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Agenda Item 16.3

Status of Proposals on Vegetable Research

Attached is a document entitled Collaborative vegetable research network in southern Africa: a proposal, for consideration by the Group under agenda item 16.3.

Attachment

Distribution

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From: W. David Hopper, Chairman, CGIAR

September 28, 1989

Report on the Proposed Collaborative Network

Attached is a report prepared by a team from SADCC, AVRDC, ISNAR, and the CGIAR Secretariat, outlining a proposed network for vegetable research in the SADCC region.

This report was recently completed and will not be reviewed by TAC in time for their comments at International Centers Week this year. Nevertheless, in view of the urgency expressed by some CGIAR members to move forward on a vegetable research network in Africa, the report provides a concrete proposal on the purposes, potential participants, the timetable and the resources required to initiate and develop a functioning network.

In the interest of expediting this matter, I would appreciate a review of the report by CGIAR members, and I have asked the Secretariat to provide some time during Centers Week for a preliminary discussion of the report. I would also ask that donors who might be interested in supporting such a network be prepared to meet during Centers Week to provide the initial finance to launch the start-up phase of network development.

The proposal that we might begin preparations for a regional workshop to launch the network early in 1990 does not presuppose an approval by TAC nor does it prejudice the findings and recommendations of TAC’s review process. I believe that the network can be established along the broad lines suggested by the collaborative report with a subsequent tuning to meet whatever recommendations TAC might make. I would like to see the network move as quickly as possible. The early steps to its initiation while awaiting TAC’s comments on the substantive nature of the research recommendations would seem to be the most pragmatic and expeditious course we could take at this time.

Attachment

Distribution

Members of the CGIAR
TAC Chairman
TAC Members
Center Directors
Director General AVRDC
Dr. Martin Kyomo, SACCAR
COLLABORATIVE VEGETABLE RESEARCH NETWORK
IN SOUTHERN AFRICA: A PROPOSAL

CG/SADCC/AVRDC MISSION
SEPTEMBER, 1989
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A Proposal for Collaborative Vegetable Research Network
in Southern Africa

Executive Summary

1. **Background:**

1.1. The importance of research to improve vegetable production, particularly on tropical vegetables, has been recognized by the Technical Advisory Committee (TAC) since the early 1970s. A proposal to establish a small International Vegetable Research Institute for the Tropics (IVRIT) was examined by the Consultative Group for International Agricultural Research (CGIAR) in 1979, but not developed further. TAC tabled a proposal in 1988 for the creation of an International Service for Vegetable Research (ISVER) and the establishment of regional vegetable research networks in Africa and subsequently in Latin America. The mid-term meeting of CGIAR, held at Berlin in 1988, endorsed in principle the need for vegetable research. At the 1989 mid-term meeting of the CGIAR in Canberra, the Group decided that as an interim action a proposal for an African Vegetable Research Network should be developed for consideration by the Group in its October 1989 meeting.

1.2. CGIAR's decision coincided with the policy decision by the leadership of Southern African Development Coordination Conference (SADCC) in according priority to horticultural research. Meanwhile, the Director General of Asian Vegetable Research and Development Center approached
the Director of Southern African Center for Cooperation in Agricultural Research (SACCAR) for a possible partnership in vegetable research and development.

1.3. In pursuance of the CG and SADCC decision, and the AVRDC's interest, a joint CG/SADCC/AVRDC mission was mounted between August 22 and September 12 to develop a proposal for a collaborative vegetable research network in Southern Africa. ISNAR contributed the services of a staff member to the mission. The mission, besides drawing upon the valuable work done by TAC, SACCAR and member countries of the SADCC region, held extensive consultations with the SACCAR leaders as well as policy makers, research leaders and concerned private sector personnel in the four countries of the SADCC region.

2. Status of Vegetable Research in SADCC countries and General Atmosphere for Collaborative Research

2.1. Horticulture, including vegetable production, has been largely ignored in the region. On the other hand, commercial production of vegetables, fruits and nuts is growing. A number of bi/multilateral initiatives and private sector enterprise are contributing to the vegetable research and development in the region.

2.2. The capability for vegetable research in the SADCC countries ranges from a national program such as Tanzania's or Zimbabwe's, which boast a fairly adequate group of research and training staff, to one such as Botswana's which has only four scientists and technicians conducting
2.3. Despite the general weakness of national vegetable programs in the region and the lack of resources — human, fiscal or otherwise, pockets of strength are perceptible. Tanzania appears to be active in training of the technicians, and in research on onion and indigenous leafy vegetables; Zimbabwe has a core of researchers working on collection and evaluation of germplasms, particularly tomatoes, and there is a tissue-culture laboratory in the private sector; Zambia has professional strength in seed production while Malawi has accumulated experience in exotic leafy brassica, i.e. common cabbage.

2.3. A number of vegetables, exotic and indigenous, are strategically important to all the SADCC countries, i.e. tomatoes, onion, common cabbage and vegetable amaranth. The research thrusts which currently receive high priorities are likewise common, i.e. cultivar identification and evaluation; seed-production; control of major pests and diseases; and development of suitable production practices. (Table 1 and Annex - 8).

2.4. There is considerable further potential to increase the output of fruits and nuts. However, in view of the importance of vegetables in diet, the prospect of quick return to the farmers, and the priority given to
vegetables by SADCC leadership, work on fruits and nuts may be deferred until the second phase.

2.5 Given the above scenario, and the accumulated experience of SACCAR in networking, the atmosphere for collaborative vegetable research appears to be favorable.

3. **General Network Strategies:**

3.1. The proposal envisions a regulated but systematic buildup of the network to avoid dispersion of efforts. Although, specific commodities for research and the delineation of research thrusts and priorities will be worked out in a regional consultative workshop, the proposal recommends the following:

- the network should start initially with a few strategically important vegetable species, i.e. tomato, onion, cabbage and leafy amaranth;
- the crucial areas of research may be confined in the beginning to where incipient research capacity exists and for which research priorities are high among the NARS;
- while each member state of SADCC shall be a beneficiary of technology and information generated by the network, selective leadership and active participation in the network's research programs may be initially limited to four advanced national programs i.e. Zimbabwe for tomato and professional training, Tanzania for onion and indigenous vegetables, Zambia for seed-production and Malawi for leafy brassicas.
3.2. The pervasive deficiency of trained professionals within the region, necessitates that the development of human resources in all the SADCC countries be one of the cornerstones of the proposed initiative. Manpower development will be geared towards two important goals, namely, 
- the buildup of a nucleus of vegetable researchers in every NARS working together as a multidisciplinary team; and 
- development of a center for professional training in horticulture in the SADCC region for the future build-up of the critical mass of scientists in the SADCC countries.

3.3. A major institutional constraint in many SADCC countries is the poor access by researchers to the state-of-the-art information in their fields of investigations. The overall goal of the network's information service will be to keep researchers in SADCC region posted on recent developments in vegetable science, both within the region, as well as relevant technological advances elsewhere.

3.4. The inadequacy of technical man-power in the region points to the need for deployment of a qualified team of experts in crucial areas of research, training and information to bridge the technology-gap and complement the NARS research as they gradually build up their technical staff.

3.5. Simultaneously one NARS should be given co-ordinating responsibility for the network. It needs to be identified and developed to build the
infrastructure, manpower and given resources for managing the network in the future. This should be instituted early so that professional relationship between the coordinating NARS and the collaborating partners can be developed. (Parameters for the selection of a coordinating NARS are delineated in the report).

4. Proposed Governance and Management Mechanisms:

4.1. It is proposed that Asian Vegetable Research and Development Center will be the executing agency for the network as well as a collaborative partner. It will provide the scientific and technical resource base of the network. It will recruit and deploy the coordinator and the team of specialists in close consultation with SACCAR Board.

4.2. SADCC's vegetable Research Committee (SAVRECO) will be the oversight committee and will be composed of Directors of Research of the participating NARS, Director/SACCAR or his representative, a representative of the faculties of agriculture, Director General AVRDC (or his representative) and a donor representative. The committee will set policy, ratify the strategic plan and approve annual work programs and budgets.

4.3. An Executive and Technical Committee (ETCO) will be the executive and technical arm of SAVRECO. National Vegetable program leaders, and a representative from SAVRECO will be members of ETCO. The network coordinator will act as member-secretary of ETCO. ETCO will develop the
annual workprogram of the network along with procedures for institutionalized monitoring and evaluation.

4.4. The network coordinator shall be responsible for overall coordination of network activities and serve as a liaison between ETCO and the participating NARS. The team of specialists will work with their national counterparts in specific research activities, and work full time in supporting specific research and development activities where national expertise is not available or requires supplementary effort.

4.5. The NARs Vegetable Research Program shall form the central core for the implementation of network activities. Each country with leadership responsibility will appoint a program leader who in addition to his country responsibility will take additional research responsibilities on behalf of the network for specific research task assigned to the NARS. A lead country for a specific commodity like tomato, for example can be a collaborator for a different task, i.e. seed-production, assigned to another country.

4.6. The Southern African Center for Co-operation in Agricultural Research (SACCAR) will provide the political, legal and logistic support in terms of providing the base for the governing body, drawing up the memorandums of understanding among the partners i.e., SACCAR, AVRDC and the NARS, overall evaluation, etc.
5. **Administrative Funding Mechanism:**

5.1. AVRDC will administer the network's financial resources. Salary and other benefits for all internationally recruited specialists, training as well as acquisition of equipment and vehicles of the network will be handled by AVRDC.

5.2. The disbursement of the annual budget for network operation approved by SAVRECO will be handled by SACCAR (Director/Finance Officer) who will insure that the resources are received in a timely fashion by the implementing NARS and the network team.

5.3. A revolving fund under the responsibility of the co-ordinator is proposed to provide him/her and the national teams with enough latitude to operate. In such case, the coordinator shall be accountable to Director/Finance Officer SACCAR.

6. **Outcome**

6.1. In the short run, the network activities will establish a framework for research partnership among SADCC countries and with external technology sources such as AVRDC and other specialized institutions.

6.2. In the medium term the initiative will generate technologies and other services for vegetable farmers; develop a nucleus of vegetable researchers in the NARS of the SADCC region; establish a center for
horticultural training and develop a coordinating unit for vegetable research and production for the region.

6.3. In the long run, a sustainable framework for collaboration in vegetable and eventually horticultural research, training, and information will be established with strong linkages among the component NARS and with other continental and international institutions.

7. Proposed Budget

7.1. The proposed budget is divided into two parts, namely start-up budget and the indicative network budget for five years.

7.2. It is proposed that seed money amounting to $200,000 plus is approved by the donors for the purpose of preparing for and conducting a regional consultative workshop. The workshop will prioritize the research agenda, finalize the project document for a five year rolling work-program and prepare a ten-year strategic plan for approval by the SADCC and the CGIAR. (Table - 2).

7.3. While a comprehensive budget will be prepared by the regional workshop for a five year work program, an indicative budget has been prepared for initial reference. The line items include, personnel cost, capital cost, equipment, support for network activities, contract research, annual programming meetings, regional technical workshops, external review and evaluation and manpower development (Table - 3). The total budget for five years comes to $10 million.
8. **Time Schedule**

Assuming that the budget for the preparatory phase is approved by the donors, it is expected that the start-up activities will commence in January 1990 leading towards the regional workshop in June/July and finalization of project document for approval by SADCC and CGIAR in September and October, 1990, respectively. The network can then be operative in January, 1991.

9. **Nomenclature of the Network**

CONVERDS is suggested as the acronym for the "Collaborative Network for Vegetable Research and Development in the SADCC Region." It sounds out the impression of numerous elements working together and "converging" towards a common goal.
I. BACKGROUND INFORMATION

Previous Consideration of Vegetable Research by TAC and CGIAR

1. The importance of research to improve vegetable production in developing countries, particularly on tropical vegetables, has been recognized by Technical Advisory Committee (TAC) since the early 1970s. TAC in 1975 commissioned a Vegetable Research Appraisal Mission and in 1976 a Vegetable Research Formulation Mission. A proposal by a strong majority of the committee to establish a small International Vegetable Research Institute for the Tropics (IVRIT) was examined by the Consultative Group (CGIAR) in 1979, but not developed further in view of the lack of consensus and financial constraints. In its 1985 review of "CGIAR Priorities and Future Strategies", TAC assigned highest priority on any new venture for which resources could become available to research on vegetables. The Committee reported to the Group's May 1986 meeting that it considers vegetables to be a neglected commodity in which considerable impact could be made in the short and medium terms for the following reasons:

- vegetables are preferred food among all income groups and social strata;
- vegetables provide nutrition to the vulnerable poor and prevent or reduce xerophthalmia in children through increased intake of vitamin A-rich vegetables, i.e. leafy greens (Table 1-6, Annex 1);
- vegetables fit into a variety of cropping systems and can be successfully grown by a number of producers in widely differing income groups i.e. home-gardeners, small and medium market-gardeners and commercial growers;
- vegetables generate high income for smallholders due to their intensive land use and their risk-reduction through crop diversification;
- demands are particularly high from the ever-growing urban population;
- export potential exists both within of regional markets and markets in the developed countries. In fact, a number of
countries are already exporting both fresh and processed vegetables to Europe and the Middle East.

2. On the basis of the positive reaction of the Consultative Group to TAC's views and making use of the outcome of a "Conference on Research and Development of Vegetables in Tropics" organized by Winrock International Institute for Agricultural Development in January 1986, the Committee began its work on a proposal with the assistance of Dr. A. Collin McClung of Winrock. The proposal, deliberated upon by TAC in its 45th meeting in Rome in March 1988, essentially advocated the establishment of regional research networks and the creation of an International Service for Vegetable Research (ISVER) staffed with a small but critical mass of qualified experts to support the networks. The proposed service was to contract a substantial portion of the international research agenda to appropriate institutions including the Asian Vegetable Research and Development Center (AVRDC), the National Agricultural Research Systems (NARS) and advanced research institutions in developed countries. Research agenda, training requirements and information/documentation services would be established through joint deliberations among the participating national systems, the regional set-up and ISVER.

3. The mid-term meeting of CGIAR, held at Berlin in 1988, endorsed in principle the need for vegetable research but left for future consideration a number of issues including the questions of where the headquarters of the proposed research operation should be located and the possibility of assigning a leading role in the proposed program to the Asian Vegetable Research and Development Center. At the 1989 mid-term meeting of the CGIAR held in Canberra from May 30 - June 1, the Group decided that while some issues remain under review, as an interim action a proposal for an African vegetable research network should be developed for consideration by TAC and CG in its October 1989 meeting.
SADCC'S Policy Decision on the Priority of Horticultural Research & the AVRDC initiative

4. TAG/CG decision regarding the establishment of a collaborative vegetable research network in Africa coincides with the SADCC 1/ decision to accord highest priority to horticultural research, particularly research on vegetables. SACCAR organized a workshop on "Potential of Horticultural Production in SADCC countries" in March 1987. Recommendations of that workshop are given in Annex 2. The SADCC Council of Ministers approved the recommendations in principle and gave a policy directive to SACCAR to launch a regional research initiative on vegetables on a priority basis. Accordingly, SACCAR prepared a technical assistance request for probable Japanese funding to undertake a feasibility study to establish a regional research unit with a mandate to breed vegetable seeds. A copy of the proposal is given as Annex 3. Of relevance to the issue is the letter from the Director General of AVRDC to Director of SACCAR on June 28, 1989 sounding out if there is an interest on SACCAR's part to have AVRDC as a partner in vegetable research and development. A copy of the letter is given as Annex 4. In pursuance of the CG and SADCC decision, a joint SADCC/CG/AVRDC 2/ mission was mounted between August 22 and September 12, 1989. The members of the mission with their affiliations and terms of reference are given in Annex 5.

1/ Southern African Development Coordination Conference. The South African Center for Cooperation in Agricultural Research (SACCAR) provides the Secretariat Service to SADCC on agricultural research.

2/ ISNAR (International Service for National Agricultural Research) participated in the mission through a staff member specializing in networking.
5. The mission, due to time-constraints and other limitations, has drawn heavily on the valuable work done by TAC, as well as the studies conducted by SACCAR and various SADCC countries. The mission started off with consultation meetings at SACCAR headquarters in Botswana, particularly with the Director and his colleagues and Dr. Lucus Gakale, Director of Agricultural Research, Botswana and Chairman, SACCAR Board of Directors, to obtain a broad understanding of SACCAR's views about the form and substance of the networking initiative, and for a general appraisal of the current situation with regard to the state of the art in vegetable research in the region, manpower constraints and information management. The aim was also to gain a clearer perception of the level of interest on the initiative at both the policy/institutional and scientific levels.

6. Visits to the national systems, including universities and private sector facilities in Botswana, Tanzania, Zambia and Zimbabwe followed. During the country visits, the mission attempted to review with the nationals, both in the public and the private sector, and at policy and technical levels, as much of the information as could be assessed from written reports and other studies and from verbal communication with concerned individuals. Representatives of bi/multilateral donor agencies and experts working in the sector within national systems were also consulted. Institutions/facilities visited and individuals contacted are given in Annexes 6 and 7. The status of vegetable research and production in the SADCC countries visited is fully described in Annex 8 entitled "country profiles". On conclusion of the country visits, wrap-up meetings were held at the SACCAR Secretariat to reach a consensus on the preliminary draft.

7. It may be mentioned here that the Director of SACCAR informed the members of the mission that the SADCC Ministerial Council is in favor of broadening the proposed vegetable research into a horticultural research
initiative because fruits and nuts in Southern Africa are important, in terms of supplemental dietary needs, high economic value, and expanding export opportunities. Moreover, vegetable research in most SADCC countries is simply a component of the integrated horticultural research. However, the mission members proposed that a modest and pragmatic beginning be made with selected vegetable species and that fruits and nuts may be incorporated into the network in a second phase. Meanwhile, the institutional capacity for horticultural research among the NARS will be strengthened through short- and long-term training. The information exchange among the countries of the network will complement and reinforce the national research efforts.

