

**Report to the
Government of Western Samoa**

The Agricultural Research System in Western Samoa



International Service for National Agricultural Research

The International Service for National Agricultural Research (ISNAR) began operating at its headquarters in The Hague, Netherlands on September 1, 1980. It was established by the Consultative Group on International Agricultural Research (CGIAR), on the basis of recommendations from an international task force, for the purpose of assisting governments of developing countries to strengthen their agricultural research. It is a non-profit autonomous agency, international in character, and non-political in management, staffing, and operations.

ISNAR is the youngest of the 13 centers in the CGIAR network, and it is the only one which focuses primarily on national agricultural research issues. It provides advice to governments, upon request, on organization, planning, manpower development, staff requirements, financial and infrastructure requirements, and related matters, complementing the activities of other assistance agencies. In addition, ISNAR has active training and information programs which cooperate with national agricultural research programs in developing countries.

ISNAR also plays an active role in assisting these national programs to establish links with both the international agricultural research centers and donors.

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The Agricultural Research System in Western Samoa

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List of Acronyms

ADAB	Australian Development Assistance Board
ADB	Asian Development Bank
AVRDC	Asian Vegetable Research and Development Center
CIBC	Commonwealth Institute for Biological Control (UK)
CIMMYT	Centro Internacional de Mejoramiento de Maiz y Trigo
CSIRO	Commonwealth Scientific and Industrial Research Organization (Australia)
DBWS	Development Bank of Western Samoa
DoA	Department of Agriculture
EDF	European Development Fund
EEZ	Exclusive Economic Zone (Maritime Fisheries)
EAPU	Economic Analysis and Planning Unit (Department of Agriculture)
FAO	Food and Agriculture Organisation of the United Nations
GDP	Gross Domestic Product
GTZ	Agency for Technical Cooperation (Federal Republic of Germany)
IBRD	International Bank for Reconstruction and Development
IDA	International Development Association
IFAD	International Fund for Agricultural Development
IITA	International Institute of Tropical Agriculture
ILO	International Labour Organization
IRETA	Institute for Research, Extension and Training in Agriculture of University of the South Pacific
ISNAR	International Service for National Agricultural Research
RDP	Rural Development Programme
SPC	South Pacific Commission
UNDP	United Nations Development Programme
USAID	United States Agency for International Development
USP	University of the South Pacific
WSTEC	Western Samoa Trust Estates Corporation

Notes:

Rate of exchange: 1 US dollar = 1.56 tala (WS\$) (in August 1983)
1 tala (WS\$) = 0.64 US dollar

Metric measurements are not in common use in Western Samoa; such measures as area and yield are given in the customary units there.

Summary

This review was carried out in August 1983 at the invitation of the Director of Agriculture in the government of Western Samoa.

The government's policy objectives for the agricultural sector emphasize the need to increase exports and decrease imports, and become self-sufficient in as many foodstuffs and forest products as possible. The essential contribution which research and extension services must make towards the attainment of these objectives has not been clearly defined and there seems to be no general administrative and political support for research.

Western Samoa has modest resources. It is a small country (about 1,100 square miles, population 160,000) and is heavily dependent on agriculture. The agricultural base, determined largely by soils and climate, is narrow. Coconuts, cocoa, bananas, and taro are the main crops; timber production is important. There is self-sufficiency in fresh fish, but appreciable quantities of tinned fish are imported. The potential for ruminant livestock is only partly realized.

Basis for Assessment

A framework within which to assess the results of the review postulates that a continuous flow of new knowledge and materials is needed to maintain or to increase agricultural production and that the research services should provide this. It is also important that there be a two-way interaction between the research service and agricultural policy-makers and between research and producers. The main issues are the definition of what part of the needed research must be done in Western Samoa and how this work can best be done.

The criteria established for the analysis of the current situation (Chapter 4) emphasize mechanisms for the formulation of policies, plans, and programs; the resources of people, facilities, equipment, and funds needed to implement the programs; and effective communications with the world knowledge base, with policy-makers and producers, and within the research service itself.

Main Findings

National Development Policy and Plans

Agricultural development has been afforded top priority in the government's published policies and plans, but there has not been a significant shift in resources to the agricultural sector' which contributes about 50% of the GDP. Agriculture's share of the total budget declined from 7.9% in 1982 to 6.4% in 1983.

National Agricultural Research Policy

Despite the recognition in the policy documents of the importance of research and other agricultural services there appears to have been no definition of a national agricultural research policy.

Research Plans and Programs

In the absence of a clear directive on research policy, the research committee that was established in the Department of Agriculture (DoA) to evaluate new research proposals and on-going work, and to coordinate work between the department and the University of the South Pacific (USP) proved ineffective.

The Resource Base for Research

Department of Agriculture

Little agricultural research was done in Western Samoa before 1975. Since then, research components have been included in several development projects, but no research division has been established in the Department of Agriculture.

There are few Samoans trained and experienced in agricultural research. Most of the research in the development projects is done by expatriates. While the projects provide training opportunities for Samoan staff, they do not help to develop Samoan skills on a career basis because of the lack of an identifiable research entity.

Good facilities and equipment are available at the Nu'u research station to accommodate from 8 to 10 research scientists. With some further development of the substations on Upolu and Savai'i and in conjunction with the soils laboratory and the food processing unit, overall facilities seem adequate for research on crops. The livestock farms are adequate in size and number for research on pasture and on cattle. In forestry and in fisheries the facilities are adequate for the small research programs.

There is no defined budget for research activities, so it is impossible to estimate how much is being spent on research. There is, however, a severe shortage of funds for salaries of local staff and operating expenses in the donor-supported projects. Lack of continuity of financial support from government sources presents major problems.

Faculty of Agriculture, University of the South Pacific

This is a regional organization with substantial staff and facilities located in Western Samoa. Much of the research work in progress is relevant to the needs of Western Samoa but, in general, the Department of Agriculture does not use to full advantage the resources available.

The estates sector

Most of the land in this sector is under the Western Samoa Trust Estates Corporation (WSTEC). The large amount of land in plantation crops and pastures is a physical resource which could be used for on-farm research work. It is not used effectively for this purpose at present.

Research in Progress

Crops

The total amount of adaptive research in progress is considerable in relation to the country's needs. Within this total, coconuts and taro, and the fertilizer needs of crops in general are not adequately covered. A national plan and program for agricultural research is needed so that these imbalances can be corrected.

Livestock

Good research has been done on pasture development and livestock in the past but work has now stopped. Research on pasture development and on ruminant livestock could be restarted at little cost.

Forestry

The research section of this division has a small program in nursery techniques, silviculture, utilization of forest products, community forestry and controlled firewood production, and watershed protection. The results from the utilization studies have prompted a major change in the choice of species to be planted in the large reforestation programs.

Fisheries

This small division has two research projects on raft culture of mussels, and on pond culture of prawns. There is virtually no work on marine fishery resources.

Relationships with Outside Organizations

Western Samoa benefits substantially from work in progress at USP and from the resources available at that institution.

The main development projects which have led to the development of modest but good research facilities have been supported by donor agencies and development banks. Several international research centers have made contributions through training and improved genetic materials.

Research/Extension Linkages

Research is done in separate units, some of which have extension components which are distinct from the extension division of the Department of Agriculture. This fragmentation of both research and extension services has not encouraged the development of close working relations. This situation should improve following the building of an extension training unit at the Nu'u research station.

Information Management in Agricultural Research

The flows of information into, within, and out of the research system are important for it to function effectively. The Communications and Information Section of the department is of reasonable size but its staff lacks adequate professional training. There is inadequate access to external sources of information, and there is a lack of formal means of interchange between research and extension.

Constraints to the Development of Effective Research Services

The main factors impeding the development of effective national research services seem to be:

- * lack of a clearly defined research policy and commitment to provide the means for its implementation;
- * lack of an effective mechanism for formulating research plans and programs in relation to national needs, using all available resources in the country and information from outside;
- * absence of any specific identity for research efforts as a whole, i.e., there is no research section, unit, or equivalent;
- * lack of a defined staff management and development program in which staff can see how their research careers can develop;
- * overdependence on expatriate staff since there are few Samoans trained in research methodology;
- * fragmentation of research efforts by project, leading to lack of cohesiveness between research activities;
- * serious shortcomings in the provision of national funds in effective amounts and on a regular, timely, and continuing basis;
- * difficulties in achieving effective interactions among farmers, extension officers, and researchers because of the dispersal of research (and to some extent extension) efforts by project.

- * To promote a wider realization of the importance of a clear research policy, the results of research which have been used to increase or to protect agricultural and forestry output in Western Samoa should be reviewed as a matter of urgency and the results publicized.
- * A research planning committee, having broad representation should be established. This committee should be charged with the development of a long-range plan for research as an essential component of agricultural development.
- * Membership of the existing research program committee should be widened to include extension, producer, and USP representatives; it should formulate research programs within a three to five year rolling program; these programs should relate directly to the objectives set by the planning committee.
- * A systematic assessment of staff requirements should be made in terms of numbers and of the range of subjects to be covered. This would form the basis of a staff training and manpower-development plan having as its main objective a substantial reduction in the present dependence on expatriate staff.
- * Greater use should be made of existing physical resources. The crop development centers should be developed to become adaptive research and development centers. In time their activities should be extended to include livestock and forestry. The interaction between DoA and WSTEC in getting effective research done in the plantation and livestock industries should be reexamined.
- * The government should adopt a flexible attitude to the funding of research while at the same time trying to ensure reliability and continuity of funding. Different ways of raising funds need to be explored.
- * The structural problems within the research organization should be addressed after plans and programs have been formulated.

Immediate action is needed to promote general support for research. To this end the Ministry of Agriculture should develop and implement a process by which it communicates the rationale for its research program and the results of that program on a regular basis to producers, policy-makers, and consumers.

Once the research program has been formulated, an assessment should be made of the organization of the research services to seek ways to provide unified leadership for the program.

Long-term Issues

- * Continuity of funding at an operationally realistic level is essential. The basis of this support and the determination of the level required can only come after at least some of the steps outlined in the recommendations have been taken.
- * Maximum use needs to be made of the varied resources in DoA, WSTEC, and USP in complementary research and development programs. The ways in which this may be done should become clear when the research plans have been formulated.

General Conclusions

These recommendations cover the main areas in which improvements appear to be needed. Though extensive, they do not imply any immediate major increases in the commitment of financial resources. Some shift in resource allocations within DoA may be needed, but the marginal increases in funding which may be required to develop the crop development centers and for staff training can most likely be obtained from existing donor commitments. The principal need is for clear plans within which the resources can be used to maximum advantage.

Chapter one: Introduction

Background to the Mission

During a visit to Western Samoa in September 1982, the Director General of the International Service for National Agricultural Research (ISNAR), Dr. W. K. Gamble, held discussions with Mr. R. J. Burgess, the Assistant Director of Agriculture responsible for research and technical services, about these services in Western Samoa and in the Pacific region generally. One outcome of these discussions was a request from the assistant director that ISNAR consider sending a mission to Western Samoa to review the research and extension situation and report to the government with a view to effecting improvements where possible. In response to this request, an exploratory visit was paid to Western Samoa in February 1983 by Dr. C. Panabokke, then an ISNAR staff member. He subsequently returned to a post with the Government of Sri Lanka.

The review team of five persons visited Western Samoa from August 1 to 16, 1983. Dr. Panabokke could not join the team, since his services were required at that time by his own government.

