

PN-ABB-307

Accomplishments, Goals and Structure of AVRDC



August 1987

The Asian Vegetable Research and Development Center
Shanhua, Taiwan

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AVRDC Publication 87-275

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FOREWORD

The Asian Vegetable Research and Development Center (AVRDC) was born out of a need to help improve the nutrition, income and food security of the millions of people living in the tropics. The AVRDC should be proud of the many contributions it has made to tropical vegetable production. This Center is a credit to those countries and agencies which have loyally supported it and to the hard working scientists and staff who have helped to turn problems into solutions for the small vegetable farmers in the tropics.

As we go forth into a new era, our tools and methods may be more modern; but our goal is the same: to help the national programs, to help their people enjoy a healthier and more rewarding livelihood.

A handwritten signature in black ink, appearing to read 'P. Ma', written in a cursive style.

Paul C. Ma
Chairman
Board of Directors

BACKGROUND

History and Purpose

The Asian Vegetable Research and Development Center (AVRDC) was officially dedicated in 1973 to assist national programs to improve their vegetable crop production and marketing in the lowland tropics. In this tropical zone, home of some of the poorest of the poor, fruits and vegetables represent approximately 16% of the diet, and provide a vital supplement of minerals, vitamins, plant proteins and edible fibers to the high carbohydrate diets of rice, cassava and other starchy foods.

The selection of Taiwan as a site for this specialized international research center was based on: the suitability of its humid tropical climate; the history of the island as an outstanding vegetable producing area; the excellent infrastructure; the strong support of a very stable government; the presence of outstanding academic institutions; the availability of highly trained labor; and proximity to a network of successful farmers, marketing associations, research institutions and supporting agricultural industries.

AVRDC is located in the center of one of the most active vegetable production and marketing areas in the world which provides the institution with unique advantages to fulfill its role in research and development.

Funding and Governance

The Asian Vegetable Research and Development Center is one of the few international agricultural research centers supported largely by contributions from developing and developed countries. The Center is supported by the Governments of Thailand, the Republic of the Philippines, the Republic of China, the Republic of Korea, the Japanese Government, and the United States; and supplementary support is provided by a number of international donors including the Asian Development Bank (ADB), the German Agency for Technical Cooperation (GTZ), the International Development Research Centre of Canada (IDRC) and the Republic of China. The Center is governed by a Board of Directors composed of a representative from each of the contributing countries in addition to several selected scientists (Appendix I). The management function is served by a Director General, Deputy Director General, Director of Administration and Comptroller.

Relationship to Other International Centers

There are approximately 20 International Agricultural Research Centers; thirteen of which are funded by the Consultative Group on International Agricultural Research (CGIAR). The AVRDC, although not formally linked to these CG Centers, participates in many cooperative programs with them; such as, international symposia, workshops, copublication, and joint research projects. For example, a shared effort with IBPGR has permitted AVRDC to develop a world class genebank. The AVRDC actively participates in CG annual meetings and the periodical studies of its Technical Advisory Committee (TAC).

Staffing and Facilities

Truly international in its concerns, programs and linkages, the senior staff of 23 represents 11 different nationalities (Appendix II). The research facilities include 102 hectares of experimental/demonstration fields, 5,500 m² of greenhouses and screenhouses, a research building of 1,700 m², offices and laboratories and a genetic resources and seed laboratory facility of 1,350 m² housing over 25,000 germplasm accessions. AVRDC scientists are supported by a staff of 175 (Appendixes III and IV).

The administration building houses a training facility with classrooms, student lounge and training offices; a modern editorial, audio-visual laboratory and publishing complex; as well as offices, a statistical services and computer center, and conference rooms. The dormitory facility for trainees, guest rooms, and a modern cafeteria and recreation complex are a vital part of campus life at the Center. There is residential housing for 21 families and a multi-purpose service building which contains maintenance and support facilities. The AVRDC administrative force of 33 and support group of 144 persons provide the logistical supplement to the research and development effort.

The AVRDC Library and Documentation Center acts as an information resource to support the research and training programs at the Center as well as to vegetable specialists in over 100 countries. At present, library holdings consist of 10,420 monograph titles, 1,085 serial titles and more than 23,000 documents on AVRDC principal crops. The computerized information retrieval system contains the main bibliographic, thesaurus, institution and serial holding data bases with on-line searching capability.

The Office of Information Services is the multi-functional communication arm of AVRDC charged with editorial, document preparation, distribution, art and photographic services and public relations. More than 6,000 institutions and individuals in 160 countries receive AVRDC publications each year.

Programs

The research and development activities of AVRDC are multi-disciplinary. The three principle divisions are each coordinated by a program director; namely, Crop

Improvement Program (CIP), Production Systems Program (PSP), and Development Program (DP) (Appendix V). The development, disease screening, characterization, and field evaluation of germplasm; the development of unique production methods to optimize yield and quality; and the preparation and distribution of germplasm are all intertwined functions of the team approach to research at AVRDC.

Crop Improvement Program (CIP). The crop improvement activities of this program include the assembly, characterization, conservation, documentation and utilization of germplasm. The Program is comprised of 5 plant breeders, 2 plant pathologists, an entomologist and a plant physiologist. The staff includes 9 senior scientists (Ph.D.) and 21 junior scientists (M.S. or equivalent).

The Genetic Resources and Seed Unit (GRSU) is headed by a Ph.D. germplasm specialist, 3 junior scientists and a laboratory field staff of twelve. This facility contains long, medium and short term germplasm storage, tissue culture and transfer rooms and various seed laboratories.

Production Systems Program (PSP). The crop management, cropping systems and soils teams address problems of a region-wide nature related to improved methods of production; handling; or to maintain freshness, nutrient content or other qualitative aspects, and developing systems to assist farmers to integrate vegetables in rotation with staples.

This program operates a continuing evaluation for inclusion of new vegetables in the crop improvement program; vegetables which may be of use to improve the nutrition and income of rural life. The research on nutritional gardens is implemented in PSP.

This program is responsible for the assembly of production technology inputs and information in written and electronic forms to serve the national programs. This group is composed of 4 senior scientists (Ph. D.), 6 junior scientists and a field-laboratory staff of 38.

Development Program (DP). The Development Program is responsible for the delivery of technological information, the upgrading of national vegetable extension and research programs through training and cooperative programs, and the influencing of policy makers to improve human nutrition or income generation through vegetable production and marketing. This group contains two senior staff members in addition to the Program Director. The consulting nutritionist (Ph.D.) and training officer (M.S.) are assisted by a staff of eight.