II. THE RATIONALE FOR DEVELOPING A NEW CGIAR INITIATIVE ON VEGETABLE RESEARCH AND DEVELOPMENT IN SOUTHERN AFRICA

8. The SACCAR document on a feasibility study for vegetable research in the region (Annex 3) candidly recognizes that, "horticulture is serviced by very few research scientists in SADCC. In all SADCC member states approximately three out of every hundred researchers work in horticulture". Inspite of the shortage of trained manpower and the consequent inadequacy of research bases in some countries, the rationale for starting with a vegetable research and development initiative in Southern Africa can be summed up as follows:

- political commitment of the leadership in SADCC countries and the priority given by them to vegetable research;
- the regional institutional framework provided by SACCAR and its experience with networking, i.e. sorghum and millet, grain legumes, agro-forestry, education and training etc; (Map at Annex 9 shows the locations of on-going and tentatively proposed networks in SADCC region);
- nutritional deficiency and the prevalence of xerophthalmia in some SADCC countries i.e. Tanzania, Botswana;
- tradition of homegardens in the countryside and the potential of increasing the income of smallholders with access to market centers, i.e. Zimbabwe, Zambia, Tanzania (Chagga gardens);

- seed production and distribution facilities through a combination of the public, the paraetatal and the private sectors in some SADCC countries, i.e. Zamseed in Zambia, seed-production unit of Horticultural Research and Training Institute (FAO Project) in Tengeru and the Tanganyika Farmers' Association in Tanzania, and private sector initiatives in Zimbabwe.

- commercial production of vegetables with processing, marketing and export facilities in the private sector or through cooperatives and the opportunities of contract growing by small farmers, such as in Zimbabwe, Swaziland, Zambia, Malawi and Tanzania;

- the existing infrastructure for training, introduction of horticultural courses and proposed establishment of horticulture department in some universities, i.e. Horticultural Research and Training Institute at Tengeru and Sokoine University of Agriculture (S.U.A.) in Tanzania, University of Zimbabwe, and Bunda College in Malawi;

- multi- and bilateral donor initiatives in vegetable research and production, i.e. FAO/UNDP seed production project in Tengeru, the Franco-Tanzania vegetable project in S.U.A., collaborative arrangements between Cornell University and S.U.A. in Tanzania, SIDA (Swedish International Development Agency) working through SVALOF A.B. Seed Company for Zamseed in Zambia, World Bank assistance for tissue culture and post-harvest research in Zimbabwe, etc.;

- a high demand growth rate due to rapid urbanization in all the SADCC countries.
III. FRAMEWORK OF THE REPORT

9. The report presents the status of vegetable research and development in the SADCC region, particularly with reference to the selected countries visited, and draws some indicative conclusions. Strategic crops, researchable areas, and possible outputs are identified. Nutritional imperative, general economic value to the farmers, and the regional perception of the preferred clientele were considered in the overall analysis. Priority issues for strengthening horticultural education and training facilities in the region, specializations outside the region, reinforcement of regional/national bibliographic and documentation services and enhancement of scientific exchange were also addressed.

10. On the basis of the above, the objectives, dimension, strategies and potential outputs of the network are projected. Institutional and management mechanisms for institutionalized monitoring and evaluation, oversight, funding, etc., are proposed for critical considerations by TAC and CG. Specifically, the report proposes an initial start-up period to prepare a long-term strategic plan (10 years) and a rolling work program (5 years) with clearly focused research, training, and information management agenda. Budgetary requirements for this phase have been worked out for immediate consideration by TAC and approval by the CG (Table 2). A first approximation of the indicative budgetary requirements for a 5-year rolling work program is given in Table 3.

IV. VEGETABLE RESEARCH AND DEVELOPMENT IN THE SADCC REGION

The general status of vegetable research and development in the SADCC region is presented below. For details on each country, please refer to Annex 8 (Country Profiles).
Historical Perspectives

11. Horticulture, including vegetable production, has been a largely ignored industry in the SADCC region. Traditionally, it has not been accorded the attention it deserves in the formulation of national agricultural development plans in Southern African countries; disparate attention is almost always directed towards increasing the production of staple crops, usually cereal grains, a situation which is not unique of the region but is normally the case in many developing countries of the world.

12. In recent years, the governments of the member states of SADCC have begun to recognize the strategic importance of horticulture (especially vegetables and fruits) as an excellent tool to enhance the nutritional well-being and the income of the people and to secure valuable foreign currency. As a consequence, the new policy in the Food, Agriculture and Natural Resources Sector of SADCC 3/ underscores the need to insure access to food by all citizens in its member countries through mechanisms as follows:

- increasing agricultural production;
- generating employment by strengthening the agribusiness sector;
- increasing the cash income of farmers through the production of food and cash crops, and;
- increasing foreign exchange earnings of member states by growing exportable crops and livestock.

13. Horticulture is unquestionably one of the most important fields in the Food, Agriculture and Natural Resources sector.4/ In particular, short-term cash and nutritionally rich crops like vegetables are prime candidates


which sufficiently meet the requirements of the above mechanisms to attain the SADCC goal.

Manpower Resources and Support Services

14. No SADCC country (Tanzania offers only diploma in horticulture) offers professional training (B.Sc. or higher) in horticulture as a specialized field of agriculture. Horticulture has always been treated as an integral component of the career in general agriculture, a curriculum that has been a legacy from the colonial times. In effect, there are no so-called "home-grown" professional researchers in the SADCC countries who are specialized in horticulture. Even professional horticulturists trained abroad are meager in number and not nearly enough to address the needs of the SADCC countries because no African country in general, has invested significantly in the training of its scientists.5/ Latest estimation by the present mission of the current manpower engaged full- or part-time in vegetable research in the SADCC countries visited, places the number of professionals and diploma holders from a low of 4 scientists in Botswana to a high of 20 in Tanzania. These estimates already include personnel who are currently undergoing training abroad. The situation is no better in other SADCC countries not visited. As a matter of fact, all SADCC countries list lack of horticulturists as the single most important institutional constraint limiting the development of the horticultural industry in the region.6/ Given the present circumstances, it is thus easy to recognize that the improvement of the vegetable industry (as a sector of horticulture) in the region will demand strong national commitments to manpower development.

15. A number of bilateral initiatives in several SADCC countries are


contributing appreciably to the vegetable research and development in the region. These initiatives include the following: FAO/UNDP seed production project in Tengeru, Tanzania; the Franco-Tanzania horticulture project in Sokoine University of Agriculture (SUA) at Morogoro; the Dutch support for strengthening the research capability at Tengeru, Tanzania; the proposed and partly operative collaborative arrangement between Cornell University and SUA (Tanzania) and Bunda College (Malawi); the Swedish International Development Agency (SIDA) seed production project (working through a private firm, the Svalof A.B. Seed Company) with ZamSeeds (Zambia Seed Company, a parastatal firm) in Zambia; and the World Bank assistance to develop the post-harvest and tissue culture facilities at Grasslands Research Station in Marondera, Zimbabwe.

16. Agricultural support services and investments in majority of the SADCC countries have disproportionately favored the commercial sector. In Zambia, for example, this has led to the rise in the contribution of the commercial subsector to agricultural output from 19% in 1965 to 41% in 1982. On the contrary, the traditional (smallholder) agriculture has remained stagnant, with its contribution to agricultural output declining from 81% in 1963 to only 50% in 1982. This inequitable trend in support needs to be rectified since the smallholders dominate the agricultural sector, comprising more than three-fourths of the total farming families in the country. A similar situation exists in Botswana, Malawi, Swaziland, Tanzania and Zimbabwe where research, extension and marketing services have been essentially aimed at the needs of the large commercial farmers. In these countries, agricultural research, extension and training can greatly assist if they are reoriented to help the smallholders meet their major problems.


17. Nowhere is the above disparity in support to the agricultural sectors more greatly felt than in the horticultural industry as it is generally characterized by a wide range of commodities that farmers regularly deal with and consequently, by a broad extent of professional services that are needed to effectively address the production and post-production constraints in these crops. Indeed, the whole gamut of horticultural activities deserve more attention, for very good reasons as described above.

**Strategic Vegetable Species and Research Thrusts**

18. The range of vegetable species that are commonly grown in the SADCC region is diverse, yet a number of them do transcend national borders in popularity and are, therefore, strategically important from a regional standpoint. Among the solanaceous vegetables, tomato by far, was unanimously rated by agricultural officers interviewed during the mission as the single most important vegetable from both a market-oriented view and from the standpoint of local culinary preferences. Other vegetables that have been widely considered as important are onion among the Alliums and leafy Brassicas, particularly species such as rape (Brassica napus) and cabbage (Brassica oleracea var. capitata). While local unconventional vegetables such as amaranth, jute mallow (Corchorus olitorius), cat's whiskers (Cleome gynandra), African bitter eggplant (Solanum macrocarpam) and a few other indigenous species are considered very important in several SADCC countries, notably in Tanzania and Zambia of the member states visited by the mission, this has not seemingly been so (with the exception of amaranth) in Zimbabwe, very likely because of the country's general preoccupation with market-oriented horticultural commodities, either for export or for domestic consumption. Even communal farms and small-scale farmers have been reported to revert from subsistence gardening to market-oriented production of traditional vegetables of commerce as soon as readily accessible markets develop nearby. Nevertheless, concerns for nutrition among the rural poor have encouraged research projects on
indigenous leafy vegetables such as amaranth which is now a regular component of "nutrition gardens" that are being field-tested in the country. A similar situation as in Zimbabwe exists for countries such as Lesotho, Botswana and Swaziland where research priorities emphasize conventional vegetables. However, interests to carry out future research on the indigenous vegetables are present in these countries.

19. With few exceptions, the current priorities in research on the important vegetable species appear largely homogenous in the SADCC countries visited. Research priorities generally emphasize short-term, problem-oriented studies in the following areas: cultivar trials with a view to identify adapted genotypes; development of suitable production practices; and plant protection studies. Other strategically important research carried out by relatively active national programs, e.g. Tanzania and Zambia, are studies on seed production methods and development of indigenous vegetables, with significant efforts on collection and evaluation of germplasm and related research on utilization patterns, nutritional values, and marketing. The strategically important vegetable crops and the comparative research priorities in the SADCC countries visited during the mission are shown in Table 1.

**General Constraints**

20. Overall, a number of factors severely limit the development of the vegetable industry in the SADCC region. The general constraints that were commonly cited are as follows:

- **institutional** problems such as the acute lack of trained scientists required to generate new technology; inadequate fiscal and physical resources for research; inadequate information base; and, poor infrastructures for marketing and distribution of farm products.
Table 1

<table>
<thead>
<tr>
<th>Species</th>
<th>Bot</th>
<th>Tan</th>
<th>Zam</th>
<th>Zim</th>
<th>Mal</th>
<th>Moz</th>
<th>Les</th>
<th>Swa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tomato (Lycopersicon esculentum)</td>
<td>1,2,3,4</td>
<td>1,2,3,4,5,6</td>
<td>1,2,3,6</td>
<td>1,2,3,4</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Onion (Allium cepa)</td>
<td>1,2,3,4</td>
<td>1,2,4,5,6</td>
<td>1,3,5,6</td>
<td>1,2,3,4,5</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Peppers (Capsicum annum)</td>
<td>1,2,3,4</td>
<td>1,2,4,6</td>
<td>P</td>
<td>1,4</td>
<td></td>
<td>+</td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>Eggplant (Solanum melongena)</td>
<td>none</td>
<td>1,2,4,6</td>
<td>P</td>
<td>1,4</td>
<td></td>
<td>+</td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>Okra ( Abelmoschus esculentus)</td>
<td>none</td>
<td>1,6</td>
<td>1,2,6</td>
<td>1,2,4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indigenous African vegetables</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amaranth (Amaranthus hybridus)</td>
<td>I</td>
<td>1,2,4,6</td>
<td>1,2,3,6,7</td>
<td>P</td>
<td>+</td>
<td>+</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Ethiopian mustard (Brassica carinata)</td>
<td>I</td>
<td>1,2,4,6</td>
<td>1,2,3,6</td>
<td>2,4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jute mallow (Corchorus ollttorius)</td>
<td>I</td>
<td>1,4,6</td>
<td>1,2,4,6,7</td>
<td>none</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cat’s whisker ( Cleome gynandra)</td>
<td>I</td>
<td>1,4,6</td>
<td>1,2,4,6,7</td>
<td>none</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>African eggplant (Solanum macrocarpum)</td>
<td>none</td>
<td>1,6</td>
<td>1,6,7</td>
<td>none</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roselle ( Hibiscus sabdariffa)</td>
<td>none</td>
<td>P</td>
<td>4,7</td>
<td>none</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leafy Brassicas</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kape (Brassica napus)</td>
<td>1,2,3,4</td>
<td>1</td>
<td>1,2,3,6</td>
<td>none</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chinese cabbage (B. pekinensis)</td>
<td>none</td>
<td>none</td>
<td>1,6</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cabbage (B. oleracea var capitata)</td>
<td>1,2,3,4,5</td>
<td>1,2,3,4,6</td>
<td>1,2,3,6</td>
<td>1,2,3,4</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Portuguese cabbage (B. o. var costata)</td>
<td>I</td>
<td>none</td>
<td>1,2,6,7</td>
<td>1,4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lettuce (Lactuca sativa)</td>
<td>P</td>
<td>1,4</td>
<td>1,2,6</td>
<td>P</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Carrots (Daucus carota)</td>
<td>1,2,3,4</td>
<td>1,4</td>
<td>1,6</td>
<td>1</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Swiss chard (Beta vulgaris cicla)</td>
<td>1,2,3,4</td>
<td>none</td>
<td>2,6</td>
<td>none</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beet root (Beta vulgaris vulgaris)</td>
<td>1,2,3,4</td>
<td>none</td>
<td>P</td>
<td>none</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>French bean (Phaseolus vulgaris)</td>
<td>none</td>
<td>P</td>
<td>1,6</td>
<td>1,2,4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Legend:
1 = cultivar trial and selection
2 = production techniques
3 = plant protection research
4 = marketing/economics
5 = postharvest/utilization
6 = seed production research
7 = Others (nutritional studies, utilization)
P = no ongoing research; currently only production for seed or crop
I = interest to undertake studies present
+ = ongoing research indicated but information is not specific
? = undefined; no information
biotic constraints such as unavailability of suitable cultivars; pest and disease problems; inadequate supply of good quality seeds; lack of appropriate production practices.

- abiotic constraints such as vicissitudes of environment arising from high temperatures, high rainfall, and drought (lack of irrigation water) which invariably cause the seasonality in production and supply of many vegetables.

21. Confounded with the above factors is the complexity of vegetables as a commodity group. Thus, each national program often takes too broad a research strategy. With the meager resources thinly distributed, feeble research and extension systems with none or very little impact are more a rule than exception in the region.

V. COLLABORATIVE VEGETABLE RESEARCH: A POTENTIAL SOLUTION TO SADCC'S CONSTRAINTS

Strengths and Weaknesses Among SADCC's NARS

22. There is no doubt that the resources for vegetable research in the SADCC region, fiscal, human or otherwise, are well below what is needed to adequately address the problems encountered by the region's vegetable farmers. Individually, none of the SADCC countries appear to have the critical mass of scientists that are crucial in generating the essential technologies for improving the productivity and quality of its important vegetable crops.

23. The capability for vegetable research and development in the SADCC countries is certainly heterogeneous, ranging from a national program such as Tanzania's which boasts a fairly extensive group of research and training staff in public research stations and universities, to one such as Botswana's which has only four scientists conducting vegetable research or Lesotho's, where there are very few horticulturists despite the importance
of the horticultural industry in the country. Despite the apparent general weakness of the national vegetable programs in the SADCC region, specific pockets of strength are perceptible. Tanzania appears to be active in the area of training and in research on vegetable species such as onion and indigenous leafy vegetables like amaranth, jute's mallow, and others. On the other hand, the presence of the Swedish group and a core of professional staff working on seed production in Zambia gives this country a comparative advantage in the area of seed research. Past experiences of the vegetable researchers of Zimbabwe in evaluating vegetable germplasm, particularly tomatoes, for adaptability to different agro-ecological conditions of the country make it comparatively stronger than other national programs in the area of adpatational research. Crop Science Department in the University of Zimbabwe has also finalised a proposal for introducing a new B.Sc. (horticulture) program.

SADCC'S Policy Initiatives and Networking Experience

24. SADCC was established in 1980 with a general goal of achieving an integrated development of the national economies of its member states through regional cooperation. Agriculture was unanimously chosen as the principal sector for collaboration, with food security and agricultural research as the main sub-sectors for implementation. In 1984, SACCAR (Southern African Center for Cooperation in Agricultural Research) was formed to provide the organizational basis for regional cooperation and to provide technical support to the national research systems. With respect to collaborative linking of research activities in the SADCC region, the most basic ingredient for success - the national commitment to regional cooperation - therefore exists already.

25. Aside from the regional institutional framework provided by SACCAR, it has already accumulated a significant experience in jointly coordinating with respective international agricultural research centers several


9/ See Footnote #3.
networks in the SADCC region, e.g., sorghum and millet network, grain legume network, agro-forestry network, education and training network, and others (see Annex 9 for the locations of the ongoing and tentatively proposed networks in the SADCC region).

Commonality of Strategic Interests on Vegetables

26. A number of vegetables, exotic and indigenous, are strategically important to all member states of SADCC, either economically, nutritionally, or both (see Annex 12). The most important species on a regional context are as follows: tomato, onion exotic leafy Brassicas such as common cabbage and indigenous leafy greens such as vegetable amaranth.

27. Apart from similarities in strategic vegetable commodities that are currently produced in the SADCC countries, the research thrusts which currently receive high priorities are likewise common although the intensity of pursuing them in individual countries does vary because of the differences in relative strength of the national vegetable research systems. General research thrusts of common interests in the SADCC region are as follows: identification of suitable vegetable cultivars; control of major pests and diseases; and, development of suitable production practices.

28. The above commonality in research targets, both commodities and research thrusts, among the member states of SADCC provides another fundamental requirement of successful research linkage, i.e., that the national interests of participating members are perceived to be equitably addressed and served and that each is bound to benefit equally from the association.

General Atmosphere for Collaborative Research

29. Given the above scenario in the SADCC region - lack of trained manpower, commonality of strategically important vegetables and research priorities, existence of political consensus among SADCC member states on regional collaboration with immediate priorities on the agriculture sector, and the accumulated experience of SACCAR and SADCC member states on
networking of research in several commodities - the atmosphere for collaborative vegetable research in the region does, indeed, appear to be favorable. The benefits that accrue from linking research efforts among a number of actively participating members are extensively discussed by Plucknett and Smith.\textsuperscript{11} Briefly, a few points may be mentioned to highlight the overwhelming advantages of collaborative research partnership especially under a pervasive condition of resource limitations as in the SADCC region:

- where individual members may not have the required number of researchers to generate new technologies, pooling of human resources among partners may enable the attainment of the critical mass for such a purpose;

- collaborative research provides opportunities for greater interaction among researchers and renders new vistas in research that would not otherwise be possible with a highly individualistic research system;

- collaborative research encourages a broader and better exchange of technical information among network researchers, thereby improving the researchers perceptions of developments in his/her field of specialization and avoiding, thus, wasteful research duplications;

- collaborative research allows each participating member to expend its limited resources on a narrow range of problems in which it has the proven expertise rather than spreading such resources over a broad range of constraint, as is normally the case with individualized research.