The team had wide-ranging discussions with the minister and staff of the Ministry of Agriculture and with staff in other departments of the government which would be directly connected with providing resources for research activities. The dean and staff of the Faculty of Agriculture of the University of the South Pacific at Alafua, staff of the main aid agencies which are supporting research and extension in Western Samoa, and a number of private individuals were also consulted. At the end of the field work the main findings of the mission were reported verbally to the minister and to the senior staff of the department.

Terms of Reference

These were agreed upon by the director of agriculture and Dr. Panabokke during the February visit and subsequently confirmed in correspondence between the director of agriculture and the director general of ISNAR. They are quoted as follows:

- * to examine the research programs of the Department of Agriculture, Forests and Fisheries in relation to the national goals and objectives set out in the Fourth Development Plan 1981-85¹ and in relation to recent reviews of the economy; and

¹Amended on August 2, 1983 at the request of the Minister of Agriculture and Forests, to refer to Western Samoa: Socio-Economic Situation, Development Strategy, and Assistance Needs (December 1982).

- * to make an appraisal of the overall research program, its appropriateness and organization with a view to suggesting possible improvements.

The review would include the following areas but would not necessarily be confined to them:

- * research programs; organization in relation to the setting of priorities, allocation of resources, and management of research activities;
- * facilities and physical resources; availability and needs;
- * research and technical staff; availability, training and career structure;
- * budget; appropriation and management of funds for research;
- * relations with other national institutions;
- * relations with regional organizations especially USP/IRETA, and with international agencies and external sources of support;
- * the present role of extension; the effectiveness of the linkage between research and extension;
- * the communication of relevant information to government and producers.

During the first meeting with the minister and the director of agriculture, shortly after the team's arrival in Apia, it was made clear that ISNAR's main activities are in the research field and that the team would not investigate the detailed organization and workings of the extension service; however, it would concentrate on the linkage between research and extension, an essential feature of any research service.

The Report

The report is presented in four parts:

- * the role of agriculture in the economy of Western Samoa and the requirements of the current agricultural development plans and strategies which have been set out in a number of government documents;
- * the role of research as an integral part of agricultural development, especially relating to small countries where the problems of staff and funding are often very severe;
- * a detailed analysis of the current situation followed by a discussion of possible ways in which the agricultural research and extension services might be made more effective;

- * a presentation of the conclusions and some recommendations which the team feel able to make, followed by a number of specific proposals with mechanisms by which they may be implemented (these are considered within a timeframe of 10 years).

Some of the proposals can be implemented in the short run with little extra cost to the government. Others will need careful consideration as to how they may be implemented, and are not expected to come into full operation in less than 10 years.

Chapter two: Agriculture in the Economy of Western Samoa

Extensive published information is available on the economy of Western Samoa and of the dominant role of agriculture in it. This chapter contains only brief summaries of some of the salient features; further details are given in Annex 1.

Agriculture provides the bulk of the country's food, work for about 80% of the people, and about 90% of export earnings. Food imports are considerable; in monetary terms they almost equal the currently depressed earnings from the major export crops. The country is small and remote from any major industrial markets, so the export of perishable commodities presents major problems.

Natural Resource Base

Soils and Climate

The two main islands of Upolu and Savai'i cover about 1,150 square miles (2,935 square kilometers), and are of recent volcanic origin. The derived soils are relatively shallow, freely drained, and heavily leached under rainfall which exceeds 100 inches (3,000 mm) in most places. Abundant stones and boulders on the surface pose additional problems and preclude extensive mechanization. A report of a general soil survey has been published (Wright 1963); the climatic situation and the topography of the islands are described in Fox and Cumberland, 1962.

Western Samoa (latitude 13°S to 14°S) is tropical on the coasts, and subtropical/tropical inland, with a mean daily temperature of about 27° centigrade. The average rainfall is about 100 inches, two-thirds of which falls between October and March. The dry season is from May to August. See Annex 1, Figure 1.

It has been estimated that about 325,000 acres are suitable for intensive agriculture. At present about 205,000 acres are cultivated or used for urban purposes. Some additional land could be used for extensive grazing of cattle. The implications of these figures are that increased productivity per unit area will be necessary to increase total output.

Crops and Forestry

The major crops are coconut, cocoa, bananas, and taro, which occupy 123,000, 12,000, 9,000, and 3 500 acres, respectively. This is a narrow base but is determined largely by soil and climatic conditions which favor tree crops and forestry, and preclude any extensive mechanized production of annual crops.

A detailed assessment of forest resources was made in 1977. The results showed a total of 256,000 acres of productive forest and that large resources of wood are currently not used. The reforestation program is substantial, and the objective is a sustainable output of good quality timber.

Livestock and Fisheries

Livestock are important nutritionally and for social reasons. Output from the cattle, pig, and poultry industries has been static for a few years, while meat imports have increased. The herds and flocks represent a major national resource.

Fish is an important component of the local diet. Present policy is designed to ensure a regular and adequate supply of fresh fish for the local markets. Commercial fishing has not been of major importance to Samoa. The potential for an increase of fish catches by inshore boats is not known (Johannes 1982).

Population

The total population of Western Samoa is approximately 160,000, of whom 21% live in towns or large villages. The main characteristics of the population are that about 47% are under the age of 15, the birth rate is high, mortality rates are low -- the life expectancy is about 63 years, and emigration is at about 2,000 per year, leading to shortages of skilled labor in some areas. Of the total estimated labor force of approximately 75,000, the subsistence sector provides work for about 65%, and the monetized sector employs about 25%, which leaves 10% unemployed or unaccounted for.

The primary and secondary educational system in Samoa is extensive and of a relatively high standard. A large proportion of students attend secondary school. There has been a tradition of numbers of Samoans being sent overseas for training of various kinds. Attention has been focused recently on degree-level training, rather than postgraduate training. This has implications for the staffing of the agricultural research service.

Land Tenure

About 75% of the land is held as customary land. The control of this land is within the village group and administered by the chief matai. Approximately 11% of the total land is held by the government, while the Western Samoa Trust Estates Corporation (WSTEC) has about 4%. This leaves about 10% in private hands.

The government has recognized that it is only by working through the matai² and involving them in the governmental and economic development process that progress can be made in increasing production at the village level.

²For the role of the matai, see Annex 1

The Agricultural Sector

As indicated above, the agricultural sector is based on few crops. Exports of copra, cocoa, and bananas amounted to 80% of the total export earnings in 1981. Forestry has assumed a significant role in export earnings, and the export of taro has recently increased.

The gross development product (GDP) attributable to agriculture, forestry, and fisheries -- tala (WS\$) 38.0 million -- is about half of the national total (Annex 1, Table 1). It is projected to grow at the rate of 3.2% in real terms over the next few years, but this depends on the prices for copra, cocoa, and taro over which the producers have little control.

In addition to recognized opportunities for increasing exports of these crops there appears to be scope for the replacement of food imports (see Annex 1, Table 2 for details) and of animal feed imports. Meat imports are substantial, but the livestock industry has not responded to this situation. Production has not increased for several years. There is a good potential for cattle raising and for the growing of some feeds for nonruminants.

It is estimated that 80% of all production comes from the village sector and 20% from estates (mainly WSTEC). Village and central government objectives do not always coincide, thus making it difficult to increase the production of export crops in the villages.

Marketing Agencies

The marketing of copra, cocoa, and bananas is handled by specialized boards managed by interministerial committees. The marketing of other crops, mostly taro, is handled by the produce marketing division of the Ministry of Agriculture.

Credit: The Development Bank of Western Samoa

The Development Bank of Western Samoa (DBWS) was set up in 1974. It has developed into the major national credit institution and is now managed entirely by Samoan staff. The emphasis of its short-term lending is on cash cropping at the village level. The DBWS is also active in promoting credit unions at the village level and various types of cooperatives to mobilize local savings and resources.

Development Policy and Plans

These have been well set out in the paper on the Socio-Economic Situation, Development Strategy and Assistance Needs (Government of Western Samoa, Dec. 1982) (see Annex 2). There are three main components: promotion of the village sector, use of leased village land for small estate-type developments, and improvements at WSTEC to increase output of plantation crops and cattle. Large development projects are in

progress in the major crops (except bananas), livestock, and forestry. These are receiving substantial assistance from several external agencies.

The role of the research and extension services is emphasized as being essential to the development of new methods of production for traditional crops and for supporting the introduction of new crops.

Structure of Government

There is a single elected assembly of 36 members. The government structure is indicated in Annex 3. Within this framework the Ministry of Agriculture is responsible for all agricultural developments.

The Ministry of Agriculture was reorganized in 1977 and new structures were agreed upon (Annex 3, Tables 2 and 3). These have not been put into operation. In this reorganization, the College of Agriculture at Alafua, which was the research arm of the Department of Agriculture (DoA) until that time, became the School of Agriculture of the University of the South Pacific (USP). The emphasis of its work was changed from that of providing for purely national needs to one of providing for the region as a whole.

Research Organization

There is no part of the ministry structure which is referred to as a research unit, section, or division. The introduction of essential research components into major development projects on an ad hoc basis has succeeded in getting some work done, but at the expense of further weakening of the function of DoA in any cohesive research program. The establishment of a research station at Nu'u indicates that the department feels a need for its own research unit.

Research work has continued at Alafua within USP but, there has been insufficient programmatic interaction between USP and DoA for maximum benefits to accrue to Western Samoa. While the mission was in the field, it was announced that the government intended to set up a university or university college of Western Samoa which would be based on the Alafua campus.

The overriding problem in Western Samoa appears to be that there are very few Samoans trained in agricultural research. In the ministry as a whole there are very few graduates, and only three appear to be involved in full-time research activities (Annex 3, Table 5). The organization of agricultural research is weak and work is fragmented between projects supported by donor agencies which also provide technical assistance personnel.

Extension Services

Extension services of DoA are headed by a chief agricultural officer supported by senior agricultural officers and others on Upolu and Savai'i. In addition, there are extension or field officers attached to the livestock division, the cocoa development and plant protection

projects, and the food processing laboratory. The mission noted the possible adverse effects of the present fragmentation of efforts, especially in relation to the interaction among research, extension, and producers.

Meteorological Services

Responsibility for the meteorological services rests with the Ministry of Agriculture. The emphasis of these services is on providing information for aviation and maritime purposes, and for general hydrological use in relation to stream flows and fresh water availability for domestic and industrial purposes. Rainfall records are maintained from sites on Upolu and Savai'i, but other parameters such as net radiation, sunshine, potential and actual evapotranspiration, and wind speed are recorded in only a few places. The reason for this seems to be that the generally high rainfall (in excess of 100 inches per year in most places), the topography of the islands, and the nature of the soils combine to make tree crops and livestock the only realistic production enterprises. They are less affected by small variations in weather patterns than are annual crops so that, apart from the length of the dry season which can be derived from rainfall records, the other parameters are of less importance than they would be in arable production systems. Nevertheless, the current estimated budget for the services in 1983 was WS\$122 thousand, or about 10% of the total for the ministry as a whole.

Chapter three: Research as a Component of Agricultural Development

The basis for this section is the search for answers to the questions:

Why is research needed?

What kind of research needs to be done?

How, by whom, and where can the work best be carried out?

What resources are required for effective action?

Why is Research Needed?

All forms of agricultural activity involve the use of land to grow nonclimax vegetation. This means that certain measures are necessary to displace the natural vegetation in favor of those crops which man wishes to have. However primitive a land-use system may appear to be, it has usually evolved by trial and error, often over a long period of time, and makes use of the resources available to stabilize output and to minimize risks. In a simple system which has a small resource base, the output may be stabilized at a low level, with little risk. To increase the output from such a system, additional inputs are needed (in this context, new knowledge or information is an input), and the risk situation may be changed in the process.