Training: AVRDC offers four different kinds of training programs, ranging in length from a few weeks to several years (when linked to University graduate degree programs).

The **research internship** provides specialized training on a topic such as plant breeding, pathology or entomology. In this program the trainee works closely with the researcher or group in the field selected and the time and content are determined by the needs expressed.

The **service internship** gives training in how to operate a genebank, seed laboratory, nutritional or soils laboratory, etc. This program is also tailored to the needs of the national program or trainee.

The **production training** program is a five month programmed course on how to grow a specific crop or groups of crops from seed to harvest. A new type of production program is being developed at the AVRDC which emphasizes market-oriented production technology. This is to be a train-the-trainer course in which participants may return to small holders as better informed advisors on the production and marketing system; with an intimate knowledge of key vegetables (growth, development, requirements); and a fundamental understanding of instructional techniques. This new production training module, the Comparative Technology Program, is a syllabus based course which emphasizes technology comparison instructional methods.

The fourth training component is a **summer student training** program in which college students have an opportunity to become involved in modern agricultural research, sharpen skills, or perform special research projects under the guidance of an AVRDC senior scientist.

The AVRDC conducts its training courses at headquarters in Taiwan and at the Regional Training Center (AVRDC-Kasetsart University, Bangkok) in Thailand. The Regional Training Center has had a large number of trainees from Mainland China and other tropical countries. The Regional Training Center is supported by several international donors and utilizes AVRDC's entire scientific staff for inputs as necessary in lecture, laboratory and counseling situations.

Cooperative programs: AVRDC cooperative programs in the Republic of China, Indonesia, the Republic of Korea, Malaysia, the Philippines, and Thailand provide feedback on the progress of newly emerging Center technologies. Program staff also work with researchers in national agricultural programs to assist in developing cultivars and crop management techniques adapted to local conditions and cropping systems.

Critical mass, a collection of scientists and body of knowledge devoted to a specialized effort, has been recognized as a vital force in scientific advancement. Most of the developing countries have only a small number of scientists working on vegetable problems, thus the assembly of scientists, germplasm and technical information at AVRDC provides this critical mass 'back-stopping' so greatly needed to solve their specific problems.

It is an honor and a great responsibility to serve in this supporting role. It is unfortunate, however, that the demand for services, training scholarships, support for workshops and symposia usually exceeds our resources to help these institution building needs of the national programs.

ACCOMPLISHMENTS

Research

Crop Improvement Program (CIP). In the lowland tropics, the production of many vegetables is generally difficult, and sometimes impossible, due to high temperatures, excessive rainfall, high incidence of insects and diseases and severe leaching of soil nutrients. Being near to the equator, the length of day seriously limits the production of photoperiodically sensitive crops. High temperatures reduce fruit setting of tomatoes and can prevent the heading of cabbage. Tropical yields are often low because of the poor nutrient-holding capacity of the soil which may be aggravated by leaching rains. Soil and air borne diseases and insects must be managed continually or crop failure can be expected. Upland and cool season production is usually much less risky than lowland, but the vegetable consumers are generally concentrated in the lowlands. Considering the generally poor infrastructure, it is necessary to produce near the population belt.

The six current principal crops selected for intensive improvement were chosen on the basis of nutritional importance, place in the tropical diet, income-generating potential, production feasibility and compatibility with existing farming systems. The principle crops are tomato, pepper (hot and sweet), Chinese cabbage, sweet potato, mungbean, and grain and vegetable soybean.

AVRDC has developed heat tolerant, bacterial wilt resistant tomatoes which now allow farmers in the tropics to produce this important vegetable throughout the entire year. Heat resistant Chinese cabbage, mungbeans and soybeans of reduced sensitivity to photoperiod, greater earliness and uniformity have also been major achievements which have benefitted tropical growers. Improved sweet potatoes and Irish potatoes have also been developed by this Center for tropical conditions, although Irish potato is no longer an AVRDC principal crop.

The germplasm development program of AVRDC is markedly different from that of a commercial seed company. Two of the greatest differences are that AVRDC produces genetic materials to be evaluated and utilized by the scientists in the national programs. The national programs field-test the AVRDC lines for adaptability, yield, disease resistance, and market acceptance. If the AVRDC material is highly suitable to a national program, it may be renamed and, after due credit, released without further hybridization for farmers to grow instead of their local varieties. Some of AVRDC's germplasm is used as breeding material and may be released only years later as a named variety. AVRDC has distributed some hybrid germplasm but most of the emphasis has been on inbred or open pollinated lines.

Seed companies, on the other hand, market 'finished varieties' often F_1 hybrids, which are usually well tested, stable and available in quantity. These hybrid varieties are usually exclusive and protected by seed and variety development laws. Hybrids are often associated with higher yields, earliness or some other advantage, but usually do best when provided higher inputs of water, fertilizer and pest management. For

a developing country, the higher cost of hybrid seed may or may not be cost-justified depending upon whether these best management practices can be provided too.

AVRDC releases germplasm primarily to national programs, but the material is also available to commercial seed companies. Seed companies appreciate this very welcome material and often use AVRDC germplasm in their varietal improvement programs. Credit for the AVRDC input into the commercial world, however, is not always as readily expressed as it is by the national programs.

The number of germplasm accessions distributed, released and officially named from AVRDC material is presented in the section entitled Impact (p. 8).

Production Systems Program (PSP). This program has developed a wide array of production technologies to help overcome the physical and environmental constraints of growing vegetables in the tropics. Formulation of the best management practices within the socio-economic capability of the small holder, and presentation of the information in a form usable to national program workers requires a broad understanding of the edaphic, climatic and technological situation.

The garden program, one of the most popularly publicized activities of the PSP, has demonstrated how a small unit of land (6 m²) can supplement the nutritional needs of a family of five on a year-round basis. This program is science based. It is a maximum (mineral, vitamin, edible fibre and leaf protein) output, scheduled and pre-tested operation. The garden program has had very wide adoption in schools, villages and urban situations.

Development

Information generation and transfer. The Center serves as a worldwide source of information on production of vegetables in the tropics. A computerized bibliographic service (part of the Tropical Vegetable Information Service), annual reports, extension publications, technical bulletins proceedings of symposia, newsletters, and the AVRDC news magazine *Centerpoint*, and a number of specialized publications are a vital part of the Center's communication efforts.