VI. CONVERDS: A PROPOSED COLLABORATIVE NETWORK FOR VEGETABLE RESEARCH AND DEVELOPMENT IN THE SADCC REGION

CONVERDS is a proposed vegetable research network organization for the SADCC region. Its full meaning is "Collaborative Network for Vegetable Research and Development in the SADCC Region". The acronym "CONVERDS" was

deliberately chosen to sound out the impression of numerous elements working together and "converging" towards a common goal. This is, indeed, the ultimate working philosophy of CONVERDS.

**Mandate**

30. CONVERDS is a regional technical network within the framework of SACCAR charged with coordinating and promoting vegetable research and development in the SADCC countries, especially fostering a research partnership approach among the region's NARS to maximize the efficiency of utilizing the scarce resources available to generate new technology.

**Goal**

31. The general goal of CONVERDS is to provide a regional framework for collaborative vegetable research and development to solve the pressing problems of vegetable production and utilization in the SADCC region.

**Objectives**

32. The specific objectives which shall be pursued by CONVERDS to attain its general goal are as follows:

- to facilitate the generation and adoption of technologies for selected vegetable crops, through collaborative research, information exchange and scientific consultations;
- to develop and/or upgrade, the technical proficiency of the vegetable researchers and technicians in the NARS, the ultimate goal being to build the critical mass of scientists capable of responding to the national and regional needs for sustained vegetable production in the region;
- to establish ways and means for collaborative research partnership among the SADCC country members, to attain a better and efficient use of expertise, technologies and the scarce resources available for vegetable research and development in the region;
- to establish and strengthen the linkages for exchange and acquisition of relevant technologies developed by regional and international centers, or other external sources of technology; and
to develop an information and diffusion network in SADCC region, aimed to facilitate the assembly and dissemination of technical information to the region's vegetable researchers and eventually to their clienteles, the extension services and the vegetable growers.

**Functions of the Network**

33. CONVERDS shall have the following general functions:

- provide the forum and mechanisms for improving communication and rapid exchange of technology derived from research;
- identify research needs, set their priorities and bring the appropriate NARS of the region to focus on these problems;
- foster collaborative and complementing research and technical exchanges, always taking into account the institutional strengths and weaknesses of the component NARS;
- minimize duplication of efforts and enable the formation of complementing vegetable research units that are able to address the production and utilization problems at the national and regional levels;
- hold periodic network meetings, as one of the means for developing collaborative plans, evaluating results, and fostering exchange of information.

**Proposed Governance and Management Mechanism**

34. Organization and structure. The successful management and operation of CONVERDS hinge on the principle of simplicity, minimal bureaucracy and operational flexibility. The organisational structure is proposed to be comprised of several functional bodies and/or personnel, each with distinct management and technical obligations to the network.

34-1. SADCC Vegetable Research Committee (SAVRECO). This is the highest level of governing authority for CONVERDS and essentially functions as an oversight committee. Initially, SAVRECO is proposed to be made up of 8 members as follows: Director of SACCAR, Director-General of the executing agency (or a designated representative), Directors of Research of the NARS (initially four DRs) which are actively participating in network research
activities, one selected representative from the regional faculties of agriculture, and a donor representative. Each Director of Research in SAVRECO will serve as the direct link between CONVERDS and the agricultural authorities of the NARS which is actively engaged in network research. SAVRECO will be chaired by the Director of Research of the NARS where the network team deployed by the executing agency (see General Strategies) is based.

The main functions of SAVRECO shall be as follows:

- To set the policy and ratify the strategic plans of the network.
- To review and confirm the selection of the network coordinator and network's expert team by the executing agency.
- To appoint the panel members of the Executive and Technical Committee (ETCO).
- To review and approve the annual work plan and budget of the network, as presented by the ETCO.
- To seek funding resources through SACCAR for executing additional regional activities relevant to the network other than those of the regular program.

It is proposed that SAVRECO meets once a year, preferably held as an extension of the SACCAR's Board meeting (all Directors of Research of SADCC's NARS are members of the SACCAR Board) to minimize additional travel and time expenditures of SAVRECO's members.

34-2. **Executing Agency.** It is proposed that the Asian Vegetable Research and Development Center (hereafter referred to as AVRDC), an organization with long and valuable experience in the field of vegetable research be designated as the executing agency of CONVERDS. As the executing agency, AVRDC is expected to provide the scientific, training and information resource base for the network. AVRDC will be an active partner in the network through the coordinator and the team of specialists who will work with their national counterparts.
The specific responsibilities of AVRDC shall be as follows:

- fiscal management of the network.
- deployment of a qualified team of experts composed of specialists, in close consultation with SACCAR Board, in crucial areas of research to bridge the technology gap and complement the NARS research as they gradually build up their technical staff.
- coordination of the network activities (through the network coordinator) including training, study tours, workshops, information build-up, etc.
- provision of genetic materials and other technologies for evaluation and adoption by the network.
- provision of an important venue for training of the NARS personnel on vegetable research and production methodologies.
- provision of liaison service with other specialized centers, institutions, universities and other external sources of knowledge deemed relevant to the objectives of the network.
- provision of technical backstop service for network's research information and training needs.

34-3. Executive and Technical Committee (ETCO). This body is equivalent to the currently existing Technical Advisory Panels (TAPs) for various SADCC-based networks jointly coordinated by SACCAR with other international agricultural research centers. The main function of ETCO is to provide network direction, programming and monitoring, develop strategic plans of the network, prepare the annual work program and the budget and liaise between the policy-making body (SAVRECO) and the operational (implementing) units of the network.

ETCO is proposed to be made up of the following members:

- one designated representative from SAVRECO who will automatically act as the chairman of the committee.
- national vegetable program leaders (initially, four team leaders) from NARS which are actively participating in network research.
- a representative from the faculty of agriculture.
A representative from the executing agency (normally, the network coordinator acting on its behalf).

A donor representative may, if necessary, participate in some, if not all, meetings of ETCO.

ETCO is expected to meet at least once a year (twice, if necessary) to review and help develop the annual plan of network activities, by consolidating the national programs and regional priorities.

Other important functions of ETCO shall be:

- to carry out for SAVRECO, through delegated authority, executive functions in order to speed up the execution of network activities.
- To evaluate and assess new initiatives in collaborative research, training and information exchange.

34-4. **Network Coordination.** The network coordinator shall be mainly responsible for the overall coordination and management of network activities. In addition, the coordinator shall help provide scientific guidance, as well as serve as liaison between ETCO and the implementing units (the NARS) of the network. The coordinator shall be contracted on a full-time basis and will be responsible to SAVRECO with respect to general network responsibilities and to AVRDC in terms of scientific and technical performance. The coordinator should be a well respected, scientist with ample experience in the execution and management of research programs. The coordinator shall also take part in the execution of research activities, especially during the initial years of the project, until such time that the demands of coordination function become heavy. The coordinator shall be housed within the coordinating NARS, as designated by the SACCAR Board.

The functions of the coordinator subject to any rules drawn up by SAVRECO, includes the following:

- to act as a secretary of ETCO.
to formulate in consultation with the NARS-vegetable program leaders, the network's annual program and budget.

to supervise, monitor and evaluate the regional network activities.

to supervise with the assistance of SACCAR administrative officer the program budget execution and ensure efficient financial management in accordance with the budget allocated to the CONVERDS activities.

to provide the scientific and technical liaison with AVRDC, as well as, with other agencies or institutions of regional and international nature.

to draw up the network's strategic plan in collaboration with the NARS vegetable research program leaders acting in consultation with the key vegetable researchers in the NARS and the network's expert team.

To accomplish the above functions, the coordinator will be assisted by a "team of specialists". This team shall will work full-time in supporting specific research and development activities where expertise is still not available or requires supplementary efforts.

The duties of the specialists shall be:

- in a close partnership with the coordinator, to program and execute the activities of the network along with their national counterparts.
- to support and carry out activities aimed to improve the skill and expertise of their counterparts.
- to serve as a link with other external sources of knowledge in specific areas of his/her expertise.

34-5. Implementing Units. The NARS vegetable research program or its equivalent shall form the central core for the implementation of CONVERD's the CONVERDS activities. The network will operate taking into account the set-up, already established within the country NARS, in terms of their organizational structure for example, in Tanzania, the national coordinating committee in vegetable research; in Zambia, the Zambian
vegetable research team; in Zimbabwe the horticulture research institute; and in Botswana the national vegetable research unit. There will be country vegetable research leaders who will take regional responsibility to carry out specific networking tasks, while continuing to function within his/her own national system. Each country with leadership responsibility will appoint a CONVERDS research leader, who will continue as a NARS country employee, but in addition taking regional research responsibilities on behalf of the network. It is recognized that the additional responsibilities given to the leader of the network will make important regional demands on the scientist; in such cases, CONVERDS will provide support services so that the leader can carry out effectively the national and the regional activities. The duties and responsibilities of the country vegetable research leadership and the leaders within the regional network will include:

- to provide the leadership and to be the focal point for the collaborative research and/or other activities related to a particular vegetable crop.
- with the cooperation of their national researchers and the assistance of the coordinator and relevant regional specialist, to design and formulate the budget needs for the annual working plan activities.
- to collaborate with other country research counterparts in carrying on the network regional activities.
- maintain effective liaison between and among researchers of the region, as well as with AVRDC and their specialist.
- advise the coordinator on matters related to the research and activities undertaken as a part of CONVERDS.
- report on the results obtained as a part of their regional activities.

35. **Operational Relationships**

In summary, national agricultural research systems, actively participating in the network, are the basic implementing units for collaborative research. A national vegetable program leader entrusted with research responsibilities for a specific crop, for example, will be the focal point for all network activities related to the crop. Specialists
deployed by the executing agency will work with their national counterparts within the respective national systems. Lead country in a specific commodity or activity can be collaborator in another commodity or activity assigned to another country.

The coordinator will be housed within the coordinating NARS whose Director of Research will also be the chairman of the oversight committee (SAVRECO). He will work through national team leaders and consolidate national research reports, work program etc. through consultations and the mechanism of the Executive and Technical Committee.

The oversight committee (SAVRECO) within the framework of SACCAR, will set the policy for the network, ratify the strategic plan and review and approve the annual work program and budget.

36. Legal, political and logistic support. The Southern African Centre for Cooperation in Agricultural Research, SADCC/SACCAR, shall provide the legal and political umbrella for CONVERDS. SADCC/SACCAR's main task will be to facilitate the provision of support services and functions as may be necessary in order to assist the coordinator, his/her expert team, and the NARS leaders in the design, planning, monitoring and implementation of the network's program. The functions of SADCC/SACCAR shall be as follows:

- serve as a base for the governing body (SAVRECO) of the network.
- participate, through representatives in the oversight committee (SAVRECO) and the Executive and Technical Committee (ETCO) in the overall planning, programming, budgeting and monitoring of the network.
- draw up the memorandum of understanding among all parties involved, i.e. SACCAR, AVRDC, NARS, to establish the network and enable its effective functioning.
- provide assistance for obtaining donor support where required.
- secure, in close interaction with AVRDC, the coordinator, and the NARS, the overall political support of the regional network activities, particularly workshops, seminars and other activities which will help promote a rapid and continuous interchange and utilization of scientific and technical information in the SADDC region.
37. **Administration and funding mechanisms.** The network according to its mandate, does away with the concept of independent research by the network staff; instead, the team will engage in joint research with the NARS - vegetable research units.

Such an arrangement and the fact that CONVERDS is a new regional approach to technical cooperation among different organizational elements (SACCAR; AVRDC; Southern African NARS; and donors) make imperative that the administration and, in particular, the funding and disbursement mechanisms be flexible, easy to carry out, and non-bureaucratic.

As CONVERDS will be partly autonomous of SACCAR in the sense that all its strategic decisions rest on SAVRECO, the administration of funds shall be charged to an institutional element of the network which is vested with adequate experience to meet the fiscal management standards of the donors.

AVRDC, appears to be the network member which bears the infrastructure, expertise and credentials to administer the network's financial resources and is thus proposed to be vested with this responsibility.

56. AVRDC, will, as a result, fulfill a dual role within the regional framework, i.e. as a technical resource base and as a fiscal administrator; in other words, it will receive the funds directly from donors and disburse them according to the network's annual budget approved by SAVRECO; AVRDC shall organize the proper account and auditing procedures, as well as submit the required accounting reports to the donor(s), as the case may be.

The director and the financial officer of SACCAR shall act as the administrative counterparts of AVRDC in terms of the mechanisms and procedures for the disbursement of the approved operational budget of the network.

The disbursement of the approved budget for network operation will be done through an "operating fund" to be handled by the financial officer of SACCAR, who in turn, shall insure that the financial resources are received
in timely fashion by all implementing units of the network, including the network team, through the network coordinator.

The use of a "revolving fund" under the responsibility of the network coordinator, is proposed to provide him/her and the team of specialists with sufficient latitude to operate; in such case, the coordinator shall be accountable to the financial officer of SACCAR.

Salary and other benefits for all internationally recruited specialists and consultants, as well as acquisition of equipment and vehicles on behalf of the network, shall be directly handled by AVRDC.

General Network Strategies

38. Gradual evolution of collaborative research. A regulated but systematic build-up of the network seeks to avoid a drastic dispersion of efforts. Moreover, the capacity for research in the region is generally not sufficiently strong to sustain an immediate vigorous drive towards a full-fledged research partnership. While the specific dimensions of the network should be worked out in a regional forum, the present mission provides some indications, as below, where conservative thoughts may be placed.

- even though vegetables are comprised of a wide range of species, it is advisable that the network start initially with a few strategically important ones where common researchable constraints exist. As indicated earlier, four species appear to be prime candidates for consideration - tomato, cabbage, onion and leafy amaranth.
- it also appears that the crucial areas of network research may be confined initially to a few areas where incipient research capacities exist and for which research priorities are high among the NARS. Three very important fields of investigation stand out and deserve emphasis in the proposed collaborative partnership: adaptability trials and selection of appropriate genotypes for specific agroecological conditions; plant protection research; and, development of suitable seed production technology.
while each member state of SADCC shall be a beneficiary of technology and information generated by the network and will participate in the training activities, the selective leadership and active participation in the network's research programs should be initially limited to comparatively advanced national programs in order to secure positive efforts in technology generation. An analysis of the comparative strengths and weaknesses of SADCC's NARS indicates that selective leadership may be allocated on a commodity and/or cross-commodity bases, as the case may be, as follows:

< lead role for Tanzania on onion research and on non-research function such as training in horticulture at the diploma level;
< lead role for Zambia on seed production research and on leafy amaranth research;
< lead role for Zimbabwe on professional training at the B.Sc. level and above (assuming that SADCC formalizes the proposal to name the University of Zimbabwe as the center of training in horticulture for the SADCC region) and on tomato research, with special emphasis on adaptation trials for major agroecological conditions existing in the SADCC region, and,
< while Malawi was not visited by the mission, published reports indicate its comparative strength on research with exotic leafy vegetables and therefore, it appears to be well placed to take the lead role in leafy Brassica research, in particular, research on common cabbage.

39. Enhancement of the NARS' capacity for research. The pervasive deficiency of trained professionals engaged in vegetable research in the SADCC countries necessitates that the development of human resources be one of the cornerstones in the proposed initiative in the region. Without the enhanced capacity for research, further development and sustenance of the collaborative relationship are bound to fail. Moreover, any plan by the executing agency to devolve the management of the network to the NARS after a fixed time period would no doubt collapse. Trained manpower must,
indeed, be an integral component of the network's formula for success.

Manpower development is proposed to be geared towards two important goals, namely:

- the build-up of a nucleus of vegetable researchers in every NARS working together as a multi-disciplinary team, and;
- development of a center for professional training in horticulture in the SADCC region which will play the major role in the future build-up of the critical mass of scientists in every SADCC country.

To achieve the above goals, four levels of training are envisaged:

- **Diploma training**: This is a two-year course proposed to be conducted by the Horticultural Research and Training Institute (HORTI) at Tengeru, Tanzania (currently, the only institution in SADCC region offering diploma in horticulture). This level of training is expected to help in developing a core of technical support staff for the professional horticulturists in each NARS as well as enhance the capability of NARS personnel making their careers in extension or other research entities.

- **Advanced degree training (M.Sc. and above)**: This training aims to upgrade the capability through graduate studies abroad of the faculty members in the center of learning identified for future training of professional horticulturists in the SADCC region. The future center for horticultural education (B.Sc. and above) may be either centralized in one institution such as the University of Zimbabwe (currently proposed as SADCC’s future center for M.Sc. training in horticulture) or split at two levels, i.e. B.Sc. training in an institute already with the nucleus staff and experience in diploma-level course which could therefore be easily upgraded (e.g. HORTI/Tengeru teamed up with Sokoine Agricultural University at Morogoro, Tanzania) and training for M.Sc. degree and above at University of Zimbabwe. Either way, the advanced degree training abroad for staff members
of this center for horticultural education in SADCC is a necessary precondition for success.

**Special skills training:** This type is a short-term (approximately a five-month course) research internship or vegetable production course for SADCC's professional level (B.Sc. or higher) vegetable researchers at AVRDC or other suitable centers of vegetable technology training such as the IAC in Wageningen, Netherlands. The training is aimed to sharpen the skills for vegetable research of SADCC's NARS personnel. Special emphasis will need to be placed on the training of NARS personnel who are directly engaged in network research, particularly at AVRDC, where the curriculum could be specifically tailored to meet the crucial needs of the network.

**Professional (B.Sc or higher) training at SADCC's center for horticultural education:** This training aims to develop the so-called "home-grown" professionals and should be aimed at achieving the critical mass of trained scientists in each NARS. Since this training is in the SADCC region, it will be comparatively cheaper thereby enabling each NARS to maximize the scarce resources available for manpower development. Moreover, students are more apt to be working on research problems that are realistically their own and thus be more relevantly related to the pressing needs of the region's vegetable farmers.

