Collaborative workplans will emphasize the reinforcement of sustainable national programs capable of making efficient use of the national and regional germplasm base. These workplans will further emphasize efforts to verify, release and promote the adoption of new cultivars.

**Germplasm Collection.** SMIP supported several major missions to collect germplasm during Phases I and II. During Phase III, a few major gaps will be filled. Priority will be given to areas of the region that have not yet been collected, or fully covered by previous collections. Based on country requirements at the SMIP Steering Committee, focus will be placed on Tanzania (southern part) and Malawi. This will be a joint activity between national programs, SADC Regional Gene Bank (SRGB) and ICRISAT. Collected accessions will be conserved in the countries concerned and at Matopos, ICRISAT (Hyderabad, India) and SRGB.

**Facilitating Access to World Germplasm Base.** Before the inception of SMIP, national programs had limited direct or indirect access to world sorghum and pearl millet germplasm. Significant efforts were made in SMIP Phases I and II to expose national scientists to new enhanced germplasm. The regional program introduced 10,200 exotic germplasm of sorghum and 6163 of pearl millet from ICRISAT Center, USA, West Africa, East Africa, Latin America, and Asia. These introductions together with 2,234 collections of sorghum and 1785 collections of pearl millet from the 10 countries of SADC were listed and conserved as working collections in the cold seed store at Matopos. The listings and pedigrees of the total accessions were made available to all national programs.

Additionally all the accessions were planted in initial observation and introduction nurseries at five locations for assessment and selection by national programs. These selections formed the basis of the regional breeding nurseries and national crossing blocks. Some national programs, notably Botswana, Malawi, Tanzania and Zimbabwe were assisted to maintain crossing blocks at SMIP nurseries which were then made available for advancement in their respective national breeding nurseries.

National programs will continue to be assisted to access previously collected germplasm in the other countries of the region together with new accessions and re-collections from other areas outside the region. This will be accomplished by facilitating contact between national breeders and ICRISAT scientists at Matopos and at ICRISAT Center in India, providing an annotated listing of major accessions specifying key quality traits of the germplasm to the region, and continuing efforts to introduce new enhanced germplasm and collections to requesting national programs.

**Generation, Testing and Verification of Genotypes.** The sustainable development of a regional sorghum and pearl millet improvement network requires that centralized breeding activities evolve into decentralized national program activities guided by national scientists. This change will be accelerated with the introduction of collaborative workplans driven by NARS goals and priorities. NARS scientists will be increasingly involved in the maintenance of regionally useful populations. SMIP scientists will step back

toward a role as advisors and as channels for continuing access to the world's enhanced germplasm. Segregating material in early and advanced stages will be provided on a limited scale to national programs that have breeders and with capacities to handle and maintain breeding nurseries for selection. Semi-finished (pure lines in preliminary testing) and finished (advanced lines and populations in advanced cultivar testing) products will be made available to those national programs without breeders and breeding capacities, but abilities for testing and selection on-station and on-farm. Specific crosses may continue to be made for national programs requesting them, though these are generally viewed as a national activity. Regional collaborative testing of varieties and hybrids will be shifted into the hands of a network of national scientists.

Advanced cultivars will continue to be distributed for national testing, including selections of national scientists from regional collaborative trials. This further expands the availability of a broad range of genotypes to national scientists.

**Off-Season Crossing Blocks and Breeding Nurseries.** SMIP supports national programs by maintaining country crossing blocks in both normal season (at Aisleby) and off-season with irrigation (at Muzarabani) for some national programs - especially Botswana, Malawi, Tanzania and Zimbabwe. Components of the crossing blocks are selections identified by each national program for their cultivar development programs. As the countries gain strength in selection process, the national programs with breeders are becoming increasingly self-supporting in this activity.

In Phase III, SMIP will provide limited backup services for more specific crosses and quicker advancement of inbred generations in the normal season and off season irrigated nurseries. An increasing amount of this responsibility will be shifted into the hands of capable NARS. Backcrossing to incorporate specific traits (e.g. disease and *Striga* resistance) into agronomically elite cultivars will be maintained as a backup service to national programs.

**Seed Production.** The success of the regional breeding program and associated success of national breeding efforts has stimulated strong interest in seed production. SMIP's regional breeders will allocate a increased portion of their time to backstop national efforts to produce breeder seed needed for advanced testing of varieties. To date, SMIP has provided breeder seed of most of the entries in such trials in their normal activity of regional collaboration. This responsibility will be shifted, during Phase III, into the hands of advanced national programs.

SMIP emphasis on technology exchange will be further pursued through the provision of backstop support to public and private agencies involved in the multiplication and dissemination of the seed of newly released cultivars to farmers. SMIP, itself, will not produce seed destined for farmers. But SMIP will provide technical advisory support to companies and non-governmental organizations involved in such efforts.

SMIP breeders will lead their NARS counterparts in the development of a sense of stewardship for released cultivars. SMIP will assist with the production of information pamphlets characterizing new varieties and publicizing their release. SMIP will encourage the establishment of multidisciplinary teams aiming to identify constraints to the multiplication and adoption of released cultivars. Recognizing the limited commercial interest historically expressed in the production of sorghum and pearl millet seed in the region, SMIP will conduct a review of constraints affecting the commercial production and distribution of improved varieties. This will include a review of the structure of demand for new varieties and the extent to which open pollinated varieties tend to be distributed by farmers within their own communities.

If necessary, SMIP will sponsor the development of training material on seed production and distribution by small-scale farmers. A consultant may be requested to conduct a short training course in seed

production and distribution.

SMIP will monitor the dissemination of improved cultivars successfully tested in the on-farm research program. This will include a review of informal channels of seed distribution from farmer to farmer.

It is likely that BMZ/GTZ will support a complementary, though independent, regional project for sorghum and pearl millet seed production. This initially aims to concentrate on developing smallholder seed production enterprises in Zimbabwe and will later apply this experience to other countries in the SADC region. SMIP will backstop this effort with technical advisory assistance.

**Contributing Disciplines and Organizations: Breeding, Entomology, Pathology, Economics, Farming Systems, Genetic Resources, and SADC Regional Gene Bank (SRGB).**

**Implementation Schedule**

Activity	1993/94	1994/95	1995/96	1996/97	1997/98
Germplasm Collection in Malawi and Tanzania		+	+		
Facilitating Access to World Germplasm Base	_____				
Generation, Testing and Verification of Genotypes	_____				
Off-Season Crossing Blocks and Breeding Nurseries	_____				
Seed Production	_____				

**Expected Outputs**

Complete germplasm collections in Tanzania and Malawi. Distribute catalog of germplasm collected to each SADC national program.

Improved and easier access of the national scientists to new and enhanced sorghum and pearl millet germplasm, which will increase the capacities for national sorghum and pearl millet improvement programs. Develop capacity in selected NARS to maintain regionally valued populations.

Develop capacity of NARS with active sorghum and pearl millet breeders to produce, distribute and maintain breeder seed.

Provide technical advisory assistance to national (public and private) sorghum and pearl millet seed multiplication and distribution efforts. Develop capacity of NARS to backstop these efforts.

Help NARS develop, test and verify improved cultivars with resistance to drought, pests, and diseases, including *Striga*.

Monitor the dissemination of improved seed and identify constraints to adoption of improved cultivars.

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#### **4.2.3 Objective 3: To develop technologies for the management of diseases, pests and the witchweed *Striga***

Integrated pest management (IPM) involves the application of systems techniques to combat damage of crops by pests (insects, weeds, diseases and nematodes). IPM techniques include application of physical, biological and chemical means to control infestation, the use of pest- and disease-resistant cultivars and cultural controls such as intercropping or varying the times of sowing and harvest. ICRISAT regards the optimization of pest management procedures as one of the major factors in promoting sustainable agricultural systems especially those tailored to the needs of resource-poor farmers.

**IPM for Armoured Cricket.** SMIP has collaborated with Zambia in the development of a simple IPM system for the armoured cricket insect pest. The system uses early ploughing, weed control, and insecticide baiting as the principal components. The system is also being tested by national programs in Namibia. The implementation of this technology will be monitored. Constraints to widespread adoption will be reviewed and strategies will be proposed for their resolution.

**IPM for Stem Borer and Shoot Fly.** In Phase III, IPM systems for stem borer and shoot fly will be developed and promoted in collaboration with national programs and ICRISAT at Hyderabad and West Africa. Basic knowledge is available on both insects. Components of the system to be tested will be seed treatment, time of sowing and field hygiene after harvest.

Survey results from Botswana and Tanzania indicate clearly that early planting reduced shoot fly and stem borer infestation from seedling to mid-whorl plant development stage. But early planting in the semi-arid tropics cannot always be achieved due to the erratic onset of rainfall. In recognition of this constraint, seed treatment with carbofuran for shoot fly and stem borer control has been tested in Botswana. This technology has proven both economic and effective.

Resistance and yield loss trials in Zimbabwe have shown that levels of resistance exist in high yielding cultivars for stem borer. Cultivars which show only ten to twenty percent yield loss after early infestation may be good candidates for an IPM system. The survey in Botswana further revealed that if crop debris is carefully removed from the field and stubbles are ploughed under very early, stem borer populations are reduced significantly at the onset of the wet season. But this has to be done on a large scale and not only by individual farmers.

Such components for a future IPM system have to be evaluated individually and then in combination in farmers' fields. Variable levels of pest and disease incidence require that these tests run for at least three years. The two additional years are required for verification and the integration of these technologies into extension recommendations. The development of stem borer and shoot fly IPM systems will initially be done in Botswana, Tanzania and Zimbabwe. Spill-over effects are expected for other SADC countries which have the same insect problems.

**Disease Resistance.** In Phases I and II cultivars resistant to downy mildew, leaf blight and anthracnose were identified. Some of these cultivars are already released - e.g. SV-1 and SV-2 in Zimbabwe and Okashana-1 in Namibia. Several cultivars are found in the national testing program and on-farm trials - e.g. in Botswana (SDSL 87019, MACIA), Malawi (SPV 351 and SV-1) and Tanzania (SDS 2293-6). It is desirable that the identified disease resistant lines also have resistances to insect pests. They would then be the preferred test entries in the proposed stem borer and shoot fly IPM systems.

Screening of breeding materials for resistance to the major diseases (leaf blight, sooty stripe, downy mildew, ergot and grain mould) and insect pests (shoot fly, stem borer, aphids and storage insects) will continue. Screening will be conducted through breeding nurseries and advanced trials. On-farm research

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under objective 1 will serve as a means of assessing the reaction of improved cultivars to diseases and insects at the farm level. After a cultivar is released and grown by farmers, disease and insect monitoring will be conducted to ensure that any possible outbreak of a new disease or insect pest is detected early. This type of research work will be a major activity of national programs and SMIP will assist as requested.

**Striga Management.** Research will continue in collaboration with Tanzania, Zimbabwe and Botswana to evaluate control packages for the parasitic weed *Striga* on sorghum and pearl millet. Components of the package include resistant cultivars, weed control and use of herbicides. The package, after a second year of evaluation, will be ready for on-farm testing. Screening for new sources of resistance to *Striga* with better productivity will continue. Also to continue is the incorporation of resistance into agronomically desirable backgrounds. This breeding activity will be carried out as part of objective 2 above and linkages with IITA/ICRISAT/FAO *Striga* Program will be developed.

**Contributing Disciplines: Entomology, Pathology, Breeding, Farming Systems, Economics.**

**Implementation schedule**

Activity	1993/94	1994/95	1995/96	1996/97	1997/98
Improve and verify IPM systems for armoured cricket in Zambia and Namibia	_____				
Adapt and verify IPM systems for stem borer and shoot fly in farmers' fields	_____	_____	_____	_____	_____
Screen breeding lines for resistance to important diseases and pests.	_____	_____	_____	_____	_____
Evaluate integrated control measures for <i>Striga</i> at research stations, hot spot locations and in farmers' fields	_____	_____	_____	_____	_____

**Expected Outputs**

Effective control measures for armoured cricket at the farm level in Zambia and Namibia.

Measures for reducing the incidence of stem borer in farmers' fields.

Effective measures for control of *Striga* at the farm level.

New resistant lines to downy mildew, leaf blight, and sooty stripe.

#### 4.2.4 Objective 4: To evaluate grain quality for various end-uses

Evaluation of grain quality is a laboratory activity that is normally part of breeding described in objective 2. The implementation of activities under this objective will be integrated with breeding activities under the supervision of the breeding program.

A database is being compiled on the grain quality of varieties and hybrids from both national programs and SMIP that are released, or are in on-farm testing, or at different stages of advanced testing. This exercise involves continuous updating of the information based on laboratory evaluation of grain quality for various end-uses. Other cultivars and new lines still undergoing preliminary testing and selection processes will be included later when their grain quality has been assessed. This database will assist breeders in their selection and screening processes. Grain quality data have been compiled for 67 sorghum cultivars for 13 grain quality traits.

Methodologies and simple techniques adapted for use in these crop product quality tests are being compiled into an information bulletin for use by national programs and others interested in this work. The bulletin will be available in late 1993.

In Phase III emphasis in crop product quality will continue to be on the evaluation of the grain for various end uses. Emphasis will be placed on uses important to the rural market and for household food security. These include such traits as grain hardness for extended storage and processing ease. In general, screening tests will include physical and chemical analysis of all cultivars moving through advanced testing and toward release. SMIP will assist national programs in carrying out these tests in their own laboratories or at Matopos.

**Contributing Disciplines: Crop quality, Breeding, Farming Systems**

#### Implementation Schedule

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Activity	1993/94	1994/95	1995/96	1996/97	1997/98
Screen grain quality for various end-uses					

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#### Expected Outputs

Cultivars bred and released will have known quality traits thereby providing options for both producers and consumers for various end-uses.

**Field days.** Public awareness and feedback on SMIP's activities will be promoted through the holding of field days for different stakeholders, with special focus on women farmers who carry out over 50% of farm activities in the SADC region.

**Contributing Disciplines: Breeding, Farming Systems, Economics, Entomology, Pathology**

**Implementation Schedule**

Activity	1993/94	1994/95	1995/96	1996/97	1997/98
In-service research fellowships					
In-service technician training					
Special topics training					
Steering Committee Meetings	+	+	+	+	+
Annual Workplans Meetings	+	+	+	+	+
Field Days	+	+	+	+	+
Consultant			+		

#### **4.2.5 Objective 5: To improve the productivity of national sorghum and pearl millet staff**

By the end of Phase II, 91 NARS scientists and more than 100 research technicians will have received SMIP and ICRISAT supported degree education and in-service training. During Phase III, the regional program will provide no further educational support. Instead, SACCAR will work with NARS to identify educational and scholarship opportunities for national scientists. The predominant effort of human resources development will be to enhance the scientific capacities of national sorghum and pearl millet scientists. Those scientists who have received educational support in the past will be linked into a regional scientific community.

A major component of the shift in the orientation of activities during Phase III of the regional program will be the formulation of joint research activities between regional and national scientists defined in the context of annual work plans. These activities will be led by national scientists. The regional sorghum and pearl millet scientists will, as requested, act as participating or supporting members of specific project activity teams.

As annual workplans are jointly formulated, the NARS will be encouraged to identify the composition of expected research impacts. The annual workplans will offer a mechanism for clarifying national sorghum and pearl millet research objectives and periodically monitor the research results. Special efforts will be made to diagnose constraints to technology generation and adoption.

National scientists will be encouraged to complete their analyses of scientific trials and publish their results in a timely fashion. Special efforts will be directed to encourage the publication of major findings in regional and international journals. During Phase III SMIP will sponsor two courses on effective written communication. These will aim to promote clearer communication with both scientific peers and extension programs.

In conjunction with efforts to facilitate the publication of scientific results, greater efforts will be made to improve the access of national scientists to the world literature base. Access to ICRISAT's Semi-Arid Tropical Crops Research Information Service (SATCRIS) will be promoted. A small budget will be set aside for bibliographic and data searches and for the distribution of key scientific papers.

Other major activities in human resources development will include the following:

**In-service research fellowships.** These will be awarded to national sorghum and pearl millet research scientists on a competitive basis to enable them to interact with scientists in their discipline at ICRISAT Center, United States INTSORMIL institutions, mentor institutions in other countries or at Matopos. These fellowships will facilitate research collaboration and completion of data analysis and the preparation of scientific publications. Fellowships tenable in the USA will be implemented through collaboration with INTSORMIL.

**In-service technician training.** Upgrading the skills of technicians of national sorghum and pearl millet programs will be provided as in Phases I and II through the 6-month course at ICRISAT Center, short courses at Matopos, and special courses conducted in collaboration with training institutes in the SADC region.

**Special topic training.** Funds have been provided for special courses for national sorghum and pearl millet research staff, and also for SMIP staff. Such courses will be identified by the Steering Committee (SC). One such course already approved by the SC is the course on effective written communication already referred to above.

## 5 PROJECT IMPLEMENTATION PLAN

The activities encompassed in the implementation plan for Phase III of the Sorghum and Millet Improvement Program (SMIP) have been broadly outlined in section 4 above. The detailed implementation plan is being constructed through an extended set of consultations with the NARS of the SADC region. These began with the proposal of main project priorities and objectives by the SMIP Steering Committee in February 1993. The initial draft of this proposal was reviewed by the SACCAR Board (encompassing the Directors of Research of each SADC country) in April 1993 and accepted by the SMIP Steering Committee in May 1993. Two months later SMIP initiated a set of planning meetings with individual NARS organized to begin the process of outlining specific collaborative workplans corresponding with each of the Phase III objectives. These planning meetings include representatives of national agricultural research programs, extension programs, non-governmental organizations (NGOs), seed companies, farmers and farmers' organizations.

By the end of October 1993, SMIP-NARS planning meetings will have been held in nine of the ten SADC countries<sup>1</sup>. Outlines of collaborative workplans for both technology development and transfer activities will have been drafted, at least in their initial form. The orientation of research work over the full Phase III period will have been established.

The details of the project implementation plan will depend on the outcome of these collaborative planning meetings. Virtually all research and technology transfer carried out under the project will be defined within the context of collaborative NARS-SMIP workplans.

While a final implementation plan cannot be presented until these workplans have been completed, an outline of the expected outputs of the project is presented below. This includes a review of the sequence of project activities.

### 5.1 Sorghum and Pearl Millet Technology Transfer

The principal endeavor of SMIP Phase III will be to promote the transfer of technologies to small farmers based in drought-prone regions. This will be accomplished through three major sets of activities.