The Center has sponsored 7 international symposia on tropical vegetable topics and cosponsored a dozen others; thus serving as a forum for scientists from throughout the world to share ideas, report research findings, and assess future research and extension needs. The proceedings from these symposia have become significant benchmark publications; reflecting the most current state of the art information available on a comprehensive topic. Examples of international symposia titles include *Tropical Tomato*, *Soybean in Tropical and Subtropical Cropping Systems*, *Sweet Potato*, *Chinese Cabbage*, *Mungbean*; and *Diamondback Moth Management*. The 2nd Mungbean and *Integrated Management Practices for Tomato and Pepper Production in the Tropics* symposia will take place in the 1987-88 biennial.

Germplasm distribution and adoption. A brief summary of some of the most important germplasm released by the AVRDC is indicated below:

Vegetable Crops	No. of Releases	Countries of Release
Chinese Cabbage	12 releases	5 Asian
Mungbean	23 releases	11 Asian, 1 Oceanian, 1 African, 2 Latin American
Soybean	12 releases	6 Asian, 1 African, 1 Latin American, 1 North American
Tomato	45 releases	8 Asian, 3 Oceanian, 8 African, 4 Latin American, 1 North American
Sweet Potato	11 releases	2 Asian, 1 Oceanian

Training. Over 530 scientists, extension workers, and graduate students from 40 countries have attended AVRDC training courses. The source of training participants is as follows:

Place of Employment	Trainees (%)	Origin of Trainees at AVRDC Headquarters	Trainees (%)
Ministry of Agriculture	44.9	- Asia	86.9
Ministry of Education	31.8	- Latin America	4.7
Education Institutions	6.4	- Europe	3.3
Research Institutes	10.9	- Oceania	2.7
Commercial Industry	6.0	- Africa	2.4
Type of Training	Trainees (%)	Origin of Trainees at Thailand Regional Training Program	Trainees (No.)
- Production course (5 months)	31.1	- Mainland China	25
- Research internships	28.2	- Sri Lanka	15
- Summer student program	23.3	- Thailand	6
- Service internships	17.4	- Bangladesh & Indonesia	5 each
Program	Trainees (%)	- 6 countries	8
• Development Type	51.8		
• Crop improvement	27.8		
• Production systems	20.4		

Cooperative Programs

The cooperative programs are continuing linkages between the national programs and AVRDC. The primary goals of the program are to upgrade the research capability of national programs; introduce new technology and germplasm; and establish networks of information sending and receiving; germplasm distribution, and testing.

In most cases, the cooperative programs are staffed by AVRDC trainees who retain significant identity and communication with the Center to maintain a ready access to the scientists and the AVRDC output. Cooperative program representatives are usually included in the Center's Research Planning and Reporting Workshops each year and receive publications automatically.

AVRDC has initiated a Vitamin A Garden Project in Niger, West Africa, which will serve the countries of the Sahel. The AVRDC team of three professionals and their counterparts will address the vitamin A deficiency problem through training programs, research on garden programs, and better nutrition education.

Impact

Situation statement. A meaningful evaluation of the impact of AVRDC activities on national programs is very difficult to make at this time. It is rather easy to measure output such as germplasm distributed; publications requested and sent; symposia organized and documented; and national program scientists trained. These, however, are not a measure of income improvement due to adoption of a cultivar or practice, labor savings, better nutrition achieved or quality of life enhanced.

This Center has not been fully staffed to evaluate the socio-economic aspects of its research programs or its impact. This short-fall needs to be corrected as soon as possible, and the addition of an effective agricultural economist has been given highest priority.

Valid statistics concerning impact should be of great value to a research center in self evaluation and planning. Similar to the drunk hanging on to the lamp post, one could consider statistics for support or for illumination. The value of knowing program effectiveness in a measured evaluation should be a rather convincing instrument.

Problems. There are many difficulties for a small Center such as the AVRDC in impact evaluation, such as:

- Lack of agricultural economist to provide such guidance and gather meaningful information for analysis.
- Number of crops (6, soon 7) spreads data requirement.
- Distance from ground level workings of national programs; inadequate feedback from cooperative program personnel.
- Nature of activities. The AVRDC goals of improved nutrition and increased income seem to have difficulty-to-measure facets. The Center has provided improved germplasm which allows nutritious crops to be grown in seasons not previously possible, thereby providing millions of gardeners with more diverse, more nutritious vegetables at lower cost. Measuring this major influence provides a great challenge.
- AVRDC does not release cultivars, it distributes germplasm to national programs and commercial seed companies for their use.
- Unreliable statistics from national programs on vegetables which are considered minor crops in relation to grain crops (which usually have more reliable documentation due to concentrated and larger plantings which are more readily surveyed).

Partial solutions.

- An agricultural economist should be added with an appropriate operating budget so that effective linkages with national programs could be established and utilized.

- Accurate partition analysis needs to be done to determine potential value of input modification, but many argue that these studies, due to their complexity, must be done at research centers where 'real-life' farming influence is lacking.
- Feedback linkages with farmer trainees should be strengthened through newsletters, questionnaires and workshops in order to achieve better assessment of AVRDC impact.
- AVRDC scientists should devise questionnaires to help guide national scientists to try to estimate changes due to input modification.

Output information.

Germplasm Distributed 1976-1986

<u>Factor</u>	<u>Africa</u>	<u>Asia</u>	<u>Oceania</u>	<u>Americas</u>	<u>Europe</u>	<u>Total</u>
Number of units sent	15,518	146,679	6,377	41,027	2,976	212,577
% of Total	7.3	69.0	3.0	19.3	1.4	100

Reader Mailing List, Current

<u>Factor</u>	<u>Africa</u>	<u>Asia</u>	<u>Oceania</u>	<u>Americas</u>	<u>Europe</u>	<u>Total</u>
Number	285	2,434	209	1,105	326	4,359
% of Total	6.6	55.8	4.8	25.3	7.5	100

FUTURE PROGRAMS

Overview

The Asian Vegetable Research and Development Center welcomes the challenge of the nineties to expand its role as the germplasm, knowledge and training center for humid tropical vegetables. The Center must work on current problems and also those that will face vegetable growers at the turn of the century. The concept of maximizing yields without adequate regard to its effect on the environment is giving way to 'sustainable agriculture' which means producing food at levels that the land can support over the long run.

AVRDC should be involved now and in the future in developing germplasm and production systems that help small holders to maximize profits, not just yields. We must be prepared to answer the many probable questions related to population growth, urban expansion, out-migration of young people from the farms and changes in food preference due to age.