40. **Deployment of an expert team.** The inadequacy of trained manpower in the SADCC region will unquestionably impede the nurturing and further development of a collaborative primordium. Thus, while most of the region's vegetable researchers are developing their research skills through various forms of training, there is a need to nurse the initial "seeds" of collaborative research until such time that the capacity for research of the NARS personnel has improved. The deployment of a team of qualified experts is viewed as a necessary cog not only to help fill the expertise gap in the network but also as a molding influence to the region's future vegetable experts. These experts are not expected to work independently; rather, they are to undertake joint research projects that are mandated and
approved by the network. Apart from this, the experts shall be heavily involved as well in major training courses and workshops conducted by the network.

Based on the projected research and non-research priorities for the network's program, the following experts will be needed to form the full complement of the expert team:
- 1 Network Coordinator
- 1 Plant Breeder
- 1 Horticulturist
- 1 Plant Protection Specialist
- 1 Training Officer cum Information Specialist

As the coordination activity may not be full blown in the beginning, it is proposed that the Network Coordinator also perform part-time research duties (perhaps in the first two years) until such time that the coordination tasks or the research duties become demanding.

Neither training nor information-related duties are expected to demand full-time staff members at least during the formative years of the network. Thus, it is proposed that a staff with an exceptional ability to carry out both tasks be posted with the team.

Development of a future network coordinating unit. In order to insure the long-term stability of the network even long after the devolution of the management from AVRDC to SADCC's NARS, a network coordinating unit will need to be purposefully developed from among the participating NARS. This unit shall also serve a liaison function between AVRDC, as a continuing source of technology, and region's NARS.

While it is tenable to argue that this coordinating NARS could be allowed to gradually evolve with the network, it is far more preferable that its development starts at the earliest possible time for several reasons:
- definition of the future coordinating unit will automatically define the headquarters for the coordinator and the expert team;
- a deliberate build-up of infrastructure and manpower to vest the unit with the wherewithal for managing the network in the future could already by instituted.
- defining the future coordinating unit in the early stage of the program will allow the gradual development of the required professional relationship between itself and the collaborating partners and to have the potential problems removed.

While the present mission recommends the early definition of the future coordinating unit, it recognizes that this effort will likely require the general consensus of SADCC member states. However, all possible objectivity in choosing the most qualified NARS to assume this future role must be maintained for the benefit of the network. The fundamental parameters against which candidate NARS ought to be measured are as follows:

- recognized potential for leadership in vegetable research in the SADCC region;
- good capacity to tap its manpower resource for qualified researchers who will be trained as future members of the coordinating unit;
- existence of an infrastructure base for research, training, and information which can be upgraded to a full-fledged center of research and development expertise in the region;
- stability of professional staff to insure continuity;
- good logistical bases to support the operation and the effective functioning of the network coordinator and the expert team, and;
- strong government support to minimize bureaucracy and assure the smooth management of network activities before and after its devolution from AVRDC to the future coordinating unit.

42. Institutionalized monitoring and evaluation. The monitoring and evaluation of the network shall constitute a regular and important activity to insure a smooth network management and highly focused programs. This activity shall be undertaken at three levels:
At the highest level, SAVRECO functioning as an oversight committee, shall have the opportunity to review and approve the network's short- and long-term agenda of activities. Moreover, it shall serve the purpose of overseeing the network by developing the guidelines for priority setting.

The second level is at the executive/technical level (ETCO) where the national vegetable team leaders actively participate in annual programming of network activities and assist the network coordinator and his/her staff of experts in developing the strategic plan of the network.

The third level is at the NARS level where the national vegetable team leader is expected to monitor the network-mandated activities, be they on behalf of another NARS with selective leadership on a particular commodity or for the commodity whose selective leadership is assigned to his/her own NARS. The NARS team leaders will receive support from the network to carry out an annual meeting among researchers in his/her country who are actively involved in the network's research so that prior activities could be reviewed and a systematic plan for the following year prepared. The national vegetable team leader is to present the research report and the subsequent plans during the ETCO meeting.

In addition to the above, the network coordinator and/or his/her staff shall undertake a strategically scheduled monitoring tours of the active network partners to keep in step with the developments and constraints in their research activities. Respective national vegetable team leaders will be included in this monitoring activity depending upon the commodity research or other activities under review.

While monitoring should be a process undertaken continuously, periodic technical and management reviews (including the evaluation of the network's impact) shall be carried out in regular time phases. The first of such external reviews, probably somewhat scaled-down in intensity because of recent start-up, will be conducted during the second year of the project.
A more intensive review is scheduled during the fourth and penultimate year of the project and has, as one of its goals, the purpose of evaluation with concomitant recommendations for use in developing the future plans of the network after the proposed five-year support terminates.

43. Development of a technical information base for vegetables. A major institutional constraint which limits progress in vegetable research in many SADCC countries is the poor access by researchers to the state-of-the-art information in their field of investigations. Even if a reasonable budget is allocated to publications, as in the case of Zimbabwe, a major difficulty lies in securing foreign currencies, thus hampering the ability of research institutes and universities to regularly subscribe to vital scientific journals or purchase important books and other articles of information from the advanced technology sources such as those in European countries and the United States. Even the exchange of information on vegetable research within the SADCC region appear to be still limited and could be greatly improved in the future.

One of the important strategies of the proposed network, therefore, is the development of a technical information base for dissemination to the vegetable researchers in the region. Initially, the emphasis will be on compiling the information on vegetable research in the SADCC region, to be extended later to cover the African continent. An attempt to expand the network's information base to include selected information from other established databases (e.g. CAB, AGRIS, etc.) may be implemented later once the capability of the network's information unit improves. Meanwhile, the overall goal of the network's information service is to keep vegetable researchers in the SADCC region posted on recent development in vegetable science, particularly within the region but not excluding selective documentation of technological advances elsewhere. Publications of newsletters, bibliographies and selected abstracts will be a regular activity of the information unit. In addition, sharing of databases with the NARS and encouraging each to disseminate the information to vegetable researchers in the country will be among its major functions.

44. Conduct of regional workshops. To promote vigorous interactions and scientific exchange and to foster a healthy atmosphere of collaboration
among SADCC's vegetable researchers, particularly those involved in the network-mandated research, region-wide workshops are proposed for the third and fifth year of the project. These workshops shall also provide platforms to review network research, and to discuss and develop long-range strategic plans for the network. It is also a venue to deliberate on certain policy issues and develop recommendations for transmission (through ETCO) and further studies by the policy-making body (SAVRECO) of the network.

45. Conscious regard for the welfare of smallholders. As noted earlier, agricultural services and investments in many SADCC countries have favored commercial vegetable farmers. There are already efforts in several SADCC's NARS to alter this trend and to start paying greater attention to communal farmers. The network research shall be consciously aimed, whenever feasible, in addressing the needs of this sector in order to assist the NARS in its efforts to redress their previous shortcomings. The proposed priority crops and research thrusts of the network partly reflects this attempt. Leafy amaranth is a favorite vegetable among the rural poor. While other crops proposed for the network, i.e. tomato, onion and cabbage, seem to be purely commercial-oriented vegetables, it is noted that smallholders do grow them especially those farming in close proximity to the market. In this regard, these crops are relevant to the needs of the smallholders yet popular enough among commercial-scale vegetable farmers as to benefit them as well in the process. In indirect terms, helping the commercial farmers develop these vegetables for local and/or export market shall also have a useful fallout in terms of creating employment opportunities for the rural poor.

Expected Output

46. CONVERDS should be viewed as an organization which will, out of necessity and design, evolve in stages, but with clear objectives to insure positive contributions in short- to long-term bases.

In the short-term, the following results are expected from the initial activities of the network:
sound assessment and priority settings for vegetable research and development at the national and regional levels;

formulation of strategic technical and institutional approaches aimed towards resolving the major constraints limiting the progressive development of the vegetable industry in the SADCC countries;

establishment of a framework for research partnership among SADCC countries and with external technology sources such as AVRDC and other institutions engaged in vegetable research.

In the medium to long-term bases, tangible accomplishments are expected in the following areas:

- generation of concrete research findings resulting in the provision of technologies and other services to the vegetable farmers in the form of improved cultivars, appropriate production techniques, good quality seeds, etc.

- development of a nucleus of vegetable researchers in SADCC's NARS with improved capacity for research and interacting vigorously with each other and with researchers within and outside the SADCC region;

- promotion of a center of excellence in horticultural training in the SADCC region with an enhanced capacity to continually develop professional horticulturists, eventually to achieve the critical mass of technical people in the NARS and in the region which are required to generate new technology;

- development of a center of leadership in vegetable research and development in the SADCC region to perform the future role of coordinating the activities of the collaborative research network after its devolution from the external executing agency;

- finally, it is expected that a long-lasting framework for
collaboration in vegetable research in the SADCC region will be in place, with strong linkages among the component NARS and with other regional and international institutes, and serving as an excellent model of research partnership for the developing regions of the world.

VII. PROPOSED BUDGET

The proposed budget is divided into two parts, namely: start-up budget and the indicative network budget.

Start-Up Budget

47. It is proposed that seed money amounting to $185,000 be allocated for the purpose of preparing for and conducting a regional planning workshop which will help define crucial issues of networking in the SADCC region. The ultimate output of the regional workshop is a comprehensive proposal for developing a collaborative vegetable research and development network in SADCC region. Major line items in the start-up budget are self-explanatory and placed below in Table 2.
Table 2
STARTUP BUDGET
(IN US dollars)

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Analysis and Preparation of Country Reports</td>
<td>$30,000</td>
</tr>
<tr>
<td>- Honorarium</td>
<td>$10,000</td>
</tr>
<tr>
<td>- Domestic travel (including hotel and food)</td>
<td>15,000</td>
</tr>
<tr>
<td>- Travel in SADCC region by workshop coordinator</td>
<td>5,000</td>
</tr>
<tr>
<td>2. Regional Planning Workshop (five-day meeting)</td>
<td>77,000</td>
</tr>
<tr>
<td>- Regional travel (incl. food/hotel) of NARS/SACCAR reps</td>
<td>45,000</td>
</tr>
<tr>
<td>- Meeting facilities</td>
<td>5,000</td>
</tr>
<tr>
<td>- Miscellaneous (incl. communication/stationeries, secretarial services, and others)</td>
<td>7,000</td>
</tr>
<tr>
<td>- Publication &amp; distribution of proceedings and preparation of the joint proposal</td>
<td>20,000</td>
</tr>
<tr>
<td>3. Mutual Orientation Program (AVRDC/SACCAR)</td>
<td>70,000</td>
</tr>
<tr>
<td>- International travel for 4 SACCAR/NARS staff on orientation tour of AVRDC/SE Asian vegetable network</td>
<td>35,000</td>
</tr>
<tr>
<td>- International travel for 4 AVRDC reps to regional workshop and visit to SADCC member states</td>
<td>35,000</td>
</tr>
<tr>
<td>4. Contingency (5%)</td>
<td>7,350</td>
</tr>
<tr>
<td>GRAND TOTAL</td>
<td>$184,350</td>
</tr>
</tbody>
</table>

Notes:
- The above budget is projected for carrying out the national consensus meetings and the joint regional workshop of representatives from SADCC’s NARS, SACCAR, AVRDC, donors, and other interested parties.

- Estimates based on a projected participation of 50 people as follows:
  NARS = 27          SACCAR = 2          AVRDC = 4
  Donors = 5          NGOs/PVOs = 5        Other IARCs = 5

12/ The total budget will need to be adjusted upward by approximately $20,000 if an AVRDC expert is brought to the region on short-term basis to assist SACCAR in coordinating the major start-up activities.
47-2. It is proposed that SACCAR takes the responsibility of coordinating start-up activities, i.e. preparation of country reports, consolidation and holding of the regional consultative workshop. SACCAR might opt to request assistance of AVRDC in carrying out this task, in which case the budget should be adjusted upward by $20,000 to cover the additional cost of bringing in a short-term AVRDC expert into the region. AVRDC in consultation with SACCAR will publish the proceedings of the workshop, prepare the final project document for the five-year rolling work program and the 10-year strategic plan.

47-3. Assuming that the preparatory phase and the start-up budget are approved by the donors, it is expected that the above activities will commence in January 1990 leading towards the regional workshop in June/July and finalization of project document for approval by SADCC and CGIAR in September and October 1990, respectively. The network can then be operative in January 1991.

Indicative Network Budget

48. While a comprehensive budget will be developed during the regional workshop at the start-up phase, an indicative network budget was prepared (Table 3) for initial reference. The major line items of the indicative budget are elaborated below.
<table>
<thead>
<tr>
<th>Item</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Staff Cost</td>
<td>$600,000</td>
<td>$648,000</td>
<td>$850,000</td>
<td>$920,000</td>
<td>$990,000</td>
<td>$4,008,000</td>
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<tr>
<td>2. Capital Cost</td>
<td>250,000</td>
<td>25,000</td>
<td>87,500</td>
<td>30,000</td>
<td>30,000</td>
<td>422,500</td>
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<tr>
<td>3. Equipment Cost</td>
<td>250,000</td>
<td>75,000</td>
<td>125,000</td>
<td>82,500</td>
<td>82,500</td>
<td>615,000</td>
</tr>
<tr>
<td>4. Support of Network Activities</td>
<td>70,000</td>
<td>80,000</td>
<td>100,000</td>
<td>100,000</td>
<td>100,000</td>
<td>450,000</td>
</tr>
<tr>
<td>5. Contract Research</td>
<td>50,000</td>
<td>50,000</td>
<td>40,000</td>
<td>40,000</td>
<td>30,000</td>
<td>210,000</td>
</tr>
<tr>
<td>6. External Review/Evaluation</td>
<td>-</td>
<td>50,000</td>
<td>-</td>
<td>50,000</td>
<td>-</td>
<td>100,000</td>
</tr>
<tr>
<td>7. Annual Programming Meeting</td>
<td>10,000</td>
<td>10,000</td>
<td>10,000</td>
<td>10,000</td>
<td>10,000</td>
<td>10,000</td>
</tr>
<tr>
<td>8. Regional Review and Planning</td>
<td>-</td>
<td>-</td>
<td>70,000</td>
<td>-</td>
<td>85,000</td>
<td>155,000</td>
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<tr>
<td>Workshop</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Training Cost</td>
<td>480,000</td>
<td>480,000</td>
<td>650,000</td>
<td>520,000</td>
<td>520,000</td>
<td>2,650,000</td>
</tr>
<tr>
<td>10. Contingency (5%)</td>
<td>85,000</td>
<td>69,000</td>
<td>96,250</td>
<td>86,125</td>
<td>91,375</td>
<td>428,525</td>
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<tr>
<td>11. Administrative Cost</td>
<td>215,460</td>
<td>176,148</td>
<td>240,975</td>
<td>217,035</td>
<td>230,265</td>
<td>1,079,883</td>
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<tr>
<td>Yearly Budget</td>
<td>$2,010,960</td>
<td>1,663,148</td>
<td>2,269,100</td>
<td>2,055,660</td>
<td>2,169,140</td>
<td>10,168,008</td>
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</table>
49. Personnel cost. This item is based on a figure of U.S.$150,000 per person per year (following the estimate given in the TAC document AGR/TAC: IAR/87/29 New CGIAR Ventures: Vegetable Research) for posting experts in Africa. The proposed posting pattern in the Southern Africa network is as follows:

Year 1 - Coordinator (also a part-time scientist during the first two years; either breeder, horticulturist); training and Information Specialist; Plant Protection Specialist, and one Breeder or Horticulturist, whichever the Coordinator is not);

Year 3 - One full-time breeder, horticulturist, or plant protection specialist (whichever the Coordinator is) to be added to the team during the third year to take the extra work load off the Coordinator. At this time, the job of coordination will have picked up and the research activities of the network is expected to intensify with the return of the national program personnel from various training courses abroad.

An estimated 8% increase in personnel cost per year is projected. Personnel cost includes salary and benefits, support services, travel, post-differential, and other allowances.

50. Capital cost. This figure is also based on the estimate of U.S.$250,000 (AGR/TAC:IAR/87/29) required for providing office, field and laboratory spaces and room renovations (e.g. meeting room, classrooms for the regional training program, etc.) adjusted slightly upward in anticipation of a relatively vigorous research and training coordination activities of the African team. The amount is distributed over a five-year period and reflects a phased posting of the team members.

51. Equipment. This budget item includes five (5) vehicles for the Africa team, one (1) minibus for the regional training center, four (4) pick-up trucks (one each for the NARS which are projected to actively participate in collaborative research during the first five-year phase), 10 desktop personal computers to give NARS researchers ready access to technical information databases) and various laboratory equipment for the Africa team
and for the participating NARS. As with the capital cost, the outlay for equipment reflects the phased deployment of the Africa team. The projected equipment budget for NARS is $200,000 spread equally over a four-year period starting from the second year. This is the same figure quoted for the proposed Africa network budget in AGR/TAC:IARI87/29. An annual budget for maintenance and repair (estimated as 10% of total equipment value) is also allocated from the second year onward.

52. Support of network activities. During the first two years, the level of collaborative research activities is not expected to be intense because of the technical staff in the NARS will be undertaking training of various nature. The network-mandated research is expected to intensify at about the third year and should remain at this level, if not more, until the end of the five-year program. The total budget also includes an annual allocation of $50,000 to support various information-related activities such as inventory of previous and current vegetable research in the SADCC region, development of a regional information database on vegetable research that can be easily accessed by researchers (to the level of abstract sourcing), publication of network newsletter and workshop proceedings, etc.

The research activities envisioned for implementation by the network include as follows: germplasm collection and maintenance, cultivar evaluation and selection, seed production experiments, plant protection research, production systems research, and a few other important special studies, e.g. marketing economics, development and utilization experiments, nutrition analysis etc. especially on the network-mandated crops, but not excluding a few of the allied, nearly equally important commodities such as okra, pepper, rape etc.

53. Contract research. An estimate amounting to $50,000 in year 1 and progressively declining thereafter is budgeted for contract research such as backstop research projects which may be contracted out to AVRDC or other research institutes in support of the network during its formative years. As the research capability in the network improves, this requirement for supporting research is expected to diminish. Some backstop research could
be contracted out to other countries in the continent with specific strength like onion-research in Senegal.