In shifting cultivation, natural regeneration of vegetation is used to restore soil fertility after specific crops have been grown. This is adequate provided that the population is small, land is available to allow for the appropriate time between successive uses for arable crops, and the climate-soil situation is conducive to forest regeneration.

This form of cultivation has been further modified to provide arable systems in which a proportion of the land is left fallow each year, or on which a crop is grown to provide roots and green manure for regenerating the soil. The old rotations developed in Europe relied heavily on a relatively low net removal of nutrients by their main crops and on a resting period under either fallow or leguminous crops. The advent of fertilizers and mechanical and chemical weed control methods has enabled soil fertility to be maintained in temperate areas without resorting to resting periods, provided that reasonable crop rotations are followed. Systems of continuous cultivation, using short duration or annual crops in the much more difficult environmental conditions of the humid tropics, are being developed with the help of modern inputs (especially at the International Institute of Tropical Agriculture, IITA). These show considerable promise on certain soil types.

In each type of agriculture there is some specific interference with the climax vegetation. This attempt to maintain a balance always in favor of the desired plants has brought with it a number of major problems. In

addition to the need to maintain soil fertility, a large problem is the control of pests and diseases. Research is needed to provide the required knowledge and materials.

In traditional systems of agriculture, the rate of change was usually slow. Informal systems of research (trial and error) were adequate to support the production of enough food and fiber for the people, while fuelwood was abundant in the areas not used for cultivation. As the demand for agricultural produce began to increase, it became necessary to speed up the rate of change in various production systems. More inputs were needed and the amount of investigational (research) effort was increased to define these inputs and how to use them effectively. This brought about a change from an informal research system at the production level to a more formalized research system involving specially trained persons working in specialized institutions. Research was needed to increase rates of change in agricultural production systems, as well as to protect those systems which had already resulted in high levels of productivity.

In established production situations, research has at least two components. One is the maintenance or protection of what already exists, and the other is the provision of the basis for changes in existing practices or systems to increase the total output or to develop new products. Research is, therefore, one component of the agricultural development process. While it is essential in that it provides the knowledge and materials which allow changes to take place, it does not of itself provide the whole framework within which increases in production can be made. Many other factors must be in balance -- cost and availability of inputs, access to markets, remunerative prices, and so on -- before the research information and materials can be used effectively in agricultural production systems.

The basic philosophy of research in agriculture is, therefore, that of providing continually changing technology as one of the essential components for agricultural development.

What Kind of Research?

While the basic philosophy for agricultural research may vary relatively little from country to country, the strategies adopted to define specific objectives within the overall goals in a particular country will be influenced by many factors. The most important of these appear to be the significance of the agricultural sector in the general development of the country, the stage of development of the sector and of the national agricultural research system, and the extent of the information available from outside the country.

Before discussing a possible strategy for agricultural research in Western Samoa on which to base an assessment of the current situation it seems important to outline what a good research system can be expected to provide.

In Western Samoa, as in most countries, there are competing demands on the resources available for national development. Agriculture is considered to have a dominant role, but for agricultural research to gain support it must be able to give convincing answers to a number of pressing questions:

- * What can agricultural research do, what sorts of results can be provided?
- * How long will it take for the results to be effective in increasing output (this may be measured in several ways besides gross yields)?
- * What resources are needed to allow the work to be done effectively?
- * How much will it cost?

In trying to set a general framework to answer the first of these questions, it should be remembered that research is a process of systematic investigation which produces only information and new materials with specific and defined characteristics (varieties, breeds, chemicals, equipment). More specifically, however, it is postulated that research activities should be able to:

1. Make available to the government, in an appropriate form, some of the information on which the agricultural development plans of the country can be based, for example:
 - a. medium- and long-range market forecasting, both local and worldwide;
 - b. the suitability of different agroclimatic zones for the production of the commodities and livestock required in competition with other forms of land use;
 - c. detailed technical information about storage, transport, and handling of produce to minimize postharvest losses;
 - d. estimates of the national resources of land, capital, labor, and expendable items (agronomic inputs such as fertilizers, insecticides, improved seeds, etc.) needed to carry out the national plans while maintaining or improving the national land capital, especially its productive capacity.
2. Make available to the farmers through appropriate channels the detailed agronomic and economic information on which to base the production of crops and stock. This includes the maintenance of existing production in the face of hazards, as well as possible changes in production based on new technology.

The identification of problems and opportunities at the farm level and the setting up of relevant research programs to develop new technologies are well understood and generally accepted in most governments as essential functions of the agricultural research system. The role that the system should have in providing one of the major technical inputs into national agricultural development plans or into the planning of individual projects is less well understood.

On a global basis there is a substantial total research effort being made in tropical areas and on tropical crops. The question is to what extent the results of work outside Western Samoa can be adapted for use in the country, and what investigations can only be done within the country.

If the national research effort is viewed as a component within a wider international framework, the answer to what kind of research is needed within the country becomes more clearly defined. If most of the required information and materials are available elsewhere, access to these and the testing of their usefulness at the national level may be all that is needed.

The stated policy objectives in Western Samoa emphasize increasing the net foreign exchange earnings of the agricultural sector by increasing exports and decreasing imports and of becoming self-sufficient in as many foodstuffs and fibers as possible. Considering both this and the country's difficult financial situation, a realistic goal for the research system is to develop the capacity to:

- * improve the knowledge base to permit improvements in the yield of coconut products, cocoa, and bananas per unit area and per unit of labor applied, and to decrease costs of production; this relates to the estate or plantation sector and to village production of some items;
- * develop ways of improving production of exportable commodities at the village level with emphasis on the quality of the produce to ensure its acceptability for export and hence the contribution to the government's objectives of increasing foreign exchange earnings;
- * make the fullest use of the world information base to assist in developing simple adaptive trials on the crops and livestock necessary to maintain self sufficiency in all major items of food; in this, taro would receive priority attention;
- * provide groups of research workers to develop improved land-use systems, whether at the plantation or village level, and in developed and undeveloped areas of the country;
- * establish effective working linkages with farmers through extension channels of various kinds, but which give adequate interaction at the village level;
- * pay particular attention to the improvements in the output of livestock, whether large or small ruminants or pigs and poultry, and to investigating ways of growing the carbohydrate base for locally prepared rations. (The supply of copra meal may be expected to increase as the mill increases its throughput, so that the protein base may already be available.)

A framework within which a system may be developed to address the above objectives was put forward recently by Stepler (private communication). His paper divides the agricultural research spectrum (which is essentially continuous) into five major phases described as follows:

- * pre-release testing and farmer field evaluation (Phase 1);
- * adaptation to local specific conditions (Phase 2);
- * generation of technology prior to adaptive research (Phase 3);
- * identification and assembly of individual disciplinary inputs and of appropriate research methodologies (Phase 4);
- * development of disciplinary inputs, synthesis of new materials, collection and evaluation of new materials, and establishment of the understanding of basic organisms and functions (Phase 5).

The spectrum ranges from adaptive research at the field end (Phase 1) to basic research (Phase 5) at the other.³ It is clear that all of the stages may need to be brought to bear on any one problem; the main question is how and where the work should ideally be done.

The pre-release testing and farmer field evaluation trials in Phase 1 must be done in the area of use and have two objectives: (1) final testing of ideas, materials, and methods which are expected to be of value, based on prior testing in similar situations elsewhere; and (2) the feedback of the findings and of problems identified during the course of the work to the appropriate stage of the research process. In the case of a country which can only afford a research effort of modest size and which produces crops which occupy small areas of land, work at Phase 1 and some adaptive research (Phase 2) may be all that is realistically possible. This would appear to apply to Western Samoa, but implies that work at the earlier stages is in progress elsewhere and that adequate links with this can be established.

How, By Whom, and Where Can the Work Best Be Done?

Adaptive research and on-farm validation (Phases 1 and 2) need to be done at many sites and in farm situations. This means that an adequate number of trained personnel must be available at this level to do the necessary trials. The two main functions of these persons would be to interpret and test at the local level methods and materials from the earlier phases of research, and to identify and refer to the appropriate unit those problems and opportunities which may need further research.

The performance of these tasks also requires a thorough knowledge of the situation within which the farmers are working and of the production systems. The requirement in terms of professional skills is, therefore, wide and includes the social sciences as well as the more usually accepted biological sciences.

³ The order of numbering is deliberate. It is the reverse of the expected order to emphasize that the first stage or phase of research is to define the problem at the producing end, then to carry out on-site research using existing knowledge and materials. Any further problems may be referred to other phases of the research process.

Further, for the research scientists at earlier phases of the work to be able to interpret existing knowledge in the light of local needs, the ecological characteristics of each area need to be thoroughly documented and their significance understood.

The professional input needed at Phases 1 and 2 can be divided into two parts: interpretative and deductive on the one hand, and the performance of large numbers of simple trials on the other. The latter part is essentially a task for skilled technicians and shrewd, trained observers; the former part calls for a much higher level of scientific training and wide experience to interpret what is already known and available on a world basis. The problem is how to provide both types of input at the right place and time, using the small total amount of resources which can be made available.

For Western Samoa, three main considerations must be taken into account:

- * the national development objectives as set out in government policy documents;
- * the research needed to service these plans;
- * the modest resources available to the government to pay for the services needed.

There is a minimum size for a research unit which can be expected to address the range of problems likely to be encountered, but this minimum cannot be defined in other than a subjective sense. The first requirement is to define precisely what research is to be done, i.e., a research policy, based on development objectives, is an essential need. From this a research program can be developed and the resources needed to carry it out can be assessed in light of the use which can be made of the world information, resources, and research base.

Chapter four: Analysis of Current Situation

The need for an agricultural research policy, based on the needs of national agricultural development and within which the research system can operate, has already been described in the preceding chapter. For the analysis of the research system itself, further criteria need to be established against which the results of the analysis can be assessed.

Criteria for Analysis

The criteria often used when analyzing research systems are subjective, but there is a general consensus among experienced research workers on some of the main ones. These may be set out as follows:

- * a critical mass of trained research workers concentrated to ensure interaction between persons trained in different subjects, preferably in multidisciplinary programs;
- * a congenial atmosphere in which to work; this implies reasonable rewards, but more particularly a situation which allows the job to be done efficiently and satisfaction to be derived from it;
- * access to information on a worldwide basis and interaction with the production situation within which the work is to be done, in order to develop purposeful research programs and to avoid repetition of work already done elsewhere;
- * adequate basic facilities of buildings, equipment, transport, and experimental areas or farms;
- * good support services (administrative and technical) to promote rather than control the research activities and to keep the facilities fully operational;
- * assured financing, especially of recurrent costs other than salaries;
- * means of dissemination of results to different groups of users;
- * some recognition by policy-makers that research is a slow process, and the outcome is often unpredictable, but that much is already known which could, if properly interpreted, be of considerable value in the agricultural planning process.

The two key issues are undoubtedly an adequate number of trained personnel -- researchers and support staff (administrative, technical, both laboratory and field) and extension workers with whom to interact -- and an assured level of funding.

Results

National Development Policy and Plans

The national goals and objectives which the research work should be designed to service are set out in Western Samoa, Socio-Economic Situation, Development Strategy and Assistance Needs (Section III, pp 24-42 of Vol 1. See Annex 2). The two main objectives are given as (a) rectification of imbalances in the internal as well as external financial front and (2) strengthening of the productive base of the economy.

To meet these objectives the government will (among other things):

- * give priority to programs that help boost exports through increased production;
- * limit the growth of imports.