The Center must be involved in seeking solutions to problems that at the moment seem remote or belonging only to developed economies. Pollution of the underground water supply due to over-use of fertilizers and pesticides; erosion due to inappropriate soil water management; or excessive losses due to improper post-harvest handling practices are universal problems.

The challenge which we accept for the future is to broaden our search for additional vegetables which can provide high nutrition, adequate yield and profit for a wide range

of edaphic, climatic and economic conditions. We must be prepared to demonstrate how to grow and market most profitably vegetables with the least labor; least fertilizer, water, space, time; and least damage to the environment; and consideration of national dietary preferences.

Crop Improvement Program (CIP)

Specifically, CIP should continue to develop germplasm of greatest use to the humid tropics with the following characteristics incorporated whenever possible:

- Wide climatic adaptation (high temperature, drought and flooding);
- Resistance or tolerance to diseases of greatest constraint;
- Resistance or tolerance to insects and nematodes of greatest constraint;
- Stable, adequate and profitable yields;
- Array of maturities with an accent on earliness;
- Enhanced nutrient content;
- Enhanced market potential, i.e. size, shape, appearance, flavor;
- Plant types that will provide suitable vegetative cover for fruiting vegetables;
- Plant types that facilitate harvesting;
- Improved field holding capacity;
- Improved post harvest handling and storage potential;
- Adequate seed or propagation potential; and
- Tolerance of varied edaphic conditions.

AVRDC continually appraises its priorities in the Crop Improvement Program. Some principal crops have been phased down as primary research goals have been achieved. Chinese cabbage improvement activities have been reduced, and after an extensive analysis sweet and hot peppers have been added because of their popularity in the tropics and the likelihood that intensive research could alleviate many current constraints. Mungbean is undergoing this appraisal currently. The selection of new crops undergoes severe evaluation based on economic and nutritional importance; researchability; and resource availability.

AVRDC must incorporate ways to supplement and accelerate traditional breeding. The Center uses tissue culture methods to achieve rapid multiplication of plants from a given genetic base. **Anther culture** would allow breeders to regenerate whole plants from haploid plants (male sex cells contain half the typical number of chromosomes) which would allow all of the recessive genes to express themselves in one generation. This method could reduce elimination time to one, instead of several, generations.

Embryo rescue techniques enable somewhat unrelated plants to be crossed. Once this happens, the developing embryo is rescued from the mother tissue before it is rejected and perishes. Ordinary plant cells, somatic cells, (not egg or pollen cells) carry a full complement of chromosomes. Somatic cell walls can be removed and somatic cells of different plants can be fused, after which a new cell wall forms. This technique incorporates the cytoplasm of one species into the cell of another, thus increasing the possibility of achieving previously difficult or impossible combinations (**protoplast fusion**).

These three techniques, developed from the new field of biotechnology, have become simplified and now require less sophisticated equipment to achieve. AVRDC should be able to incorporate some of these new methods into its program or develop cooperative linkages with interested research institutes so that its vegetable crop improvement program can be accelerated.

Crop improvement requires patience, skills and large inputs of manpower, land, and materials. This large investment is justified because of its potential to overcome major constraints at the least cost, least disruption of the environment and greatest profit to the vegetable grower.

Production Systems Program (PSP)

PSP is charged with the development of effective and transferable production, marketing and utilization technologies to improve nutrition and farm income in the tropics. AVRDC must deal only with broad principles of tropic-wide use, as site-specific research is the responsibility of national programs. If national programs do not have site-specific answers to their problems, they must implement studies or rely on available technology from other sources.

PSP contributes to the technology pool of information **directly** and **indirectly**. Indirect methods include the systematic search and cataloguing of applicable literature from worldwide sources; establishment of an input range data base for each of the most useful crops; and compilation of a master list of constraints that are now known to inhibit profitable vegetable enterprises in the tropics. The results of these indirect methods should be useful to national programs for extension and research use and planning.

The direct elements of PSP efforts include immediate and long range components. PSP is responsible for commercial, as well as non-commercial, horticultural technology; which although complementary in principle, are different in scale and output. The non-commercial or home garden program emphasizes nutrient and food output with due consideration given to convenience, aesthetics, personal preference and convenience. The commercial grower is driven by a profit motive determined by the input-output relationship.

Current research efforts.

- Assessment of potential input cost reduction practices for the 10 most frequently grown tropical vegetables;
- Testing of feasible, cost reduction practices which reduce inputs (fertilizer, water, labor, pesticides);
- Evaluation of cost-effective relationship due to these input modifications;
- Screening for N-fixing legume vegetables;
- Development of practices to help reduce severity of crucifer internal rot;
- Evaluation of new vegetables for potential market development and home garden use;

- Continue development of non-circulative hydroponics system; and
- Development of methods to enhance closure of the nutrient flow loop.

Long range research efforts.

- Evaluate responses of major tropical vegetables to poorer land, poorer drainage, poorer quality water, reduced inputs of manual labor, pesticides, etc.
- Screening for edible plants which could be used as vegetables in the tropics. Of some 80,000 edible species, and 3,000 possible food plants, only 30 different plants provide 95% of man's food crop plants.

Development Program (DP)

The Development Program is charged with institution building functions. The upgrading of information networks, development of professional manpower services of tropical researchers, and the improvement of research and extension capability through training highlight the goals of this newly formed program. This unit should also improve information transfer technology to increase feedback information between scientists in the national programs and AVRDC.

One aspect that AVRDC has developed recently is to offer contract training for international assistance projects. For example, universities or consulting firms often need to provide short term, specific use training for client groups in the country they are contracting to assist. The AVRDC training program, with its four specialized modules, can provide this service effectively; whereas, most universities are not equipped to provide this type of training.

Another new initiative is the building up of a computerized professional register of vegetable workers available for short/long term assignments in the tropics. This registry will serve the needs of development organizations and the national programs.

Future goals include continual improvement of program content and instructional methodology, expansion of public awareness of the AVRDC training programs, and expansion of the scholarship funding base.

CONSTRAINTS TO DEVELOPMENT

Financial

A brief appraisal of research funding on a global basis (1986 CGIAR Annual Report) shows that support for vegetable research represents less than 2%; whereas support for cereals research is 51%; roots, tubers and starchy foods, 14%; food legumes, 16%; and livestock 19%. The irony of this support distribution is that vegetable consumption ranges from 8 to 17% of the human diet, and that vegetables are man's richest source of vitamins, minerals, plant proteins and edible fibers.