5.1.1 The first major set of activities underlying the technology transfer agenda relates to the production and distribution of improved sorghum and pearl millet seed. SMIP will play a key role in the production and distribution of breeders seed, initially through the direct supply of seed to NARS research effort and over time through the development of NARS capacities to produce their own breeder seed. Further, SMIP will review variety release procedures of the SADC NARS and identify opportunities for improving the efficiency with which new cultivars move from release through multiplication and distribution. This will include the provision of assistance with the production of seed release announcements incorporating information about the yield potential, quality traits and management requirements of new cultivars. SMIP will provide training in methods of seed production and help monitor the distribution and adoption of improved seed by small farmers.

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<sup>1</sup> No meeting is scheduled for Angola at this time because of the internal conflict. The meeting for Zambia has still to be scheduled. But meetings with NARS in Botswana, Lesotho, Malawi, Mozambique, Namibia, Swaziland, Tanzania and Zimbabwe have already been scheduled.

### **Key Outputs:**

- **Development of NARS capacities to produce breeder seed (three countries by 1995, seven countries by 1998).**
- **Review of variety release procedures and propose amendments necessary to speed the availability of improved cultivars to seed producers and farmers (1994).**
- **Pamphlets developed with NARS for each improved sorghum and pearl millet cultivar (1994 and on-going).**
- **Training and advisory assistance in seed production (1994 and 1996).**
- **Monitor the distribution and adoption of improved varieties with periodic summary status reports (1995 and 1998).**

**5.1.2** Second, the technology transfer agenda encompasses a program of impact assessment designed to help NARS evaluate the success of their sorghum and pearl millet research efforts and diagnose opportunities for improving the targeting of research projects. This will include evaluations of the determinants of the adoption of improved cultivars and management technologies, and assessments of the longer-term contributions of sorghum and pearl millet to food security and sustainable agriculture in drought-prone regions. SMIP will contribute (in collaboration with SACCAR<sup>2</sup>) to the development of impact assessment capabilities in the NARS.

### **Key Outputs:**

- **Impact assessments of sorghum and/or pearl millet technology adoption patterns and constraints (3 countries by 1995, 6 countries by 1998).**
- **Collaborative impact assessment training workshops with SACCAR (1994, 1996).**

**5.1.3** Finally, SMIP will support the completion of advanced testing and verification of technology with an expanded emphasis on on-farm research and demonstration. This will incorporate efforts to assist NARS with the verification of improved varieties and with the revision of extension recommendations for sorghum and pearl millet.

There are improved varieties of sorghum and/or pearl millet nearing the final stages of advanced testing and verification in at least eight of the ten SADC countries. Several countries, including Malawi, Namibia, Zambia and Zimbabwe, have recently released or are about to release new sorghum or pearl millet cultivars.

As these cultivars are released and disseminated, assessments of farmer preferences for alternative grain and plant traits will provide information for refining the targeting of national breeding objectives. For example, as newly available cultivars begin to fulfill the demand of farmers for early maturing varieties, breeding efforts may be redirected toward cultivars with harder grains supporting longer grain storage or cultivars with thicker stems for building material.

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<sup>2</sup> Preliminary discussions regarding collaborative support to NARS on impact assessment were held with SACCAR's newly appointed Impact Assessment Economist in June 1993.

### Key Outputs:

- **Verification of farmer's acceptance of improved sorghum and pearl millet cultivars recently released in Namibia, Zambia and Zimbabwe (1994) and of sorghum cultivars about to be released in Malawi (1995).**
- **Advanced testing of improved cultivars leading to release of new varieties of sorghum and/or pearl millet in Botswana, Lesotho, Mozambique and Tanzania (1994-1997).**
- **NARS breeding programs for sorghum and pearl millet are better targeted in at least four SADC countries by 1995 and in all SADC countries by 1998.**

5.1.4 While extension recommendations for sorghum and pearl millet have been offered to small farmers in drought-prone regions for many years, few of these proposals for improved crop management have been adopted. SMIP's technology transfer efforts will promote identification of the justification for the failure to adopt extension recommendations. In some countries this will lead to revisions in the recommendations. In others, efforts will be directed toward the identification and resolution of input supply constraints.

### Key Outputs:

- **Extension recommendations for sorghum and pearl millet reviewed in all SADC countries<sup>3</sup> (1995).**
- **Extension recommendations revised in at least four SADC countries (1998).**

## 5.2 Integrated Sorghum and Pearl Millet Improvement Programs

Phases I and II of SMIP aimed toward the development of the sorghum and pearl millet research capabilities of the NARS with large investment in the training of NARS scientists and the subsidiary investments in the strengthening of facilities for research on these crops. A significant regional research capacity was established to reinforce the efforts of national programs. The regional program served as a conduit for new technology (particularly germplasm) into the national programs and backstopped many national research programs weakened by the departure of key scientists for advanced degree training. By the end of Phase II, virtually all of these national scientists will have returned. Therefore, the emphasis of SMIP assistance to the NARS will shift to a partnership designed to strengthen the quality of research being conducted and to enhance the verification and delivery of new technologies to small farmers. No further support will be provided for degree (post-graduate) education. Instead, emphasis will be allocated to in-service training in the context of collaborative research and special topics seminars. NARS scientists will lead the development and implementation of collaborative workplans. SMIP's role will shift toward the provision of technical support in research including assistance with the analysis and publication of research results.

A key component of the strengthening of NARS research capacities is the development of collaborative workplans designed to improve the delineation of expected research outputs and clarification of the division of responsibilities between all participants in the technology development and transfer process. Improved planning will enhance the productivity of both national and regional research resources.

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<sup>3</sup> Except Angola, until the internal conflict is resolved.

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SMIP will also work towards the strengthening of a regional sorghum and pearl millet research network capable of a self-sustaining sharing of scientific ideas and new technologies. SMIP already functions under the guidance of a regional steering committee. During Phase III, responsibility for identifying opportunities for collaborative work between SADC countries and for leading the implementation of this work will shift into the hands of national programs. SMIP will encourage stronger NARS to share improved technology with weaker NARS. Meanwhile SMIP's regional research program will more narrowly focus on problems of a more basic or strategic nature where a regional approach has a strong comparative advantage over a set of separate activities at the national level. This network will form a centerpiece of the continuing SMIP program during Phase IV.

Efforts to promote greater inter-institutional collaboration between SADC countries will be complemented with efforts to stimulate improved coordination between the wide range of technology development and transfer institutions within each country. Special efforts will be made to incorporate the contributions of extension, seed companies, non-governmental and farmers organizations into collaborative workplans. SMIP will promote a stronger sense of stewardship for technologies through efforts to reduce the hierarchical barriers between research and technology transfer.

#### **Key Outputs:**

- Collaborative workplans will be developed with each of the SADC NARS except Angola (1993).
- Special topic seminar in research planning, monitoring and evaluation (1994).
- Special topic seminar in methods of data analysis (1995).
- NARS will gain access to the world database of scientific literature on sorghum and pearl millet (1994).
- Establishment of a collaborative NARS-SMIP working paper series aiming to distribute key research results of regional significance (established in 1994).
- Regional sorghum and pearl millet improvement network coordinated by NARS scientists aiming to exploit complementarities in the research foci of each national program (under NARS guidance by Phase IV).

#### **5.3 Provision of Improved Sorghum and Pearl Millet Cultivars and Germplasm and Integrated Pest Management Technologies**

5.3.1 During Phases I and II, SMIP's breeding and plant protection efforts emphasized the collection of germplasm, review of the adaptability of the world germplasm base to southern African conditions and the development of improved varieties with regional applicability either as parent material for national breeding programs or as direct introductions into advanced testing. For plant protection, efforts to identify varietal resistance to pests and diseases complemented research on management practices and pest characteristics. During Phase III, this emphasis will shift toward helping national sorghum and millet improvement programs make more effective use of the regional and world germplasm and knowledge base.

For breeding, the early part of Phase III will be directed toward helping national programs complete the process of advanced testing of improved varieties suitable for release to farmers. Much of this testing will

occur on farm. SMIP will help gather and analyze data necessary to justify formal release of varieties. Concurrently, SMIP will assist national programs to improve their capability to produce breeders seed.

As improved cultivars are delivered to farmers, SMIP's breeders will help national scientists re-target their breeding efforts toward the evolving demands of the semi-arid farming systems. Most varieties recently found in the process of release have been targeted toward providing farmers an early maturing variety. Many farmers have placed priority on the early maturity trait. But as these seeds reach farmers, a set of second generation priorities will arise requiring a re-examination of available germplasm and targeted delivery of varieties with a range of alternative plant traits to national breeding programs and the newly defined set of production niches.

In the development and testing of new genotypes, attention will be given to the following areas:

- > Drought resistance
- > Resistance to stem borer and shoot fly,
- > A broader range of end-use qualities,
- > Storage and processing characteristics.

**Key outputs:**

- Assist NARS with the completion of advanced testing of improved cultivars and the compilation of documentation for release (aiming toward the release of new cultivars in at least four SADC countries by 1998).
- Assist NARS re-target breeding priorities and develop a genotype base encompassing priority grain and plant traits (re-targeting completed in at least four countries by 1995, seven countries by 1998).
- Breeding lines with drought resistance traits available for testing in Zimbabwe and Botswana (1997).
- Develop breeding lines for long season pearl millet production zones of Tanzania (initial selection completed by 1995).
- ICRISAT Genetic Resources staff will collaborate with the SADC Gene Bank and IBPGR to complete supplementary germplasm collections in Malawi and Tanzania (1996).
- *Striga* resistance incorporated into agronomically desirable germplasm for use by NARS breeders (1997).

**5.3.2** Research on integrated pest management (IPM) will focus on improving control measures for armoured cricket and verifying these through field tests, developing IPM practices to control *Striga*, and testing IPM packages for stem borer and shoot fly.

**Key Outputs:**

- IPM systems for the control of armoured cricket recommended for adoption in Zambia (1995) and Namibia (1996).
- On-farm testing of IPM packages for *Striga* in Zimbabwe (1996) and Tanzania (1997).

#### **5.4 Continued Operations of the Regional Program at Matopos Research Station**

Phases I and II were periods of build-up of SMIP's regional research program at Matopos. In some respects, the regional research facility and staff substituted for national commitments to sorghum and pearl millet research, or at least stood in for these commitments during periods when scientific staff were away for training. During Phase III, the regional program will be consolidated and re-targeted toward backstopping national commitments to sorghum and pearl millet research and technology transfer.

Near the end of Phase II, SMIP professional staff were already being reduced in line with the narrowing of priorities and reductions of funding expected for Phase III. This reduction will be completed at the beginning of Phase III. In association with these adjustments, SMIP and SACCAR are examining options for the reallocation of a part of the Matopos facilities for uses related to the SMIP mandate, for example, sorghum and pearl millet processing or for research on other components of the semi-arid production systems.

ICRISAT appears likely to commit core funding resources toward 1 or more scientific positions in the regional research facility. These will allow the continuation of more strategic research on sorghum and pearl millet -research of regional importance but beyond the capacity of any individual national program.

##### **Key Outputs:**

- **Reduction of professional and scientific staff on SMIP funding (1993) period.**
- **One or more ICRISAT core scientist(s) based at Matopos (1994/95).**
- **Plan for the longer term use of SMIP-Matopos facilities agreed with SACCAR and the Government of Zimbabwe, and a sustainability plan acceptable to donors (1994).**

## 6 FINANCE, PLANNING, MANAGEMENT, ADMINISTRATION, AND IMPLEMENTATION

Guided by the findings of the mid-term evaluation conducted by USAID in 1991 and the directives of SACCAR and the SMIP Steering Committee, SMIP is adjusting the scope and scale of its activities to reflect current priorities and available resources. This is not an easy process, but essential to enable SMIP to successfully implement Phase III and determine its role and support levels in the longer term in the process. This section begins with a review of currently available resources, including carryovers from Phase II and new funds in prospect for Phases III and IV. This is followed by a summary of the consolidated budget covering the period 1993-2003, physical plant services, management and administration.

### 6.1 Available Financial Resources

Funding for Phase III will come from two sources: carryover from Phase II from all three current donors (USAID, CIDA and BMZ/GTZ) plus new funds specifically intended for Phase III from USAID and BMZ/GTZ.

Anticipated carryover of funds (in US\$) as of September 1993 are as follows:

USAID	729 670
CIDA	1 049 372
BMZ/GTZ	48 567
Total	<u>1 827 609</u>

The CIDA "carryover" is the balance of funds anticipated in September 1993 from the current CIDA financial agreement with ICRISAT which expires on 31 March 1994. It is hoped that CIDA will allow an extension on use of these funds. If this is not possible, the CIDA funds must be spent in their entirety by March 1994.

BMZ/GTZ's "carryover" funds from their current operating grant with SMIP is \$48 567. In addition, via a grant extension, BMZ/GTZ will contribute new funds of approximately \$988 372 for the period 1993 to 1994. Further grant extensions are expected for the period 1995 to 1998 at a rate of approximately \$988 372 for every two-year period bringing BMZ/GTZ's total contribution to \$3 122 109.

USAID's expected carryover of \$729,670 will be added on to its expected new contribution of \$7,000,000 for the five year period beginning 15 September 1993. In addition it is expected that USAID will contribute an additional \$3 million towards Phase IV (1998 - 2003).

The total amount currently available for Phases III and IV, including the new funds from USAID and BMZ/GTZ, is:

DONOR	PHASE II Carryover	PHASE III New Funds	PHASE III Total	PHASE IV Contributions	PHASE III and IV Total
USAID	729 670	7 000 000	7 729 670	3 000 000	10 729 670
CIDA	1 049 372	0	1 049 372	0	1 049 372
BMZ/GTZ	48 567	3 073 542	3 122 109	0	3 122 109
Other Sources	0	0	0	3 000 000	3 000 000
	<u>1 827 609</u>	<u>10 073 542</u>	<u>11 901 151</u>	<u>6 000 000</u>	<u>17 901 151</u>

## 6.2 Project Budget (in US\$)

### 6.2.1 Budget for Objective 1: To promote the transfer of technologies

	9-12/93	1994	1995	1996	1997	1-9/98	Total
<b>Professional Staff</b>							
Princ. Scientist (Farming Sys.)	38 550	94 578	99 307	104 272	109 486	86 220	532 413
Princ. Scientist (Economics)	38 550	94 578	99 307	104 272	109 486	86 220	532 413
Princ. Scientist (Agronomy)	38 550	0	0	0	0	0	38 550
	<hr/>						
	115 650	189 156	198 614	208 544	218 972	172 440	1 103 376
<b>Support Staff</b>							
Research Associate x 2	7 004	28 014	29 415	30 885	32 430	25 538	153 286
Technician x 2	3 813	15 252	16 015	16 815	17 656	13 904	83 455
Secretary x 1	1 226	4 902	5 147	5 404	5 675	4 469	26 823
Data Entry Technician x 1	1 226	4 902	5 147	5 404	5 675	4 469	26 823
Driver x 2	1 414	5 656	5 939	6 236	6 548	5 156	30 949
	<hr/>						
	14 683	58 726	61 663	64 744	67 984	53 536	321 336
<b>Operations</b>							
Labour	3 750	15 000	15 750	16 538	17 191	13 127	81 356
Travel	13 950	53 800	57 123	60 079	59 954	39 160	284 066
Fuel	3 496	13 984	14 764	15 502	15 788	11 278	74 812
Vehicle Repairs/Maint./Insur.	4 104	16 416	17 344	18 211	18 473	13 017	87 565
Field Supplies/Inputs	838	3 350	3 518	3 693	3 878	3 054	18 331
Office Supplies	938	3 750	3 975	4 174	4 155	2 735	19 727
Reports	750	3 000	3 200	3 360	3 225	1 823	15 358
Communications	1 825	7 300	7 750	8 138	8 029	5 105	38 147
Review Meetings	9 375	28 002	29 877	31 846	33 913	25 147	158 161
Miscellaneous Res. Expenses	825	3 300	3 510	3 686	3 597	2 188	17 103
Consultants	0	10 000	10 000	10 000	10 000	10 000	50 000
	<hr/>						
	39 851	157 902	166 811	175 227	178 203	126 634	844 628
<b>Capital</b>							
Field/Lab/Office Equip	0	2 000	2 000	2 000	2 000	2 000	10 000
Computers/Printers/Software	0	21 000	1 000	1 000	6 000	0	29 000
Vehicles	0	35 000	20 000	15 000	0	0	70 000
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	0	58 000	23 000	18 000	8 000	2 000	109 000
<b>Overhead</b>	28 673	54 534	57 261	60 123	63 130	49 715	313 437
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<b>Grand Total</b>	198 857	518 318	507 349	526 638	536 289	404 325	2 691 777

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## Budget Notes

- 1 Budget is based on historical costs, based on identical activities conducted in the past.
- 2 Base year for calculations is 1994. 5% inflation rate has been applied throughout.
- 3 Principal Scientist (Agronomy) is continued from Phase II for three months of Phase III in order to complete the work currently in progress.
- 4 Labour includes all casual/seasonal labour as well as temporary employees. Diagnostic surveys, on-farm research and impact assessment activities especially will require teams of enumerators on a seasonal basis.
- 5 Due to the nature of the survey work to be undertaken, extensive staff travel will be necessary throughout the region.
- 6 Vehicle costs will be for three cars. However, the extensive travel in the region greatly increases the costs of operations and maintenance of these vehicles.
- 7 Field supplies include pesticides, insecticides, and fertilizers as well as seeds and regular field supplies.
- 8 Office supplies include stationery and other office consumables.
- 9 Reports include research publications and regular reports to management and donors.
- 10 Communications include telex, fax, e-mail, postage and courier service charges.
- 11 Review meetings will be held twice a year to review and plan for on-farm research activities.
- 12 Research expenses will cover miscellaneous charges, for instance uniforms and protective clothing and small equipment.
- 13 Consultants will be required for special studies and activities to complement on-going activities.