54. Annual programming meeting. In order to keep the network operation on an even keel, annual planning meetings are scheduled among the network coordinator, his/her technical staff and the designated national vegetable program leaders from the NARS estimated at no more than 5 NARS during the first five-year phase which are actively engaged in network research. The line item includes round-trip transportation cost and travel allowance (hotel and food) for participants attending the annual two-day planning workshop. The meeting venues are expected to be on rotational basis among the actively participating NARS.

55. External review and evaluation. Management and technical review of the network is programmed during the second year of its operation, to be repeated in the fourth year as a preparatory analysis for developing the future plans after the five-year project ends. The projected budget item includes travel, allowance (hotel and food), and honorarium (for invited experts) for a six-man external review team composed of representatives from SACCAR, AVRDC, NARS, invited expert and the CGIAR. Interested donor representatives may also be invited. The evaluation phase is projected as a three-week activity, including the preparation of the report and recommendation.

56. Regional technical review and planning workshop. Plans for a region-wide workshop among the vegetable researchers in the SADCC countries, SACCAR and AVRDC representatives, the Africa network staff and other interested parties are included in the third and the fifth (final) year. These workshops are projected as one-week exercises. The estimated budget includes transportation cost, travel allowance (hotel and food), publication fees and other essential services. Participation from each of SADCC’s NARS involves three participants at the policy and technical levels (particularly those involved in network research). The fifth year workshop is extended to include donor representatives and other experts invited for the purpose of an overall review of the network activities and future planning, taking into account the evaluation report and recommendations of the external review panel prepared in the fourth year.
57. **Manpower development.** The program is projected to strongly emphasize the upgrading of the NARS' research, training and development capability through degree-oriented and special skills training of the personnel of all member countries of SADCC. Budget estimates for training were calculated as follows:

- **Special skills training:** A five-month intensive research internship or vegetable production course at AVRDC or other suitable centers of training such as the IAC in Wageningen. The cost estimate is based on a round-trip travel cost of $5,000/scholar and a training fee (including tuition, book allowance, board and lodging, insurance, etc.) of $1,500/month or a total of $7,500 per scholar for the duration of training. A minimum of five scholars (B.Sc or M.Sc level) per NARS, spread equally over the five-year period, is proposed to go through this intensive course.

- **Two-year diploma training at HORTI-Tengeru in Tanzania:** Two (2) scholars per NARS per year or a total of 10 per NARS spread over a five-year period is proposed to undertake this course during the lifetime of the project. The cost estimate includes travel cost ($600 round-trip airfare per scholar) and a training cost (including tuition, board and lodging, book allowance and other supplies, etc.) of $2,500 per scholar per year.

- **Advanced degree training (M.Sc and above):** A total of ten (10) professionals is expected to undergo advanced training abroad (either USA or European universities). The cost estimate is based on a $20,000 support per student per year, each projected for a training duration of three years, and a round-trip travel cost of $12,000 per scholar (cost of two round-trip airfare tickets to USA).

- **Professional (B.Sc. or above) training in SADCC's center(s) of horticultural education:** Estimated cost is U.S.$5,000 per student per year (including transportation cost, board and
ladging, tuition, stipend, school supplies, etc.) based on figures provided by University of Zimbabwe during the mission's visit there. Training duration is two years for M.Sc. degree and four years for B.Sc. degree. A total of two students per NARS per year (estimated for B.Sc. level) is proposed to enter this SADCC-based professional training during the last three years of the project.
ANNEXES: 1 - 9
ANNEX 1

TABLES GIVING DATA FOR ANNUAL PRODUCTION, CONSUMPTION AND NUTRITIVE VALUE OF VEGETABLES

Table 1: Composition of some vegetables compared with pulses and starchy foods.

Table 2: Annual production and consumption of vegetables in the major regions of the world.

Table 3: Estimated daily vegetable consumption and annual production in developed, centrally planned and developing countries.

Table 4: Average daily intake of food (g per capita) reported in various surveys.

Table 5: Average nutritive value for vegetables.

Table 6: Potential yield of valuable nutrients from vegetables.

Note on Tables 4 and 5

ANV stands for 'Average Nutritive Value'.
This is derived from the equation:

\[ \text{ANV} = \frac{g\text{ protein} + g\text{ fibre} + \frac{mg\text{ Ca}}{100} + \frac{mg\text{ Fe}}{2} + mg\text{ carotene} + mg\text{ Vit. C}}{40} \]

It is a formula developed by Rinno (1965) for estimating the so-called 'Essential Factor of Nutritive Value'. Grubben (1977) regards ANV as giving a suitable picture of the relative dietary importance of different vegetables.
Table 1  Mineral and Vitamin content of some vegetables, compared with pulses and starchy foods. Extracted from PLATT (1975).
Requirements for an adult man (55 kg) from FAO/WHO standards for East Asia; protein biol. val. 60%

<table>
<thead>
<tr>
<th>Product</th>
<th>dry matter</th>
<th>calcium (mg)</th>
<th>iron (mg)</th>
<th>carotene (mg)</th>
<th>Thiamine (mg)</th>
<th>Riboflavin (mg)</th>
<th>Niacin (mg)</th>
<th>Vitamin C (mg)</th>
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<td>Starchy Basic Food</td>
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<td>0.25</td>
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<td>0.10</td>
<td>0.04</td>
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<td></td>
<td>Column 1 (total world production x 10^6 t)</td>
<td>Column 2 (world population x 10^6)</td>
<td>Column 3 (consumption/ kg/head)</td>
<td>Column 4 (consumption/ kg/head)</td>
<td>Column 5 (total world production x 10^6 t)</td>
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<td>------------------------------------------</td>
<td>-----------------------------------</td>
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<td>81</td>
<td>75.9</td>
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<td>S.W. and C. Asia</td>
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<td>40</td>
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<td>Centrally planned</td>
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Column: (1) and (2) : FAO production yearbook 1974. Rome, 1975.
(3) estimated (1)/(2) x 0.80. About 20% is lost as waste or used for seed.
(4) estimated average of nutritional surveys (net intake, edible portion) see table 3.
(5) estimated (4) x (2) x 1.25 see table 3.

Source: G J H Grubben, The Tropical Vegetables and their Genetic Resources. IBPGR Doe 77/23
<table>
<thead>
<tr>
<th>Type of Vegetable</th>
<th>Developed Countries</th>
<th>Planned Developing Countries</th>
<th>Developing Countries</th>
<th>World Production x 10^6 t</th>
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<td>cons. pro. for cons.</td>
<td>pro. for cons.</td>
<td>consumption</td>
<td>pro. for cons.</td>
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<td>g/day x 10^6 t</td>
<td>g/day x 10^6 t</td>
<td>per day</td>
<td>Production</td>
</tr>
<tr>
<td>1. tomato</td>
<td>1.16 85</td>
<td>1.3</td>
<td>9</td>
<td>55</td>
</tr>
<tr>
<td>2. peppers</td>
<td>1.0 90</td>
<td>1.1</td>
<td>6</td>
<td>7</td>
</tr>
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<td>0.7 90</td>
<td>0.8</td>
<td>2</td>
<td>2</td>
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<td>4. fleshy cucurbits</td>
<td>5.5 85</td>
<td>6.7</td>
<td>8</td>
<td>8</td>
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<td>6.2 85</td>
<td>7.6</td>
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<td>5</td>
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<td>6. heading cabbage</td>
<td>6.5 85</td>
<td>8.0</td>
<td>2</td>
<td>6</td>
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<tr>
<td>7. cauliflower, broccoli</td>
<td>4.8 85</td>
<td>5.9</td>
<td>8</td>
<td>1</td>
</tr>
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<td>8. leaf cabbage</td>
<td>1.0 80</td>
<td>1.3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>9. onions and shallots (dry)</td>
<td>5.1 90</td>
<td>6.3</td>
<td>4</td>
<td>2</td>
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<td>1.0 85</td>
<td>1.3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>11. garlic</td>
<td>0.3 95</td>
<td>0.1</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>12. leguminous pods</td>
<td>3.1 75</td>
<td>3.0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>13. green beans</td>
<td>1.0 85</td>
<td>1.3</td>
<td>2</td>
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</tr>
<tr>
<td>14. green peas</td>
<td>3.1 85</td>
<td>3.8</td>
<td>1</td>
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<td>15. dry beans for sprouting</td>
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<td>0.1</td>
<td>0</td>
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<td>5.1 85</td>
<td>6.3</td>
<td>1</td>
<td>1</td>
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<tr>
<td>17. green leaf veg. (excl. 8, 10, 16)</td>
<td>6.8 75</td>
<td>8.4</td>
<td>21</td>
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<td>18. carrot</td>
<td>3.8 85</td>
<td>4.6</td>
<td>1</td>
<td>1</td>
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<tr>
<td>19. roots, tubers (excl. 18)</td>
<td>2.4 75</td>
<td>2.9</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>20. shoots, sprouts, flowers, stalks</td>
<td>2.1 80</td>
<td>2.5</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>21. sweet corn</td>
<td>3.8 80</td>
<td>0.1</td>
<td>0</td>
<td>0</td>
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<td>22. okra</td>
<td>0.7 65</td>
<td>0.4</td>
<td>6</td>
<td>2</td>
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<tr>
<td>23. various seeds (excl. 13, 14, 15)</td>
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<td>0.1</td>
<td>0</td>
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<td>24. mushrooms</td>
<td>0.3 95</td>
<td>0.4</td>
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<td>1</td>
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<tr>
<td><strong>Total:</strong></td>
<td>221 75.3 87</td>
<td>88.6</td>
<td>69 60 162</td>
<td>110 101 87.9</td>
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<td></td>
<td>THAILAND&lt;sup&gt;1&lt;/sup&gt;</td>
<td>INDIA&lt;sup&gt;2&lt;/sup&gt;</td>
<td>SRI LANKA&lt;sup&gt;3&lt;/sup&gt;</td>
<td>PHILIPPINES&lt;sup&gt;4&lt;/sup&gt;</td>
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<td>----------------------</td>
<td>------------------</td>
<td>----------------------</td>
<td>----------------------</td>
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<tr>
<td></td>
<td>Muang</td>
<td>Chiang-Mai</td>
<td>Average of surveys</td>
<td>Average of surveys</td>
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<td>Cereals - Rice</td>
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<td>Wheat</td>
<td>510</td>
<td>502</td>
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<td>Other</td>
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<tr>
<td>Other</td>
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<tr>
<td>Pulses, nuts, seeds</td>
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<td>4</td>
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<td>18</td>
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<td>Roots and tubers (incl. plantains)</td>
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<td>93</td>
<td>11</td>
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<tr>
<td>Vegetables - leafy</td>
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<td>116</td>
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Sources:
1 Ministry of Public Health, Bangkok, Division of Nutrition 1955-59: (surveys of 30 families in Muang, 280 families in Chiang Mai).
2 Indian Council of Medical Research 1953: Results of diet surveys in India 1935-48.
<table>
<thead>
<tr>
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<th>G.J.M. Grubb, The Tropical Vegetables and their Genetic Resources. IBPGR Doc 77/23</th>
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<tbody>
<tr>
<td><strong>Table 5: Average nutritive value of vegetables. Data from:</strong></td>
<td><strong>Food composition table for use in East Asia (FAO, 1972).</strong></td>
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<td><strong>per 100 g edible portion</strong></td>
<td><strong>ANV per 100 g dry matter</strong></td>
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<td>16</td>
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<td>pepper, hot</td>
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<td>Lima bean (fresh)</td>
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<td>sprouts, bulbs, tubers, etc.</td>
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<td><strong>source:</strong></td>
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Table 6: Potential yield of valuable nutrients from vegetables.

Average Nutritive Value (ANV) and duration from Table 4.
Yield data recorded as "high production" in the USA (see KNOTT, 1966).
For the tropical vegetables (*) records of the Horticultural Centre, Porto-Novo, Benin (W. Africa) have been used.

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<th>Vegetable</th>
<th>Yield t/ha</th>
<th>Edible portion</th>
<th>ANV</th>
<th>ANV per m²</th>
<th>Duration</th>
<th>ANV per m² per day</th>
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<td></td>
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<td>Gross portion</td>
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<td>15</td>
<td>13.5</td>
<td>3.21</td>
<td>43</td>
<td>90</td>
<td>0.48</td>
</tr>
<tr>
<td>Cucumber</td>
<td>50</td>
<td>40.0</td>
<td>1.69</td>
<td>68</td>
<td>150</td>
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</tr>
<tr>
<td>Pumpkin</td>
<td>20</td>
<td>16.6</td>
<td>2.68</td>
<td>44</td>
<td>150</td>
<td>0.30</td>
</tr>
<tr>
<td>Watermelon</td>
<td>40</td>
<td>25.2</td>
<td>0.90</td>
<td>23</td>
<td>120</td>
<td>0.19</td>
</tr>
<tr>
<td>Leaf vegetables</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Amaranth</td>
<td>30</td>
<td>18.0</td>
<td>11.32</td>
<td>204</td>
<td>50</td>
<td>4.08</td>
</tr>
<tr>
<td>Kangkong</td>
<td>30</td>
<td>25.8</td>
<td>6.99</td>
<td>180</td>
<td>90</td>
<td>2.00</td>
</tr>
<tr>
<td>Chinese cabbage</td>
<td>20</td>
<td>14.8</td>
<td>5.35</td>
<td>79</td>
<td>50</td>
<td>1.58</td>
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<tr>
<td>White cabbage</td>
<td>40</td>
<td>34.0</td>
<td>3.52</td>
<td>120</td>
<td>90</td>
<td>1.33</td>
</tr>
<tr>
<td>Cassava leaves</td>
<td>60</td>
<td>22.2</td>
<td>16.67</td>
<td>870</td>
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<td>3.22</td>
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<tr>
<td>Leguminous vegetables</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Asparagus bean (pods)</td>
<td>7</td>
<td>6.2</td>
<td>3.74</td>
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<tr>
<td>Lima bean (fresh)</td>
<td>9</td>
<td>5.1</td>
<td>4.88</td>
<td>25.0</td>
<td>210</td>
<td>0.12</td>
</tr>
<tr>
<td>Mung bean (sprouted)</td>
<td>2.5b</td>
<td>20.9</td>
<td>2.94</td>
<td>61.5</td>
<td>110</td>
<td>0.56</td>
</tr>
<tr>
<td>Hyacinth bean (dry)</td>
<td>3</td>
<td>3.0</td>
<td>14.03</td>
<td>42.1</td>
<td>180</td>
<td>0.23</td>
</tr>
<tr>
<td>Bulbs, tubers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Onion</td>
<td>40</td>
<td>38.4</td>
<td>2.05</td>
<td>78.7</td>
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<tr>
<td>Carrot</td>
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<td>6.48</td>
<td>107.6</td>
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<td>1.20</td>
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<tr>
<td>Taro</td>
<td>20</td>
<td>16.8</td>
<td>2.38</td>
<td>40.0</td>
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<tr>
<td>Turnip</td>
<td>13</td>
<td>10.3</td>
<td>2.03</td>
<td>20.9</td>
<td>80</td>
<td>0.26</td>
</tr>
</tbody>
</table>

a) ANV (for 100 g) x edible portion (t/ha) = total ANV per m²
b) 1 kg of dry mung bean produces 9 kg of sprouted beans

Source: G J H Grubben, The Tropical Vegetables and their Genetic Resources.
IBPGR Doc 77/23
Recommendations

Research

1. Introduced and indigenous horticultural crops should be listed and documented so that selection of germplasm can be made to improve the horticultural industry.

2. Training of technical assistants and professional staff should be improved. Their progression in the fields of their specialization should be monitored to be more effective in their research work and to maintain them.

3. Resources (both material and personnel) and research facilities should be improved.

4. A SADCC Vegetable Breeding Project should be established to develop pests, diseases, and environmental stress, resistant varieties and produce suitable seed.

5. Annual horticultural workshops should be held to encourage exchange of germplasm and publications.

Possible priority research projects in horticulture

1. A strong research team should be formed to identify cashew cultivars resistant to the most important diseases and pests, such as Oidium spp. and helopetes spp. and their control and to study vegetable propagation, agronomic factors and processing.

2. In so far as National interests and world markets guarantee, research on coconut and oil palms should, at the moment, remain at national levels. This, however, should not rule out collaboration among member states in SADCC.

3. Research and Production in SADCC countries is limited by water even where there are potential rivers. Work should be done to identify potential areas to use and conserve water (e.g. dam building). This would alleviate the effect of drought which is currently affecting most SADCC countries.

4. Regional expertise should be recognized and used wherever possible by SADCC countries in future projects in preference to expatriates who have no local experience. SACCAR should keep and maintain a directory of horticulturalists within the region for the above purposes.

Production, Marketing, Processing, Utilization and Nutrition

1. Government Policy should be clearly defined and production priorities should be precisely spelt out.

2. The government:
   (a) ought to be committed and ensure the implementation of its policies and follow up action;
   (b) should be flexible with some of its existing regulations that are by nature capable of hampering successful implementation of programs stipulated in its policy i.e. duty and taxes on raw materials such as pesticides, fertilizer, irrigation pumps, packaging material, air freight charges etc;
   (c) should ensure availability of well trained staff cadre for research and extension;
   (d) should encourage formation of farmer's cooperatives which should coordinate production and marketing of produce mostly by smallholder farmers;
   (e) should ensure availability of inputs and ensure that horticulture is on the priority list for allocation of foreign currencies;
   (f) should encourage improved linkages between research extension, and farmers to improve relevancy of research objectives and development of appropriate technologies for evaluation by farmers in on-farm trials and extension educational programs;
   (g) should provide guidelines for marketing of horticultural crops.
   (h) should improve the road net-work for crop extraction and distribution...
   (i) should encourage the formation of farmer based...
local organizations such as marketing boards, cooperatives which will make available marketing facilities (trucks, cold rooms, pre-coolers); stabilise prices promote consumption of the highly nutritious vegetables of both local and foreign origin;

(j) should promote marketing and processing research, develop techniques on processing (solar energy), preservation, utilization and development of recipes to utilise the available indigenous vegetables and fruits;

(k) should develop the appropriate technology on packaging and packaging material using readily available and cheap local material such as bamboo, banana/plantain leaves.

3. There is a pressing need to establish a SADCC Vegetable Seed Production Project to supply good quality seed to the SADCC countries and which could form a seed foundation for the vegetable industry.