There is mounting interest in support for vegetable research by the Consultative Group on International Agricultural Research (CGIAR). The FAO estimates that one billion people are malnourished and the role of vegetables as a supplement to the high starch diets of the poor is becoming increasingly more evident.

AVRDC is one of the few international agricultural research centers supported largely by contributions from the developing countries as well as developed countries. The valiant efforts by these developing countries is appreciated by the less developed countries who also benefit from the AVRDC research output, but are themselves unable to contribute to its support. Fortunately, supplementary assistance is provided by the Federal Republic of Germany, the Republic of China, and several international donors, the details of which are shown in the Financial Report (p. 15).

The contributions of support to the core budget by developing countries is usually somewhat fixed; thus inflationary erosion over a 5 to 6 year period can cause serious consequences. A secondary problem is one of cash flow, as each country has its own contribution release date. These release dates are also quite flexible, ranging from 1 to 7 months from expected time of receipt.

AVRDC has an aggressive program to seek additional support for its operations and research projects. The Center has expanded its research capability, training offerings and consulting services to interest more funding opportunities.

The Center also confronts the general problems faced by most non-profit organizations which are rising costs, increasing demands from developing countries, and inadequate growth income. Appeals have been made to current contributors to help off-set inflation loss but only the Governments of Japan and the Republic of China have been able to program modest increases in the past 2 or 3 years.

AVRDC has been forced to temporarily scale-down some services. It has reduced its complimentary publication distribution, begun to charge for mailing cost of germplasm distribution for those who can afford to pay, and make similar reductions of a non-qualitative nature in order to protect the primary function of the Institution.

AVRDC's location-specific problems are of a geopolitical nature. This has, in the past, influenced growth and development of the Center. But times have changed, and AVRDC can and does serve as a bridge builder between countries of different political structures. This is another contribution to peace and prosperity.

AVRDC is thankful to its donors who have helped to make these efforts possible. With growing financial resources, the Center would be able to strengthen these ties. It should not be forgotten that the ultimate target group of AVRDC is the poorest people of our globe.

Personnel

Crop Improvement Program (CIP). The AVRDC staffing pattern, like most organizations, has its strengths and weaknesses. The five, well qualified, dedicated

plant breeders are complemented by a plant physiologist, an entomologist, a virologist, and a fungal plant pathologist (who shares his time as Director of the Development Program.) The need for 2 more plant pathologists to augment the crop improvement research effort is urgent.

AVRDC is aggressively seeking support for 2 professional plant pathologists; one in mycology and one in bacterial diseases. It is hoped that one or more donor nations may provide the salary and benefits for 2 scientists for a 2 to 3 year period at the Center.

Production Systems Program (PSP). The three senior scientists staffing this program are in crop management, cropping systems and soils science. The soils scientist is funded by the Japanese Government. In PSP, a serious short-fall is obvious. There is a great need for an agricultural economist, a marketing specialist and a post-harvest physiologist. A strong appeal is hereby made for at least one market economist to be supported by a developed country. Of the three positions which need to be filled, a market-economist is the most critical.

The market-economist is urgently needed to help appraise research input-output relationships, assess region-wide impact, and provide better socio-economic perspective to Center research programs. This speciality is also very necessary to the development and implementation of a more balanced training program. This position (or positions) would provide an outstanding post-doctoral experience and opportunity to be part of grass roots assistance to developing countries.

Development Program (DP). There is need for assistants to help the training officer in the expanding training program. The production of a training syllabus requires a short term technical consultancy in the preparation of educational materials and program evaluation. It is hoped that donor support will be forthcoming.

Program

National policy planners favor improved nutrition and income generation for their people, but vegetable programs are usually not given very high priority for support. AVRDC must seek to improve political awareness of the importance of vegetables in human nutrition, food security and income generation. Support for an 'awareness workshop' for developing country planners is greatly needed.

Most national programs in the developing countries have only a small number of scientists working on vegetable research. The extension programs on vegetables in many developing countries often receives only modest assistance from their national research ministries. AVRDC, as a consulting force, can only consult and help national programs wanting and able to receive assistance. Upgrading national program workers requires financial assistance for workshops, symposia and in-country consultation. This upgrading should be linked to a program to increase political awareness by planners.

The weak interactive force between extension and research is one of the greatest constraints to development in the poorest countries. Every development worker knows

this, but the gap remains and the small holder suffers. AVRDC cannot overcome this alone, but the need for improved nutrition, more income generation, and diversification in the rice-based economies is now in sharp focus. Innovative enlightenment toward a constructive pathway could be initiated if adequate support was made available.

Grant proposals have been developed to enlist support for an assessment of the interest, potential and needs of small holder vegetable growers in the tropics. Following the assessment, a project design workshop is planned to bring together national planners, research and extension leaders to examine the constraints to profitability of the small grower and develop corrective measures to assist them.

FINANCIAL REPORT

Background

The economic structure of the AVRDC is presented in Table 1, entitled 'Income and Expenditure for 1986' and Table 2, 'Operational Requirements for 1987 through 1990'. The AVRDC income level is quite small compared to the large CGIAR Centers. This Center maintains a consistent prioritization and monitoring schedule, a very cost-effective purchasing system, and a cross-training personnel program to maximize labor efficiency. The labor turn-over at AVRDC averages 5% to 6% per year, which is quite impressive considering the strong economic growth of the host country.

Outlook

AVRDC is optimistic about its future because of the new appreciation of vegetables as a reasonable approach to improve nutrition and income generation in the tropics. The donor base is showing greater interest in this Center as a germplasm and information pool and as a training center for research and extension.

The strong encouragement from Mainland China in support of AVRDC programs is signaling a positive message to donors who have been concerned previously about the geo-political situation. We also feel that this encouragement may enhance the possibility of some form of support from the CGIAR.

AVRDC is endeavoring to assess the specific needs of the national programs in vegetable production, marketing and utilization of vegetables for which the Center may provide direct or indirect assistance. Each country has unique needs; to some help is needed in input-cost reduction for small commercial growers; others may be initiating seed or processing operations; and others accent the need for help in home nutrition gardens.

Regional assistance is continually sought to help finance these broad-scale programs. An example of urgency is the cost of distribution of germplasm and requested publications. The cost of distribution has increased many-fold in the past 4 years. Most developing countries do not have the foreign exchange to pay for

technical publications, and even when they do, the method of payment is difficult for them. This is a very real problem and a small budget Center is constantly faced with want-to, can-do and can't-do situations. One solution is proving to be the recently established publication distribution fund supported by donor contributions.