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**6.2.2 Budget for Objective 2: To breed improved varieties, collect and exchange germplasm**

	9-12/93	1994	1995	1996	1997	1-9/98	Total
<b>Professional Staff</b>							
Princ. Scientist (Breeder)	26 626	91 784	96 373	101 192	106 252	83 673	505 900
Snr Scientist (Breeder)	14 718	0	0	0	0	0	14 718
	<hr/>						
	41 344	91 784	96 373	101 192	106 252	83 673	520 618
<b>Support Staff</b>							
Senior Technician x 2	6 143	21 940	23 037	24 189	25 398	20 003	120 710
Technician x 2	4 271	15 252	16 015	16 815	17 656	13 904	83 913
Secretary x .75	1 601	5 720	6 005	6 306	6 621	5 214	31 467
Driver x 2	1 584	5 656	5 939	6 236	6 548	5 156	31 119
General Hands x 4	2 673	9 548	10 025	10 527	11 053	8 704	52 530
	<hr/>						
	16 272	58 116	61 021	64 073	67 276	52 981	319 739
<b>Operations</b>							
Casual/Seas. Labour	2 242	8 967	9 415	9 886	10 380	8 174	49 064
Travel	9 027	45 318	39 489	49 963	43 536	44 112	231 445
Fuel	233	930	977	1 025	1 077	848	5 090
Vehicle Rep./Maint./Insur.	913	3 651	3 834	4 025	4 226	3 328	19 977
Field Operations	117	469	492	517	543	427	2 565
Field Supplies/Seed	8 038	30 153	31 761	33 449	35 221	27 312	165 934
Lab. Supplies	1 294	5 175	5 434	5 705	5 846	4 718	28 172
Office Supplies	881	3 525	3 701	3 886	4 081	3 213	19 287
Reports	831	3 325	3 491	3 666	3 849	3 031	18 193
Communications	531	2 122	2 228	2 340	2 022	1 934	11 177
Miscellaneous Res. Exp.	250	1 000	1 050	1 103	1 158	912	5 473
Consultants	0	0	25 000	0	25 000	0	50 000
	<hr/>						
	24 357	104 635	126 872	115 565	136 939	98 009	606 377
<b>Capital</b>							
Lab/Field/Office Equip	0	2 000	2 000	2 000	2 000	2 000	10 000
Vehicles	0	0	25 000	0	0	0	25 000
Computer/Printer/Software	0	0	5 000	0	0	0	5 000
	<hr/>						
	0	2 000	32 000	2 000	2 000	2 000	40 000
<b>Overhead</b>	12 675	32 918	34 627	36 358	38 176	30 064	184 878
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<b>Total</b>	94 648	289 513	350 893	319 188	350 643	266 727	1 671 612

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## Budget Notes

- 1 Budget is based on historical costs based on similar activities conducted in the past.
- 2 Base year for calculations is 1994. 5% inflation rate has been applied throughout.
- 3 Senior Scientist (Breeder) position is for 3½ months until the position is funded by ICRISAT Core.
- 4 Labour includes all casual/seasonal labour in the field as well as ad-hoc temporary employees.
- 5 Due to the nature of the breeding work to be undertaken, largely in collaboration with national programs throughout the region, extensive travel by SMIP staff will be necessary.
- 6 Vehicle costs will be for three cars.
- 7 Field supplies include pesticides and fertilizers as well as seeds and regular field supplies.
- 8 Office supplies include stationery and other office consumables.
- 9 Reports include research publications and regular reports to management and donors.
- 10 Communications include telex, fax, e-mail, postage and courier service charges.
- 11 Research expenses will cover miscellaneous charges, for instance uniforms and protective clothing and small equipment.
- 12 Consultants will be required for special studies and activities to complement on-going activities.

**Budget for 6.2.3 Objective 3: To develop technologies for the management of diseases, pests and the witchweed *Striga***

	9-12/93	1994	1995	1996	1997	1-9/98	Total
<b>Professional Staff</b>							
Princ. Scientist (Entomology)	33 626	134 505	141 230	148 292	155 706	122 619	735 978
	<hr/>						
<b>Support Staff</b>							
Technician x 2	3 813	15 252	16 015	16 815	17 656	13 242	82 793
Secretary x .25	477	1 907	2 002	2 102	2 207	1 655	10 350
General Hand x 2	1 194	4 774	5 013	5 263	5 527	4 352	26 123
	<hr/>						
	5 484	21 933	23 030	24 180	25 390	19 249	119 266
<b>Operations</b>							
Casual/Seas. Labour	500	2 000	2 100	2 205	2 315	1 823	10 943
Travel	7 218	26 870	28 314	24 317	25 633	19 761	132 113
Fuel	390	1 560	1 638	728	764	602	5 682
Vehicle Rep./Maint./Insur.	1 279	5 117	5 373	1 783	1 872	1 474	16 898
Field Operations	39	156	164	172	181	142	854
Field Supplies	1 359	5 436	5 708	4 064	4 267	3 360	24 194
Lab. Supplies	288	1 150	1 208	1 268	1 331	1 048	6 293
Office Supplies	506	2 025	2 126	1 130	1 187	934	7 908
Reports	128	510	536	287	301	237	1 999
Communications	88	350	368	276	289	228	1 599
Miscellaneous Res. Expenses	750	3 000	3 150	2 205	2 315	1 823	13 243
Consultants	0	0	25 000	25 000	0	0	50 000
	<hr/>						
	12 545	48 174	75 685	63 435	40 455	31 432	271 726
<b>Capital</b>							
Lab/Field/Office Equip	0	2 000	2 000	2 000	2 000	2 000	10 000
Vehicles	0	0	25 000	0	0	0	25 000
Computer/Printer/Software	0	0	10 000	0	0	0	10 000
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	0	2 000	37 000	2 000	2 000	2 000	45 000
<b>Overhead</b>	8 604	34 416	36 137	37 944	39 841	31 211	188 154
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<b>Total</b>	60 259	241 028	313 082	275 851	263 392	206 511	1 360 113

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## Budget Notes

- 1 Budget is based on historical costs based on similar activities conducted in the past.
- 2 Base year for calculations is 1994. 5% inflation rate has been applied throughout.
- 3 Labour includes all casual/seasonal labour in the field as well as ad-hoc temporary employees.
- 4 Due to the nature of the this objective, largely in collaboration with NARS throughout the region, extensive travel will be necessary by staff.
- 5 Vehicle costs will be for one car.
- 6 Field supplies include pesticides and fertilizers as well as seeds and regular field supplies.
- 7 Office supplies include stationery and other office consumables.
- 8 Reports include research publications and regular reports to management and donors.
- 9 Communications include telex, fax, e-mail, postage and courier service charges.
- 10 Research expenses will cover miscellaneous charges, for instance uniforms and protective clothing, and small equipments.
- 11 Consultants will be required for special studies and activities to complement on-going activities.

**6.2.4 Budget for Objective 4: To evaluate grain quality for various end-uses.**

	9-12/93	1994	1995	1996	1997	1-9/98	Total
<b>Support Staff</b>							
Technician x 2	4 650	18 596	19 526	20 502	21 527	16 953	101 754
General Hand x 2	1 194	4 774	5 013	5 263	5 527	4 352	26 123
	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
	5 843	23 370	24 539	25 765	27 054	21 305	127 877
<b>Operations</b>							
Casual/Seas. Labour	750	3 000	3 150	3 308	3 473	2 735	16 416
Lab. Supplies	1 625	6 500	6 825	7 166	7 525	5 926	35 567
Office Supplies	225	900	945	992	1 042	820	4 924
Reports	100	400	420	441	463	365	2 189
Communications	100	400	420	441	463	365	2 189
	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
	2 800	11 200	11 760	12 348	12 966	10 211	61 285
<b>Capital</b>							
Lab Equipment	0	0	5 500	0	0	0	5 500
Computer/Printer/Software	0	0	5 000	0	0	0	5 000
	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
	0	0	10 500	0	0	0	10 500
<b>Overhead</b>	1 285	5 141	5 398	5 668	5 952	4 687	28 131
	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
<b>Total</b>	9 929	39 711	52 197	43 781	45 972	36 203	227 793
	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>

## **Budget Notes**

- 1 Budget is based on historical costs based on similar activities conducted in the past.
- 2 Base year for calculations is 1994. 5% inflation rate has been applied throughout.
- 3 Labour includes all casual/seasonal labour in the field as well as ad-hoc temporary employees.
- 4 Laboratory supplies form a component for successful implementation of this activity.
- 5 Office supplies include stationery and other office consumables.
- 6 Reports include research publications and regular reports to management and donors.
- 7 Communications include telex, fax, e-mail, postage and courier service charges.

**6.2.5 Budget for Objective 5: Human resources development and information management and exchange**

	9-12/93	1994	1995	1996	1997	1-9/98	Total
<b>Support Staff</b>							
Information Officer	3 502	14 007	14 707	15 443	16 215	12 769	76 643
	<hr/>						
	3 502	14 007	14 707	15 443	16 215	12 769	76 643
<b>Operations</b>							
Degree training (Phase II ext.)	304 347	33 050	0	0	0	0	337 397
In-service research fellowship	0	45 000	47 250	49 613	52 093	0	193 956
In-service technician training	0	30 980	32 529	34 155	35 863	0	133 527
Special topic training	0	15 750	16 538	17 364	18 233	0	67 885
Steering committee meetings	0	15 000	15 750	16 538	17 364	18 233	82 885
Annual workplans meetings	0	63 993	117 559	77 271	142 246	0	401 069
Field days	0	12 050	13 255	14 581	16 039	17 642	73 567
Reports/Publications	7 000	28 000	29 400	30 870	32 414	25 526	153 210
Consultants	0	0	50 000	0	0	0	50 000
Travel	2 000	8 000	8 400	8 820	9 261	9 724	46 205
Office Supplies	300	1 200	1 260	1 323	1 389	1 459	6 931
Communications	250	1 000	1 050	1 103	1 158	1 216	5 777
Library Bks, Periodicals, N/papers	500	2 000	2 100	2 205	2 315	2 431	11 551
SATCRIS Database	3 455	11 500	12 075	12 679	13 313	13 978	67 000
	<hr/>						
	317 852	267 523	347 166	266 522	341 688	90 209	1 630 960
<b>Capital</b>							
Office Equipment	0	2 000	2 000	2 000	2 000	2 000	10 000
Computer/Printer/Software	0	0	0	5 000	0	0	5 000
	<hr/>						
	0	2 000	2 000	7 000	2 000	2 000	15 000
<b>Overhead</b>	770	3 082	3 236	3 397	3 567	2 809	16 861
	<hr/>						
<b>Grand Total</b>	322 124	286 612	367 109	292 362	363 470	107 787	1 739 464

## Budget Notes

- 1 Degree Training. This is for the extension of degree study periods for students who began their studies in Phase II but who will only be able to complete their degree requirements in Phase III.
- 2 In-Service Research Fellowships. These will be tenable at Matopos, ICRISAT Centre, the United States or at other mentor institutions overseas. A lump sum of \$45,000 is set aside for this activity in the base year 1994 with 5% inflation afterwards. Fellowships will not be awarded in 1998.
- 3 In-Service Technician Training. This will include 1 - 6 month training at ICRISAT Center, one to three weeks at Matopos or at institutions in the SADC countries.
- 4 Special Topic Training Workshops. This will cater for special needs of NARS and SMIP scientists as identified by the Steering Committee.
- 5 Steering Committee Meetings. These will take place once a year. Costs are for travel, hotel, per diem, and incidental costs in organizing meetings.
- 6 Annual Workplan Meetings. These meetings will take place every year attended by 20 NARS scientists (2 per SADC country) to meetings in 1994 and 1996; and up to 40 NARS scientists (4 per SADC country) in 1995 and 1997. The latter meetings will ensure that all sorghum and millet scientists have an opportunity to meet and review progress at least every two years. All research will be based on the workplans emerging from these meetings.
- 7 Field Days. Field days are for public awareness of farmers and others of SMIP's activities. They also serve as a forum for exchange of ideas and better understanding of farmers' problems and needs.
- 8 Reports and Publications. This will provide for basic reporting and publication needs, including all quarterly and annual reports to donors, SACCAR, and ICRISAT, project reports, annual workplans, workshop proceedings, information bulletins, bibliographic data searches, etc. This is an important part of SMIP's attempt to heighten public awareness and dissemination of information of its activities.
- 9 Consultant. A consultant will be hired to study and report on the impact of human resources development activities of Phases I and II and make recommendations for future activities.
- 10 Library Books, Periodicals, Newspapers. This will provide for the basic upkeep of the SMIP library to assure that scientists, students and visitors of SMIP have access to books, periodicals and newspapers that support SMIP's objectives.
- 11 SATCRIS is ICRISAT's Semi-Arid Tropical Crops Research Information Service that provides regular and up-to-date information on published articles and abstracts, in this case sorghum and pearl millet. The budget is also for bibliographic data searches and distribution of scientific papers.

**6.2.6 Budget for Farm and Physical Plant Services (FPPS)**

	9-12/93	1994	1995	1996	1997	1-9/98	Total
<b>Professional Staff</b>							
FPPS Manager	13 602	54 409	57 129	59 986	62 985	49 601	297 712
	<hr/>						
	13 602	54 409	57 129	59 986	62 985	49 601	297 712
<b>Support Staff</b>							
Senior Technician x 1	3 502	14 007	14 707	15 443	16 215	12 769	76 643
Mechanic x 1	1 907	7 626	8 007	8 408	8 828	6 952	41 728
Caterer x 1	1 907	7 626	8 007	8 408	8 828	6 952	41 728
Secretary x 1	1 226	4 902	5 147	5 404	5 675	4 469	26 823
Electrician x 1	1 226	4 902	5 147	5 404	5 675	4 469	26 823
Carpenter x 1	1 226	4 902	5 147	5 404	5 675	4 469	26 823
Welder x 1	707	2 828	2 969	3 118	3 274	2 578	15 474
Driver x 2	1 414	5 656	5 939	6 236	6 548	5 156	30 949
Tractor Operator x 2	1 414	5 656	5 939	6 236	6 548	5 156	30 949
Cook x 1	707	2 828	2 969	3 118	3 274	2 578	15 474
General Hand x 7	4 177	16 709	17 544	18 422	19 343	15 232	91 427
	<hr/>						
	19 413	77 642	81 522	85 601	89 883	70 780	424 841
<b>Operations</b>							
Casual/Seasonal Labor	701	2 803	2 943	3 090	3 245	2 555	15 337
Vehicle Fuel	388	1 550	1 628	1 709	1 794	1 413	8 482
Vehicle Repairs/Maint./Insur.	896	3 585	3 764	3 952	4 150	3 268	19 615
Tractor & Plant Service	754	3 014	3 165	3 323	3 489	2 748	16 493
Tractor Repairs	1 816	7 262	7 625	8 007	8 407	6 620	39 737
Farm Equipment Repairs	1 709	6 834	7 176	7 534	7 911	6 230	37 394
Workshop Supplies	2 720	10 880	11 424	11 995	12 595	9 919	59 533
Estate Maintenance	5 634	22 535	23 662	24 845	26 087	20 544	123 307
Estate Insurance	794	3 174	3 333	3 499	3 674	2 894	17 368
Office Supplies	874	3 496	3 670	3 854	4 047	3 187	19 128
Communications	427	1 709	1 795	1 884	1 978	1 558	9 351
Electricity	7 069	28 277	29 691	31 175	32 734	25 778	154 724
Water	716	2 863	3 006	3 156	3 314	2 610	15 665
Security	2 172	8 688	9 122	9 579	10 057	7 920	47 538
Fire Services	1 200	4 800	5 040	5 292	5 557	4 376	26 265
Uniforms & Prot. Cloth.	495	1 980	2 079	2 183	2 292	1 805	10 834
Travel	2 785	11 141	11 698	12 283	12 897	10 156	60 960
Travel & Visitors Center	2 750	11 000	11 550	12 128	12 734	10 028	60 190
	<hr/>						
	33 900	135 591	142 371	149 488	156 962	123 609	741 921
<b>Replacement Capital</b>							
Office Equipment	0	2 100	2 100	2 100	2 100	2 100	10 500
Ford 6610 Tractor	0	0	0	0	0	40 000	40 000
Vehicles	0	0	0	38 000	0	0	38 000
	<hr/>						
	0	2 100	2 100	40 100	2 100	42 100	88 500
<b>Overhead</b>	7 263	29 051	30 503	32 029	33 631	26 484	158 962
	<hr/>						
<b>Grand Total</b>	74 178	298 793	313 626	367 204	345 560	312 574	1 711 935

## Budget Notes

- 1 Budget is based on historical costs taking into account reduced activities and personnel for Phase III.
- 2 Base year for calculations is 1994. 5% inflation rate has been applied throughout.
- 3 Casual and seasonal labour will be engaged during the peak periods in maintenance of the grounds, farm structures, farm roads and any other maintenance jobs that do not require skilled labour.
- 4 Vehicle costs are for three vehicles allocated to the unit to support its activities, one of these will be a seven ton truck.
- 5 Tractor and plant service is for the regular changing of oils, oil filters, air filters and greasing. Repairs are those both planned and unplanned and for replacement of parts. Plants are stationary machines like generators, welders, drills, saws and other workshop machines.
- 6 Workshop supplies are used for repairs of machinery, buildings, vehicles and furniture. Welding electrodes, nails, hammers, drill bits, welding gas, sand paper, etc. are the types of supplies used.
- 7 Estate maintenance includes grounds, roads, electricals, plumbing, carpentry and painting of buildings.
- 8 Electricity is a variable cost paid to Zimbabwe Electricity Supply Authority for the power used at the station.
- 9 Water costs are paid to the Department of Water Resources for their water pumps and their staff who take care of the water supply of the station. It is a shared cost between SMIP and Matopos Research Station.
- 10 Security covers security guards who guard our offices, farm area and the hostel and catering facilities.
- 11 Fire services - for fire extinguishers in offices and laboratories which are on loan to SMIP and are serviced twice a year.
- 12 Uniforms and protective equipment are issued to all the support staff (except the secretaries) each year depending on type of activity they are assigned.
- 13 Travel is mostly to Muzarabani to monitor the activities as the station is directly under FPPS. Twice a year there will be a trip to Botswana or South Africa to purchase spare parts not readily available in Zimbabwe.