In order to support the objective of increasing production, the government will give priority to the agricultural sector, with particular emphasis on programmes that help make full economic use of unused or underutilised village lands.

Specific programs were outlined as follows for the agricultural sector.

A major reorientation is required and envisaged with regard to agriculture. While decisions with regard to WSTEC are of paramount importance at this juncture, efforts will be made to bring the village sub-sector into the mainstream of agricultural planning and development. It is, therefore, proposed to

- * develop and implement projects that help reconcile the need for economic orientation in village agriculture with the traditions and customs of the Samoan people;
- * gradually develop commercial plantations based on village land leased for a long term;
- * reorganize WSTEC and require it to produce and export to its full potential;
- * operate the stabilisation schemes in a manner that yield fair and stable returns to producers;
- * give adequate research support and encourage selected crops for the further development of processing industry in the country;

* use forest resources on a sustained yield basis and encourage exports of processed forestry products.

In the context of this report, the undertaking to give "adequate research support" is particularly important.

Unfortunately these intentions appear not to have been carried through in the definition of a research policy or in the provision of funds to carry out these policies and programs. The proportion of expenditure for agriculture in the current 1983 estimates is lower in absolute terms and as a proportion of the national total than it was in 1982.

Table 1. Budget estimates for 1982 and 1983 (WS\$ thousands).

	1982			1983		
	Current budget	Development budget	Total	Current budget	Development budget	Total
Total	32,363	9,033	41,396	36,777	6,870	43,647
Agriculture	1,294	1,998	3,292	1,219	1,589	2,808
As % of Total	4.0	22.1	7.9	3.3	23.1	6.4

Table 1 indicates the actual amounts and the proportion of the national budget allocated to agriculture in the two years. While it is realized that the government's financial position is extremely difficult, the dependence in the long term on the agricultural sector is substantial and a reduction in the current relatively low percentage of the national total which is devoted to agricultural development appears to be difficult to reconcile.

It is concluded that:

- * the national agricultural development objectives have been set out clearly, and the importance of the agricultural sector to the national economy has been fully recognized;
- * there has not been a significant shift in resources to the agricultural sector despite its importance.

National Agricultural Research Policy

Despite the references in the development policy documents to the need to improve the efficiency of agricultural production enterprises, the undertaking to give "adequate research support and encourage selected new crops etc.," and the apparent dissatisfaction with the Faculty of Agriculture of USP as the main research resource for Western Samoa, there appears to have been no definition of an agricultural research policy.

This is considered to have had adverse consequences, particularly in research program formulation and in staff development. This issue can only be handled at the ministerial level.

Research Plans and Programs

In the absence of a clear directive on research policy, the research committee established under the chairmanship of the deputy director of agriculture for research and technical services was in a difficult position with regard to the establishment of plans and programs. The committee itself was composed of five members, all from the research or production parts of the department. It had no representative from the producers or from the extension service.

Although initially it held one or two meetings and was charged with the responsibility for setting up departmental plans and programs, it no longer appears to be used.

The responsibilities of the committee were to evaluate all new research proposals, to review ongoing projects, and to coordinate work between the department and the Faculty of Agriculture of USP. The composition of the committee was too narrow to allow this to be done effectively, and in the absence of a firm directive on research policy, the committee was clearly unable to function.

For there to be a Western Samoan effort in agricultural research, all the resources and facilities which are available within the country need to be used. To do this effectively requires a research planning and programming committee at a national level which includes persons from DoA representing research and extension, from the producers representing both the estates and village sectors, and from the University of the South Pacific which has a considerable input into agricultural research in the region. This committee could only function effectively if it were given clear policy guidelines.

Coordination between the various agencies doing research appears to be good, but this is on a personal basis and is cooperation after the work has started rather than at the planning and programming stage. It would appear appropriate at this time to consider formalizing the arrangements so that there can be a better understanding of the total requirements and a more realistic allocation of resources according to national priorities.

This is important in two ways: first, to get the work done and to use the resources effectively and, second, to demonstrate to the political side of government that the work is being planned carefully and resources are being used to best advantage, i.e., to improve the political visibility of the research, planning, and programming process.

It is concluded that:

- * A national agricultural research committee having broad representation should be established under the chairmanship of the director of agriculture. It would be the responsibility of this committee to draw up programs relevant to national needs and to enlist support for them. It would also ensure that resources available outside DoA and which could be allocated to work on Samoan projects are used effectively within the national program.

The Resource Base for Research

Department of Agriculture

This resource base is considered in four parts: first, human resources (the availability of Western Samoans with appropriate qualifications is given priority consideration); second, the physical facilities within which research can be done; third, the equipment, both laboratory and field, including transport, and the current budget allocations to allow these resources to be used effectively; and fourth, funding of research as a whole.

Human resources. The number of graduates within the Department of Agriculture is extremely small, and of these only two or three are involved in full-time research activities. This represents a very small base on which to build a national research unit. The problem does not seem to stem from the shortage of persons from the secondary school level or from the availability of training opportunities overseas or at the University of the South Pacific. Whatever the reason, the numbers available are small, and this applies also to the supporting staff of laboratory technicians and field workers.

Agricultural research has a comparatively short history of development in Western Samoa; little was done before about 1975. There is no establishment specifically for research officers within DoA, and such work as is being done is to service specific development projects. This does not allow for the establishment of a cohesive and interactive research unit. This makes it difficult to plan the training and the posting of Samoan staff into research which will ultimately reduce dependence on expatriate staff. There is a realization within the individual development projects of the need for some research support; it is probably because of the lack of an identifiable research unit within DoA capable of providing this support that research components were built into individual donor-supported projects. Unfortunately, these have had an adverse effect on the development of a research identity in the department, and it now seems timely that this trend towards fragmentation should be reversed.

The problem of retaining staff qualified to do research is accentuated by the differences in the salaries and terms of service between the public service in Western Samoa and autonomous national corporations, the private sector, and the Faculty of Agriculture at USP. Within the public service itself, salaries are related to qualifications with only minor differences related to the subject of those qualifications.

It is concluded that:

- * The lack of an identifiable research entity makes it impossible to draw up an effective program for the training and career development of Samoan research staff. Such a program is essential if the present dependence on expatriate staff is to be reduced.
- * Similar considerations apply to support staff for laboratory and field work.
- * In the absence of a general plan for research activities and for developing a research unit in DoA, the project approach to agricultural development and research support does little to develop Samoan research capacity or reduce dependence on expatriate staff.

Physical facilities. When the College of Agriculture facilities were transferred to USP in 1977, DoA was left with virtually no facilities for carrying out agricultural research. At that time it was anticipated that research work in the Faculty of Agriculture of USP would be adequate to meet the needs of the country.

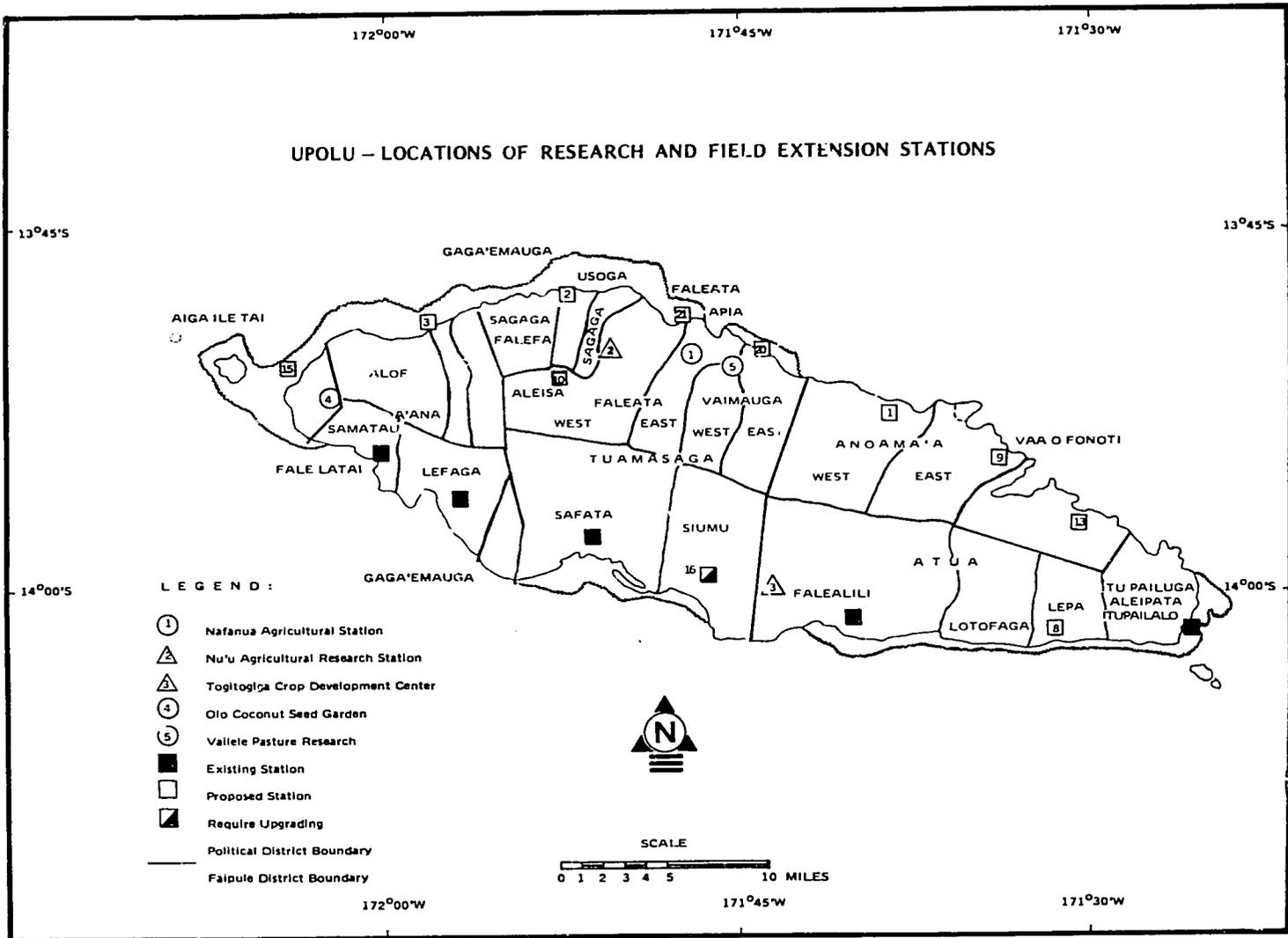
The need for additional research activity to service major development projects in crop protection and cocoa and in the redevelopment of the WSTEC estates was also recognized. These needs were met by including research components in individual development projects. Collectively these components have allowed the department to develop a research station at Nu'u with good physical facilities which have the capacity to house some 8 to 10 scientists and the necessary supporting staff. The laboratory buildings are good, and there are a number of houses which will ultimately be available to the government.

A post-entry plant quarantine unit with two screen houses and ancillary equipment has been built at Vaea with assistance from UNDP/FAO and ADAB. This unit, with its three staff, should be adequate for the near- and medium-term needs of Samoa. An extension training unit has been set up and research staff are heavily involved in the training program. This should promote interaction among the research staff at the station, the extension service, and, ultimately, the farmers, since groups will be invited to Nu'u for field days and training sessions.