AVRDC has proven itself to be an effective research and training center which delivers full measure for each dollar invested. We are optimistic that our concern, capability, and dedication to help tropical peoples will continue to be supported and expanded.

Table 1. Income and Expenditures for 1986 in US Dollars.

I. Core Budget Fund	
A. Grant Fund	
Kingdom of Thailand	194,642.54
Republic of the Philippines	60,000.00**
Republic of Korea	140,000.00**
Republic of China	1,537,125.26
Government of Japan	250,000.00
U.S. Government	1,000,000.00
Variance on rate changes	165,178.53
Sub-total	3,346,946.33
B. Restricted Core Fund (Fed. Rep. of Germany)	266,488.72
C. Miscellaneous Grant Fund	60,476.26
D. Translation Adjustment	52,678.07
E. Other Income	634,701.84
Sub-total	1,014,344.89
TOTAL	4,361,291.22
F. Disbursements	
Capital Improvements	2,230.30
Equipment and Furniture	177,816.76
Operating Expenses	4,004,880.85
TOTAL	4,184,927.91
G. Core Budget Fund Balance	176,363.31
II. Special Project Fund	
Previous Fund Balance, 1985	642,952.81
Funds Received, 1986	1,370,164.63
Funds Disbursed, 1986	1,411,355.30
Balance, 31 December 1986	601,762.14

** Contribution for 1986 arrived partially in 1987.

Table 2. Operation Requirements, 1987-1990. (US\$'000, in 1986 Constant Dollars)

Details	Current 1987	Proposed		Projections	
		Budget 1988	1989	1990	
MAJOR ACTIVITIES					
Research Programs					
Crop Improvement Program	1,232	1,399	1,511	1,632	
Production Systems Program	400	459	495	535	
Development Program	139	145	157	169	
Sub Total	1,771	2,003	2,163	2,336	
Research Support Service Activities					
Office of Information Services	124	139	150	162	
Genetic Resources & Seed Unit	123	159	171	185	
Chemistry	132	149	161	173	
Statistics & Computer Service	50	56	61	66	
Experimental Farm	323	373	403	435	
Library & Documentation Service	82	94	101	110	
Sub-Total	834	970	1,047	1,131	
Total Research Activities	2,605	2,973	3,210	3,467	
Administrative Support					
General Administration	535	596	644	695	
Building & Maintenance	380	440	475	513	
Food & Dormitory Service	115	134	145	157	
General Expenses	365	407	426	468	
Sub Total	1,395	1,577	1,690	1,833	
GRAND TOTAL (Core Budget)	4,000	4,550	4,900	5,300	

APPENDIX I.

BOARD OF DIRECTORS

Dr. Paul C. Ma, Chairman
Food Industry Research and Development Institute
Taiwan, ROC

Dr. Yoshiaki Ishizuka, Vice Chairman
Sapporo
Japan

Rector Prof. Sutharm Areekul
Kasetsart University
Thailand

Dr. Jung-Ho Kim
Rural Development Administration
Korea

Dr. Klaus J. Lampe
German Agency for Technical Cooperation
Federal Republic of Germany

Dr. Manuel M. Lantin
Department of Agriculture
Philippines

Dr. Shu-Huang Ou
San Jose, Calif.
USA

Dr. James Garrett Ryan
Australian Centre for International Agricultural Research
Australia

Dr. Allan K. Stoner
Department of Agriculture
USA

Dr. M. Guy Vallaeys
Inter Ministry Committee of International Agricultural Research
France

Dr. George A. Marlowe Jr.
Asian Vegetable Research and Development Center
ex officio

APPENDIX II.

ASIAN VEGETABLE RESEARCH AND DEVELOPMENT CENTER

Current Senior Staff Listing

July 1987

ADMINISTRATIVE STAFF

Title	Name	Citizenship	Date of Birth	Date Joined AVRDC
Director General	George A. Mariowé (Ph.D. Horticulture, Univ. of Maryland, USA, 1955)	USA	1925	1986
Deputy Director General	Paul M. H. Sun (Ph.D. Plant Pathology, Purdue Univ., USA, 1971)	ROC	1937	1980
Director of Administration	Michael K. H. Chin (B.S. Chemistry, Yenching Univ., China, 1945)	ROC	1921	1972
Comptroller	David I. K. Chi (B.A. Economics, National An-Hui Univ., China, 1943)	ROC	1925	1972

RESEARCH STAFF

Crop Improvement Program: Dr. R. T. Opeña, Program Director

Mungbean Breeding	George C. J. Fernandez (Ph.D. Plant Breeding, Texas A & M Univ., USA, 1985)	Sri Lanka	1952	1986
Tomato Breeding	Romeo T. Opeña (Ph.D. Genetics, Univ. of Calif., Davis, Calif., USA, 1972)	Philippines	1944	1972
Soybean Breeding	S. Shanmugasundaram (Ph.D. Crop Science, Kyushu Univ., Japan, 1981)	India	1939	1972
Sweet Potato Breeding	Hiroko Takagi (Ph.D. Plant Breeding & Genetic Resources, Univ. of Tsukuba, Japan, 1983)	Japan	1956	1986
Chinese Cabbage Breeding	Jing-Young Yoon (Ph.D. Plant Breeding & Hort., Seoul Nat. Univ., Korea, 1982)	Korea	1946	1985
Entomologist	N. S. Tatekar (Ph.D. Entomology, Univ. of Wisconsin, USA, 1973)	India	1940	1974
Plant Pathologist (Mycology)	Arnold T. Tschanz (Ph.D. Plant Pathology, Cornell University, USA, 1977)	USA	1942	1978

Plant Pathologist (Virology)	Sylvia K. Green (Ph.D. Plant Pathology, Univ. of Bonn, W. Germany, 1979)	Germany	1943	1980
Plant Physiologist	George C. Kuo (Ph.D. Plant Physiology, Univ. of Calgary, Canada, 1973)	Canada	1942	1975

Production Systems Program: Dr. Samson C. S. Tsou, Program Director

Crop Management	Adisak Sajjapongse (Ph.D. Soil Science, Univ. of Minnesota, USA, 1973)	Thailand	1943	1979
Cropping Systems	James J. S. Tsay (Ph.D. Physiology, Univ. of Queensland, Australia, 1985)	ROC	1944	1986
Principal Soil Scientist	Yasuo Ota (Ph.D. Agriculture, Tokyo Univ. of Agriculture, Japan, 1967)	Japan	1929	1987