**6.2.7 Budget for Project Management (in US\$)**

	9-12/93	1994	1995	1996	1997	1-9/98	Total
<b>Professional Staff</b>							
Executive Director	13 313	53 251	55 914	58 709	61 645	48 545	291 377
Regional Administrator	18 105	72 419	76 040	79 842	83 834	66 019	396 259
	<hr/>						
	31 418	125 670	131 934	138 551	145 479	114 564	687 637
<b>Support Staff</b>							
Accounts Officer x 1	3 502	14 007	14 707	15 443	16 215	12 769	76 643
Executive Officer x 1	2 743	10 970	11 519	12 094	12 699	10 001	60 026
Senior Accountant x 1	2 743	10 970	11 519	12 094	12 699	10 001	60 026
Computer Technician x 1	2 743	10 970	11 519	12 094	12 699	10 001	60 026
Accountant x 1	1 907	7 626	8 007	8 408	8 828	6 952	41 728
Purchaser x 1	1 907	7 626	8 007	8 408	8 828	6 952	41 728
Storeskeeper x 1	1 907	7 626	8 007	8 408	8 828	6 952	41 728
Travel/Visitors Services Officer	1 907	7 626	8 007	8 408	8 828	6 952	41 728
Commun. and Filing Sec. x 1	1 226	4 902	5 147	5 404	5 675	4 469	26 823
Secretary x 2	2 451	9 804	10 294	10 809	11 349	8 938	53 645
Cashier x 1	1 226	4 902	5 147	5 404	5 675	4 469	26 823
Reprography Assistant x 1	2 121	8 484	8 908	9 354	9 821	7 734	46 422
Driver x 3	2 121	8 484	8 908	9 354	9 821	7 734	46 422
Telephone Operator x 1	707	2 828	2 969	3 118	3 274	2 578	15 474
	<hr/>						
	29 211	116 825	122 665	128 800	135 239	106 502	639 242
<b>Operations</b>							
Travel	10 734	42 936	45 083	47 337	49 704	39 139	234 933
Communications	5 683	22 733	23 870	25 063	26 316	20 724	124 389
Audit/Legal/Bank Fees	3 250	13 000	13 650	14 333	15 049	11 851	71 133
Supplies	4 436	17 743	18 630	19 562	20 540	16 175	97 086
Freight & Handling	1 109	4 436	4 658	4 890	5 135	4 044	24 272
Project Equipment	750	3 000	3 150	3 308	3 473	2 735	16 416
Fuel	388	1 550	1 628	1 709	1 794	1 413	8 482
Vehicle Repairs/Mainl./Insurance	896	3 585	3 764	3 952	4 150	3 268	19 615
Miscellaneous Expenses	500	1 500	1 575	1 654	1 736	1 367	8 332
	<hr/>						
	27 746	110 483	116 008	121 808	127 897	100 716	604 658
<b>Project Evaluation</b>	0	0	0	200 000	0	0	200 000
<b>Capital</b>							
Office Equipment	0	2 000	2 000	2 000	2 000	2 000	10 000
Vehicles	0		0	65 000	0	0	65 000
	<hr/>						
	0	2 000	2 000	67 000	2 000	2 000	75 000
<b>Overhead</b>	13 338	53 349	56 016	58 817	61 758	48 634	291 911
	<hr/>						
<b>Grand Total</b>	101 712	408 327	428 643	714 976	472 373	372 416	2 498 447

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## **Budget Notes**

- 1 Budget is based on historical costs taking into account reduced activities and personnel for Phase III.
- 2 Base year for calculations is 1994. 5% inflation rate has been applied throughout.
- 3 Travel will be mostly within the SADC region to cater to the regional needs of the project. The Executive Director will also be travelling to ICRISAT headquarters four times a year. The Regional Administrator will travel to ICRISAT headquarters twice a year.
- 4 Communications costs cover postage, courier service, telephone, e-mail, fax and telex.
- 5 Supplies are basic office supplies.
- 6 Freight and handling is 25% of supplies.
- 7 Project equipment is for items of less than \$800 in value. This would include replacement of individual office furniture, calculators and miscellaneous items.
- 8 Vehicle costs are for 5 vehicles, 3 cars for the Executive Director, Regional Administrator, Travel and Visitors Service; a mini-bus and a big bus for the daily transport of professional and support staff from Bulawayo to Matopos and back.
- 9 General expenses are for unforeseen miscellaneous expenses.

### 6.3 Summary Budget for Phase III (in US\$)

	9-12/93	1994	1995	1996	1997	1-9/98	Total
Professional Staff	236 640	595 524	625 300	656 565	689 394	542 897	3 346 320
Support Staff	94 409	370 619	389 147	408 606	429 041	337 122	2 028 944
<b>Operations</b>							
Human Resource Development	304 347	124 780	96 317	101 132	106 189	0	732 765
Meetings, Seminars, Workshops	9 375	119 045	176 441	140 236	209 562	61 022	715 681
Information Management and Exch.	12 764	48 735	51 222	53 508	55 816	47 455	269 500
Travel	45 714	188 065	190 107	202 799	200 985	160 828	988 498
Communications	8 904	35 614	37 481	39 245	40 255	31 130	192 629
General Research/Office Expenses	7 434	29 236	30 743	31 179	32 463	24 920	155 975
Supplies	24 322	95 283	100 185	102 261	107 104	83 860	513 015
Vehicle Operations and Fuel	12 983	51 928	54 714	52 596	54 088	39 909	266 218
Farm & Physical Plant Serv & Support	33 208	132 822	139 463	146 437	153 584	120 536	726 050
Consultants	0	10 000	110 000	35 000	35 000	10 000	200 000
<b>Total Operations</b>	<b>459 051</b>	<b>835 508</b>	<b>986 673</b>	<b>904 393</b>	<b>995 046</b>	<b>579 660</b>	<b>4 760 331</b>
Project Evaluation	0	0	0	200 000	0	0	200 000
<b>Capital</b>							
Vehicles	0	35 000	70 000	118 000	0	0	223 000
Lab/Field/Office Equip.	0	12 100	17 600	12 100	12 100	12 100	66 000
Farm Equipment	0	0	0	0	0	40 000	40 000
Computers and Associated Equip.	0	21 000	21 000	6 000	6 000	0	54 000
<b>Total Capital</b>	<b>0</b>	<b>68 100</b>	<b>108 600</b>	<b>136 100</b>	<b>18 100</b>	<b>52 100</b>	<b>383 000</b>
Overhead	72 831	212 551	223 179	234 337	246 054	193 604	1 182 556
<b>Grand Total</b>	<b>862 931</b>	<b>2 082 302</b>	<b>2 332 899</b>	<b>2 540 001</b>	<b>2 377 635</b>	<b>1 705 383</b>	<b>11 901 151</b>

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**6.3a Summary Budget for Phases III and IV (in US\$)**

	9/93-9/98 Phase III Total	9/93-9/2003 Phase IV Total	Grand Total
Professional Staff	3 306 770	1 850 768	5 157 538
Support Staff	2 028 944	891 159	2 920 103
Operations	4 808 586	2 287 379	7 095 965
Project Evaluation	200 000	200 000	400 000
Capital	383 000	167 470	550 470
Overhead	1 173 851	603 224	1 777 075
<b>Total</b>	<b>11 901 151</b>	<b>6 000 000</b>	<b>17 901 151</b>

Note: only 50% of Phase IV will be donor funded

## **6.4 Farm and Physical Plant Services**

One of the vital factors in building effective agricultural research stations is the development of research support services. The pace of research advancement is also known to be greatly influenced by the quality and adequacy of facilities and services available at the research station.

Adequate research support facilities have been developed for SMIP (see Section 3.1). A Unit has been established called Farm and Physical Plant Services to provide professional farm management and furnish field conditions and facilities appropriate to the particular research needs of scientists. This affords scientists the opportunity to devote their time and talents to the maximum extent possible for the accomplishment of their research.

All the development work and setting up of all the facilities was completed in Phases I and II. In Phase III emphasis will be towards the management and maintenance of the infrastructure developed. The shift in emphasis is important because if the utilization of this vital research facility is not properly managed and maintained permanent damage may occur.

### **6.4.1 Research Farm Operations**

Most of the operations will be related to the backup research that SMIP scientists will be conducting at Matopos, Lucydale and Muzarabani in Zimbabwe. The Bulawayo City Council has allowed SMIP to use 13 ha of its land at Aisleby specifically for breeding nurseries and isolations. The land for experiments at the above locations total 117 hectares.

The Muzarabani facility in the Zambezi Valley provides an excellent off-season opportunity for generation, advance and seed increase and thus accelerates the rate of breeding work. It is a location with high winter night temperatures of above 10°C making it possible to continue breeding work under irrigation in winter. The location is also used for breeders seed increase for collaborating national programs which lack such a facility.

Field operations include cultivation, maintenance of farm structures, crop rotation, pest control, irrigation and casual labor management.

### **6.4.2 Farm Machinery and Vehicle Maintenance**

Timely field operations are important for SMIP scientists to perform quality research. Farm machinery and equipment available within SMIP are geared for the above need and they include those for farm development, maintenance, routine farming activities, as well as those which provide support for precise and quality field research operations. All regular vehicle and machinery maintenance services are done in the workshop except for major repairs which are done in Bulawayo.

### **6.4.3 Building and Estate Maintenance**

Maintenance of the buildings (laboratories, offices, workshops, staff houses, etc.) involves electricals, carpentry, plumbing, painting every four to five years, repair of office and house furniture and laboratory equipment. Maintenance of estate grounds, roads and water supply also fall under this activity.

### **6.4.4 Housing and Catering Complex**

A hostel built in 1989 accommodates in-service trainees and research associates from the region visiting SMIP. It has 10 rooms (each with two beds), two simplex houses, a catering and recreational facility. The catering facility provides lunch for workers and visitors. Like other buildings, this requires regular maintenance.

## **6.5 The Management Team**

The Management Team consists of the Executive Director, the Regional Administrator and essential support staff. It provides support for all research conducted in the project in the following areas: accounting, budgeting and finance; personnel; purchasing and stores; computer support; travel and visitors services; staff transport; and communications. The Regional Administrator is responsible for the day to day functioning of the administrative units mentioned above. Overall management and coordination of all research activities and administration comes under the purview of the Executive Director.

The Executive Director and Regional Administrator have responsibilities that extend beyond SMIP. They also oversee the SADC/ICRISAT Groundnut Project and the ICRISAT Pigeonpea Project based in Malawi, and the Eastern Africa Regional Cereals and Legumes Program (EARCAL) based in Kenya. The Executive Director is a member of ICRISAT Management.

During Phase III the Management Team will devote a portion of its time to exploring future funding possibilities with specific attention to sources within the region, including NARS institutions and the private sector. While the issue of longer term sustainability of SMIP is appropriately one which SACCAR must address, ICRISAT as management agent is prepared to assist in this effort which will define the future character of regional sorghum and pearl millet research activities. The identification of opportunities in this regard will be a concern of all SMIP senior staff as a natural outgrowth of the collaborative activities described in section 7. The Executive Director will provide follow up to explore funding possibilities for specific activities and projects which are consistent with the objectives and priorities for Phase III as defined by the Steering Committee and address the needs of sorghum and pearl millet research and development efforts in individual countries. The Regional Administrator will examine the feasibility of different funding and contractual mechanisms by which funds made available in this manner can be efficiently accessed, expended and accounted for. The progress in this area will define the scope and scale of SMIP in Phase IV and beyond as discussed further in the following section.

## **6.6 Support Staff**

Administration and management support staff include an accounts officer, executive officer, senior accountant, cashier, purchaser, travel and visitors service officer, storeskeeper, computer technician, two secretaries, three drivers and a switchboard operator.

Two accounts staff are required for the proper accounting of the various grants, keeping in mind that no commingling of funds is allowed. This means three separate bank accounts (interest, call and current) are maintained for each grant. In addition, accounting must be done in four currencies (US\$, CAN\$, DM and ZIM\$) on a daily basis to satisfy donor and ICRISAT Center financial reporting requirements. The cashier's primary function is the receipt and payment of cash for the entire program. He/she is also used as a general utility person, updating stores kardex cards, doing data entry and in general providing miscellaneous administrative backup support. The executive officer is a new position. The incumbent will serve as a personal assistant to the Executive Director. The computer technician is a new position. Responsibilities will include the installation and maintenance of all computer hardware and software. This will become especially important as we introduce computer networking into the program. The two purchasing and stores personnel take care of all purchasing, stores, disposal and assets management. The travel and visitors service officer takes care of all aspects of travel for SMIP staff and visitors including organization of all workshops, seminars, meetings, etc. Drivers provide support for all administrative units and the Executive Director. They are also used for miscellaneous administrative backup support, i.e. messengers. Both professional and support staff are provided bus transport. The switchboard operator handles all telephone communication coming in and going out of SMIP.

## 7 SUSTAINABILITY

### 7.1 Toward a Sustainable Regional Sorghum and Pearl Millet Improvement Program

The two dimensions of sustainability that will be considered in Phase III are (a) the future of the Matopos facility; and (b) nature and support of a future SMIP program. The dimensions are related, but are being considered from different perspectives by SACCAR. The discussion in this section focuses upon the sustainability of SMIP. The reduction in the size of the SMIP program which is in progress will create opportunities for the alternate use of a portion of the facilities at Matopos. Although it is anticipated that SMIP will continue to be headquartered at Matopos, the program may become one of a number of tenants of the Matopos facilities. There are several possible alternate uses for the facilities which will be examined through the consultancy mission noted in sub-section 2.5.

ICRISAT's core-funded program would be one of the users of the Matopos facilities. The ICRISAT Medium Term Plan 1994-98 includes several research themes in the SADC region which are similar to the regional research priorities of SMIP as determined by the Steering Committee. Depending upon the level of funding from CGIAR, ICRISAT may establish core-funded research activities in sorghum and pearl millet for southern Africa. Such activities would complement SMIP's activities and be based at Matopos.

The question of the financial sustainability of SMIP is being examined by SACCAR in the context of the decisions SADC/SACCAR must make about the set of functions which are fundable on a continuing basis from sources other than traditional donors. If SMIP is going to continue as a part of the SACCAR system of research programs, SACCAR must locate the necessary funds to sustain a small core program or network. The scope and scale of the core program or network will depend on SACCAR, the SMIP Steering Committee and most importantly on the needs and wishes of the institutions concerned with sorghum and pearl millet research and development in the SADC member states **and their ability to secure the necessary funds to support collaborative activities**. In Phase IV there are at least two scenarios which can be envisaged depending upon the set of functions and levels of support that are deemed desirable and attainable.

- **Network** staffed by one full time coordinator based at Matopos with a modest budget for meetings and communications. No core research activities, but collaborative research among NARS researchers and the network coordinator.
- **Small Core Regional Research Program with a Network** staffed by 3 or 4 scientists based at Matopos who would conduct research in 1 or 2 high priority areas and operate a network.

At a minimum SMIP is confident that, beginning in Phase IV, SADC member countries will wish to maintain a network and will be able and willing to support it. ICRISAT in its capacity as an international center responsible for sorghum and pearl millet research worldwide, would prefer that SADC/SACCAR and members would opt to continue a core research program which would focus on one or more areas of high priority where a regional approach has a strong comparative advantage over a set of separate activities at the national level. Germplasm enhancement may be one such area. SMIP's core program funded by SADC would be complemented by a contribution from the ICRISAT core budget in the form of 1 or more ICRISAT scientists who would be posted to Matopos to work alongside SMIP staff in specific areas<sup>a</sup>.

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<sup>a</sup> The number of positions in SMIP Phase III supported through the ICRISAT core budget for 1994-1998 will be determined following decisions on the overall level of funding from the CGIAR which is expected by late 1993.

Either scenario could accommodate a flexible capacity to service public and private institutions concerned with sorghum and pearl millet research and development in the member countries, specifically tailored to the needs and resources of specific clients. The flexible capacity could be expanded and contracted in response to levels and timing of effective demand. In essence, SMIP could be contracted by an institution to carry out services with support from that institution.

Particular attention will be given to utilizing national staff from different countries and institutions within the region in helping one another, rather than reliance on external expertise. "Exchanges" of the staff of national institutions will be pursued in a fashion which does not disrupt national programmes, but furthers interdependency and mutual cooperation among organizations and individuals concerned with sorghum and pearl millet research and development.

This approach will not only complement efforts to sustain the regional program, but can be considered as an additional activity under Objective 5 (improving the productivity of national sorghum and pearl millet staff). Collaborative relationships among international and national researchers will build a foundation of scientific expertise and experience designed to serve the region for several decades. National scientists will take the lead in the region's sorghum and pearl millet research. Further, the collaborative working agenda guiding the regional and national programs will highlight the objective of achieving impact on farmers' fields.

SMIP will also examine the full range of possibilities for sharing and recovering costs for the services which it provides. With respect to the Matopos station, the feasibility of different income-generating activities will be examined as part of the consultancy mission on the future of the facility. One possibility would be to utilize a portion of the land and equipment not required for research purposes to produce seed on a commercial basis<sup>a</sup>. The training and visitors center is already being used by other institutions at their expense. In the future training programs offered by SMIP will charge tuition at levels which will be designed to at least cover the variable costs of such courses. Most NARS have training funds which could be utilized. During an interim period, SMIP might provide partial scholarship support for candidates from countries which do not have access to such funds.

A number of research institutions in the region are in the process of examining possible approaches to maintaining or improving their financial situations with the reduction in funding from donors and governments. The Department of Research and Specialist Services in Zimbabwe has commissioned a study of the financing of agricultural research as part of an effort to improve the ability of the department to support itself and reduce its reliance on donor and government funding. SMIP is interested in the results of this study and will cooperate closely with those conducting it given its special relationship with Zimbabwe as the host country of SMIP.

## **7.2 Future Direction of Farm and Physical Plant Services**

A complete inventory and full accountability of fixed and movable assets took place in 1992. The same exercise will take place in 1993 keeping in mind that the reduction of SMIP activities during Phase III will mean that some equipment and physical facilities will be in excess of SMIP needs.

Consequently, action will be taken as soon as possible during Phase III to determine any adjustments needed in light of the new size and direction SMIP will take. Disposal of redundant items and conversion of some facilities for alternate uses in accordance with the grant agreement will take place as necessary. Cost recovery mechanisms for charging of services and use of the facilities by outside agencies and

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<sup>a</sup> Responsibility for the actual production of the seed might be with a private producer who would utilize the land and selected services (e.g. land preparation) on a rent or lease basis.

organizations and the private sector will be investigated. To further assist SMIP management in addressing this issue, SACCAR is setting up a consultancy (to be funded by SMIP Phase II) to examine the problem and make recommendations for efficient and economical use of the facilities at Matopos.

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## **8 MONITORING AND EVALUATION**

The Project Implementation Plan (Section 5) includes details of project activities and key outputs which will be monitored and evaluated during the life of the project. SMIP staff will take the lead in data collection and analysis of the progress towards meeting the purpose and outputs of the project objectives. As much of the basic information required is for project management, annual work plans and reports prepared by SMIP will contain most monitoring information. SMIP work plans will describe annual progress increment toward management objectives and proposed annual expenditure of resources. Annual SMIP implementation reports will include: (a) progress toward meeting purpose level indicators; (b) summary progress report on management objectives (output) noting problems that may require donor attention; (b) review of resource expenditures (annual and cumulative); review of major assumptions e.g adequacy of technology transfer channels, and (ii) institutional capacities of NARS.

Relations and linkages between SMIP and the NARS are critical albeit complex elements of this project. Project implementation plans call for a substantial investment in collaborative activities between SMIP and the NARS, and the development of in-country linkages with extension services, seed companies, NGOs and other organizations involved in agricultural development in the SADC drought-prone regions. Details for working out these critical relationships are being worked out.