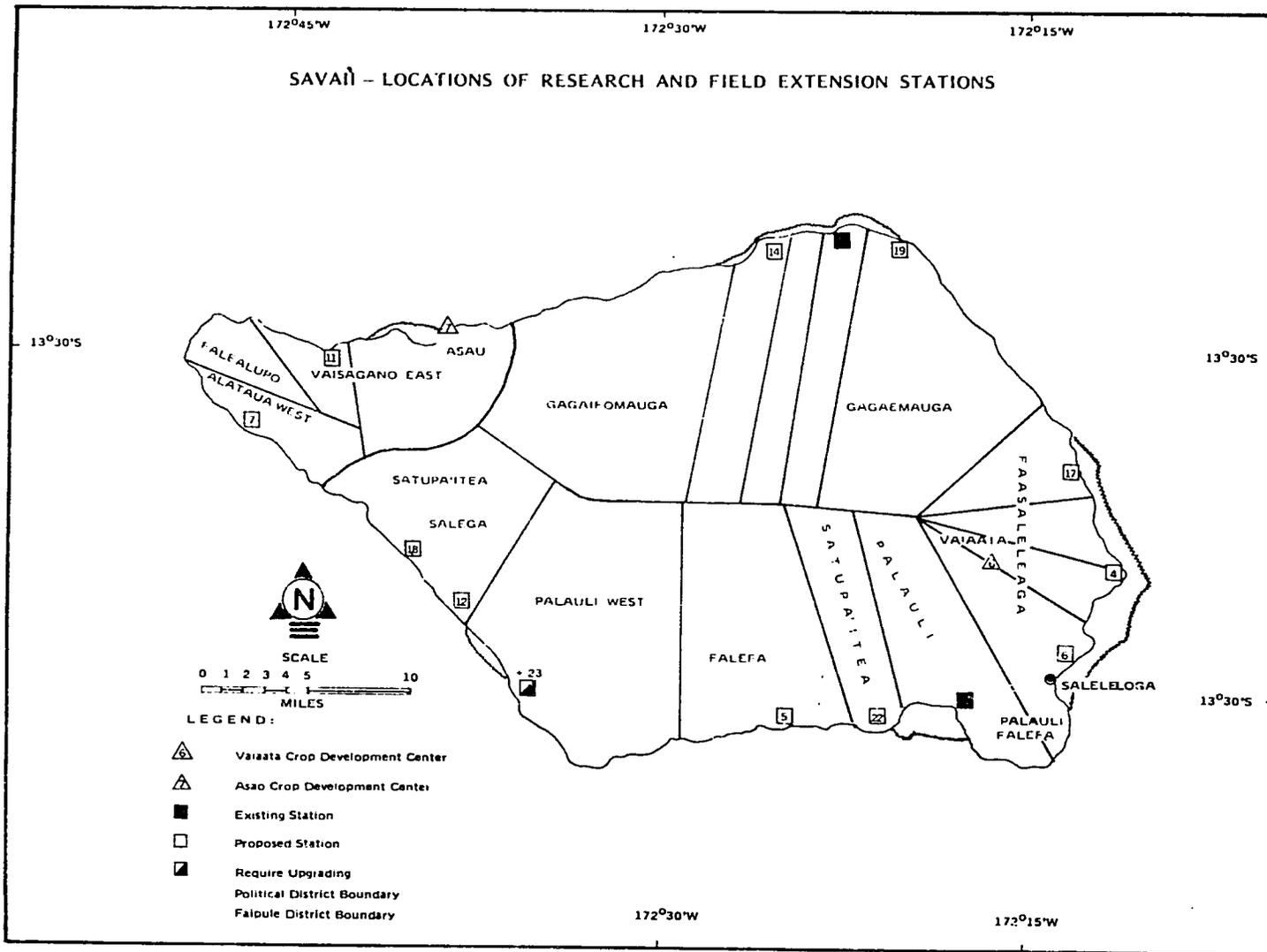
Facilities other than at the Nu'u research station are not well used, but land and facilities are available at Asan and Togitogiga crop development stations and at a number of extension development centers. The livestock division of DoA has a number of farms which have good facilities for field work and adequate areas of land. (The locations of existing and new stations proposed under the ADB support project are shown on Maps 1 and 2).

The forestry division has access to large areas of reserve forest land for its experiments and nurseries, two of which adjoin the two main crop development centers. It has a small nursery research unit at the Nafanua crop development station, while on the milling side, facilities provided under assistance from the Government of New Zealand are available.

UPOLU – LOCATIONS OF RESEARCH AND FIELD EXTENSION STATIONS



SAVAII – LOCATIONS OF RESEARCH AND FIELD EXTENSION STATIONS



In fisheries there are small facilities, developed originally under UNDP/FAO-sponsored projects, available for research on freshwater prawns and on mussels. The division has a number of vessels which can be used for survey work in nearby waters.

The main additional need is for better facilities for crop and livestock research activities of an adaptive kind in which extension staff would be involved at the crop development centers. This was foreseen in the projects (supported by ADB) which developed the centers. It is unfortunate that these centers have not been broadened into the more comprehensive research and extension development centers as was envisaged at that time. Nevertheless, the land is available and there is a nucleus of buildings at each site.

Some important resources of DoA are located at the Alafua campus. The food processing laboratory and the soils laboratory (jointly funded by DoA and USP) are substantial units; the former has a commercial operation in addition to research on new products.

To summarize, the main conclusions are that:

- * Good facilities are available at the Nu'u research station to accommodate a unit of from 8 to 10 research scientists and support staff. These seem adequate for the size of research unit needed on crops.
- * The work of the crop development centers should be intensified so that they become the focal points of interaction between producers, extension, and research workers as was originally planned.
- * The livestock farms are adequate in size and number for the needs of a research program on pasture and cattle.
- * In forestry, the resources are adequate for the current small program of research.
- * Onshore facilities in fisheries are adequate for the current needs of the division.
- * The facilities at the food processing laboratory are good, but may need modification when research on new products is started.

Equipment and vehicles. At the research station at Nu'u there is good equipment provided mainly by the projects, and this is adequate for present purposes. The individual projects have adequate transport which is available to the research staff for field visits and for working on the experimental areas. Fortunately, Western Samoa is fairly small and is endowed with good roads, so that given a reasonable number of vehicles the country is accessible to the research staff. The biggest single problem is in the provision by the government of local operating funds, both for payment of local staff and for the maintenance and use of the facilities and equipment which exists.

The main problems are that although the numbers of vehicles and the amount of equipment is reasonably adequate, maintenance is not good

unless paid for from project funds, and the shortage of funds for operational and running expenses restricts the use of these vehicles.

Funding of Research. There is no specific line item in the budget of DoA for research activities. Budget provisions are made strictly to the divisions; funds allocated for research purposes and the salaries of the staff engaged in research activities are not mentioned separately. This makes it difficult to determine how much money is being spent on research from government sources. It is possible in the specific donor-supported projects to get a better picture, but here there is some confusion because the budgeted amounts are not being made available and the projects, particularly the cocoa development project, are suffering from a shortage of local staff and local operating funds. The crop protection project appears to be better off in this regard, but the amount of research in that project is small and most of the operational costs are taken up by applying crop protection measures in farmers' fields and in survey work and similar activities. These activities have a much higher visibility than research, which could account for the better supply of funds to them.

There is a lack of continuity of support from government sources and this is inimical to the development of effective research programs. Although the exact amount spent on research cannot be estimated, it is clear that the total amount is less than the 1% of GDP which is regarded by many authorities as being a reasonable sum to be spent on research in a development situation.

Faculty of Agriculture, USP

The staff resources at the Faculty of Agriculture of USP applied to problems of Western Samoa can only be estimated, but it appears to be about equivalent to three man-years on a full-time basis. This is substantial in terms of the total requirements of the country. In addition, there are other facilities at Alafua (such as the library, the livestock department, and the soils laboratory) which represent resources to be used in part for the benefit of Western Samoa.

The soils laboratory is reasonably well equipped and could carry out routine soil and leaf analyses for DoA. Until 1983 it was receiving a substantial grant from the ministry's budget, but this has stopped; now it relies entirely on funds provided through USP. These are inadequate to maintain the laboratory at full operational load and the throughput of samples has been much reduced. When members of the team visited the laboratory the staff were concerned at the lack of resources to continue the work which had earlier been in progress.

In the context of making full use of all resources to assist in agricultural research and development it is concluded that:

- * The facilities now available at Alafua for research of a regional nature, much of which is useful for Western Samoa, are substantial.
- * DoA does not make full use either of the facilities or of the resources which are available at this site.

The estates sector, WSTEC

The position of the estates sector gives cause for concern. This sector has a large amount of land in plantation crops or used for pastures for cattle. These plantations and cattle farms represent a large physical resource which could be used by the research staff in DoA at minimal cost to the estates and to the department. At the present time there does not seem to be any working arrangement between the department and WSTEC by which this work can be done. Continuing the theme that it is important in a small country to use all available resources to maximum advantage, it is noted that the large site resource which WSTEC represents cannot for long continue to be underused.

External Support for Research and Extension (Annex 4)

Mention has already been made of the establishment of the Central Agricultural Research Station at Nu'u and of the post-entry plant quarantine facilities at Vaea, mainly through assistance from UNDP and the governments of Australia and West Germany. It was also intended that a substantial research facility would be developed in WSTEC under an ADB loan agreement, but this appears to have gone by default, except in that small amounts of work have been done on a contract basis by the staff of the Faculty of Agriculture of USP.

There are two main agroecological zones in Western Samoa known as the "wet zone" and the "dry zone," which are relative terms. The establishment of the agricultural research station at Nu'u may be considered to meet most of the requirements of the dry zone. The strengthening of the crop experiment centers at Togitogiga on Upolu and at Asau on Savai'i, under the support from the agricultural development project of ADB, would meet the needs of the wet zone on Upolu and the very dry part of Savai'i. These latter facilities have, unfortunately, not been developed as fully as the project appraisal report proposed. They are little more than plant propagation units with no resident staff and no adaptive research and extension program.

There has been substantial external support for the establishment of the Institute for Research, Extension and Training in Agriculture (IRETA) and of the research activities of the School of Agriculture of USP. Even though the research done is of regional significance, much of it has been done in Western Samoa and many of the results should, therefore, be of direct benefit to Samoan agriculture.

In addition to the provision of resources, the various projects in DoA and at USP have provided substantial amounts of consultancy services and of expatriate staff. These have been, and still are, the backbone of research activities in the country. Although an extension program organizer was provided under the agricultural development project supported by the Asian Development Bank, which started in 1980, this post has not been filled. A substantial gap remains in the research/extension system.

Under all of the projects substantial amounts of funds have been made available for training, both within the country and outside. There appears to be no shortage of donor support for training activities.

Crops (Annex 5)

The main crops grown in Western Samoa are coconuts, cocoa, bananas, and taro. All except cocoa are regular food crops and all of them are exported in considerable quantities.

Coconuts

Despite the dominance of the coconut palm in the lifestyle of the people and of copra, and, recently coconut oil in the export earnings of the country, there has been remarkably little systematic research on coconuts in Western Samoa.

At present research work is in progress in three main areas:

- * the production and testing of hybrid seednuts;
- * investigations into the incidence and control of blast disease on coconut seedlings in the nursery;
- * the control of rhinoceros beetle and coconut leaf beetle, using predominantly biological measures.

The recent recruitment of a coconut agronomist by DoA using funds made available through the ADB loan should permit an intensification of the research activities on this important crop. The component which appears to have received inadequate attention so far is the general agronomy and nutrition of the palms, particularly since it is known that coconuts require a good supply of potassium, and there is considerable evidence that this element is deficient in most of the soils in the country. The need for work in this field has been recognized for many years, both in DoA and among the aid agencies; the two main projects aimed at rehabilitating some of the coconut areas under IBRD and ADB auspices have both made provision for large-scale trials and use of fertilizers in these projects.