Development Program: Dr. Arnold E. Tschanz, Program Director

Training Officer	Diosdado V. Castro (M.S. Agronomy, Univ. of the Philippines, Phil., 1969)	Philippines	1933	1975
Consulting Nutritionist	Jack Gershon (Ph.D. Medical Anthropology, U.C. Berkeley, Calif., USA, 1978)	USA	1928	1980

SUPPORT STAFF

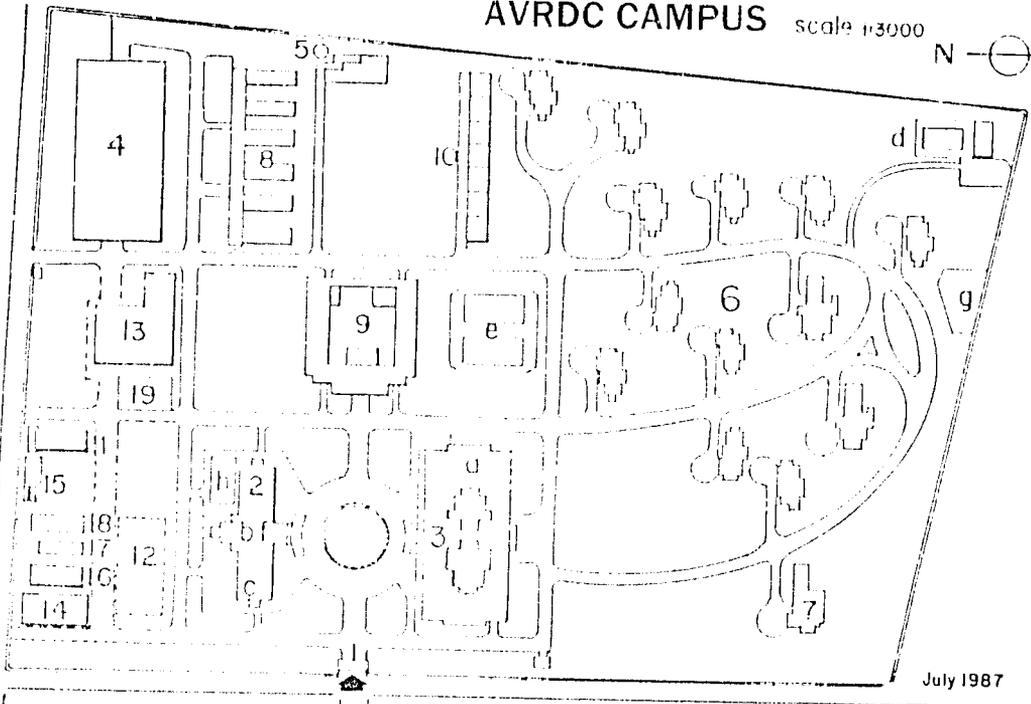
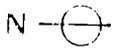
Biochemist	Samson C. S. Tsou (Doctor of Natural Science, B.C.P. Janssen Inst., Univ. of Amsterdam, The Netherlands, 1970)	ROC	1939	1973
Genetic Resources & Seed Unit (GRSU)	Chung-Seng Tay (Ph.D. Plant Biology, Univ. of Birmingham, UK, 1979)	Malaysia	1950	1983
Information Officer	Bruce T. McLean (B.A. Political Science, San Francisco State Univ., USA, 1972)	USA	1948	1985
Librarian	T. H. Hwang (B.A. English, Tamkang College, Taiwan, ROC, 1957)	ROC	1934	1974

THAILAND REGIONAL TRAINING PROGRAM IN VEGETABLE PRODUCTION & RESEARCH

Director & Resident Scientist	Charles Y. Yang (Ph.D. Plant Pathology, Univ. of Wisconsin, USA, 1964)	USA	1931	1972
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APPENDIX III.