4. There is strong need to establish a SADCC Vegetable Research Institute to:

(a) develop varieties;

(b) develop production technology relevant to the SADCC countries for both the indigenous and exotic species;

(c) help in the production of high quality seed in cooperation with the seed producing companies and liaise with the network of national research stations.

5. There is a need to establish a SADCC Fruit Tree Research Institute to coordinate the collection of the best available germplasm of the world for both indigenous and exotic fruits and vegetables; develop new varieties and production packages of appropriate technology relevant to environmental conditions of SADCC countries; to run a Central nursery of the largest collection of germplasm which will be maintained by member countries and where plants will be vegetatively propagated.

5.2 Emphasis should not be limited to cashew, palm oil and coconut but should also be placed on all major crops that can be used for export substitution for generating foreign currency and for improving incomes of farmers and the dietary quality of the ordinary people.

5.3 The following crops should be looked into: citrus; mango; pineapple; strawberry; plantain; banana; coffee; macadamia; passion fruit; grape; apple and peach as the production of these crops is not as advanced in the SADCC region as it is in other African countries.

6. SADCC should form a SACCAR Services Coordinating Unit for rendering services most needed by SADCC member countries. The Unit's responsibilities would be to:

(a) update, develop and expand the national and regional horticultural resources data base on agrometeorological data that eliminates potential production areas for special crops and maintain central libraries for dissemination of information through journals a newsletter and produce guides for use by researchers, extension agents and producers.

(b) Provide an updated information on supply and demand of horticultural produce and products on the domestic markets within countries of the SADCC region and overseas for the benefit of producers and importers.

(c) Provide sales promotion of horticultural produce in SADCC countries and any relevant intelligence to facilitate exports of the produce.

(d) Update information on nutrition, amounts consumed, and the plans to increase production to meet consumption requirements.

There is a need to establish training facilities at one of the universities in SADCC for training at postgraduate level in horticultural production, processing storage and marketing.

Training and Extension

1. Certificate Level Training
Institutions offering certificate in general agriculture should be encouraged to introduce additional horticulture courses and support courses should use horticulture examples.

2. Diploma Level Training
(i) Institutions offering Diploma in General Agriculture should offer an option in horticulture.

(ii) A Regional Horticulture Institution should be identified to train horticulture specialists.

3. Graduate Level
(i) The Regional Institution should also offer MScand PhD in horticulture;

(iii) National institutions considering introducing MSc. programmes in Horticulture should be encouraged.

4. Extension

(i) Extension workers lacking training in horticulture should be given inservice training on the subject.

(ii) National and regional short courses on workshops should be introduced.

5. General

(i) Regional Institutions should also offer course in English for non-English speaking students.

(ii) Exchange of Horticultural Personnel within the region should be encouraged.
HORTICULTURAL RESEARCH IN SADCC

TECHNICAL ASSISTANCE FROM THE JAPANESE GOVERNMENT TO UNDERTAKE A FEASIBILITY STUDY TO ESTABLISH A REGIONAL RESEARCH UNIT TO BREED VEGETABLE SEEDS

Horticulture is important to both temperate and tropical regions for nutritional, ornamental and foreign exchange earning purposes. Vegetable growing in particular is not adequately developed in most tropical countries including those which are members of the Southern African Development Coordination Conference (SADCC). Table 1 shows FAO production figures of vegetables for domestic and export production for developed, centrally planned and developing countries in 1974, respectively. Vegetables play the following roles in the diets of people in developing countries.

- Enrich diets with nutrients
- Render staple food more palatable hence enhance intake
- Improve digestion
- Possess curative effects.

Table 2 shows that Africa has the lowest consumption in kg per head of vegetables.

Horticulture is served by very few research scientists in SADCC. In all SADCC member States approximately three out of every hundred researchers work in horticulture.

In developed countries investment in horticulture is high, for example in U.S.A. the expenditure is five times higher than in cereals' research if the two are compared on a produce-value basis.

Ref. Tropical Vegetables and their Genetic Resources IBPGR/FAO Rome. 1977
In addition to current demands for vegetables there is a high demand growth rate due to urbanisation. SADCC must double up its research in horticulture. The successful research programme would need to have a substantial element of production and economics research in order to show the economic benefits in monetary terms that the potential producer may derive from the various crops.

The development of horticulture in SADCC will depend on the availability of good genetic material - good quality seeds and it will mean having horticultural research station at regional level and this will be networking with national research stations. The tested material will be bulked and distributed to smallholder farmers in both urban and rural areas for production.

It is being recommended therefore that the Japanese Government be requested to send a four man team comprising:

1. Vegetable production research agronomist
2. Vegetable seed production specialist
3. Vegetable processing specialist
4. Vegetable marketing agricultural economist.

**TERMS OF REFERENCE FOR THE TEAM**

1. Study the production of vegetables in each of SADCC member States any constraints to production and recommend how these might be removed.
2. Visit each of the SADCC countries to assess the vegetable production for domestic and exports markets.
3. Study the existing marketing system and recommend any improvements.
4. Study the vegetable seed production in SADCC and recommend a regional research project to test and breed vegetable seeds.
5. Investigate possibilities of setting up subprojects on research in vegetable seed production at national level and see how these can be linked to the regional research programme.

6. Investigate the capacity to undertake vegetable research in SADCC and recommend training overseas and later in Universities in SADCC in vegetable production research.

7. Look into the linkage of vegetable seed production research and commercial vegetable production.

**DURATION OF THE STUDY**

The team will spend about nine weeks in travel around SADCC. It will take about four weeks in finalising the report which will later be submitted to SACCAR for consideration by the Board and later by the Ministers of Agriculture.

**COST OF STUDY**

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
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<tr>
<td>Salary for 13 wks @ US $1700 per person per week \times 4 persons \times 13 wks based on US $80,000 per person per year as salary</td>
<td>88,400</td>
</tr>
<tr>
<td>Per diem of US $300 per day for 91 days and for 4 persons</td>
<td>109,200</td>
</tr>
<tr>
<td>Travel international for 4 persons</td>
<td>40,000</td>
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<tr>
<td>Travel within SADCC for 4 persons</td>
<td>20,000</td>
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<tr>
<td>Production of Report</td>
<td>2,000</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>259,600</td>
</tr>
</tbody>
</table>
The Hague, Netherlands
23 June 1988

Professor Martin Kyomo, Director
SACCAR
Post Office Box 00108
Gaborone, Botswana

Dear Professor Kyomo:

The Asian Vegetable Research and Development Center (AVRDC), based in Taiwan, is being asked by the international development community to get involved in Africa. Although AVRDC-developed vegetable varieties are already being used to different degrees in various parts of the continent, AVRDC has not had a direct involvement with African national research institutions, except for a vitamin A gardening project in Niger.

In this connection we are contemplating to take a more active role in Africa and have identified southern Africa and SACCAR as a possible entry point and partner for our involvement. I am writing this letter to sound out if there is interest on your part to have AVRDC associated with SACCAR in the area of vegetables R&D improvement.

In order to get to know each other better and lay the groundwork for potential collaboration, I foresee the following possible sequence of steps/activities:

STEP 1: Invitation by AVRDC to two scientists from southern Africa (one from SACCAR, and the second a national vegetables expert) to visit AVRDC in Taiwan to observe tropical and subtropical vegetables research and development in Taiwan, Philippines, Indonesia, and Thailand, to get acquainted with the Southeast Asian vegetable research network.

STEP 2: Report of a two-man mission to help SACCAR determine if there is a basis for further collaboration and involvement.

STEP 3: Visit of an AVRDC senior scientist to SADCC member countries, accompanied by a SADCC vegetables researcher; planning for a SADCC regional consultation workshop to determine regional priorities for vegetables research and prospective focal points and mode of collaboration.

STEP 4: Conduct of SADCC regional consultation workshop; preparation of proposal for external funding.

STEP 5: Approval by SACCAR Board of proposal on regional vegetables R&D.

STEP 6: Approval for funding by prospective donor.
Composition of the Mission

1. A. Z. M. Obaidullah Khan: CGIAR. Team Leader
2. Dr. Romeo T. Opena, Director, Crop Improvement Program, AVRDC
3. Dr. N. A. Mnzava, Senior Vegetable Research Officer, Zambia Seed Company & SADDC scientist;
5. Mr. Mogapi E. Madisa M.sc (Hort.), Research Officer, Department of Agricultural Research, Gaborone, Botswana.

Terms of reference:

-- Broadly focus on research and training requirements in countries participating in the network, relevant to widely grown vegetables which are significant both for nutritional content and market demand.

-- Identify a small number of vegetables for initial research thrust keeping in view the three major problems, i.e., high temperature, heavy load of pests and diseases, and availability of reliable seed through a viable seed production and delivery mechanism.

-- Delineate the problems and constraints in handling marketable vegetables from the time it is harvested until it reaches the consumers and the ways and means to overcome them through adequate expertise in post-harvest physiology and market economics for example.

-- Explore appropriate research thrust that complement and improve the existing practices in subsistence farming systems so that the technological changes are more likely to be accepted by small farmers.

-- Examine the strengths of and critical gaps within the collaborating national systems, in equipments and facilities; in training and expertise; in information and documentation needs etc., both for horizontal distribution of research responsibilities as well as for estimating the resources and inputs required to meet the critical gaps.
-- Elaborate areas of collaboration between network members, the regional framework and AVRDC in terms of provision of scientific and bibliographic services, biological materials, training, contractual research, etc.

-- Recommend a coordinating mechanism within the regional framework of SACCAR, the regional hub and the collaborative executing agency, i.e. AVRDC.

-- Prepare a modest, flexible and indicative budget proposal for setting up the research network with approximate funding needs at various levels, national, regional and international.
ANNEX 6

Botswana: August 22 - 27 and September 10-12

1. Dr. Martin Kyomo, Director, SACCAR
2. Dr. Dennis M. Wachinga, Manpower & Training Officer, SACCAR
3. Mr. Cliff Kwalambota, Finance Administration Officer, SACCAR
4. Mr. C. Namponya, Information Officer, SACCAR
5. Dr. Lucus Gakale, Director, Agricultural Research, Botswana and Chairman, SACCAR Board
6. Professor G.C. Mrema, Dean of the Faculty of Agriculture, Botswana Agriculture College and University of Botswana.
7. Dr. G.I. Willson, SANITAS, (Botswana) (PTY Ltd.) "The Green Diamonds of Botswana".

Tanzania (August 27-September 1)

Ministry of Agriculture:
1. Mr. A. Mshangama, Principal Secretary
2. Dr. I.S. Mpelumbe, Commissioner for Agriculture and Livestock Development
3. Dr. F.M. Shao, Assistant Commissioner, Crop Research
4. Mrs. J.F. Btegeico, Senior Economist, Planning Department
5. Mrs. J.S. Muro, Subject matter Specialist, Horticulture,

Sokoine University of Agriculture
1. A.B. Lwoga, Vice Chancellor
2. Prof. A.N. Xphuru, Dean of the Faculty of Agriculture
3. Dr. Athansio N. Minjas, Head, Department of Crop Science and Production

Tengeru Horticultural Research and Training Institute
1. Mr. Benny P.S. Nchanjala, Deputy Principal and Tutor
2. Mr. Daniel V. Chilossa, Assistant Coordinator
3. Mr. Gideon N. Nanyaro, Vegetable Crop Agronomist
4. Mrs. S.M. Kuandika, Vegetable Seed Production Scientist
5. Miss R. Gerson, Researcher on indigenous vegetables
6. Mr. Mboaku 0. Mgeni, Vegetable Crop Agronomist and Manager, Madiira Farm

Tanganyaka Farmers' Association
1. Mr. W.J.C. Mallya, Corporate Secretary
2. Mr. Mangi, Director, Operations
3. Mr. Jiv Raj, Director, Procurement

Donor Missions:
1. Mr. Allen Dennesse, World Bank
2. Mr. Marten A. Brouwer, Royal Netherlands Embassy
3. Mr. Guy Evers, Project Leader, Franco Tanzanian Horticultural Development Project
4. Mr. M.K. Rai, Vegetable Seed Production Expert, FAO
Zambia (September 1-5)
1. Dr. Munyinda, Deputy Director, Agricultural Research
2. Mr. Donald Shamba MIngochi, Horticulturist and Leader, Vegetable Research Team and his colleagues
3. Dr. Winter M. Chibasa, General Manager, Zambia Seed Company Ltd. and the Swedish expert on Plant Protection

Donor Mission:
  Mr. S. Khan, World Bank

Zimbabwe
1. Mr. N. Mead, Chairman, H.P.C.
2. Mr. W. E. Collett, Executive Director, H.P.C.
3. Mr. K.S. Ndoro, Chief Economist, National

Farmers Association of Zimbabwe
4. Mr. P.R. Mattison, Enterprise Cooperatives
5. Mrs. B.S. Wright, Seed Production Specialist, ARDA
6. Dr. P. Maramba, Plant Pathologist, ARDA

Agricultural and Rural Development Authority (ARDA)
1. Dr. Joseph M. Made, Deputy General Manager, Agricultural Operations, Planning and Development

D& SS
1. Dr. R.J. Penner, Director
2. Mr. Jackson, Acting Head, Horticultural Research Center
3. Research Officers at Marendaro

Agritex
1. Mr. Peter H. Johnson, Chief of Crop Production

University of Zimbabwe
1. Dr. Rukini, Dean of the Faculty of Agriculture
2. Dr. D. Cole, Acting Chairman Crop Science Department
3. Mrs. R. Madakadre, Horticulturist
4. Mr. M. Masariambi, Horticulturist

Donor Missions
1. Dr. Hassan Inam, World Bank
2. Mr. Winston C. Chidawanyika, World Bank Resident Mission in Zimbabwe
3. Dr. Sam Aggrey, Horticulture Section, Agritex, FAO
Annex: 7

Botswana:

1. Agricultural Research Farm and Horticultural Field Experimentation Station at Sebele
2. Concrete bench vegetable production at SANITAS, Botswana (PTY) Ltd.
3. Botswana Agriculture College

Tanzania:

1. Horticultural unit and field laboratory at Sokoine University of Agriculture, Morogoro.
2. Facilities Tengern Horticultural Research and Training Institute, Aruska, and field experimental stations.

Zambia:

1. National Irrigation Research Centre and vegetable trials at Mazabuka.
2. Zambia Seed Corporation (Vegetable Research and Seed-production Farm).
3. University of Zambia and field laboratory.

Zimbabwe:

1. DR & SS Headquarters and seed services Centre, in Harare.
2. Horticultural Research Centre at Grassland Research Station in Marondera.
3. Vlei area research (Dambo) project in Marondera.
4. Crop-Sciences department in the University of Zimbabwe.
ANNEX 8

COUNTRY PROFILES

1. BOTSWANA

Introduction

Botswana is situated in the Central Southern African plateau. Most of the country is between 860-1300 meters above sea level. Rainfall is uncertain and the average varies from 650-700 mm in the extreme north to 150-200 mm in the extreme southwest. Long hours of sunshine and its intensity lead to rapid growth, but causes problems of germination of vegetable crops. The high diurnal temperature variation, most marked in the south and the west of the country, results in much higher incidence of frost there. Surface water, sufficient for irrigation is found along the border with South Africa from Sikwane in the Kgatleng district (the Marico river) to the northern end of the Tuli block (the Limpopo); along the border with Namibia on the Chobe (Linyati river); in the Okvango delta and in some stretches of sand rivers in the eastern central district and then north and west to include the Sashe catchment. Distance and lack of infrastructure between the areas with irrigation-potential and the consuming area with high density of population are major constraint to increasing production of perishable vegetable crops. Botswana has traditionally been a livestock and dryland farming country. Only a small portion of the land along the main rivers of eastern and northern Botswana is irrigated.

Background Information on research and development efforts in vegetables:

Botswana currently imports 80% of its vegetables from neighboring countries particularly from South Africa, and a small quantity from Zimbabwe. Most children particularly in the rural areas suffer from vitamin deficiency. Import-substitution, nutritional needs of the vulnerable groups, creation of employment opportunities in the rural areas were the major considerations that led to the creation of the horticultural unit in the Ministry of Agriculture in late 1977 and early 1978. In 1977 a
unit was established under crop production division of the ministry to carry out horticultural/vegetable extension. Another unit was started in the department of Agricultural Research to carry out horticultural research in general and vegetable research in particular. At about the same time, the Horticulture Advisory Committee was formed. This committee comprises of researchers, extension personnel and farmer-representatives.

Organizations of vegetable research and development and existing manpower

Horticultural research unit which is responsible for vegetable crops is of recent origin. Prior to its establishment there were no locals trained in horticulture, specifically vegetable production. Currently, there are two professionals, one with Masters degree and the other with B.sc in horticulture. They are supported by two technicians, one with associate degree in horticulture and the other, general diploma in agriculture. On the extension side, there are six permanent horticultural officers, five in five region and one in Gaborone at the headquarters. Currently there are one Ph.d, one M.sc. and three B.Sc's (on training). They are supported by extension workers, with diploma or certificate in general agriculture. Botswana Agriculture College, currently being upgraded as faculty of agriculture of the university has two qualified horticulturists on the staff, one M.sc. and one B.sc. (now under training abroad for M.sc).

Because of shortage of trained manpower, most of the vegetable research work are carried out at the main research station at Sebele. Horticulture research unit draws upon the support services under the department of agricultural research i.e. soil and plant analysis laboratories, farm machinery and cold storage facilities. Some work is carried out on growers' fields and at Bolionong substation. Botswana Development Corporation, a parastatal, also conducts limited adaptive research in commercial vegetables production, particularly tomato, on their farms. All vegetable research in Botswana is supported by government funding.
**Manpower development**

Botswana Agriculture College offers certificate, diploma and bachelor degree (B.sc) in general agriculture. The new curriculum developed by the faculty of agriculture offers two and a half courses in vegetables and fruit production. Most of the training of the professionals are done abroad, mainly United Kingdom and the United States.

**Crop priorities**

The following vegetables are important to Botswana both in terms of economic value and market demand:

- Cabbage
- Tomato
- Onions
- Leafy vegetables (spinach & Kale)

These are the same vegetables which were recommended to be given first priority by Horticultural Research Advisory Committee in 1978, along with potato. However, work is carried out on other vegetable crops - carrots, beet, root, sweet peppers, etc. No work has so far been done on indigenous vegetables.