SACCAR and ICRISAT will plan monitoring activities of SMIP. The SMIP Steering Committee during its annual meeting will review progress of the project for SACCAR. SMIP will also submit an annual progress report to the SACCAR Board. ICRISAT will monitor implementation of the project through SMIP quarterly and annual reports, in-house reviews, and annual in-country collaborative work plans meetings.

Diagnostic surveys and impact assessments planned under Objective 1 (Technology Transfer) will provide data for monitoring the impact of the project on technology adoption. The impact assessment will provide case studies of the broader impact of new sorghum and pearl millet technologies on target farming systems.

Donors will receive research and financial reports as stipulated in the agreements between ICRISAT and each donor. A mid-term donor review is planned for March/April 1996.

## 9 IMPACTS

This section considers the impacts of SMIP on food production, food security and incomes in the SADC region with specific regard to the poorer families living in the drier areas. The initial sub-section examines trends in area, yield and production of sorghum and millet in each of the member countries in relation to food needs. This is followed by an estimate of the economic rate of return to past and near term (Phase III) investments in sorghum and millet research and development. The section concludes with a discussion of the prospective impacts on the welfare of small farm families based in the region's drought prone areas.

### 9.1 Trends in Area, Yield and Production

Although maize is the dominant cereal crop in the SADC region, sorghum and pearl millet remain critically important for food security and income generation among some of the poorest of small farmer populations. These crops are widely grown in the roughly one-third of the SADC region less suited to the production of maize. These are areas where crop failures are common. The semi-arid regions of Zimbabwe, for example, experience severe drought (rainfall less than 400 mm) every third year and moderate drought (rainfall less than 500 mm) every other year. The majority of households farming in these semi-arid areas consistently fail to produce enough grain to meet their family food requirements. Correspondingly, most sorghum and millet is consumed by farm households.

More than 90 percent of the small quantities of grain entering the market flows directly between rural households, augmenting local food supplies or generating income through the sale of beer. Less than 10 percent of the aggregate crop enters the formal national market.

Sorghum and millet are still widely viewed as traditional, subsistence crops because of their low yields and the concentration of their production in outlying areas. But the classification of these grains as inferior to other grains has proven to be untrue. Research support for maize and other cash crops, and an accompanying set of promotional campaigns to encourage the adoption of these enterprises, have discouraged the production of the small grains. The failure to promote new sorghum and millet technologies has prevented the exploitation of the genetic advantages of these more drought-tolerant grains and discouraged the recognition of their vital contributions to rural economies. Such failures have also increased the risks of malnutrition and poverty faced by the growing SADC population residing in semi-arid regions.

Despite historical maize promotion campaigns and the limited availability of improved sorghum and millet technologies, sorghum and millet remain critically important food security crops in most SADC countries. Sorghum and millet<sup>a</sup> still account for more than a quarter of the cereal grain area in 6 out of the 10 SADC countries (Table 3). In Botswana, the small grains account for almost 85% of cereal sowed. In Namibia roughly one-half of all grain area is sown to sorghum and millet. These crops are relatively minor components of the national cropping system only in Malawi and Swaziland.

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<sup>a</sup>. Note: most available data for millet combine information for pearl millet and finger millet. Finger millet is produced in significant quantities in Zimbabwe, Zambia, and Tanzania. Only Zambia produces more finger millet than pearl millet.

**Table 3. Sorghum and millet as a proportion of cereal production area in the SADC countries, 1988-90.**

Country	Sorghum as a percentage of total area cropped to cereals	Millet as a percentage of total area cropped to cereals	Sorghum and millet as a percentage of total area cropped to cereals
Angola	5.6 <sup>a</sup>	5.5	11.1
Botswana	80.3	4.2	84.5
Lesotho	32.2	0.0	32.2
Malawi	2.3	1.4	3.7
Mozambique	35.4	1.9	37.4
Namibia	6.8	41.4	47.1
Swaziland	2.5	0.0	2.5
Tanzania	17.9	9.9	27.9
Zambia	5.2	5.1	10.3
Zimbabwe	9.7	17.3	27.0

<sup>a</sup> Combined with millet data in the FAO Production Yearbook. An equal division of sorghum and millet area and production has been assumed.

Source: FAO Production Yearbook, Vol 44, 1990.

More significantly, the common perception that maize is broadly replacing sorghum and millet in the semi-arid cropping system is untrue. During the last ten years, the crop area planted to sorghum and millet has increased in eight of the ten SADC countries (Table 4). The two small grains have increased as a proportion of coarse grains area in three SADC countries and remained essentially fixed in four others. Only two countries have recorded an apparent shift of land from sorghum and millet to maize. In Tanzania, a sharp decline in small grains area corresponds with the promotion of the high tannin sorghum variety (Serena) during the late 1970s and its subsequent rejection by small farmers. The decline in sorghum and millet in Zimbabwe corresponds with the strong promotion of hybrid maize production after independence.

**Table 4. Changing proportion of coarse grains<sup>a</sup> area planted to sorghum and millet, in SADC countries 1979-81 to 1988-90.**

Country	Average annual growth in crop area 1979-81 to 1988-90 (%/year)		Percent of coarse grain area planted to sorghum and millet	
	Sorghum and Millet	Maize	1979-81	1988-90
Angola	3.23	3.94	11.8	11.1
Botswana	6.07	-1.41	72.4	84.5
Lesotho	1.09	1.69	33.3	32.2
Malawi	1.98	1.88	3.7	3.7
Mozambique	2.57	0.76	33.6	37.4
Namibia	1.68	2.03	52.1	47.1
Swaziland	0.00	1.71	2.9	2.5
Tanzania	-5.51	3.36	46.3	27.9
Zambia	7.15	5.21	9.0	10.3
Zimbabwe	-2.46	1.13	31.0	24.5
SADC	-1.37	2.56	30.1	27.0

<sup>a</sup>maize, sorghum and millet

Source: FAO Production Yearbook, 1990.

The contribution of sorghum and millet to total national cereal production generally corresponds with the areas sown (Table 5). In countries where advances in maize technologies have been greatest (eg Zimbabwe, Zambia and Lesotho), the yield advantages of maize increase the relative importance of this crop in the nation's cereal supply. In countries with poor annual rainfall (Botswana and Namibia) and less developed research and technology promotion programs (Angola), sorghum and millet represent a higher proportion of aggregate cereal production.

**Table 5. Sorghum and millet as a proportion of cereal production in the SADC countries, 1988-90**

Country	Sorghum as a percentage of total cereal production	Millet as a percentage of total cereal production	Sorghum and millet as a percentage of cereal production
Angola	11.0 <sup>a</sup>	11.0	22.0
Botswana	83.3	3.1	86.4
Lesotho	20.2	0.0	20.2
Malawi	1.3	0.8	2.1
Mozambique	29.7	0.9	30.6
Namibia	6.2	44.9	51.1
Swaziland	negligible	0.0	negligible
Tanzania	13.6	8.2	21.8
Zambia	2.4	1.9	4.3
Zimbabwe	4.6	7.6	12.2

<sup>a</sup> Combined with millet data in FAO data; divided equally here.  
Source: FAO Production Yearbook, Vol 44 1990

During the relatively favorable 1988 to 1990 period, the countries of the SADC region imported more than 900 000 tons of grain at a cost of more than US\$175 million (Table 6). These imports included more than 50 000 tons of maize costing more than US\$21 million per year. Yet this aggregate picture hides the massive import dependence of virtually every country except Zimbabwe. Without the contributions of Zimbabwe, the region annually imported more than 400 000 tons of maize at an average annual cost of over US\$60 million. This is the closest food substitute to sorghum and millet and the grain most commonly consumed when small grains supplies run short.

**Table 6. Net cereal import requirements of the SADC countries, 1986-88.**

Country	Net imports of cereals	Cost of net cereal imports	Net imports of maize	Cost of net maize imports
Angola	251.0	32.4	60.2	6.8
Botswana	129.5	22.2	44.3	5.8
Lesotho	114.1	17.1	46.0	7.0
Malawi	14.1	6.5	0.1	3.6
Mozambique	383.1	75.7	178.6	33.4
Swaziland	38.5	5.4	12.0	1.6
Tanzania	127.7	34.5	-18.1	-2.7
Zambia	137.2	18.4	69.0	8.1
Zimbabwe	-283.0	-33.3	-345.5	-42.4

Source: FAO Trade Yearbook, Vol 42, 1988

The average costs of SADC's cereal imports during the recent favorable rainfall years have been dwarfed by the regional import requirements of the 1991/92 drought year. SADC estimated a need for over 8 million mt of cereal grain imports at a cost of over US\$1.2 billion. By the end of 1992, the region had negotiated imports of over 6 million mt. Over 2.4 million mt of this was delivered in the form of food aid at a cost of over US\$600 million. The remainder was purchased on the commercial market. To cover the costs of these imports, investment in other sectors of the SADC economies must be foregone. Investment capital is quickly absorbed for consumption expenditures and governments are forced to reallocate scarce foreign exchange for food imports.

## **9.2 Economic Rate of Return**

The investments in building regional sorghum and millet research capacities and in developing new production technologies represent a longer-term commitment to find solutions to the region's poor rainfall. These investments, initiated in 1983, are now beginning to bear fruit. For the first time, many small farmers living in semi-arid regions are being offered realistic opportunities for improving their productivity and food supplies. Improved seed, generated with the assistance of ICRISAT, is being distributed in Namibia, Mozambique, Zimbabwe, Zambia and Malawi. The regional sorghum and millet program has directly contributed cultivars for release and also facilitated the movement of advanced materials from ICRISAT's main program in India to southern Africa. During the next 10 years, these are expected to make a significant contribution to improve food supplies and incomes in semi-arid regions.

Three estimates of the economic rate of return were calculated based upon alternative assumptions of technology adoption paths and grain prices (see Appendix 2). These include a conservative scenario of slow adoption and low price, an intermediate scenario of moderate adoption and higher import parity price, and a third scenario with a higher adoption ceiling and a high price.

The conservative estimate assumes that 20% of the total area of sorghum and millet will be sown to improved cultivars by the year 2010. These cultivars are assumed to offer an average productivity gain of 20%. Employing a common form of adoption function, this would require at least 2% area coverage by 1995 and 10% area coverage by the year 2000. This calculation of economic returns accounts for the full investment costs in SMIP and the sorghum and millet research of the NARS during the 10 year Phase III and Phase IV period. Under this scenario, continuing national and regional investments in sorghum and millet research yield an internal rate of return of at least 24.35 percent. The present worth of the incremental net benefits at a discount rate of 10 percent stands at US\$25 million and the benefit cost ratio is 2.38.

In practice, the adoption gains projected for the year 1995 may be achieved earlier as a result of the distribution of improved seed under drought relief programs early in the 1992/93 cropping season. Improved seed has been distributed to over 120 000 farm households in Zimbabwe, Zambia, Namibia, Malawi, and Mozambique. The second estimate of economic returns correspondingly assumes that 10 percent of sorghum and millet crop area in the SADC region may be planted to improved varieties by the year 1996. This also increases the adoption ceiling to 25 percent and raises the grain price to levels (US\$200/mt) more closely approximating the cost of grain purchased by food deficit households in semi-arid regions. This yields a present worth of over US\$83 million and a benefit cost ratio of 5.61. The net benefit stream is consistently positive.

In a third scenario under which the proportion of total sorghum and millet area ultimately planted to improved cultivars (the adoption ceiling) is increased to 40 percent, the regional investments offer a net benefit of over US\$125 million and a benefit cost ratio of 7.9.

Echoing the words of the SMIP mid-term donor evaluation conducted in 1990, **"The overall returns to investment in research in small grains have the potential to match those from most agricultural research investments."**

It must also be noted that these returns account for the economic value of the additional grain. They do not account for the secondary gains associated with reduced expenditures on drought relief and food subsidy programs, the prevention of periodic dislocation and disinvestment in the farm communities of semi-arid regions following each drought, and the costs of malnutrition on public health and long-term human productivity. Nor do they account for the longer term gains associated with human capital development in the regional research community. The next phase of investment in the regional sorghum and millet program will strengthen the likelihood of continuing productivity gains in the sorghum and millet subsectors of southern Africa.

### **9.3 Equity, Food Security and Incomes**

The limited availability of improved technologies for southern Africa's extensive semi-arid regions, and the persistence of low sorghum and millet yields have contributed to a large and consistent demand for cereal grain imports. Countries must import grain from the international market and farmers based in semi-arid regions within these countries must purchase grain on the local market. Even in the most favorable rainfall years, few small farmers in the region's dry areas contribute surplus grain to feed urban consumers and industry. Instead, these farming regions are fairly consistently net grain buyers or food aid recipients. When national stocks are high, households farming in semi-arid regions depend on the availability of surplus grain production from higher-rainfall zones. When stocks are low, these farmers depend on the distribution of cereal grain imports. The consistent need to distribute grain back into each nation's farming regions is costly.

Further, such aggregate statistics hide the fact that the threat of malnutrition persists in the semi-arid farming regions even when national grain stocks are relatively high. Though Zimbabwe has been a fairly consistent maize exporter during the past few decades, internal drought relief programs have become an annual occurrence. Farmers in some semi-arid regions (e.g., parts of Masvingo) have experienced drought or severe mid-season dry spells during 8 of the last 12 years. Widespread failures of rainfall have affected Matabeleland on an average of every other year. In the long run, these farmers may be best off seeking jobs in other parts of the country. But the industrial economy currently offers no prospects of absorbing this labor. New technologies are desperately needed to improve the productivity of these farmers -- to improve the efficiency with which they make use of limited soil and water resources. Without such productivity gains, drought relief will continue simply to drain the public treasury.

At the household level, drought forces small farmers to sell off farming assets to purchase food. While food is being widely distributed under drought relief programs, logistical problems prevent consistent and timely relief and most households must use savings to buy grain. Many of the poorer farmers based in semi-arid zones have been forced to reduce their food intake, often dropping back to one meal a day. The migration of family members in search of food and money from urban sources is common.

The dislocation caused by drought takes years to resolve. The threat to human life and welfare caused by malnutrition is difficult to calculate. In southern Zimbabwe, data following several above average rainfall seasons in 1988 indicate rates of weight for age malnutrition above 13 percent. Height for age malnutrition, a sign of longer term stress, affected about 30 percent of the population.

Following each significant drought in the region, governments call upon farmers to sow more drought-tolerant crops. Yet they have failed to invest in the development and distribution of technologies necessary for such recommendations to be meaningful. Farmers have most commonly been offered a

choice between improved maize cultivars and the traditional sorghum and millet landraces. In some instances, when improved sorghum or millet varieties have been available (eg, Serena in Tanzania) these have proven unsuitable to food consumption (eg, because of high tannin). In effect, pronouncements of the need to respond to drought have not been backed by the means to do so.

Again, in Zimbabwe, the 80 percent of the population living in Natural regions III, IV and V (receiving less than 800 mm of rainfall and most subject to drought) account for only 30 percent of smallholder grain production and less than 20 percent of smallholder grain sales (Table 7). Most of these sales are on the local market - directly from households with small production surpluses to households experiencing production deficits. These households account for less than 10 percent of the fertilizer use in the smallholder sector. While over 90 percent of these households use hybrid maize seed, as a result of the post-independence maize promotion efforts, until the drought relief related seed distribution programs of 1992, improved sorghum and millet remained largely unknown.

**Table 7. Zimbabwe agricultural indicators: distribution of participation in the commercial grain economy by smallholders across rainfall zones, late 1980's<sup>a</sup>**

Natural Regions	High Rainfall I-II	Medium Rainfall III-IV	Low Rainfall V
<b>Percent of Smallholder:</b>			
Population	19.8%	61.0%	19.2%
Grain Production	68.4%	18.2%	13.5%
Grain Sales	80.2%	16.9%	2.9%
Fertilizer Use	91.4%	8.4%	0.3%
<b>Percent of Smallholders Who:</b>			
Use Hybrid Maize Seed	93.6%	98.6%	77.8%
Use Fertilizer	84.6%	14.0%	3.5%
Receive Credit	33.5%	3.1% <sup>b</sup>	4.2% <sup>b</sup>
Receive Extension Advice	53.4%	15.8% <sup>b</sup>	12.5% <sup>b</sup>

<sup>a</sup> Derived from four sets of detailed farm surveys covering a wide cross-section of smallholder farming areas of Zimbabwe.

<sup>b</sup> includes households who have received credit or extension advice at any time.

The production of drought tolerant crops has widely been viewed as a major component of the solution to the region's persistent droughts. At the bare minimum, the technology gains derivable from support for the regional sorghum and millet program will reduce the severity of impoverishment and malnutrition caused by poor rainfall. These gains will offer one basis for building a more sustainable agricultural system designed to better serve SADC's drought-prone regions. Investment in the regional program represents a small payment offered to offset the costs of massive food aid and drought relief commitments in the future.

## APPENDIX 1

### Area yield, and production of sorghum and millet in the SADC countries, 1979-81 to 1988-90

Country	Sorghum 1979-81			Sorghum 1988-90			Sorghum growth rate (%) 1979-81 to 1988-90		
	Area	Yield	Production	Area	Yield	Production	Area	Yield	Production
	(x1000 ha)	(kg/ha)	(x1000t)	(x1000 ha)	(kg/ha)	(x1000t)			
Angola	na <sup>2</sup>	na	na	na	na	na	na	na	na
Botswana	98	185	21	191	329	63	7.4	6.4	12.2
Lesotho	58	1 036	59	64	544	36	1.1	-7.2	-5.5
Malawi	30	667	20	30	601	18	0.0	-1.2	-1.2
Mozambique	288	627	181	368	440	161	2.7	-3.9	-1.3
Namibia	15	423	6	15	529	8	0.0	2.5	3.2
Swaziland	2	715	1	2	1 750	4	0.0	9.9	15.4
Tanzania	713	763	543	457	933	425	-4.9	2.2	-2.7
Zambia	31	550	16	49	605	30	5.1	1.1	7.0
Zimbabwe	140	499	71	168	658	114	2.0	3.1	5.3
Total/Av.	1 375	607	918	1 344	710	859	-0.3	1.7	-0.7
S Africa	377	1 420	540	293	1 535	450	-2.8	0.9	-2.0

Country	Millet 1979-81			Millet 1988-90			Millet growth rate (%) 1979-81 to 1988-90		
	Area	Yield	Production	Area	Yield	Production	Area	Yield	Production
	(x1000 ha)	(kg/ha)	(x1000t)	(x1000 ha)	(kg/ha)	(x1000t)			
Angola	80	612	49	107	582	62	3.2	-0.6	2.6
Botswana	12	140	2	10	247	2	-2.0	6.3	0.0
Lesotho	0	0	0	0	0	0	0.0	0.0	0.0
Malawi	11	594	7	19	583	11	6.1	-0.2	5.0
Mozambique	20	250	5	20	250	5	0.0	0.0	0.0
Namibia	77	448	34	92	654	60	2.0	4.2	6.3
Swaziland	0	0	0	0	0	0	0.0	0.0	0.0
Tanzania	450	800	360	251	1 048	260	-6.5	3.0	-3.6
Zambia	21	1 038	22	50	587	29	9.6	-6.3	3.1
Zimbabwe	353	439	153	301	611	188	-1.8	3.7	2.3
Total/Av.	1 024	432.2	632	850	456.2	617	-2.7	0.6	-0.5
S Africa	22	682	15	22	682	15	0.0	0.0	0.0

1. Source : FAO Production Yearbook (1990)
2. na = not available

## APPENDIX 2

### ASSESSMENT OF POTENTIAL RETURNS TO INVESTMENT IN SORGHUM AND PEARL MILLET RESEARCH IN THE SADC REGION

The economic return to a further 10 years of investment in the regional Sorghum and Millet Improvement Program (SMIP) and an associated 10 years of investment by the NARS in sorghum and millet research was calculated. Three scenarios of direct economic impact were considered using alternative assumptions of technology adoption paths and grain prices. These include a conservative scenario of slow adoption and low price, an intermediate scenario of moderate adoption and higher import parity price, and a third scenario with a higher adoption ceiling and the high price.