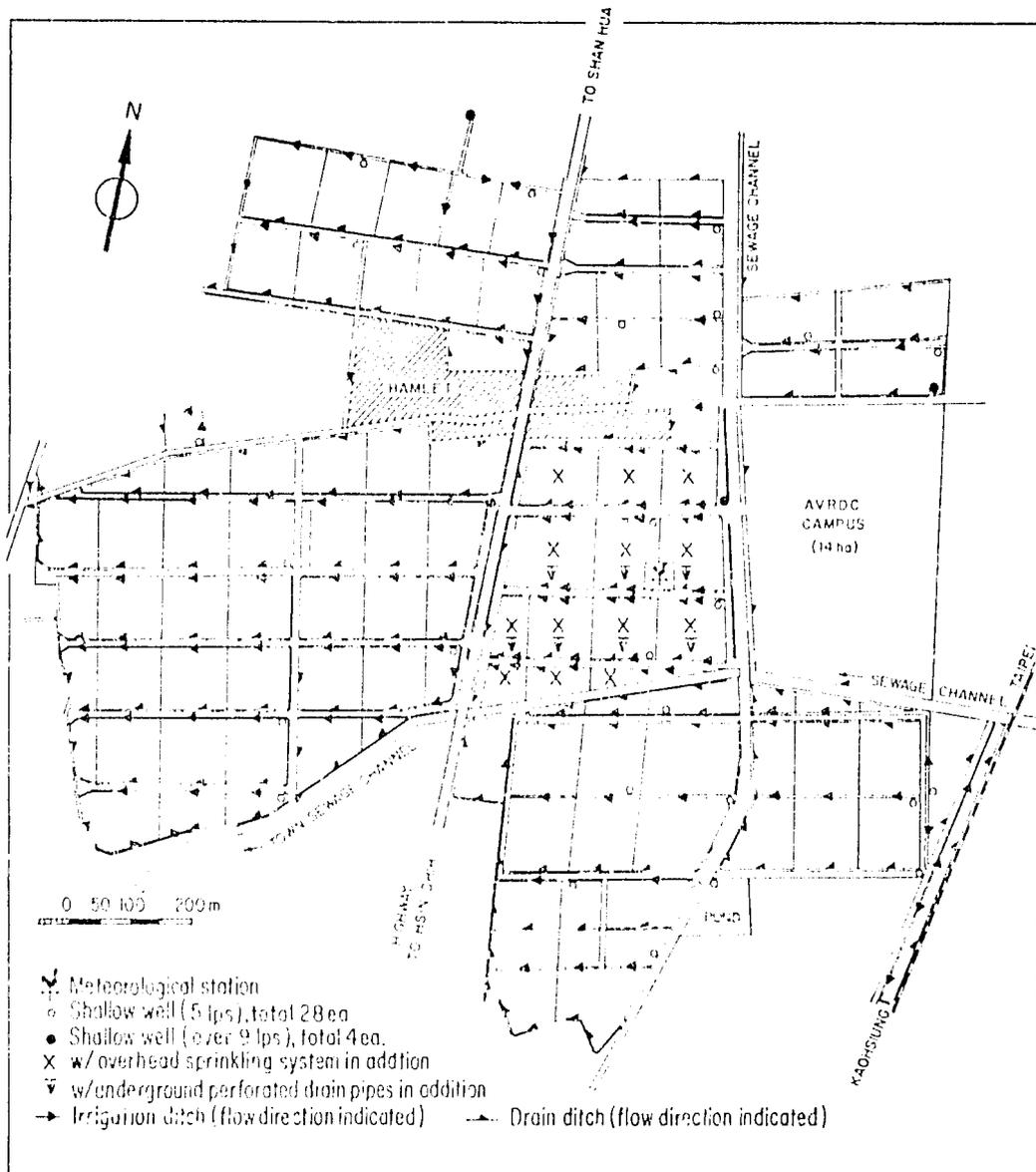
AVRDC CAMPUS scale 1:3000



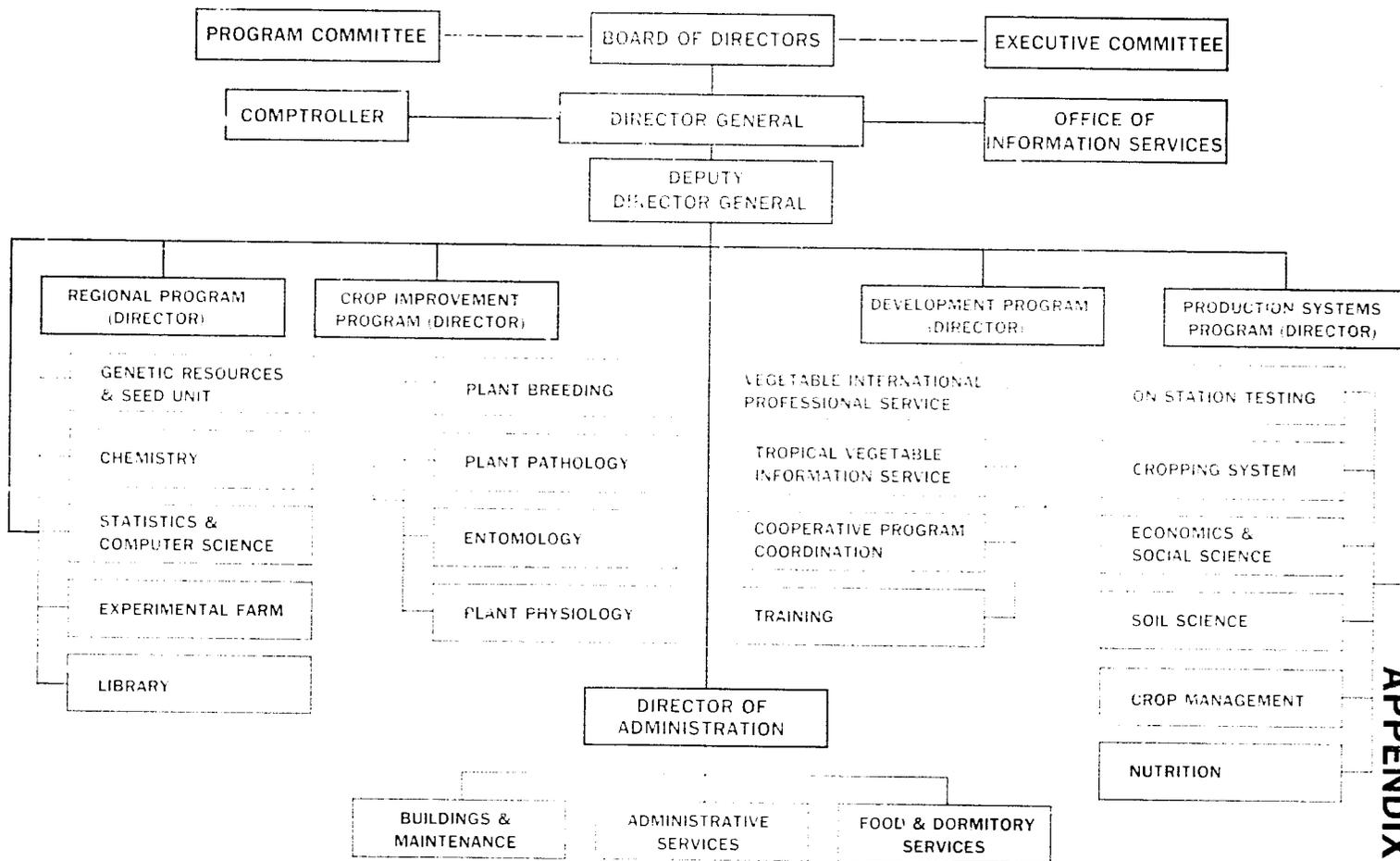
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|------------------------------------|-------------------------------|
| 1. Main Entrance | a. Library |
| 2. Administration Building | b. Auditorium (3rd Floor) |
| 3. Laboratory Building | c. Post Office (1st Floor) |
| 4. Service Building | d. Swimming Pool |
| 5. Water Tower | e. Tennis Courts |
| 6. Staff Houses | f. Recreation Room (Basement) |
| 7. Director's Residence | g. Children's Playground |
| 8. Main Greenhouse Complex | h. Volleyball Court |
| 9. Cafeteria/Dormitory-Guest House | |
| 10. Staff Apartments | |
| 11. Insectary | |
| 12. Net House | |
| 13. Genebank and Seed Laboratory | |
| 14. Sweet Potato Quarantine House | |
| 15. Seedling Greenhouse | |
| 16. Greenhouse | |
| 17. Greenhouse | |
| 18. Greenhouse | |
| 19. Greenhouse | |

APPENDIX IV.

THE EXPERIMENTAL FARM OF AVRDC



AVRDC ORGANIZATION CHART 1987



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APPENDIX V.