It is recognized that the price of copra has been low and that the cost of fertilizers is high, but this should not prevent investigations on the economic use of fertilizers in the growing of coconuts, whether grown in pure stands using hybrid material, or in mixed cropping enterprises either with livestock or with understory crops such as cocoa. Many countries have found that combinations of systems of growing coconuts are most advantageous to the national economy. There is already considerable information from the Philippines and from Malaysia on the overall economics of different systems of growing coconuts, and it would seem that these should be reviewed before a program is drawn up for research work in Western Samoa. The recently recruited coconut agronomist has worked in the Philippines for many years, and should be able to bring firsthand experience of the different systems which are in use in that country.

The main conclusion, therefore, is that for a crop of such national importance the amount of research work on coconuts cannot be considered adequate, and there is urgent need to broaden the current program. Priority should be given to agronomic and nutritional aspects of the crop in pure stands and in mixed cropping situations.

Cocoa

Despite the steady deterioration of the cocoa industry over the past 20 years, little has been done to find the causes, to try to arrest the decline, or to reverse the trend. A major project was started in 1979 with ADAB funding to assist the industry in three major areas:

- * the improvement of planting materials and techniques;
- * the improvement of processing and storage;
- * the provision of technical services and training through field extension teams.

Most of the cocoa currently produced in Western Samoa is of the Trinitario type, which suffers seriously from black pod and canker and from pink disease infections. The rose beetle and rats are major pests, but the country is remarkably free from other serious diseases to which the crop is sensitive.

When well-grown and prepared, Trinitario cocoas produce fine quality beans, which normally secure a premium price on the world markets. Recent evidence, however, shows that the quality of Western Samoan cocoa has deteriorated sharply. It is currently being sold at a substantial discount on Ghana No. 1, which is the standard international price base for the crop. Samoa has produced quality cocoa in the past, so the large project which is now thoroughly established should be of major benefit in the rehabilitation of the industry.

The climate of the country is wet, and the dry season is relatively short, conditions which favor the diseases to which the Trinitario cocoas are highly susceptible. With the recent development of Amelonado hybrids having high-yielding, good quality, and disease-resistant characteristics, this climatic situation can be turned to advantage, and the production of cocoa can be increased.

The research needs of the crop seem to be well-covered within the total scope and timespan of the project.

Bananas

The banana industry of Western Samoa is predominantly a small-farmer industry. It has been reviewed recently (Wickramasekera 1983) and the major changes, mainly during 1966 to 1983, have been described.

The area under cultivation is difficult to estimate because of the large number of small producers involved. In addition to these, there are a few larger growers (up to 80 acres each), the government plantation at Tanumalala (250 acres), and production within WSTEC estates. Virtually all of the smallholdings are less than 6 acres. Produce is disposed of in several ways. It is a major item of food both in the villages where it is grown and in the urban markets (mainly Apia). In the past, large quantities were exported.

From 1953 to 1959, exports increased steadily because of the availability of regular shipping space, the popularity of bananas as a short-term cash

crop, and increased accessibility of production areas following the building of new roads. In 1958 exports of bananas accounted for 34% of export earnings. Exports have declined since that time to about 6% of the 1958 figure. The reason for this decline seems to be a combination of storm damage, disease (bunchy top), low profitability of export sales, high prices in local markets, and lately, the relatively high export prices realized for taro which encouraged some village growers to substitute bananas for taro for home consumption.

Because of the problems now associated with the production of high-quality bananas for export, export quotas for village production have been withdrawn so that current exports are confined to produce from the Tanumalala plantation and from WSTEC. This is in spite of the availability of potential markets in American Samoa, Hawaii, and New Zealand. These markets include possibilities for dessert-quality and green cooking-quality bananas.

The use of fertilizers and crop protection measures have resulted in increases in yield per acre. Yields of 22,000 pounds per acre (15,000 pounds of export quality) have been obtained in the 10-acre experimental block at the Nu'u research station. At the Tanumalalu plantation yields have been lower than this but are expected to increase to about 20,000 pounds of export-quality fruit. This is given as a target (Tasi Neru 1983) but in the absence of input subsidies, the expansion of banana-growing on commercial estates was described in 1982 by the then Minister of Agriculture in a submission to the cabinet as nonviable at this level of production.

Research has been largely confined to the control of leaf diseases, especially black streak disease caused by Mycosphaerella fijiensis, nematodes, and the banana weevil borer (Cosmopolites sordidus). Economical methods of killing bunchy-top-infected plants have been investigated to assist in the control of this serious disease.

The nutrient requirements of the banana crop are well known, but there appears to have been little work done on the use of fertilizers on the crop in Western Samoa. The need for intensive investigation of economically viable systems of production was recognized during the development of the research and extension support component of the ADB project in 1979. The banana agronomist provided for in this project (36 man-months) has not been recruited.

It cannot be emphasized too strongly that competition is severe for world markets for agricultural commodities. To develop a competitive export industry in Western Samoa requires the establishment of well-managed production units supported by effective research and technical services. The latter could include nurseries for providing disease-free planting materials, production services to plantations, and export services in the form of internal transport, inspection, packaging, storage, shipment, and marketing. The banana export industry authority which has been proposed would appear to be an essential part of this development.

In the research field, intensive work is needed to develop economically viable production systems (not necessarily maximum-yield situations).

The recruitment of a full-time banana agronomist (with adequate supporting staff and resources) needs to be expedited. He would receive

substantial support from staff of the Samoan-German crop protection project in the area of pest and disease control. This work may need to be extended to the reduction of postharvest, but preshipment, losses.

Taro (Colocasia)

Taro is the staple food of Western Samoa. It is usually grown in a shifting cultivation system -- either alone or mixed with ta'amu (Alocasia spp.) and bananas. In recent years, in response to demand from Western Samoans living in New Zealand, and from other areas, a large export trade has developed. The earnings from this were in excess of WS\$2.0 million in 1981 (see Annex 1, Table 3). The limited air freight capacity from Apia appears to be restricting further development of this export trade. Research on postharvest treatments to permit exports by ship has been started.

The only major field problem seems to be the control of the taro cluster caterpillar, Spodoptera litura. Research on biological (fungal pathogens), chemical, and physical methods of control has resulted in an integrated pest control recommendation to minimize the damage caused by this pest.

The export demand for taro is equivalent to meeting the demands of a rapidly increasing local population. In the traditional system of production, clearing of the forest is a major task which uses a large amount of labor. In addition, the amount of forest land is limited so that increased production of taro could result in either an increased rate of destruction of forests or a reduction in the length of the resting period under secondary bush before the land is used again. An alternative would be to develop systems of production which give higher outputs per unit of land and labor and permit land to be used for extended periods between fallows or even on a continuous basis with suitable crop rotations. These developments would require a considerable research effort, since intensification of production often requires additional inputs and protective measures to ensure that these inputs are fully productive. The work already in progress at Alafua on "alley-cropping" of taro with leguminous species is one example of the kind of work which is needed.

Research work in DoA is confined to control of the major pests and a small amount of survey work on minor pests and diseases. This survey work is important in relation to any changes which may be envisaged in systems of taro production. There is a major program of research on root crops including taro in the Faculty of Agriculture of USP. This regional program, developed initially as a UNDP/FAO regional project and continued with joint FAO/South Pacific Commission (SPC) support has a component in the Solomon Islands on the breeding of taro with resistance to taro leaf blight caused by Phytophthora colocasiae. This disease does not appear to be a problem as yet in Western Samoa but, using tissue-culture techniques, it would be possible to move resistant material from the Solomon Islands to Western Samoa should the need arise.

The specialists involved in this work are of international standing and the results of their work throughout the Pacific area will be available to Western Samoa. Nevertheless, the project-oriented nature of donor support for this work means that there is always some uncertainty about future funding.

It would seem prudent, therefore, for Western Samoa to develop a national capacity to do research on taro and to work closely with other research units on a worldwide basis to maximize the benefits to be derived from national efforts.

Passion fruit (Passiflora edulis f. flavicarpa)

The production of passion fruit has increased rapidly during 1981 to 1983 in response to a demand from the food processing laboratory. This laboratory and pilot production unit is part of DoA but is physically located at Alafua. It was established and is supported by assistance from the Government of New Zealand.

Foreign exchange earnings from the sale of juice and pulp were almost W\$0.5 million in 1982, and export demand was not fully met. In addition, imports of fruit juices for local consumption are no longer necessary.

Production has been assisted by the Government of Western Samoa through the provision of technical services and subsidized inputs to farmers. There appear to be few data, however, on the detailed economics of the production of the crop with which to determine the potential economic viability of the industry should the government be unable to meet the cost of expanding production further on the basis of present practices.

The crop is relatively free from serious pests and diseases for which control measures are not available. The cost of crop protection is said to be high, so there appears to be scope for research to reduce these costs.

Little research work is in progress, but as the scale of production increases, it seems likely that research will be needed on varietal improvement (quality and disease resistance), systems of production including costs, and pest and disease control using minimum-cost methods.

Other crops

The topography, soils (especially the stony and bouldery surfaces), and climate of Western Samoa limit the range of crops which can be grown and the extent to which mechanization can be used to increase the output from land and labor. In this situation, tree crops are of particular value. This has been recognized by staff in Western Samoa for a long time, and various assistance agencies have made contributions over the years towards the development of tree crops.

An early UNDP/FAO project assisted with the establishment of a collection of tree crops at Asau on Savai'i at what is now the Asau crop development center. Several varieties of citrus, avocados, mangoes, macadamia nuts, rambuttans, and mangosteens are present. Some are growing well on a very rocky site, but systematic records of performance are not available. There is a duplicate collection at the Togitogiga crop development center on Upolu.

The major ADB support for the development of research and extension services in DoA which was negotiated in 1981 includes a tree crop agronomist for coffee, rubber, and oil palm investigations. It would seem that the other horticultural crops should also be included,

especially those which may be exported by air to New Zealand or American Samoa. Other fruit crops are included in the terms of reference for the banana agronomist to be provided under the ADB project, but there is a horticulturalist attached to the Vaea plant quarantine unit who could undertake some of this work in addition to his other duties.

The agroecological conditions in parts of Western Samoa appear to be suitable for growing Robusta coffee. The amounts imported are small, however, and the world market is, in general, over-supplied. Before starting any extensive coffee development, research into potential markets would seem to be essential. When potential markets have been identified, agronomic research can be intensified, although there is little doubt that the crop can be grown. It is, however, a labor-intensive crop and labor is already reported to be in short supply on WSTEC estates and elsewhere. Care will be needed, therefore, in choosing sites for possible coffee developments.

Oil palm is also considered to be a possible additional crop for Samoa, but unless WSTEC land could be used, there appear to be serious problems in obtaining enough land in one area for an oil palm development of commercially viable size.

Rubber, the other crop specifically mentioned in the ADB appraisal report, is a labor-intensive crop and subject, therefore, to the same reservations about labor availability as were made for coffee production.

So far very little research has been done on any of these tree crops. All can likely be grown, but most are difficult to sell in world markets. The research needed is, therefore, into markets and economic prospects, as well as into the agronomic aspects of growing the crops.

Some research work has been done on vegetables, but mainly on exotic types for the Apia market. At present, most of the work is in protection against pests and diseases. A shift in emphasis to those crops which might have a wider appeal in Western Samoa or which could be exported might be worth discussion. Examples are Out-pollinated types of maize, which could be eaten as green cobs or left to mature for animal feed, Hibiscus esculentum, leafy Amaranthus spp., and a range of legumes for the dual purpose of food production and maintenance of soil fertility.