#### Scenario 1: Slow Adoption and Low Prices

The first calculation of economic returns assumed a slow adoption of improved cultivars with only a five percent coverage of the region's sorghum and millet area by 1997, 10 percent by 1999 and a ceiling level of 20 percent adoption reached in the year 2010. These cultivars were assumed to offer a 20 percent gain in grain yield which was valued at an estimated, average import parity price for grain into the capital cities of the SADC region (US\$140/mt). This conservative assessment offers a net economic benefit of US\$25 million in current day prices and an internal rate of return of 24.35 percent. The ratio of investment benefits to costs is 2.38 to 1.

#### Scenario 2: Moderate Rate of Adoption and Moderate Prices

The second calculation of economic returns assumed a moderate rate of adoption of improved cultivars. Accounting for the expected impact of the distribution of improved sorghum and millet seed following the 1991/92 drought, this scenario assumes a 4 percent level of adoption is achieved in the first year of the project and a ten percent level of adoption is achieved by 1996. Early indications of the success of the improved varieties currently being distributed justify raising the adoption ceiling in this scenario to 25 percent, a level achieved in the year 2004. Further, recognition that most of this additional grain will be consumed by the farm households hertofore experiencing grain production deficits justifies use of a grain price (US\$200/mt) reflecting the costs of purchasing food in outlying semi-arid regions. The projected productivity gains remain the same as in scenario 1.

This less conservative assessment offers a net economic benefit of over US\$86 million in current prices and a consistently positive stream of net benefits. The ratio of investment benefits to costs is 5.6 to 1.

#### Scenario 3: Rapid Rate of Adoption and Moderate Prices

The third calculation of economic returns assumed a marginally faster rate of adoption of improved cultivars and higher adoption ceiling. This scenario assumes that 40 percent of the SADC area currently grown to sorghum and millets may be planted to improved cultivars by the year 2007. All other model parameters remain as in Scenario 2.

This more optimistic assessment offers a net economic benefit of over US\$125 million in current prices and a consistently positive stream of net benefits. The ratio of investment benefits to costs is 7.9 to 1.

#### General Assumptions

**Small grains analyzed together:** Sorghum and millet are not clearly differentiated in some national data sets. Similar productivity gains and adoption patterns are anticipated for each crop. Therefore, these grains

were considered as if they were a single enterprise. The total area planted to sorghum and millet in the SADC region was 2,120,000 ha in 1988-90.

**Productivity grains:** The analysis consistently assumes a 20 percent gain in sorghum and millet yields corresponding with the adoption of improved cultivars. Average SADC yields for sorghum and millet rise from 700 kg/ha to 840 kg/ha over the area planted to improved varieties.

**Area planted:** These estimates assume there is no change in the area of sorghum and millet planted during the investment period. In practice, there may be an increase in area planted as productivity of sorghum and millet rises relative to the productivity of the closest substitute in the semi-arid production system - maize. The 1991/92 drought probably also encouraged an increase in sorghum and millet area.

**Grain price:** In the conservative scenario, a grain price of US\$140/mt is used to represent a capital city based import parity price for coarse grains (maize and sorghum). Eight of the ten SADC countries are consistently net importers of grains. The export parity price of the remaining two SADC countries (Zimbabwe and Tanzania) probably approximates this value.

In the two remaining scenarios, a more realistic price of US\$200/mt was used. This assumes that the additional grain derived from the 20 percent increase in average yields will primarily be used to resolve production deficits in the major sorghum and millet growing regions of SADC. Most of the semi-arid regions in SADC face food deficits every year, regardless of the incidence of drought. Poor rains simply magnify the size of this deficit. Correspondingly, this production will primarily offset the need to import grain into the food deficit semi-arid regions. Most of these areas are relatively distant from capital cities and face high grain import costs.

**Research cost:** 1993-1998 (Phase III) = US\$2.2391 million per year SMIP investment plus US\$1.25 million per year estimated NARS investment in sorghum and millet research.

1998-2003 (Phase IV) = US\$600,000 per year SMIP investment plus US\$1.25 million per year estimated NARS investment in sorghum and millet research.

The NARS investment cost assumes each national program scientist costs US\$25,000 per annum including salary, operating and capital costs. The estimate assumes 50 full-time scientists will be allocated to sorghum and millet in the future.

**Discount factor:** 10%.

**Limited enumeration of research benefits:** These estimates take no account of the possible additional benefits accruing to the continuing NARS investment in sorghum and millet research. In practice, these investments will likely contribute to additional gains in both productivity and technology adoption.

Also, the economic analysis takes no account of the additional value of grain stover. Nor does it account for the reduction in malnutrition associated with a more consistent and larger supply of grain and the reduced dislocation associated with a reduction in the severity of food shortfalls associated with drought. Nor do they account for the reduced costs of drought relief programs derived from the reduced need for food aid and technical assistance.

## Scenario 1 Conservative

Year	Adoption Percent	Area of Adoption (ha)	Production Gain (mt)	Discount Factor	Grain Price (US\$/mt)	Present Value	Research Cost (US\$)	Discounted Cost	Net Benefit (US\$)
1993	1	21200	2968	1	140	415520	872275	872275	-456755
1994	1	21200	2968	0.909	127.26	377707.68	3489100	3171591.9	-2793884.22
1995	2	42400	5936	0.826	115.64	686439.04	3489100	2881996.6	-2195557.56
1996	3	53600	8904	0.751	105.14	936166.56	3489100	2620314.1	-1684147.54
1997	5	106000	14840	0.683	95.62	1419000.8	3489100	2383055.3	-964054.5
1998	7	148400	20776	0.621	86.94	1806265.44	3079325	1912260.825	-105995.385
1999	10	212000	29680	0.564	78.96	2343532.8	1850000	1043400	1300132.8
2000	12	254400	35616	0.513	71.82	2557941.12	1850000	949050	1608891.12
2001	13	275600	38584	0.467	65.38	2522621.92	1850000	863950	1658671.92
2002	14	296800	41552	0.424	59.36	2466526.72	1850000	784400	1682126.72
2003	15	318000	44520	0.386	54.04	2405860.8	1700000	656200	1749660.8
2004	16	339200	47488	0.35	49	2326912	0	0	2326912
2005	17	360400	50456	0.319	44.66	2253364.96	0	0	2253364.96
2006	18	381600	53424	0.29	40.6	2169014.4	0	0	2169014.4
2007	18	381600	53424	0.263	36.82	1967071.68	0	0	1967071.68
2008	19	402800	56392	0.239	33.46	1886876.32	0	0	1886876.32
2009	19	402800	56392	0.218	30.52	1721083.84	0	0	1721083.84
2010	20	424000	59360	0.198	27.72	1645459.2	0	0	1645459.2
2011	20	424000	59360	0.18	25.2	1495872	0	0	1495872
2012	20	424000	59360	0.164	22.96	1362905.6	0	0	1362905.6
2013	20	424000	59360	0.149	20.86	1238249.6	0	0	1238249.6
2014	20	424000	59360	0.135	18.9	1121904	0	0	1121904
2015	20	424000	59360	0.123	17.22	1022179.2	0	0	1022179.2
2016	20	424000	59360	0.112	15.68	930764.8	0	0	930764.8
2017	20	424000	59360	0.102	14.28	847660.8	0	0	847660.8
2018	20	424000	59360	0.092	12.88	764556.8	0	0	764556.8
2019	20	424000	59360	0.084	11.76	698073.6	0	0	698073.6
2020	20	424000	59360	0.076	10.64	631590.4	0	0	631590.4
2021	20	424000	59360	0.069	9.66	573417.6	0	0	573417.6
2022	20	424000	59360	0.063	8.82	523555.2	0	0	523555.2
						43118094.9		18138493.73	24979601.16

Grain Value = US\$140/mt

Adoption Ceiling conservatively estimated at 20%

Economic Value of Investment in Sorghum and Millet Research = US\$25.0 million

Benefit Cost Ratio = 2.37715962

## Scenario 2 - Accounting for Adoption Stimulated by Drought Relief Program

Year	Adoption Percent	Area of Adoption (ha)	Production Gain (mt)	Discount Factor	Grain Price (US\$/mt)	Present Value	Research Cost (US\$)	Discounted Cost	Net Benefit (US\$)
1993	4	84800	11872	1	200	2374400	872275	872275	1502125
1994	6	127200	17808	0.909	181.8	3237494.4	3489100	3171591.9	65902.5
1995	8	169600	23744	0.826	165.2	3922508.8	3489100	2881996.6	1040512.2
1996	10	212000	29680	0.751	150.2	4457936	3489100	2620314.1	1837621.9
1997	13	275600	38584	0.683	136.6	5270574.4	3489100	2383055.3	2887519.1
1998	15	318000	44520	0.621	124.2	5529384	3079325	1912260.825	3617123.175
1999	17	360400	50456	0.564	112.8	5691436.8	1850000	1043400	4648036.8
2000	20	424000	59360	0.513	102.6	6090336	1850000	949050	5141286
2001	22	466400	65296	0.467	93.4	6098646.4	1850000	863950	5234696.4
2002	23	487600	68264	0.424	84.8	5788787.2	1850000	784400	5004387.2
2003	24	508800	71232	0.386	77.2	5499110.4	1700000	656200	4842910.4
2004	25	530000	74200	0.35	70	5194000	0	0	5194000
2005	25	530000	74200	0.319	63.8	4733960	0	0	4733960
2006	25	530000	74200	0.29	58	4303600	0	0	4303600
2007	25	530000	74200	0.263	52.6	3902920	0	0	3902920
2008	25	530000	74200	0.239	47.8	3546760	0	0	3546760
2009	25	530000	74200	0.218	43.6	3235120	0	0	3235120
2010	25	530000	74200	0.198	39.6	2938320	0	0	2938320
2011	25	530000	74200	0.18	36	2671200	0	0	2671200
2012	25	530000	74200	0.164	32.8	2433760	0	0	2433760
2013	25	530000	74200	0.149	29.8	2211160	0	0	2211160
2014	25	530000	74200	0.135	27	2003400	0	0	2003400
2015	25	530000	74200	0.123	24.6	1825320	0	0	1825320
2016	25	530000	74200	0.112	22.4	1662080	0	0	1662080
2017	25	530000	74200	0.102	20.4	1513680	0	0	1513680
2018	25	530000	74200	0.092	18.4	1365280	0	0	1365280
2019	25	530000	74200	0.084	16.8	1246560	0	0	1246560
2020	25	530000	74200	0.076	15.2	1127840	0	0	1127840
2021	25	530000	74200	0.069	13.8	1023960	0	0	1023960
2022	25	530000	74200	0.063	12.6	934920	0	0	934920
						101834454		18138493.73	83695960.68

Grain Value = US\$200/mt landed in the food deficit sorghum and millet growing regions.

Adoption Ceiling conservatively estimated at 25%

Economic Value of Investment in Sorghum and Millet Research = US\$86.7 million

Benefit Cost Ratio = 5.61427293

### Scenario 3 - Adoption Ceiling Lifted to Rate More Common for Successful Improved Cultivars

Year	Adoption Percent	Area of Adoption (ha)	Production Gain (mt)	Discount Factor	Grain Price (US\$/mt)	Present Value	Research Cost (US\$)	Discounted Cost	Net Benefit (US\$)
1993	4	84800	11872	1	200	2374400	872275	872275	1502125
1994	6	127200	17808	0.909	181.8	3237494.4	3489100	3171591.9	65902.5
1995	8	169600	23744	0.826	165.2	3922508.8	3489100	2881996.6	1040512.2
1996	11	233200	32648	0.751	150.2	4903729.6	3489100	2620314.1	2283415.5
1997	15	318000	44520	0.683	136.6	6081432	3489100	2383055.3	3698376.7
1998	19	402800	56392	0.621	124.2	7003886.4	3079325	1912260.825	5091625.575
1999	23	487600	68264	0.564	112.8	7700179.2	1850000	1043400	6656779.2
2000	27	572400	80136	0.513	102.6	8221953.6	1850000	949050	7272903.6
2001	30	636000	89040	0.467	93.4	8316336	1850000	863950	7452386
2002	33	699600	97944	0.424	84.8	8305651.2	1850000	784400	7521251.2
2003	35	742000	103880	0.386	77.2	8019536	1700000	656200	7363336
2004	37	784400	109816	0.35	70	7687120	0	0	7687120
2005	38	805600	112784	0.319	63.8	7195619.2	0	0	7195619.2
2006	39	826800	115752	0.29	58	6713616	0	0	6713616
2007	40	848000	118720	0.263	52.6	6244672	0	0	6244672
2008	40	848000	118720	0.239	47.8	5674816	0	0	5674816
2009	40	848000	118720	0.218	43.6	5176192	0	0	5176192
2010	40	848000	118720	0.198	39.6	4701312	0	0	4701312
2011	40	848000	118720	0.18	36	4273920	0	0	4273920
2012	40	848000	118720	0.164	32.8	3894016	0	0	3894016
2013	40	848000	118720	0.149	29.8	3537856	0	0	3537856
2014	40	848000	118720	0.135	27	3205440	0	0	3205440
2015	40	848000	118720	0.123	24.6	2920512	0	0	2920512
2016	40	848000	118720	0.112	22.4	2659328	0	0	2659328
2017	40	848000	118720	0.102	20.4	2421888	0	0	2421888
2018	40	848000	118720	0.092	18.4	2184448	0	0	2184448
2019	40	848000	118720	0.084	16.8	1994496	0	0	1994496
2020	40	848000	118720	0.076	15.2	1804544	0	0	1804544
2021	40	848000	118720	0.069	13.8	1638336	0	0	1638336
2022	40	848000	118720	0.063	12.6	1495872	0	0	1495872
						143511110		18138493.73	125372616.7

Grain Value = US\$200/mt landed in the food deficit sorghum and millet growing regions.

Adoption Ceiling estimated at 40%

Economic Value of Investment in Sorghum and Millet Research = US\$125 million

Benefit Cost Ratio = 7.91196406

**UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT  
MISSION TO ZIMBABWE**

## INTERNATIONAL MAIL

1 Pascoe Avenue  
P.O. Box 6988  
Harare, Zimbabwe



## UNITED STATES MAIL

Agency for International Development  
Harare (ID)  
Washington DC 20521-2180  
U.S.A.

September 15, 1993

Dr. J.G. Ryan  
Director General  
ICRISAT  
Patancheru  
Andhra Pradesh 502 324  
India

SUBJECT: Grant No. 613-0224-G-00-3029  
Project 690-0224  
Regional Sorghum and Millet Research Project  
Grant Amendment No. 9

Dear Dr. Ryan:

I have the honor to refer to the Letter Grant Agreement for the Regional Sorghum and Millet Research Project (Grant No. 613-0224-G-00-3029), dated September 15, 1983, as amended on September 30, 1983, August 17, 1984, September 30, 1984, May 13, 1985, June 27, 1988, August 9, 1988, January 25, 1989, and September 29, 1992.

I am pleased to inform you that the proposal, as defined in the Project Paper Supplement, for Phases III and IV has been approved. Accordingly, pursuant to the authority contained in the Foreign Assistance Act of 1961, as amended and the Foreign Operations, Export Financing and Related Programs Appropriations Act of 1991, the Government of the United States of America, acting through the Agency for International Development (hereinafter referred to as A.I.D.) hereby further amends the Grant referred to above in order to extend the Grant for an additional 5 year period, to provide additional funding, to modify the description of activities to be funded, and to make necessary related changes in the Grant.

Therefore, Grant Number 613-0224-G-00-3029, as amended, is hereby further amended as follows:

1. Paragraph 2 of the Grant Letter is revised (to reflect an increase of \$7,000,000 in the amount of the grant and an increase of \$10,000,000 in the amount that subject to the availability of funding A.I.D.'s total contribution to the Project will be) as follows:

Phone: 720630/720739/720757  
Country Code 263, City Code 4  
Telex No. 24428 ZW  
Fax No. 722418

"I am pleased to inform you that, pursuant to the authority contained in Section 531 of the Foreign Assistance Act of 1961, as amended and the Foreign Operations, Export Financing and Related Programs Appropriations Act of 1991, the Government of the United States of America, acting through A.I.D. hereby grants to ICRISAT (hereinafter referred to as the Grantee) the sum of Thirty Eight Million One Hundred and Ten Thousand Dollars (\$38,110,000) to be used for support of the SADC/ICRISAT project for Regional Sorghum and Pearl Millet Research as more fully described in Attachments A and B and the Project Paper Supplement. A.I.D.'s contribution to the Project will be provided in increments. These increments will be subject to the availability of funds to A.I.D. for this purpose, and to the mutual agreement of the Parties at the time of a subsequent increment, to proceed. It is anticipated that, subject to the above, A.I.D.'s total contribution to the Project will be Forty One Million One Hundred and Ten Thousand Dollars (\$41,110,000)."

2. Paragraph 3 of the original Grant Letter is revised by deleting the date September 15, 1993 and replacing it with September 15, 1998.