**Research work**

<table>
<thead>
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<th>Crop</th>
<th>Vr Trial</th>
<th>Prod Practices</th>
<th>P &amp; D Control</th>
<th>Seed Multip</th>
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<td>+</td>
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<td>+</td>
<td>-</td>
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<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
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</tr>
<tr>
<td>Tomato</td>
<td>+</td>
<td>+</td>
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<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Beet roots</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Green pepper</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
</tbody>
</table>
HORTICULTURAL REGIONS OF BOTSWANA

1. Hot summers, mild winters (normally frost-free)
2. Hot summers, cool winters
3. Warm summers, cool winters
4. Mild summers, cool winters
5. Mild summers, cold winters
6. Summers warm to hot, cold winters

NOTE: "Frost-free" areas occasionally experience frost, especially in depressions and low-lying areas.
**Constraints**

Shortage of trained professionals and technicians limit the scope and intensity of research. Dependence on scarce and expensive water, lack of market intelligence, problems of post-harvest handling, extremely inadequate physical infrastructure and high transport costs and competition from large-scale growers in South Africa continue to inhibit market-gardening by small-holders. As a study by the Department of Agricultural Research (1986) concludes, "only production of highly perishable leaf crops such as rape and spinach, which do not face competition from imports, could be carried out profitably on an all-year round basis."¹

2. **TANZANIA**

**Introduction**

Tanzania is situated within the tropics in the Equatorial Zone between 10-11° South of the Equator. Its total area is 942,630.50 Sq Km, 883,578.50 Sq Km being land and 59,052 Sq Km being water. About 6-10% of cultivatable land is used as small holder cultivation - 38,000 Sq Km while large scale agriculture covers 5,850 Sq Km.

¹ Production Costs for Vegetable Crops in Botswana by G.C. Wiles, Sebele, 1986.
Its altitude lies between 0 m and 5,803 m above sea level. The days are normally short with high light intensity all the year round.

There is little variation in temperature. Above 1600 m frosts may occur, usually in the valley frost pockets. The entire country has its coolest period around July - August. There is very little information available in Tanzania concerning soil temperatures which are important for root growth.

The rainfall in Tanzania is highly variable. The Southern part of the country receives a single rainy season lasting from November till May, January or December being the wettest months. The other part of the country, north of Mafia - Lake Victoria line, gets two peaks of rainfall, April being the wettest. Kyela District is the wettest part of the country, with more than 2,500 mm (2.5 m) per annum, followed by Kagera region (Bukoba 2000 mm) and Pemba. Rainfall in the center of the country is generally low; 600-800 mm per annum with Dodoma and Singida receiving only 400 mm per annum.

Background information on centers of vegetable production:

Vegetable crops, both temperate and tropical are extensively produced in Tanzania. There are four major vegetable producing districts: the Kilimanjaro-Arusha area, the Usambaras, the Ulugurus and the Southern highlands. Vegetable production in coastal areas benefits from large urban
centers and markets of Dar-es-Salaam and Tanga. The lake areas (Ukerewe island, Kagera region, Kigoma region and Tarime district) have better distributed rainfall and supply fruits and vegetables to the drier hinterland. Cheap transport across the lakes make possible the export of commodities to neighboring countries like Kenya, Uganda, Rwanda, Burundi and Zaire. Indigenous vegetables are extensively gathered and produced and represent a preferred food in rural areas and in both semi-urban and large urban centers.

**Current status of vegetable research:**

Several institutions are involved in vegetable research although as part of an overall horticultural research thrust. Institutions involved in vegetable research are: Horticultural Research and Training Institute (HORTI, Tengeru) under the Ministry of Agriculture; Uyole Agricultural Centre (UAC); and the Sokoine University of Agriculture (SUA). A map of the six horticultural research centers and equal number of sub-stations in Tanzania is appended (Attachment 1).

HORTI (Tengeru): Horticulture Research and Training Institute in Tengeru began offering diplomas in horticulture since 1970. With Dutch assistance in 1976, the Institute has developed into a major specialized center for both research and training in horticulture. Coordination of National Horticultural Research including vegetables is vested in Tengeru. UNDP/FAO funded seed production programme (mainly tomato and onions) is
also located at HORTI. Situated at 1800 meters above sea level, the institute has 35 ha land at Tengeru proper; 220 ha at Madeira farm of which 50 ha have been allocated for vegetable research; 10 ha respectively at Maniyere and Tanga; 2 ha at West Kilimanjaro and Moshi each; and 3 ha at Olmotonyi.

The institute is equipped with screen houses, glass house, lath/bush house, irrigation facilities (both surface overhead) and laboratories (plant protection, seed lab, soil lab, tomato processing lab and cold storage). It is also serviced by plant quarantine facilities at Tropical Pesticide Research Institute; by Seed Testing Laboratory, and National Plant Gene Bank at Arusha.

**Vegetable research at Tengeru**

(i) - Varietal performance of five different varieties of cabbage under field condition - organoleptic test for these cabbage varieties was satisfactorily carried out.

- Fertilizer trial on the yield of cabbage c.v. Drum head.

- Vegetable Seed Production trials on: Onion c.v. Singida variety; cabbage c.v. sugar loaf and tomato c.v. money maker.

(ii) - Investigations on indigenous vegetable crops including:
Conducting a case study on indigenous vegetables in different areas in the Northern part of Tanzania aiming at evaluating the present production and marketing situations, problems being faced by the farmers, priority given for production of indigenous vegetables, etc.

Leaf yield response of *Brassica carinata* to the frequency of harvesting.

Collection of indigenous vegetables for the purpose of storing different planting materials for future research work.

(iii) - Plant Protection trials comprising:

- Screening cabbage varieties resistant to black rot.
- Evaluation of the efficiency of Kocide 101 in the control of black rot in cabbage caused by the bacterium *Xanthomonas campestris*.

Observations are also carried out on the following Vegetable crops: Okra, Carrot, Cauliflower, Bitter eggplant, cucumber, Lettuce.
Sokoine University of Agriculture:

The Franco-Tanzanian Horticulture Development Project (FTHDP) is based in the Department of Crop Science and Production. This project is co-financed by the French Ministry of Foreign Affairs, the Non-Government Organization (NGO), CIMADE and Tanzania. FTHDP started in 1983 and it is now at the second phase which extends to the end of 1990, with prospects for extension to Phase II.

Among the objectives of FTHDP is to assist SUA in developing a curriculum in horticulture and developing infrastructure for horticultural research. In this regard, the Project has been working on campus at the Horticulture Unit and in two major villages in Morogoro region, Mgeta and Malolo. Research approach at the two villages is based on farming systems development.

Research on vegetables is also conducted at other centers, notably at Dakawa and at U.A.C. (Uyole and Mbeya).

Crop priorities:

Priority crops in Tanzania are Solanecous vegetables (mainly tomato), Brassica (cabbage and rape), indigenous vegetables (amaranthus, African eggplants, chafercarus, etc.) and alliums (onion). Major research thrusts as indicated earlier are cultivar evaluation, pest and disease control and
increasingly seed production and post-harvest physiology.

Manpower

Manpower at Horti-Tengeru, by far the most important institutions for vegetable research and development, is given at Attachment II.

Sokoine University of Agriculture presently has three horticulturists in the crop science department, two Msc.s and one B.sc beside support staff from other disciplines like plant pathology, entomology, etc. An agreement has also been reached with Cornell University for Graduate training and research in horticulture in general and in vegetable production in particular. Franco-Tanzanian project has three expatriate experts.

Private Sector involvement

Tanganyka Farmers' Association which originally started in 1935 as one of the branches of the Kenya Farmers' Association is involved in supplying reliable vegetable seeds to its members which now include beside the commercial farmers, the small-holders, the village cooperatives and the state farms.

Government Commitment:
Horticultural Research has been lagging behind the food and cash crop research for a long time. Tanzania's "National Agricultural Policy" on horticultural crops clearly recognizes the potential and need for intensive research and development in this subsector over the entire continuum of production, marketing, processing and export. Private entrepreneurs are being encouraged to organize export by liberalizing the licensing procedures and foreign exchange regulations (Attachment III).
ATTACHMENT 1

Figure: Horticultural Research Centres and Sub-Station
In Tanzania

△ Horticultural Research Centres
1. HORTI- Tengeru
2. VRTI- Kakutopora
3. SUA- Morogoro
4. CHOLIMA- Dakuwa
5. UAC-Mbeya
6. KATRIN- Ifakara

○ Research Sub-Stations
<table>
<thead>
<tr>
<th>NAME</th>
<th>QUALIFICATIONS</th>
<th>ACTIVITIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Mr. R. Swai</td>
<td>B.Sc. (Agric) M.Sc. (Fruit Science) Plant Propagation</td>
<td>NATIONAL Research Coordinator, Head, Fruit growing and Plant Propagation Section</td>
</tr>
<tr>
<td>2. Mr. Daniel N.V. Chilosa</td>
<td>B.Sc. (Agronomy)</td>
<td>Asst. Research Coordinator, head, Vegetable growing, National Vegetable seed Production counterpart</td>
</tr>
<tr>
<td>3. Mr. D.R. Kisanga</td>
<td>B.Sc. (Agric.)</td>
<td></td>
</tr>
<tr>
<td>4. Mrs. V. Kchanjala</td>
<td>B.Sc. (Botany)</td>
<td>i/c round potato research programmes</td>
</tr>
<tr>
<td>5. Miss R. Gerson</td>
<td>B.Sc. (Agriculture)</td>
<td>i/c Indigenous vegetable research programmes</td>
</tr>
<tr>
<td>6. Miss Marilyn Monyo</td>
<td>B.Sc. (Food Science)</td>
<td>Food science activities</td>
</tr>
<tr>
<td>7. Mr. I.S. Swai</td>
<td>B.Sc. (Crop Science) M.Sc. (Plant Pathology)</td>
<td>Further studies PhD</td>
</tr>
<tr>
<td>8. Mr. D. Marandu</td>
<td>Diploma (Horticulture)</td>
<td>Further studies B.Sc.</td>
</tr>
<tr>
<td>9. Mrs. E. Kuandika</td>
<td>Diploma (Horticulture)</td>
<td>Head, Vegetable Seed Production Laboratory participates in vegetable seed production researches</td>
</tr>
<tr>
<td>11. Mr. G. M. Nanyaro</td>
<td>B.Sc. (Vegetable Agronomy)</td>
<td>Farm Manager, Participates in Coordination of farmer training courses.</td>
</tr>
<tr>
<td>12. Mr. O. Mgeni</td>
<td>B.Sc. (Vegetable Agronomy)</td>
<td>Farm Manager, Madiira Farm</td>
</tr>
<tr>
<td>NAME</td>
<td>QUALIFICATIONS</td>
<td>ACTIVITIES</td>
</tr>
<tr>
<td>---------------------</td>
<td>---------------------------------------</td>
<td>--------------------------------------------------------------</td>
</tr>
<tr>
<td>13. Mr. G.R. Mchau</td>
<td>Diploma (Horticulture)</td>
<td>Further studies - PhD.</td>
</tr>
<tr>
<td>14. Mrs. R. Zuberi</td>
<td>Diploma (Horticulture)</td>
<td>i/c compound, Farm System</td>
</tr>
<tr>
<td>15. Mr. N. Merinyo</td>
<td>Certificate (Agric.)</td>
<td>Further studies - diploma (Horticulture) HUKTI Tengeru</td>
</tr>
<tr>
<td>16. Mr. J.H.S. Shekidele</td>
<td>Diploma (Horticulture)</td>
<td>Involved in Plant Propagation researches</td>
</tr>
<tr>
<td>17. Mr. M.A. Mbelwa</td>
<td>Diploma (Horticulture)</td>
<td>involved in Farm work at Madiira farm</td>
</tr>
<tr>
<td>18. Mr. L. Manyelle</td>
<td>Diploma (Farm Management)</td>
<td>Seed Production field work</td>
</tr>
<tr>
<td>19. Mrs. J.H. Ngowi</td>
<td>Diploma (Home economics)</td>
<td>Involved in food science researches</td>
</tr>
</tbody>
</table>

Note: * Full-time Research staff.

"There is a great potential for producing fruits, and vegetables and flowers both tropical and temperate varieties, to satisfy domestic needs and for the export market. Although the Party has put great emphasis on the expansion of production in "Siasa ni Kilimo," the performance of this sub-section has been dismal. The reasons for the poor performance include: non-existence of official marketing channels; high perishability of the crop; lack of research and extension services; shortages of seeds and planting materials; poor transport and storage and minimal efforts put into irrigation.

In order to realize the existing potentialities in horticulture, the following policy recommendations are proposed:

a) Production should be enhanced through research, extension and irrigation.

b) Marketing (organized) and processing of horticultural crops should be given high priority.

c) Location of processing plants should be near producing areas as possible to reduce waste and transport costs.

d) Private entrepreneurs should be encouraged to organize export enterprises by streamlining the licensing procedures.
3. ZAMBIA

Introduction

Zambia is a land-locked country with a surface area of 763,000 square kilometers. Of the estimated 60 million ha of land in Zambia, about 12 million or 20% have been cleared, and only about 5 million ha of cleared land is under cultivation. Irrigated agriculture covers about 18,000 ha. Of this, 50% is devoted to sugar cane, and the balance to wheat, tea, coffee, rice and bananas.

Zambia's agriculture is dominated by a traditional farming system comprising 460,000 farm households (75% of the estimated 660,000 rural households) who cultivate an average of 2 ha using very few modern inputs and producing mainly for subsistence purposes. The other extreme, is the medium and large scale commercial farmers cultivating an average of 60-100 ha using modern inputs. Between the two extremes are the emergent farmers estimated to be about 125,000 who produce significantly from 10-15 ha for the market using modern inputs.

Vegetables are an important part of the Zambian diet, and are predominantly produced by small scale and emergent farmers. A few commercial growers produce for export. Most exotic species are grown during the cool dry season (April-July) under irrigation, and an abundance
of indigenous species are grown and gathered during the humid rainy season (November-March). Periods of gluts and scarcity characterize production pattern. The major vegetable growing areas are located around highly populated urban centers of Lusaka and the Copperbelt. Vegetable production has received greater emphasis during the past two decades.

Prior to 1970 Zambia used to import horticultural produce from neighboring South Africa, Malawi and Zimbabwe. Currently, Zambia does not import any vegetable produce except for seeds.

Current status of Vegetable Research and Manpower

Vegetable research is conducted primarily by the Vegetable Research and Development Team of the Ministry of Agriculture and Cooperatives.

The Vegetable Research program conducts research at 3 locations: at National Irrigation Research Station (NIRS) near Mazabuka, at Golden Valley Research Station near Chisamba, and at ZamSeed Farm. The latter two locations have recently been added to increase effectiveness of the program which had been based at NIRS for the past decade. The Team has not been able to address the problems of high rainfall in the northern part of the country with leached and acidic soils, or the hot dry valley areas.

The program is coordinated from NIRS and has 4 professional staff (2 of whom are expatriate) and 4 technical cadre. Two of the latter are in
training for B.sc (Agr) and 1 professional is studying for Ph.d. By 1994, the Team is expected to have local manpower as follows: 1 Ph.d, 1 M.sc, 2 B.sc 1 Dip and 1 Cert. Of the expatriate staff one is in charge of seed production and olericultural practices, and the other, of plant protection.

The staff has benefitted from professional tours to Zimbabwe and Malawi and has a strong spirit of sharing research findings as evidenced by several technical publications on a variety of topics.

Crop priorities:

The priority vegetable crops are as follows:

Solanaceae: Tomato, African eggplant
Brassicas: cabbage, rape/mustards
Alliums: Onion
Indigenous Leafy species: Cleome, Amaranth, Corchorus
Malvaceae: Okra

Current research thrusts:

Research Thrusts are aimed at:

1. Cultivar evaluation to determine adaptability/yield potential.
2. Generation of production packages to increase production.
3. Seed production particularly the biennials.

4. Indigenous vegetable species with respect to germplasm collection, production/consumption surveys, selection, yield potential, nutrient content and seed production.

5. Germplasm maintenance.

6. Crop protection to determine cheaper but effective ways of integrated pest and disease control.

Facilities and Funding:

Research facilities are very modest: a cold room, a modern nursery and a field house exist at NIRS, and a new complex of offices, stores, field laboratories, etc. are being constructed at Golden Valley as the future hub of the Research program.

The program is funded by SIDA and executed by Svaloef AB Company along with other commodity research programs since 1982. The major objective of all programs is to establish and consolidate seed production and for this reason the program is linked with the Zambia Seed Co. The Government contributes only the salaries of local staff and the entire recurrent and capital expenditure is provided by SIDA.

Other Institutions:

Other institutions involved in vegetable research are as follows:
Zambia Seed Co. has a Farm and a Vegetable Seed Production Officer who organizes seed production with contract growers. ZamSeed produces and markets seeds of a number of vegetables locally including those of prominent indigenous species (see Table 1).

The Seed Control and Certification Institute (SCCI) plays a key role in the pre-release and release of cultivars, field inspection and certification.

The National Food and Nutrition Commission monitors patterns of nutritional (deficiency) diseases and promotes balanced nutrition among the vulnerable groups.

The National Council for Scientific Research has carried out nutrient analyses in traditional vegetable species.

The SADCC Regional Gene Bank (SRGB) located in Lusaka has a regional mandate for conserving germplasm.

The University of Zambia's School of Agriculture provides tuition in general agriculture but offers a few courses in general horticulture in its B.sc (agric) curriculum. The Department of Crop Science has one Ph.d horticulturist working on indigenous vegetables especially amaranths.
Table 1
Vegetable seed sales (1985)
(locally produced seeds)

<table>
<thead>
<tr>
<th>Crop</th>
<th>Quantity (kg)</th>
<th>Indigenous Crop</th>
<th>Quantity (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rape</td>
<td>14137</td>
<td>Amaranthus</td>
<td>14</td>
</tr>
<tr>
<td>Beans</td>
<td>6110</td>
<td>Date (C. cocchurus spp.)</td>
<td>0.5</td>
</tr>
<tr>
<td>Peas</td>
<td>4334</td>
<td>African eggplant</td>
<td>6</td>
</tr>
<tr>
<td>Tomatoes</td>
<td>2974</td>
<td>Cleome (Cat's whiskers)</td>
<td>0.5</td>
</tr>
<tr>
<td>Okra</td>
<td>1905</td>
<td>Brassica Spp.</td>
<td>2</td>
</tr>
<tr>
<td>Chinese Cabbage</td>
<td>1561</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carrots</td>
<td>771</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Swiss Chard</td>
<td>504</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Squash</td>
<td>236</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Egg Plant</td>
<td>200</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pumpkin</td>
<td>188</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cauliflower</td>
<td>184</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cucumber</td>
<td>178</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watermelon</td>
<td>171</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lettuce</td>
<td>120</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bell pepper</td>
<td>77</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hot pepper</td>
<td>38</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Muskmelon</td>
<td>27</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Constraints:

The basic constraints are shortage of manpower and total dependence on external assistance for research funding. Extension work for vegetables oriented towards the smallholders is extremely weak and research-extension interface is virtually non-existent.