General conclusions

Taking the work in DoA, in the development projects, and at Alafua together it would seem that:

- * the total amount of research work in progress on crops is considerable in relation to the country's needs;
- * some important crops and subjects are not receiving adequate attention;
- * a large part of the total research is being done by expatriates;
- * in the absence of a national plan and program for agricultural research, there is no mechanism for allocating total resources to meet national priority needs (this applies directly to DoA and indirectly to USP at Alafua).

Livestock (Annex 6)

Production

Production in the three major livestock industries (pigs, poultry, and beef cattle) has been stagnating over the past three or four years despite a number of government-initiated development programs.

Cattle numbers have remained constant or dropped slightly to around 25,000 head. The pig population has fluctuated between 110,000 and 120,000 but there has not been a significant population increase. Similarly, poultry numbers at around 270,000 have not shown any significant increasing trends. These national herds and flocks represent a substantial resource base upon which viable industries could be developed given the appropriate technical and managerial support.

One of the stated objectives of the fourth development plan was to increase the production of local meats to reduce dependence on imported products. Over the last few years, however, the demand for meat has far outstripped local supply, and meat imports have increased to a maximum of WSS\$3.2 million in 1981.

There are no serious physical limitations to livestock development in Western Samoa. The major debilitating livestock pests and diseases are not present; the humid tropical climate with an absence of seasonal temperature extremes provides a satisfactory growth environment and, in the case of cattle, a virtual year-round feed supply. Although there are no natural grasslands as such, there are large tracts of underutilized naturalized pastures under coconuts and in areas cleared from forest which have potential for further development.

It appears that the main factor limiting livestock development in Western Samoa is the lack of management skill in both the estate and village smallholder sectors.

Research

The Division of Livestock of DoA is responsible for research and development in the livestock industries in Western Samoa. The physical resources at its disposal are more than adequate for undertaking this task. It has three reasonably well developed farms (Togitogiga, Lemafa, and Avele) which up until recently were used mainly for supplying breeding stock to farmers at subsidized prices. These farms are stocked with approximately 1,000 head of cattle, of which 600 are breeders. There is a small dairy unit on the Avele farm, while the pig and poultry units of the Livestock Department of USP at Alafua are available to DoA for the purposes of breeding stock for distribution to farmers.

At present there are approximately 40 staff (including IFAD project members) within the livestock division. Although this is not a full complement because there are a number of vacancies and several personnel are away training overseas, it represents a considerable manpower resource which, if effectively mobilized, could have a significant influence on livestock development in the country.

Over the last year, research within the livestock division has virtually ceased. In the past the main research effort was undertaken through the

FAO/UNDP-funded pasture and animal production project, and concentrated mainly on pasture research. This project was due for completion at the end of 1982, and the pasture agronomist left in that year. However, there is an interim arrangement to continue funding the expatriate veterinarian in the animal health subsection to maintain continuity in the brucellosis eradication program.

A substantial pasture research program was undertaken by the FAO/UNDP project in Western Samoa from 1974 to 1982. Many detailed reports, papers, extension booklets, and other documents were compiled which adequately describe the research and the results obtained. In summary, the major findings were that stoloniferous grasses such as Brachiaria miliiformis, B. humidicola, B. brizantha, and Ischaemum aristatum were the most suitable species for use in pastures under coconuts, while the legumes Centrosema pubescens, Desmodium heterophyllum, and Leucaena leucocephala showed some promise. Beef production on improved grass-legume pastures under coconuts was twice that on naturalized pastures. A major fault with all the grazing trials, however, was their short duration. In no case was a trial conducted for more than 12 months, and production per year had to be extrapolated from a limited amount of data (in some cases only six months).

Some research has also been conducted by the Livestock Department of USP. This has mainly involved preliminary evaluation of locally grown materials for use as carbohydrate sources in pig and poultry rations. In addition, some research on the relative performance of different pig and poultry breeds has also been undertaken. There has been little formal collaboration between USP staff and staff of DoA in livestock research. Any interaction that has occurred has generally been due to individual initiative.

Scope for improvement

Research implementation. A worthwhile research effort could begin almost immediately using the facilities and staff already present on the government farms. The result of the quarantine restrictions imposed under the brucellosis control program has been that government farms have ceased their function of providing young breeding stock to farmers. Staff have been temporarily relieved of their stock distribution duties and part of their extension duties. These staff members could be productively used in carrying out some simple adaptive research on pasture and animal management on the farms.

This situation also provides an opportunity to consolidate the farms. Stock numbers can be built up and old cows replaced and the efficiency of the herds can generally be improved, thereby demonstrating on a farm scale improved cattle-breeding and husbandry practices. This will enable the staff of the government farms to better serve the farmers once quarantine restrictions have been lifted.

Research should, in the first instance, be directed towards utilizing available resources more efficiently through better management.

Some specific problems/areas which require investigation include:

- * appropriate herd management and husbandry practices to maximize productivity. This applies particularly to goats since, although in

the recently established IFAD livestock project goat production is to be promoted, there is little information available on their management;

- * techniques for more effective management and utilization of pastures, particularly pastures under coconuts;
- * the interaction between cattle and goats grazing the same pastures;
- * long-term productivity of cover crop legumes, such as Pueraria and Centrosema, as pastures under coconuts and effect on coconut yields;
- * shrubby/tree legumes such as Leucaena and Albizia as forage sources in local systems;
- * control methods for the weeds Navua sedge (Cyperus aromaticus) in open pastures and Elephant's foot (Pseudoelephantopus spicatus) in pastures under coconuts;
- * further evaluation of locally produced sources of carbohydrates to be used in nonruminant feeds.

In addition to these research requirements a good plant introduction and observation nursery should be established at one of the farms to ensure that introduced species are not lost.

There is also a need for the division to maintain links with livestock personnel at USP. Research on pigs and poultry, and evaluation of feeds for these animals can best be undertaken using USP facilities. The IFAD project has strengthened the links between the two units and these should be further developed for the mutual benefit of both parties.

Forestry

The Forestry Division is the only division which has a named research section. Government policy is aimed at producing a sustainable yield of quality hardwoods and at increasing the value of the products by local preparation (milling and treatment) prior to export. There is a realization that there could well be competition between forestry and agriculture for available land, particularly as agricultural tree crops and forest trees can often be grown with equal facility on a particular site. The work of the research section is aimed at maximizing the use of the country's resources to provide timber and fuel while assisting in increasing food production.

Forestry research

The program of the forestry research section relates to six main areas of the division's work. These are in plant introduction, silviculture, utilization of forest products, community forestry, controlled firewood schemes, and watershed protection. Research is regarded as a basic component of forest management.

Plant introduction. In connection with the vigorous program of reforestation which is being carried out with assistance from ADB and the Government of New Zealand, a program of introduction of fast-growing

hardwoods and of testing these under a range of conditions in Western Samoa is in progress. Among the most promising are Eucalyptus deglupta, Anthocephallus chinensis, Swietenia macrophylla, and Cedrella odorata.

Silviculture. This covers all aspects of the growth and production of native and introduced species. Trials are in progress to improve growth: at the nursery stage by using fertilizers and a range of improved practices, followed by low-cost establishment practices in the field. Spacing trials are in progress, the aim being to obtain high rates of growth at minimum cost. While wide spacing gives high rates of growth, weeding is needed for up to five years; closer spacing with subsequent thinning produces thinnings for which there are few uses at present. Subsequent growth and yield measurements are being done.

Utilization of forest products. A major sawmilling study has been completed in conjunction with the Forest Research Institute in New Zealand of the four main species which are being used in the reforestation projects. The local research unit covered stand and test trees measurements, sawing and grading, density survey, and drying studies. The Forest Research Institute was responsible for the determination of kiln drying, timber preservation, glueing, and mechanical properties.

As a result of this study, policy decisions with regard to the choice of species for reforestation have been taken. These will lead to an increase in the proportion of Eucalyptus deglupta to be planted and to restrictions on the use of Anthocephallus chinensis to a very few areas.

This provides a good example of the use of research findings in guiding national policy.

Community forestry. This work aims to encourage village tree planting for timber, fuelwood, and conservation purposes and to promote agroforestry using traditional food crops as an alternative to uncontrolled shifting cultivation. Four USAID-sponsored volunteers are assisting in this work and also in designing economical stoves which burn wood and charcoal to reduce dependence on electricity and imported fuels, especially in urban areas.

This work is closely allied to controlled firewood production schemes and to watershed protection in special areas. The main cause of watershed degradation is the cutting of fuelwood rather than damage from logging or agricultural activities.

This valuable program does not appear to be receiving the extent of government support which its importance would seem to merit.

The forest research section

The forestry division has about 50 staff, about half of whom have had some formal training in forestry. There are four B.S. graduates (and two in training) and about 20 holders of diplomas or certificates mainly from the Fiji Forestry School. Of these, two graduates, five diploma-holders, and five certificate-holders are in the research section. Projects assisted by ADB and the Government of New Zealand have provided most of the training opportunities. Loss of trained staff to other employers is, however, a major problem.

Land availability for nurseries is adequate. The nurseries seen by the mission were well maintained and in good condition. The facilities for studying the properties of wood and wood utilization are small. Provided that access to the facilities of the Forest Research Institute in New Zealand can be maintained, the local facilities may be adequate.

The major problem facing the research section is the shortage of funds to meet local operating costs. In 1983 budget allocations have been reduced to the extent that they cover only salaries and wages. Work has been seriously curtailed. For the 125 acres of silvicultural experiments there are only 12 maintenance staff, so the work cannot be done to the standards desirable for this type of trial.

Conclusions

The small research section appears to have worked effectively and produced results of considerable value to the country. The withdrawal of funds for operating costs must seriously affect the work of the section and the morale of the staff, some of whom may seek alternative employment.

The government's stated objective of providing adequate research support for major development projects in the agricultural sector cannot be reconciled with the budget action described above.

Fisheries

The Fisheries Division is small. It has five professional officers and is assisted by two Peace Corps volunteers. The main policy of the government appears to be to ensure a supply of fresh fish for local markets at a reasonable price, rather than to develop full exploitation of fisheries resources to earn foreign exchange. Support for various aspects of fish catching, handling, and marketing has been provided from mainly UNDP and Japanese government sources.

There are two small research projects in operation on brackish water prawns and on mussels, respectively; exploratory work has been done on bottom fishing on the Pasco bank and catching marine prawns in deep water.

The mussel project (under moored rafts) is adaptive research in that the techniques are known from elsewhere but adaptation to local circumstances is needed. With support from UNDP and the Canadian government, trials were begun in 1982 and are continuing. Questions by team members about markets for the mussels went unanswered.

The pond culture of Machybrachium prawns is an established technique and is exploited commercially in several countries, the biggest single operation being in Ecuador. The main costs are at the hatchery stage and in providing feed for the prawns. At present the fisheries division is supplying the juvenile prawns free of charge to what appears to be a commercial operator. This seems difficult to justify in the current financial crisis unless the produce is exported and earns foreign exchange. The information gained may prove useful. The work is being done by two volunteers (one a marine biologist), which brings welcome professional capacity to the division.

The staff of the division did not identify any specific areas in which they felt that additional research efforts are needed.

Relationships with Outside Organizations

Research for agricultural development in Western Samoa gains much from the aid of a number of regional and international organizations. Some place resources in the country to work on specific national problems; some contribute scientific knowledge and materials that can be adapted to the local situation. Various other services fill gaps or substitute for scarce resources.