3. Of the four attachments to the original Grant Letter, Attachment C "Financial Payment and Reporting Provisions" remains unchanged. The other three attachments, A,B, and D, are amended as follows:

Following Attachment A is inserted a new Attachment A-2, Purpose and Project Description Phases III and IV. Attachment A-2 is annexed to this Amendment No. 9 .

Following Attachment B is inserted a new Attachment B-1 Implementation Plan. Attachment B-1 is annexed to this Amendment No. 9

Following Attachment D is inserted a new Attachment D-1 Financial Plan and Budget Phases III and IV. Attachment D-1 is annexed to this Amendment No. 9.

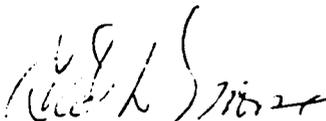
As a condition for the disbursement of funds after September 30, 1994, SADC/SACCAR, assisted by ICRISAT, will develop a sustainability plan which is acceptable to USAID. The plan will indicate the decisions by SADC on the recommendations from the consultancy mission on the future of the SMIP facilities at the Matopos station in so far as they relate to the development of a sustainable regional research program for sorghum and pearl millet research. Further, the plan will detail the steps that are being taken to transfer responsibility for supporting SMIP from external donors to other sources in Phase IV and beyond.

Except as amended herein, the Grant Agreement dated September 15, 1983, as amended, remains in full force and effect.

Please confirm your acceptance of this Grant Agreement Amendment by signing the original and four copies of this letter in the space provided below, and returning the original and two copies of the amendment to USAID/Zimbabwe.

We are pleased that SADC/ICRISAT have made important progress in researching improved sorghum and millet cultivars for the dry lands. We are equally pleased that your organization will lead the effort to transfer these technologies for farmer use.

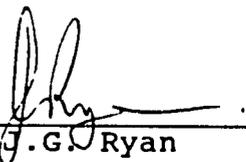
FOR THE UNITED STATES OF AMERICA



Ted D. Morse  
Director

Acceptance:

FOR THE INTERNATIONAL CROPS RESEARCH INSTITUTE  
FOR THE SEMI-ARID TROPICS (ICRISAT)



Dr. J.G. Ryan  
Director-General

Appropriation : 72-113/41014  
Budget Plan Code : GSS3-93-21613-IG12  
Obligation Document No. : PA-690-0224-G-00-3029  
Reservation Control No. : G322400  
Amount : US\$7,000,000.00

**POSTED**

## 1. PROJECT DESCRIPTION

Phases III and IV of Sorghum and Millet Improvement Program (SMIP) are described below in LOGFRAME terminology. As this is an extension of an existing project, the goal and the purpose of the project remain unchanged from Phases I and II. Outputs and inputs have been revised to reflect results expected from Phase III efforts and investments.

### 1.1. PROJECT GOAL

The project goal is the stabilization of food supplies in the region, leading to improved nutrition and income for poorer people farming in drier areas.

### 1.2. PROJECT PURPOSE

The project purpose is to increase the production of sorghum and pearl millet with good consumer acceptance, local adaptation and pest resistance.

Over the ten year life of Phases III and IV of the project, the following are performance targets for increasing sorghum and pearl millet productivity within the SADC region. In addition to tracking the relevant changes for the SADC, performance in relation to the country of Zimbabwe will be monitored as this regional effort is closely linked to the strategic objectives defined for the Zimbabwe bilateral program. Hence targets to be achieved by the end of the third phase are defined in absolute terms for Zimbabwe and on a relative basis for the SADC region.

#### 1. Increase in the area planted to improved varieties.

	<u>-For Zimbabwe</u>	<u>-For SADC Region</u>
Sorghum:	38,000 ha.	10-20% of total
Pearl millet:	43,000 ha	area of pearl millet and sorghum.

#### 2. Increase in sorghum and pearl millet yields per hectare.

	<u>-For Zimbabwe</u>	<u>-For SADC Region</u>
Sorghum:	660 kg/ha	10-20% increase on
Pearl millet:	600 kg/ha	three year average.

#### 3. Increases in productivity (decreases in production costs per unit output) of sorghum and pearl millet.

	<u>-For Zimbabwe</u>	<u>-For SADC Region</u>
	20% increase	10-20% increase

### 1.3. PROJECT OUTPUTS

The achievement of the project purpose is expressed in increased sorghum and pearl millet production and productivity. These improvements will require a collaborative effort involving the SMIP regional program, the NARS and other national level institutions. Project outputs, as defined

for Phase III, are those within the management control of SMIP. Activities necessary to increase sorghum and pearl millet productivity at the national level are considered as assumptions since they are outside the management control of this project and receive no project resources directly.

In the attached SADC/ICRISAT proposal reference is made to a number of objectives which have been established by the newly created SMIP Steering Committee made up of the leaders at national sorghum and pearl millet research programs. The outputs defined in this project paper supplement are not intended to replace those set forth by the Steering Committee, but rather to rephrase the objectives in terms that are more easily understood by USAID.

#### OUTPUT 1. Sorghum and Pearl Millet Technology Transfer<sup>2/</sup>.

Phase III of SMIP will give priority attention to transferring technologies developed by SMIP and NARS to development agencies and farmers. SMIP is currently developing detailed plans and making the adjustments in staffing to enable it to work collaboratively with a variety of public and private agencies in member countries toward this end. The staff time and resources devoted to technology transfer are being increased from 10% (Phase I and II) to 50% (Phase III). The shifts in resource allocations for SMIP are illustrated by Figure 1 on page 1 of the Phase III proposal.

SMIP's work with other agencies on technology transfer will focus primarily on following three areas:

- (1) making improved cultivars available to farmers;
- (2) reviewing national extension recommendations for pearl millet and sorghum improvement and updating/revising as needed;
- (3) testing and assessing the performance of new technologies and using such information in planning future research programs;

SMIP will play an entrepreneurial role in assessing problems and opportunities associated with technology transfer efforts. SMIP will commission studies, host workshops and provide advisory assistance to facilitate the dissemination process. Examples include studies of markets and prices; assessments of NARS technology release procedures; and advisory assistance on seed production and distribution. SMIP will give priority attention to supporting the release and dissemination of improved varieties.

SMIP will assist national agencies to locate information and support to address needs in areas which lie beyond SMIP's capacity, but are critical to the progress of technology dissemination efforts. Such activities include advising on the preparation of feasibility studies for private or public financing and research proposals for cross-cutting issues other than breeding and pest management.

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<sup>2/</sup> Output I is based on and relates specifically to objective I in the SMIP proposal

Major milestones in relation to the development of this output include:

- (1) Development of NARS capacities to produce breeder's seed (three countries by 1995, seven countries by 1998);
- (2) Review variety release procedures and propose amendments necessary to speed the availability of improved cultivars to seed producers and farmers (1995);
- (3) Extension aids developed with NARS for promoting improved sorghum and pearl millet cultivars and management practices (1994 and on-going);
- (4) Training in seed production (1994 and 1996);
- (5) Monitor the distribution and adoption of improved varieties with periodic summary status reports (1995 and 1998);
- (6) Impact assessments of sorghum and pearl millet technology adoption patterns and constraints (3 countries by 1995, 6 countries by 1998);
- (7) Collaborative training workshops on impact assessment with SACCAR (1994, 1996);
- (8) Verification of farmer's acceptance of improved sorghum and pearl millet cultivars recently released in Namibia, Zambia and Zimbabwe (1994) and of sorghum cultivars about to be released in Malawi (1995);
- (9) Advanced testing of improved cultivars leading to release of new varieties of sorghum and/or pearl millet in Botswana, Lesotho, Mozambique and Tanzania (1994-1997);
- (10) NARS breeding programs for sorghum and pearl millet are better targeted in at least four SADC countries by 1995 and in all SADC countries by 1998;
- (11) Extension recommendations for sorghum and pearl millet reviewed in all SADC countries<sup>3/</sup> (1995);
- (12) Extension recommendations revised in at least four SADC countries (1998);

OUTPUT 2. Integrated sorghum and pearl millet improvement research programs<sup>4/</sup>.

Whereas Phases I and II of SMIP established sound and viable research programs at the regional center, Phase III seeks to devolve substantial responsibility for those research programs to the NARS. The regional program will not continue to have core staff with expertise in agronomy,

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<sup>3/</sup> Except Angola, until the internal conflict is resolved.

<sup>4/</sup> Output 2 is drawn from the overall discussions in the proposal and cuts across all objectives.

food processing and grain quality<sup>5/</sup>. On subjects such as plant breeding and pest management, research operations will be shared between SMIP and the NARS. By the end of Phase III, the regional program will be monitoring the sorghum and pearl millet improvement programs of the ten NARS and providing support functions which are more efficiently conducted at the regional level.

SMIP will be available to assist NARS in reviewing, planning and strengthening the management of pearl millet and sorghum research programs. Activities include i) training workshops on farmer participatory research; ii) monitoring tours of farmer test locations; and iii) analysis of test results. Advisory services, primarily provided by national sorghum and pearl millet research staff with backstopping from SMIP, will assist agencies operating with farmers in modifying the selection of technologies for specific areas in the light of the results from the farmer tests. The involvement of SMIP and NARS staff in this process will help ensure a rapid response in making the adjustments that should be expected in most instances.

SMIP services will strengthen internal NARS linkages between the commodity research programs with farm level adaptive research activities and on-farm testing as it builds information systems for monitoring the performance of shared research programs and technology transfer. The regional program will be available to assist NARS sorghum and pearl millet programs in planning and budgeting exercises to better ensure that priority activities are financed and conducted in a cost efficient manner.

The regional program has played an important role in respect to human resources development for the NARS during Phases I and II. Phase III will emphasize improving performance and creativity among the more than 90 national scientists that received degree training through SMIP. Collaborative activities include the development of research program and project workplans, reviews of research results and analysis, and networking activities within the region.

Major implementation actions:

- (1) Collaborative workplans will be developed with each of the SADC NARS except Angola (1993);
- (2) Special topic seminar in research planning, monitoring and evaluation (1994).
- (3) Special topic seminar in methods of data analysis (1995);
- (4) NARS will gain access to the world database of scientific literature on sorghum and pearl millet (1994);
- (5) Establishment of a collaborative NARS-SMIP working paper series aiming to distribute key research results of regional significance (established in 1994).
- (6) Regional sorghum and pearl millet improvement network coordinated by NARS scientists aiming to exploit complementarities in the research foci of each national program (under NARS guidance by Phase IV).

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<sup>5/</sup> However, studies and advisory assistance in these areas may supported by SMIF during Phases III and IV, as needed.

**OUTPUT 3.A. Provision of improved sorghum and pearl millet cultivars and genetic material<sup>6/</sup>.**

This output has been central to the project from its inception and will continue after the end of the project. Continued progress in developing genetic materials is essential for sustainable improvements in productivity. Germplasm improvement received emphasis in Phases I and II and resulted in the production of the current stock of cultivars which are the basis of technology transfer efforts.

In Phase III, decision-making for the breeding program is being progressively shifted to NARS sorghum and pearl millet programs who in turn will be guided by feedback from the technology transfer efforts. SMIP and NARS research program workplans and reports will indicate the effectiveness of these linkages in producing results in station based research that reflect farmer needs.

The ICRISAT will (in collaboration with SADC Regional Gene Bank) complete the collection, analysis and documentation of indigenous cultivars. SMIP will also facilitate the exchange of germplasm within the region and with world germplasm collections as a regional center function.

Major implementation actions:

- (1) Assist NARS with the completion of advanced testing of improved cultivars and the compilation of documentation for release (aiming toward the release of new cultivars in at least four SADC countries by 1998).
- (2) Assist NARS to re-target breeding priorities and develop a genotype base encompassing priority grain and plant traits (re-targeting completed in at least four countries by 1995, seven countries by (1998).
- (3) Breeding lines with drought resistance traits available for testing in Zimbabwe and Botswana (1997).
- (4) Develop breeding lines for long season pearl millet production zones of Tanzania (initial selection completed by 1995).
- (5) ICRISAT Genetic Resources staff will collaborate with the SADC Gene Bank and International Board for Plant Genetic Resources (IBPGR) to complete supplementary germplasm collections in Malawi and Tanzania (1996).
- (6) Striga resistance incorporated into better agronomic material for use by NARS (1997).

**OUTPUT 3.B. Integrated technologies for pest management**

Previous phases of SMIP have provided valuable information in combatting the many diseases and pests which attack sorghum and pearl millet (insects, weeds, diseases and nematodes). Phase III will lead to a more focused, integrated program to be continued at the regional center, but linked to the specific needs of the NARS. The mode of operation is similar to that being followed by the breeding program (OUTPUT 3.A).

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<sup>6/</sup> Outputs 3a and 3b are a translation of objectives 2,3, and 4.

Major implementation actions:

- (1) IPM systems for the control of armoured cricket recommended for adoption in Zambia (1995) and Namibia (1996).
- (2) On-farm testing of IPM packages for Striga in Zimbabwe (1996) and Tanzania (1997).

OUTPUT 4. A Sustainable Regional Sorghum and Pearl Millet Research Program and a Viable Plan for the Future of SMIP Facilities at Matopos Station<sup>7/</sup>.

As USAID funding is progressively reduced during Phases III and IV, SMIP and SACCAR are actively exploring options for sustaining the SMIP facilities at the Matopos Station in cooperation with the Department of Research and Special Services (DR&SS) of Zimbabwe. As the size and scope of SMIP operations at the station are reduced and attention shifts more to interactions with national organizations, the facilities required will be less than those developed and utilized during Phases I and II.

Several possibilities are being considered for the future use of the Matopos facilities, including its conversion into a SACCAR training and research center serving the needs of several regional programs, including SMIP. DR&SS is interested in using a portion of the facilities. It is understood that SMIP needs will take precedence in determining the future of the Matopos facilities. These and other possibilities will be assessed through a consultancy mission commissioned by SACCAR for September 1993.

With reference to the future of SMIP itself, the proposal offers two options, notably

- (1) Network staffed by one full time coordinator based at Matopos with a modest budget for meetings and communications. No core research activities, but collaborative research among NARS researchers and the network coordinator.
- (2) Small Core Regional Program with a Network staffed by 3 or 4 scientists based at Matopos who would conduct research in 1 or 2 high priority areas and operate a network.

Either scenario could accommodate a flexible capacity to service public and private institutions concerned with sorghum and pearl millet research and development in the member countries, specifically tailored to the needs and resources of specific clients. The flexible capacity could be expanded and contracted in response to levels and timing of effective demand. In essence, SMIP could be contracted by an institution to carry out services with support from that institution.

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<sup>7/</sup> Output 4 is based on objectives 2,3,4 and 5, and will in the longer term be greatly influenced by the result, of output I - also discussion of sustainability in the project proposal.

Key implementation milestones:

- (1) Reduction of professional and scientific staff on SMIP funding (1993).
- (2) One or more ICRISAT core staff based at Matopos mid-1995.
- (3) Plan for the longer term use of SMIP-Matopos facilities agreed with SACCAR and the Government of Zimbabwe (1994).
- (4) SACCAR plan for sustaining SMIP with the phase-down of donor support acceptable to AID (Sept. 1994).

1.4. PROJECT STRATEGY AND MAJOR ASSUMPTIONS

The central elements of the project strategy are:

- (a) Improved sorghum and pearl millet cultivars have been developed and have sufficient productivity increasing potential for rapid adoption by farmers; and
- (b) Public and private input distribution and information dissemination channels exist to test and extend available technologies to a substantial number of pearl millet and sorghum producers in the region.

SMIP will play a catalytic role in moving sorghum and pearl millet technologies to farmers by making information and cultivars available and assisting a range of national organizations in fulfilling their responsibilities through advisory and backstopping services. SMIP is accountable to see that the necessary arrangements are made to alleviate constraints and exploit opportunities in the technology transfer and adoption processes.

Major assumptions include:

- 1) Technology transfer channels will operate adequately to transfer improved sorghum and pearl millet technologies to farmers with assistance from the project in the provision of breeders seed and on-farm-testing methods. Channels for transferring technology under consideration include the public sector extension service as well as seed companies, farmer's organizations and other NGOs. Existing channels are considered adequate to reach the estimated number of farmers required in order to have the magnitude of impacts expected from this project effort<sup>8/</sup>.
- 2) NARS bilateral programs financed by various donors will improve the management, incentives and performance levels of NARS. Improvements will also take place which will make research agendas more client oriented as a consequence of reforms in extension organizations; liberalization of policies influencing prices and input supplies; and the expanded participation of the private sector in adaptive research and promotional activities. Collectively these changes will increase the effective demand for technologies

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<sup>8/</sup> USAID/SARP has scheduled a special evaluation report and analysis on technology transfer efforts of the project at the end of the second year. This report will be a major input into the mid-term evaluation.

and pressures on NARs to perform.

- 3) Efforts to maintain soil fertility in the drier areas of the SADC region will continue and will result in at least no significant deterioration in soil fertility throughout the region.

The degree of change predicated by the end of this project will be affected by the following factors which are outside the control of project management, USAID, ICRISAT and SADC:

- (a) Major adverse changes in environment (such as the recent drought);
- (b) Progress in settling civil wars (particularly Angola and Mozambique);
- (c) Progress with structural reform and policies toward liberalizing their national economies;
- (d) Peaceful and orderly transition to democracy throughout the region, particularly in South Africa.

#### 1.5. PROJECT INPUTS

The project inputs are the estimated amount of funding required to implement Phases III and IV are indicated in the adjoining box.

Other sources include contributions from the NARS and SADC member states to the core budget and revenue from the provision of materials and services to public and private agencies.

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#### BMIP SOURCES OF SUPPORT 1993 - 2003

USAID	\$10,729,670
CIDA	1,049,372
BMZ/GTZ	<u>3,122,109</u>
Sub-Total	14,901,151
Others	<u>3,000,000</u>
Total	17,901,151

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### 3. REVIEW OF IMPLEMENTATION

The implementation and financial plans contained in the SADC/ICRISAT proposal were reviewed as part of the preparation of the Project Paper Supplement for the Phase III activity. The major conclusions and recommendations of that review are briefly noted below. These have been discussed with the ICRISAT team who prepared the proposal and it has been modified to incorporate these considerations into their proposal.

#### 3.1. IMPLEMENTATION PLAN

In general, ICRISAT's implementation plans follow the management objectives that have been defined for this project (OUTPUTS) and the objectives of the SMIP Steering Committee. The implementation plans show a logical breakdown of the multiple project activities that result in the achievement of management objectives defined for the project. For example, the implementation plan describes three major types of activities (on-farm testing, the review and revision extension recommendations and seed production\distribution) required for technology transfer. Lastly, the implementation plans identify key target dates and schedules of performance that seem realistic and correctly sequenced.