4. ZIMBABWE

Introduction:

Zimbabwe produces a wide range of horticultural crops including vegetables. Differences in altitude ranging from 300 meter to 2600 meter above the sea level allow production of both temperate and topical fruits and vegetables. The majority of these crops have been under production for many years and are marketed both in the local and export markets. The thriving industry, as far as export is concerned has been dominated almost completely by commercial growers supported by private sector seed companies tissue culture laboratory, and packaging and processing facilities. The industry has been generously assisted by government in terms of foreign exchange allocation, export incentive, etc. Horticultural Promotion Council comprising of all sectors of farming groups, i.e., commercial growers, small and communal farmers, and state farms and of companies involved in the industry is the major supportive institution behind the impressive export drive to Europe. Government has currently undertaken a
number of horticultural development projects to upgrade and encourage the communal peasant and small-scale vegetable growers particularly around major urban centers at Harare, Bulawayo and Mutare.

Production Pattern of Vegetables:

In the South Western part of Zimbabwe where grapes is the major crop along with plantations of pecan nuts and strawberries, a few large and many small-scale growers supply the Bulawayo market with tomatoes, onions, cabbage, broccoli, cauliflower, green beans, peas, pumpkins, etc. throughout the year.

In the lower altitudes such as the Hondo and Burma Valleys, beside great quantities of tropical fruits, (bananas, pineapple, lichis, avocado, mangoes and grandilla) melons, cucumbers, aubergins and pepper are produced during winter. In the colder higher altitudes, where deciduous fruits are grown, fresh vegetables for the local market and a limited quantity of seed of selected vegetables are produced. All of the country’s seed potato is grown in the Nyanga highlands.

The main stone fruit and pecan nut plantations are located east of the capital city of Harare. Large areas are devoted to grapevine growing in which both large and small-scale growers are involved. Kiwi fruit growing is on the increase here and in Nyanga area farther east. Around the capital city, Harare, the emphasis is on market gardening and the major
produces are onions, tomatoes, brassicas of all types, beans, carrots, asparagus, capsicums, etc.

In the South and Western lowveld of Zimbabwe around Hippo valley, where a variety of citrus is produced, vegetables such as tomatoes, pumpkins, squash, susceptible to lower temperatures in the higher altitudes in winter, are produced.

In Masvingo province, mostly mid-way altitude between Harare and the lowveld, both cool season and warm season types of vegetables are produced all the year round.

Shamva area, northeast of Harare, produces papaya, pineapple and a variety of vegetables. The Midlands area produces all types of vegetables with one of the largest tomato and cucurbit grower located here.

Current status of vegetable research:

Horticultural/Vegetable research is carried out by the Horticultural Research Center under the crop division of the Department of Research and Specialist Services. Headquarters for horticultural research is at Horticultural Research Center within the Grasslands Research Station at Marondera. Research work here basically concentrates on temperate vegetables. Recently experiments are being conducted for vegetable growing in vlei areas (dambos) or swamps with hydromorphic soil. The clientele are
specifically the communal farmers in the highveld marginal areas.

Inyanga experiment station and Coffee research station at Chipinge mainly concentrate on fruits. The Lowveld research station at Chiredzi conducts extensive research on sub-tropical vegetables, particularly tomato, onion and cabbage.

Significant work has been done on leafy greens, particularly amaranthus, in terms of germplasm collection, screening, selection and yield evaluation over the last ten years. The results and the high yielding varieties have been extended by the Department of Agricultural Technical and Extension Services (Agritex) to 400 home/nutrition gardens in the communal area.

Agritex also conducts some on-farm adaptive research in collaboration with DRSS. Programs are drawn up annually by the Committee for On-Farm Adaptive Research and Experimentation (COFRE). At present there is an ongoing FAO project on training and inductive research formulated out of farming practices. The findings go to DRSS for research and analysis and the results are fed back to extension workers.

Another institution which is actively involved in cultivar evaluation and seed production is Agricultural and Rural Development Authority (ARDA). The Nijo state farm under ARDA is a large producer of tomato and onion over 32 and 45 hectares respectively. Intensive management practices have
resulted in very high tomato yields of 100 ton per hectare. ARDA has recently received the mandate under the Seeds Act for seed production.

Many of the commercial growers engaged in the export sector receive technical assistance from importing countries.

**Crop priorities and Research thrusts:**

Vegetables receiving priority attention in research and development are tomato (mainly selection for heat tolerance), cabbage, onion, rape, pepper, peas and eggplants. Major research thrusts so far have been selection and screening of germplasm and cultivars for adaptability, high yield and heat tolerance; pest and disease control and crop husbandry. Future priorities include breeding program for pest resistance in tomato, seed production and cytoplasmic hybridization. A tissue culture laboratory is being set up at Marendaro Center with World Bank assistance. There is also close collaboration with the University of Zimbabwe, particularly with Dr. A. Ian Robertson working on molecular biology, genetics and plant breeding. Similarly, capacity is being built up with World Bank and ODA assistance for post harvest physiology and crop protection.

**Manpower Development:**

Currently, there are nine professionals in the various experiment stations working on both fruits and vegetables. Of them, two are abroad.
for graduate studies. In Agritex two out of 5 positions for horticulturists have been filled in. Of the two one will be coming back soon from M.sc studies abroad.

The university under a collaborative program with Michigan State University introduced horticultural courses in Crop Science Department. Two Msc.s have joined the department while Dr. Rice from M.S.U. has gone back to the States. A proposal for introducing a new B.sc. program in horticulture has been approved by both the university and the national planning authorities. SPAAR/SADCC report on Strengthening Higher Agricultural and Natural Resources Education in the SADCC Member States (April 1989) also provides favorable consideration to the proposal for building up indigenous capacity within the region.

Constraints:

Number of researchers specializing in vegetables is rather inadequate. Conceivably because of a thriving export industry, research priorities are directed more towards the large commercial growers producing fruits, cut flowers and selected vegetables rather than towards communal peasants and small-holders growing vegetables for home consumption and local markets. Recent attention to vegetable growing in vlei areas (dambos) is a welcome change. So also, the establishment of home/nutrition gardens. However, the need for specialization in vegetable research and a stronger orientation towards the peasant sector is widely perceived among the
policy-makers and the leaders of the National Farmers Association of Zimbabwe.

OTHER COUNTRIES IN THE SADC REGION
(Excerpted from secondary sources)

5. LESOTHO

Lesotho has 400,000 hectares of arable land of which about 17,000 hectares is used for vegetable production. Export crops like asparagus are generally grown by commercial farmers. But they are also grown by state farms for sale and for demonstration. Home gardeners grow vegetables mainly for consumption with a little surplus going to nearby markets. Of the various vegetables grown, i.e. cabbage, tomatoes, carrots, Swiss chard, beet roots, green peas, asparagus, etc., cabbage constitutes about 80% of the vegetables grown in Lesotho. Asparagus is grown by large farmers (in 1987 there were 583 asparagus farmers) for export to Europe after being processed at the Masianokeng cannery. As far as cabbage is concerned, more than half of the cabbage marketed in Lesotho is imported from South Africa, while home garden production accounts for about 50 percent of the local production.

Asparagus survives well under low rainfall condition of Lesotho and because of the climate is disease-resistant. Research thrust is mainly on agronomic practices and fertilizer response. Research results show that
cabbage can be grown round the year in the lowlands of Lesotho. Research work is conducted on evaluation of both non-hybrid and hybrid cultivars, pest control and crop husbandry.

Lesotho Agricultural College offers a three-year diploma course in general agriculture. Because of lack of specialized horticultural training in the country and in the region, students are sent to Egerton College in Kenya.

6. MALAWI

Introduction

The horticultural industry in Malawi is young but has great potential. The variation in altitude which in turn affects the climate makes it possible to grow tropical, sub-tropical and temperate horticultural crops well. Currently important vegetable crops are sweet and European potato, cabbage, tomato, onion, garlic, green beans, lettuce, green chillies, red birds eye chillies, ginger, turmeric and sesame.

Production constraints:

Major constraints to production of horticultural crops are identified by horticulturists with the help of the growers themselves and through agronomic and socio-economic surveys conducted by adaptive research teams.
Experiments are proposed and designed according to the identified constraints, and conducted at Bvumbwe Agricultural Research Station, as also on Estate farms and smallholders' plots. Some of the major constraints, beside scarcity of credit facilities to buy high cost inputs, are inadequacy of high yielding good quality cultivar; insufficient execution of recommended pest control measure; lack of trained personnel in both research and extension and little or no extension service; high risk involved in marketing perishable produce; and lack of research and knowledge in post-harvest technology.

Research Activities:

The four major areas of research are outlined below:

A. Crop Improvement

1. Plant introduction and building up of a local and exotic germplasm reservoir.

2. Cultivar screening and evaluation for possible replacement of low yielding cultivars with high yielding ones. Research efforts in tomato, for example, are on screening about 75 lines from AVRDC for heat tolerance and evaluating new releases for yield as compared to the current cultivars.
B. Crop Production

1. Studying the plant-climatic relationship to determine the suitability of areas for specific crops.

2. Monitoring causes of loss in yield and quality due to cultivar, management or pests.

3. Crop nutritional requirements emphasizing fertilizer quantity, quality and method of application.


5. Plant population.

6. Time of planting.

7. Weed control systems.

8. Rootstock evaluation and standardization.

9. Seed/plant selection, multiplication and maintenance of basic plant material and propagation for farmers.

C. Crop Protection
This involves studying and screening the available pesticides and development of spraying schedules for the control of insects, nematodes, and fungal, viral and bacterial diseases.

D. Post Harvest Technology

This covers research on maturity standards, produce handling, storage; processing, marketing and utilization.

Manpower development:

Bunda College of Agriculture has been offering a five-year degree program since 1967 over and above a 3-year diploma program in general agriculture. Out of the Bunda college graduates, 11 professionals were working on fruits and vegetables, as of 1986, with four researchers specializing in vegetables including potatoes. A lecturer in Bunda College has been pursuing his studies for Ph.d in horticulture in 1987-88. The horticulturist in Bunda, after his training, will start a post-harvest physiology course. Natural Resources College in Malawi offers a certificate course in the principles and practical procedures of vegetable production. The course has an evaluation and weighting of 60% practical and 40% theory. As V.W. Saka of Bunda College points out, there is a need

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to broaden the existing courses both at the degree and diploma/certificate level and that provision should be made for graduate studies both at M.sc and Ph.d levels.³

7. SWAZILAND

Swaziland is located on the south-eastern part of Southern Africa, between latitudes 25 and 27 and between east longitudes 30 and 32. It is a land-locked country surrounded by South Africa on all sides except for a portion of the eastern border, which is formed with Mozambique. The area of the country is 17,000 sq. km. with a population of more than 600,000.

The climate is sub-tropical with hot summers and dry cool winters. The physical features of the land, however, modify this general climate slightly thus resulting in 4 agro-ecological regions. These regions stretch from north to south. The western region has the highest elevations (Highveld) while the lowest region (Lowveld) is on the eastern side. The two intermediate ones, the Middleveld and Lubombo Plateau (a relatively small area next to Mozambique) are somewhat similar in elevation and climate.

Production of Horticultural Crops

Farmers engaged in fruit and vegetable production are categorized into the Title Deed Land owners (TDL) and Land Tenured of Swazi Nation Land (SNL) farmers. TDL farmers greatly excel in fruit and vegetable production as compared with the SNL farmers (Table 1).

Most vegetables are produced in winter because the traditional agronomic crops (maize, cotton, and sorghum) do not compete for time at this period and there are less disease problems with the crops at this time of the year.

The TDL farmers are much better able to tap markets in foreign countries, because of their ability to produce a constant supply of quality produce and to locate and reach the market outlets. The SNL farmers on the other hand are at a disadvantage: they do not have the knowledge of the market requirements and lack the capital to set up a successful production operation.
<table>
<thead>
<tr>
<th>Crop</th>
<th>Swazi Nation Land (SNL)</th>
<th>Title Deed Land (TDL)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Area (ha)</td>
<td>% of Total Prod Area (tons)</td>
</tr>
<tr>
<td>Cabbage</td>
<td>55</td>
<td>17</td>
</tr>
<tr>
<td>Tomato</td>
<td>99</td>
<td>31</td>
</tr>
<tr>
<td>Potato</td>
<td>15</td>
<td>5</td>
</tr>
<tr>
<td>Gr. maize</td>
<td>107</td>
<td>33</td>
</tr>
</tbody>
</table>

Production Potential:

The potential for vegetables and sub-tropical and temperate fruit is enormous in the country. The different agro-climatic zones in the country makes this possible in the Highveld and upper Middleveld. Vegetables may
be grown during most of the year. In the lower elevations (Middleveld and Lowveld) sub-tropical fruits and vegetables grow well.

Rivers are a big asset for the Middleveld and Lowveld where there is ample land for cultivation but less rainfall. The planned construction of dams across the rivers to catch flood water will help put more land under irrigation.

Vegetables in the country are traditionally grown by SNL farmers during the winter months. But with the discovery of heat tolerant vegetable varieties (e.g. cabbages, carrots, onions) it is possible to grow vegetables all year round. As a more favorable marketing structure develops and farmers become aware of the potential incomes that can be derived from the production of fruit and vegetables this is expected to change.

Between 1979/80, when a ban on the importation of fresh fruits and vegetables into the country was initiated for a period of several years, production by farmers increased by 31%. This shows clearly that farmers have a potential for producing vegetables but are hindered by the lack of a marketing system.

The availability of markets will surely encourage farmers to try growing both new crops that are being promoted and the more traditional ones.
Research:

The country has one main research station located in the Middleveld. There are sub-stations distributed in all the agro-climatic regions. The objectives of these research stations are two fold:

1. To solve problems that hamper vegetable and fruit production.

2. To introduce and evaluate fruit and vegetable cultivars for adaptability and to develop new production techniques for them.

Contrary to the past agricultural research, which was primarily directed toward the needs of the larger TDL farmers, the current research puts emphasis on the small scale SNL farmer who is lagging behind in production.

Consequently on-station research results are further tested on farmers' fields to find their applicability to the farmers' situation. This on-farm work is being carried out by the Cropping Systems and Extension Training Project funded by USAID.

Vegetable projects center around the evaluation of varieties for major crops, the testing of modified productions systems, the introduction of new crops, and low cost irrigation technology.
Long-day onion tests were started in 1983 to identify varieties that would satisfactorily bulb under summer day length conditions. Currently, only short-day varieties are grown in the winter. Several cultivars which produce marketable bulbs in summer have been identified. The testing of growth regulator to enhance bulbing has now been added to this effort.

Practices that show promise at the research stations are usually moved into the on-farm research program. Trials in this category that are currently underway include evaluation of varieties of tomatoes that are resistant to bacterial wilt.

Exploratory trials are under way to provide information useful in making fertilizer recommendations. Rates of fertilizer recommended previously were directed to the large scale TDL farmers and were not feasible for small scale farmers. Rates of N, P and K are being tested in on-farm experiments. Similarly, trials are going on to evaluate low technology dip irrigation for small farmers.

**Manpower development:**

The Faculty of Agriculture of the University of Swaziland offers a B.sc degree program in general agriculture and also a diploma program. No degree or diploma programs are offered in horticulture. Horticultural courses are offered both in the degree and diploma program. These comprise in terms of teaching contact hours per week, 14.6% and 21.6% of the total
crop production courses and 4.23% and 6.23% of the total courses, respectively. The degree and diploma programs attract students from Botswana, Uganda, Lesotho and Zambia.

8. MOZAMBIQUE

(i) The role of Research

The main task of the Agronomic Research Institute is to work on the main aspects related to the technology and varieties for development and improvement of vegetable production.

To achieve these objectives, the Horticultural Division maintains experimental trials for selection of better adaptable varieties, using imported collections.

Today a diversity of varieties of different types of vegetables whose characteristics of adaptation are not known are used.

The present experimental program aims at identifying varieties from those under production today and others just imported as samples, with better yielding qualities during normal vegetable season (February/September). During the slack season (November/February) the same

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4 Horticultural training at the University of Swaziland, SACCAR Workshop, 23-27 March, 1989.
varieties are tested to determine those that are suitable for the summer time.

In the short term the program foresees the development, multiplication and production of vegetable seed.

The first phase of this program will take place at experimental station level land at the existing seed production and multiplication centers. Later it will spread to other Production units, like state farms, cooperatives or private farms. During this phase, trials will focus on cabbages, lettuce, tomatoes, onions, garlic and pumpkins.

However, there is a need to rehabilitate experimental stations by the provision of personnel and by improving the buildings which deteriorated after independence.

For the time being Experiments on vegetables take place in Umbeluzi and Chokwe, for the south zone, Sussun Denga, for the center zone and Lichinga for the north zone. The last two have similar altitude and climate.
(ii) The Link Between Research and Extension

Before independence research was not done and so there was no link between research and extension.

Mozambique is now giving priority to research for improvement of production, and to the transfer of experimental results to the producers.

In horticulture, one of the first programs was through the so called Casa Agraria in green zones especially in Maputo City, which had 6 of them.

The Casas Agraria has a team responsible for contacting the producers called "monitores". They are distributed to the different areas under a zone of the respective District.

The monitors give technical assistance to the producers by providing information on how to produce, and by selling small plants from the nurseries and making demonstrations of technology in the fields of the Casa Agraria or in the producers' plots.

Within the Ministry of Agriculture, the National Board for Rural Development was created to repackage information under the rural extension philosophy.
Training programs on extension are taking place at various levels. Some experiment pilot programs are also being tested for better and clear definition of application of extension methodology.\(^5\)

\(^5\) Excerpted from an article, Horticulture Production in Mozambique by Jorge Mabay Tembe, National Agricultural Research Institute, Mozambique (SACCAR Workshop, March 1987).
Location of SADCC agricultural research and training projects

ANNEX 9