As specified and presented, the implementation plans do not focus on several important crosscutting issues or questions which SMIP management will need to consider. These crosscutting issues are important to maintain cohesion between the different management objectives and ensure efficient use of resources (human and financial). For example, each of the management objectives require consistent and efficient information flows about the availability and impact of technology between SMIP and the NARS and ultimately across the various NARS. Further, information flows must assure the effective monitoring of collaborative SMIP-NARS workplans.

A second management concern evident from the workplans will be dealing with trade-offs in allocating available manpower between research activities and technology transfer. It's fully expected that technology transfer will absorb most of the available staff time in the early years of the project; but, as technology performance information filters back to the regional center, more staff resources may need to be reallocated to research. Third, the division of responsibilities between NARS and SMIP as defined through collaborative workplans should be reflected in the SMIP implementation plan.

Given these considerations, it is recommended that SMIP management systematize essential information flows between the regional center and the NARS. This should include a means to track the performance of newly released varieties and associated rates of adoption. It should also include a means to disseminate the results of NARS research of regional significance.

In so doing, SMIP may initially work out a standard procedure for sharing information with individual NARS based on the operational requirements of the collaborative workplans. As these are regularized, SMIP should explore methods for consolidating information flows across all of the NARS. In order for these to be used effectively, the information system should avoid the indiscriminate distribution of information. This creates operational difficulties and would not be sustainable. Instead, the regional information system should target information around the priority needs of users.

The monitoring and evaluation arrangements for the project are expected to ensure that these considerations are adequately taken into account during implementation.

**3.2 FINANCIAL PLAN:**

The proposal contains detailed budgets for the Phase III and projections through Phase IV. Phase III is conservatively estimated to consist entirely of the resources from carryovers of previous funding agreements and new funds from USAID and BMZ\GTZ. Including carry-over funds from Phase II, the total project funding currently planned by the donors is as indicated in Table 8 .

**TABLE 8: FUNDS AVAILABLE FOR  
SMIP PHASES III AND IV**

USAID	\$10,792,670
CIDA	1,049,372
BTE/GTZ	3,122,109
Total	\$14,901,151

Funds required to implement the program through Phases III and IV total \$17,901,151. Available donor funding will be adequate to cover expenditures in the first five years of Phase III, but an additional \$3 million will be needed from other sources during Phase IV. Beyond Phase IV, SMIP activities will be essentially financed by SACCAR, the NARS and governments of member states, and other public and private institutions.

The proposal deals with financial sustainability in a forthright and realistic manner from two perspectives: (1) the future use of the Matopos facilities; and (2) the nature and support for a future SMIP program. The strategy and the key milestones are summarized under Output 4 (A Sustainable Regional Sorghum and Pearl Millet Research Program and a Viable Plan for the Future of the Matopos Station) of the project description. The discussion of this strategy is included in the analysis (section 2.5). Subject to the concerns noted in that discussion, the strategy in the proposal is sound basis for addressing SMIP sustainability and the future of the Matopos station.

**3.3. PHASING OF EXPENDITURES**

The overall structure of the budget for Phase III is consistent with the priorities as established by the SMIP Steering Committee. As discussed in the analysis section (section 2.5), consideration should be given to increasing the level of resources available for technology transfer activities during the initial two to three years of Phase III. Further, the budget should take account of the staff time and resources that will be needed during Phase III to pursue the strategy for achieving sustainability. These shifts could be accommodated in one of several ways, including accelerating the disbursement of the USAID funds during the initial years. The increase in support for technology transfer would have to be matched by reductions in latter years as far as USAID support is concerned.

**3.4. FINANCIAL MANAGEMENT**

The USAID grant to ICRISAT provides for funding advances for the next 90 days to be replenished by ICRISAT submission of monthly vouchers. This system has been working well and will be continued.

### **3.5. FINANCIAL SUSTAINABILITY**

On July 21st 1993 USAID received a letter from SACCAR laying out the timetable and rationale for SADC commitment to the sustainability of the project. The grant Ammendment contains a paragraph identifying the conditions for disbursement of funds after September 30 1994. This condition precedent requires the submission; by SADC/SACCAR, assisted by ICRISAT; of a sustainability plan which is acceptable to USAID.

### Summary Budget for Phase III

	9-12/93	1994	1995	1996	1997	1-9/98	Total
Professional Staff	236,640	595,524	625,300	656,565	689,394	542,897	3,346,320
Support Staff	94,409	370,619	389,147	408,606	429,041	337,122	2,028,944
<b>Operations</b>							
Human Resource Development	304,347	124,780	96,317	101,132	106,189	0	732,765
Meetings, Seminars, Workshops	9,375	119,045	176,441	140,236	209,562	61,022	715,681
Information Management and Exch.	12,764	48,735	51,222	53,508	55,816	47,455	269,535
Travel	45,714	188,065	190,107	202,799	200,985	160,828	988,508
Communications	8,904	35,614	37,481	39,245	40,255	31,130	192,629
General Research/Office Expenses	7,434	29,236	30,743	31,179	32,463	24,920	155,975
Supplies	24,322	95,283	100,185	102,261	107,104	83,860	513,015
Vehicle Operations and Fuel	12,983	51,928	54,714	52,596	54,088	39,909	266,218
Farm & Physical Plant Serv & Support	33,208	132,822	139,463	146,437	153,584	120,536	726,050
Consultants	0	10,000	110,000	35,000	35,000	10,000	200,000
<b>Total Operations</b>	<b>459,051</b>	<b>835,508</b>	<b>986,673</b>	<b>904,393</b>	<b>995,046</b>	<b>579,660</b>	<b>4,760,320</b>
Project Evaluation	0	0	0	200,000	0	0	200,000
<b>Capital</b>							
Vehicles	0	35,000	70,000	118,000	0	0	223,000
Lab/Field/Office Equip.	0	12,100	17,600	12,100	12,100	12,100	66,000
Farm Equipment	0	0	0	0	0	40,000	40,000
Computers and Associated Equip.	0	21,000	21,000	6,000	6,000	0	54,000
<b>Total Capital</b>	<b>0</b>	<b>68,100</b>	<b>108,600</b>	<b>136,100</b>	<b>18,100</b>	<b>52,100</b>	<b>383,000</b>
Overhead	72,831	212,551	223,179	234,337	246,054	193,604	1,182,556
<b>Grand Total</b>	<b>862,931</b>	<b>2,082,302</b>	<b>2,332,899</b>	<b>2,540,001</b>	<b>2,377,635</b>	<b>1,705,383</b>	<b>11,901,151</b>

### Summary Budget for Phases III and IV

	9/93-9/98 Phase III Total	9/98-9/2003 Phase IV Total	Grand Total
Professional Staff	3,306,770	1,850,768	5,157,538
Support Staff	2,028,944	891,159	2,920,103
Operations	4,808,586	2,287,379	7,095,965
Project Evaluation	200,000	200,000	400,000
Capital	383,000	167,470	550,470
Overhead	1,173,851	603,224	1,777,075
<b>Total</b>	<b>11,901,151</b>	<b>6,000,000</b>	<b>17,901,151</b>

Note: only 50% of Phase IV will be donor funded



# SACCAR

Southern African Centre for Cooperation  
in

**Agricultural Research & Training**

Private Bag 00108 Gaborone Botswana  
Telephone: 373847/8 Telex: 2752 SACAR BD Fax: 375204

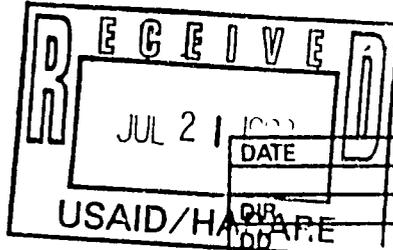


*Ho make me a copy*

16th July, 1993

REF: SAR/3/11

Dr. R.E. Armstrong  
USAID  
P.O. Box 6988  
HARARE  
Zimbabwe



FAX: 722

DATE	ACTION	INFO
JUL 21 1993	DIR	
	DDA.P.E	
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	DUE DATE	2-07-93
	ACTION TAKEN	
	INITIALS/DATE	NAR

Dear Dr. Armstrong,

**RE: SUSTAINABILITY OF SMIP**

*REA  
Add to  
PP. for  
SMIP  
7/21*

I refer to our telephone conversation of yesterday on the above subject.

In line with the agreement that SADC made to Donors (particularly USAID) regarding its ability to sustain SMIP during and after donor's grants, the following action has so far been taken:

1. SACCAR informed the Sectoral Committee of Ministers of Food, Agriculture and Natural Resources in June, 1993 that it was no longer possible to run SMIP by Donors' grants alone. It was necessary therefore to find ways in which SADC could start putting some resources into the programme. Ministers were further informed that a Consultancy team was being put in place to look into the future use of the facilities at Matopos. Included in the Consultants' Terms of Reference is the question of Sustainability which the team must address in detail. Accordingly, Ministers agreed with SACCAR's recommendations. These recommendations will then be tabled to Council in August, 1993 for endorsement.
2. The team of Consultants begins its work on 1st September, 1993 and hopefully their report will be ready by October in readiness for the SACCAR Board meeting of November, 1993.

①

**CONSULTANCY ON THE ESTABLISHMENT AND FINANCING OF A REGIONAL  
RESEARCH PROGRAMME ON CROPS AND NATURAL RESOURCES FOR SADC  
DROUGHT PRONE REGIONS BASED AT MATOPOS RESEARCH STATION,  
ZIMBABWE**

**Background**

In the Lusaka Declaration of April 1, 1980 which established the Southern African Development Coordination Conference (SADC), the nine independent states of Southern Africa committed themselves to policies aimed at the economic liberation and integrated development of their national economies. The International Crops Research Institute for Semi-Arid Tropics (ICRISAT) was identified as the external agency particularly equipped to provide assistance with the region's priority problems in agriculture and animal husbandry. The declaration states:

"A majority of people of Southern Africa is dependent on farming and animal husbandry. Their future livelihood is threatened by environmental degradation and in particular by desert encroachment as well as recurrent drought cycles. Even today few of the states of the region are self-sufficient in staple foods. Both environmental protection and food security are major challenges both rationally and regionally. We therefore, urge the International Centre for Research on Agriculture in the Semi-Arid Tropics (ICRISAT) to set up a Southern Africa Regional Centre in Botswana".

ICRISAT responded by sending a fact finding mission to the region in November 1980. After several consultations with the Consultative Technical Committee for Agricultural Research (CTC/AR) of SADC it was recommended and agreed that a regional centre for sorghum and millet research be established. This regional program began in 1984 and is now in phase III (1993/98).

(a) **Rationale**

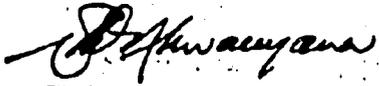
Recurring drought in Southern Africa, erratic nature of rainfall, presence of semi-arid zones in all SADC Member States, the need to understand the climatic patterns in Southern Africa, the fact that a majority of SADC citizens will continue to live in rural areas and mainly in marginal lands and therefore the need to improve their food security and employment warrant to have a research program in the region which focuses on improving the management of natural resources in semi-arid areas so that agricultural productivity may be increased and the above problems may be addressed.

(b) **Relation with ICRISAT and other Research Institutes that have mandates to work with commodities including livestock that are drought tolerant**

There is room in the foreseeable future for the region to continue to require a core group of researchers to work with regional scientists on rainfed agriculture in the semi-arid areas of SADC and specifically at Matopos.

3. It is anticipated that by June/July 1994 a concrete decision will have been made by SADC through its various decision making levels.

Yours sincerely,



Christopher T. Nkwanyana

**PRINCIPAL PROGRAMMES OFFICER & ACTING DIRECTOR**

(2)

(c) Possible Activities of the Program

- i. Research in sorghum and millet improvement.
- ii. Resource Management (soil fertility enhancement techniques, water harvesting, tillage methods that protect fragile soils from erosion and protection of the environment).
- iii. Agroclimatology Studies on climate as it affects all aspects of crop production in semi-arid areas at every cycle of crop growth.
- iv. Integration of crops with trees and livestock to achieve reasonable yields while protecting the environment.
- v. In service training in various research fields.
- vi. Agroforestry for drier regions of SADC.
- vii. Grain Legumes and oil seeds.

3

**CONSULTANCY ON THE ESTABLISHMENT AND FINANCING OF A REGIONAL RESEARCH PROGRAMME ON CROPS AND NATURAL RESOURCES FOR SADC DROUGHT PRONE REGIONS BASED AT MATOPOS RESEARCH STATION, ZIMBABWE**

**Preamble**

The Southern African Development Coordination Conference (SADCC) now known as the Southern African Development Community (SADC) invited ICRISAT to establish a research station to specialise on research on sorghum and millet in order to meet the food security needs of rural populations living in the drought-prone regions. Donors, namely Canada, Germany and USA responded generously to assist SADC fund the Sorghum and Millet Improvement Program (SMIP) including the establishment of adequate regional research facilities at Matopos Research Station.

In view of the recurring droughts and the importance of research to deal with crops that occur in drought-prone areas the Southern African Centre for Cooperation in Agricultural Research and Training (SACCAR) of SADC, wishes to establish a dryland/natural resources research programme which would look at crops and natural resources found in these areas. This is important because of Agenda 21 on preserving biodiversity and taking care of the environment, and research requires integrated approach. Most of the Individual national research programmes lack the capacity to undertake the research on these issues on their own, and hence the need for a regional activity. The natural resources base of these dry areas is very fragile and generation of technologies to manage them on sustainable basis and increase agricultural production require multidisciplinary research.

The facilities at Matopos were primarily established for sorghum and millet but SACCAR feels that Matopos is the best location for other activities related to dryland agriculture. Therefore, it is the wish of SACCAR to see how all these activities can co-exist. ICRISAT as an executing agency has assisted SADC through SACCAR to implement a very successful research programme on sorghum and millet.

SADC requires expert opinion on how to establish and finance a dryland/natural resources research programme for dry areas that would include sorghum and millet starting with the existing facilities at Matopos.

1. Examine the agricultural research needs of drought-prone regions of SADC with the view to determining the research activities which might be located at Matopos side by side with sorghum and millet research.

4.

2. Examine the financial implications of this proposal and advise on sustainable funding of its activities.
3. Examine the possible contribution of the private sector, NGO's and International Research Institutes to this proposal.
4. To accomplish this task team members will visit SADC member states and talk to Policy Makers in the Ministries of Agriculture and Finance, the Universities, private sectors, NGO's , Directors of Agricultural Research and individual scientists and International Research Centres.

July 29, 1993

Mr. Christopher T. Nkwanyana  
SACCAR

Dear Chris,

SUSTAINABILITY OF SMIP

Thank you for your fax with the complete text of your letter of 16th July and the TOR for the consultancy on the establishment and financing of a regional research program based at Matopos. I understand that 3 consultants have been identified for this task and that the mission is scheduled to commence in the near future. I don't know how much time has been allocated for this task, but the TOR seems very broad and it will be extremely difficult for the consultants to do more than cover the ground superficially, unless a considerably amount of preparatory work has already taken place.

As a general observation, the prospects for significant support from donors or members state NARS for even a modest regional program of the character described in the TOR, appear to me to be dim at best in the near term. USAID funds are likely to continue to decline and priority attention will be given to enable programs such as SMIP to achieve substantial impact, rather than getting involved in any new initiatives. The attitude of most other traditional donors is likely to be similar.

My specific concern is the extent to which the consultancy mission will be able to adequately address the issues associated with the future of SMIP amongst the broad range of topics included in the TOR. In all probability, the development of plan for sustaining SMIP beyond the end of Phase III which is acceptable to AID will be made a condition for disbursement of funds after September, 1994. SMIP and AID are looking to the consultants' study and recommendations and subsequent actions by SACCAR/SADC to provide the basis for such a plan. In this regard, it is important that we have a clear understanding from the onset as to level of detail and attention that will be given to SMIP in the consultancy mission, especially in the event that funding for the broader regional research program is not forthcoming in the medium term. (I do not think that a plan that ties the future of SMIP to funding for a larger regional research program will be adequate, unless there is some assurance that the funds can be located.)

One possibility would be to divide the mission into two components, the first to look at options for the future use of the Matopos facility and develop, at least in preliminary form, a strategy for sustaining SMIP, with or without the establishment of a regional research program for drought prone areas. The second component of the study would look at the broader issue of the regional research program. The results of the first study can provide a basis for the second, specifically with reference to models for financially sustaining regional research efforts without dependence on donor funding.

The second study would also benefit from background data collection and studies of specific issues aimed at defining both the scope of a possible regional research program in relation to what NARS are planning to do; and the prospects for financial sustainability. The background studies would indicate what has already been done or is in progress in relation to the potential research agenda. Without this background work, I fear that mission will not be able to do much more than produce a long list of potentially researchable subjects, most of which have been given some attention by someone in recent years.

An alternate approach for the second study would be to have the consultants address the question as to whether it makes sense to create a regional research program for the drought prone areas at this point in time. My own feeling is that there should be progressive movement toward integrated regional research programs which define divisions of labor among NARS and regional centers such as SMIP. However, changes in attitudes and general reforms in NARS are required to make this happen. Putting together a consensus just for sorghum and millet will be a major accomplishment. If SMIP is successful on this front, (as it will be required to be in order to survive beyond the end of Phase III), the program can possibly serve as a model for others. Agreement on a regional research program covering several commodities is another dimension of complexity and may be years away, especially if national governments and other institutions in the region are expected to support all or a significant portion of the cost.

The issue of where a regional research program might be located depends on many factors, only one of which is the availability of facilities. SMIP is drastically shifting its program in accordance with the priorities of its Steering Committee toward working closely with NARS and other national institutions on technology transfer and strengthening national research programs. Accordingly, the activities will be much more dispersed throughout the region than during Phases I and II. This "model" might be worth considering as an alternative to a large program centered at Matopos, the existence of facilities not withstanding.

With reference to options for the future use of Matopos, I trust that SACCAR and the consultants will give attention to possible interest by the Department of Research and Special Services (DR&SS) of Zimbabwe. *of ent?* The terms of the current grant agreement with ICRISAT and agreements with the Rhodes Trust and the government of Zimbabwe which preceded the development of the SMIP center at Matopos. It might be useful for SACCAR to come to some general understanding with DR&SS on future options that would be acceptable under the terms of the current agreement and other statutes governing the use of the land and facilities at Matopos prior to the consultancy mission.

I hope these comments will be helpful in increasing the potential utility of the mission and I look forward to seeing the results.

Yours sincerely,

Robert Armstrong

cc: L. Munghogho  
R. Fenner