USP School of Agriculture

The location of this unit in Western Samoa brings many benefits to the host country:

- * Results of faculty research carried out locally can be adapted to farmers' conditions with some further work. Work on root crops is a good example.
- * The library at Alafua permits Western Samoan researchers access to one of the best collections of technical agricultural literature to be found in the Pacific islands. The collection and professional library services are available at no cost.
- * The recently enhanced conference program of IRETA gives Western Samoa unusual access to experts from the region and beyond. (The recent conference on problems of small farmers in Western Samoa is an example.)
- * The range of expertise gathered in the Faculty of Agriculture of USP appears to be available to Western Samoa for a variety of contributions: consultations, program planning and evaluation, and as contributors to training (such as for the extension division).

United Nations agencies

Western Samoa gains from an incountry program in animal health and from FAO/UNDP regional projects in root crops and plant protection (originally developed in Samoa and now based in Fiji).

Development banks

The World Bank and the Asian Development Bank are credit and grant sources for programs across a range of agricultural development areas: coconut improvement, community development schemes with livestock, forestry, strengthening of research and extension services, and others.

Bilateral arrangements

Programs central to the agricultural development goals of Western Samoa have research components because of support by aid agencies of other nations. These include:

- * the cocoa rehabilitation program, supported by the Australian government;
- * crop protection research and dissemination, by the Government of the Federal Republic of Germany;

- * a wide range of agricultural sector projects provided through the bilateral aid program of the New Zealand government.

Training opportunities

International research centers have made contributions in areas of training and improved genetic materials. These centers include IITA, AVRDC, CIMMYT, and ISNAR.

Regional training activities of USP, SPC, and the Fiji School of Forestry have made it possible for staff to receive training essential to their work. Support from bilateral sources is available for training at appropriate overseas universities.

Observations

The contributions noted here indicate the central importance of outside organizations in the advancement of research and development in Western Samoan agriculture. The impacts have been valuable. It may be noted, however, that the programs tend to reflect the interests, and sometimes the working approaches, of the individual support groups. There is less evidence of vital Western Samoan initiative in the formulation of projects or their integration within a national plan. Such integration requires that there be a research development plan within the country.

Efforts to develop a sound national plan for agricultural research rank as one of the primary needs in Western Samoa in order that it places its limited resources into those program areas that best meet national goals. Such a plan calls for attention at the highest levels of government and would require professional planning support, possibly from external sources.

Research/Extension Linkages

Research is done in several separate units under different administrative and funding schemes; responsibility to extend results to potential users also takes different organizational forms and arrangements. The essential linkage for stimulating use of improved materials and practices varies widely in form.

The most fully organized and tightly linked scheme is that in the cocoa rehabilitation project. An establishment of research-extension-programmer-trainers and field teams is part of the total project. Weekly training meetings at the main research station assure regular interaction with researchers and two-way communication. Even closer linkage is found in the crop protection project: since there is no extension establishment, the researchers themselves carry out extension functions (farm visits to problem areas, materials development, etc.). Role priority may notably limit the attention given to one function or the other. Persons involved in the passion fruit development activity work directly with growers, carrying out several "extension" functions. The livestock division has little research activity underway and does not have persons titled as extension officers; yet it takes responsibility for field activities. The staffs of all these units claim to work closely with the regular extension services, but the officers in these services felt that much more interaction was needed.

The Extension Division of DoA has the main establishment for extension officers assigned to and residing at field centers. The principal subjects under their domain, however, represent a relatively limited range -- root crops, vegetables, fruits, and other minor crops. Few research resources are devoted to these crops, and the subjects tend to be a relatively minor concern of many of their clients. It was often said by the extension officers that they had little useful or wanted information to extend to the farmers.

The diverse and scattered sources of research results, and the divided extension responsibilities, create a difficult situation in which to develop the extension function to its potential. That potential can include a means of feeding back from farmers on the results of their use of research findings and the definition of farmers' problems that need research attention. And there is potential for the extension system to be the leading force in spreading and encouraging materials and practices that increase productivity and profitability of the nation's agriculture.

Involvement of research staff in monthly extension training sessions (a recent innovation) seems to be improving the linkage of research and extension. It helps mainly in giving field officers better knowledge for the subjects they deal with; it does not provide them with either mandate or expertise to respond fully to the wider range of problems of the farmers.

The longer-term ability of the extension services to disseminate research results would be enhanced by a penetrating study of farmers' needs and wants, dissemination requirements within major policy objectives, and organizational options for linking research and extension. The present situation of different systems and jurisdictions might be recast to implement the earlier intention that one general extension service would be supported by research field staff acting as subject matter specialists.

In specific terms, irrespective of broader institutional changes, the research/extension linkage should be improved in the field. There is potential for cooperation between the research officers and extension field officers to bring adaptive trials to the fields of farmers -- design and management of the research could remain under the research officer, with the extension officer supervising and overseeing the trials. Crop development centers could contribute more to Samoan agricultural development if deliberately planned and operated as joint research-and-development sites.

Information Management in Agricultural Research

Obtaining information

Access to world scientific literature is vital as a source of research done elsewhere, which may be applicable to Western Samoa, and as a means for an individual scientist to evaluate and extend his own work. The staff of the agricultural library of the University of the South Pacific, located on the School of Agriculture campus at Alafua, has offered to make its collections and services available to researchers in Western Samoa. These services could be used to a considerably greater extent than they are at present.

Exchanging information

The review team did not find much evidence of interaction between research officers and policy-makers. The most recent annual report to Parliament consisted of summary statements of activities by divisions. Little attention was devoted to research problems or results. No doubt numerous person-to-person links exist among research officers and policy-makers; however, the review team did not systematically identify or describe these informal ties, since they are usually not linkages that can be managed in a planned program sense.

Delivering information

Primary audiences for the results of agricultural research include (a) political or government personnel concerned with social, cultural, and economic policies for agricultural development; (b) potential users of findings -- producers and input suppliers and organizations which disseminate technologies and advise users, such as extension services; and (c) researchers working in the same areas of science.

Information Staffing and Organization

Information services for the ministry are provided by the Communications and Information Section of DoA under the chief agricultural officer. The staff provides services throughout the divisions of DoA. It comprises seven posts with creative information responsibilities: radio, publications, audiovisuals, information officer, librarian (vacant), artist-illustrator (vacant), and the head of section, who serves as acting senior agricultural officer for extension on Upolu. The section head was trained to the baccalaureate level, some staff hold diplomas in tropical agriculture, and most had only short courses or special short-term training in their area of production. A summary of the main communication activities by which this section serves the information needs of the ministry follows.

Information services

Radio. These programs appeared to be the most regular means of getting farm information (including reports from research) to the largest audience of producers. Three weekly programs are produced by the communications and information section.

Publications. In recent years 7 to 10 publications and a quarterly magazine were prepared for use in the agricultural sector. Due to restricted operations budgets, two publications and two issues of the magazine would be produced in 1983 but only 500 copies of each publication would be run (in the Samoan language), and there would be no money for reprinting.

There is interest in published material, as is shown by experiences reported from the cocoa rehabilitation project. Two publications and a poster for that project have been distributed in respective quantities of 5,000, 10,000, and 8,000.

The attractiveness of these commercially printed materials contrasted sharply with the appearance of some of the section's publications, which

were typically duplicated from stencils prepared on a worn manual typewriter. (An electric typewriter and a small office offset-duplicator were cited as principal needs by the communications staff -- needs with which the review team concurs.) The magazine and some reports, such as the annual report to Parliament, went through the government printery -- typically with considerable delay.

Publications offer the main channel by which Western Samoan researchers may communicate their results to scientists in other parts of the world. But there was little evidence of any organizational concern for this activity. Individual scientists may write and submit material for journals of their choice, largely on their own initiative and without formal review. The Communications and Information Section has provided some assistance in illustration and photography, but it has not played a significant editorial role.

Audiovisuals. The main work in audiovisuals has related to annual field days at research stations, most notably at the Nu'u station. Two videotape programs have been produced and have proved popular, as indicated by requests for use of the programs, especially from schools. At least one educational slide set has been prepared.

Newspapers. Three newspapers are being published in Western Samoa, two are private enterprises (weekly) and one is a government paper (monthly) which functions mainly as an information service of government to matais. The Communications and Information Section reported that most of its initiative went into a regular column in the government paper.

Communication between units

Other than by personal contact between individuals, few activities or services stimulate the exchange of information among units developing or using research results. Quarterly meetings and reports are said to include relatively little attention to the content aspects of research programs and results. Yet, coordination and integration of efforts call for constant interchange. Attention needs to be given to procedures and materials to assure such interactions as: among all interested in research that has significance beyond a single scientific specialty; from extension to research and research to extension; between researchers and policy-makers within department and ministry and in other ministries; and from researchers to other researchers.

Observations on information services

The number of staff and the range of posts appeared to be reasonable in relation to the size and needs of the organization to be served. Prime constraints seemed to be limited professional training for most staff (both prior to appointment and in-service), lack of efficient equipment, and shortage of support funds to purchase needed materials and services. It is doubtful that any structural changes are needed, but clear lines of responsibility for information support for the research program must be established. Also, this section, a vital source of support, should be considered carefully in any plans for development and enhancement of the research effort.

Relationships between the section and other groups were found generally to be informal. Although all publicity releases are supposed to go through the section, it was reported that this rule is frequently broken. No formal review procedure, other than final approval by the agricultural director, was involved for manuscripts for publication or submission to scientific journals. Informal channels appeared to be appropriate for the present, but this area should have attention as development and change occur.

Constraints to the Development of Effective Research Services

The main factors impeding the development of effective national research services seem to be:

- * lack of a clearly defined research policy and commitment to provide the means for its implementation;
- * lack of an effective mechanism for formulating research plans and programs in relation to national needs, using all available resources in the country and information from outside;
- * absence of any specific identity for research efforts as a whole, i.e., there is no research section, unit, or equivalent;
- * lack of a defined staff management and development program in which staff can see how their research careers can develop;
- * overdependence on expatriate staff since there are few Samoans trained in research methodology;
- * fragmentation of research efforts by project, leading to lack of cohesiveness between research activities;
- * serious shortcomings in the provision of national funds in effective amounts and on a regular, timely, and continuing basis;
- * difficulties in achieving effective interactions among farmers, extension officers, and researchers because of the dispersal of research (and to some extent extension) efforts by project.

The main findings are discussed in more detail in Chapter 5 from the viewpoint of finding possible ways to improve the overall situation and towards making specific recommendations for action.

Chapter five: Discussion and Recommendations

The nature of an analysis which seeks to identify ways in which research and allied services may be improved means that weaknesses receive more attention than strengths. In this chapter the emphasis is on exploring ways of improving the national research service and its linkages with policy-makers, extension services, and producers, leading to recommendations for actions needed both in the short run and over a longer period.

Agricultural Development Policy

This is clearly defined in recently published policy documents. The Agriculture Advisory Committee at the ministerial level has been reestablished so that there is a forum for discussion and formulation of development policy. The technical services in agriculture should contribute information through the Minister of Agriculture to assist the committee in its deliberations. It should be emphasized that these services supply information, they do not supply policy advice except when asked.

Agricultural Research Policy

During the course of the study of the research, extension, and development program and from discussions with a wide range of people in Western Samoa, the team gained the impression that there is no general administrative and political support for research as an essential component of the development process. There is a realization in the Ministry of Agriculture of the importance of research in relation to the development of the passion fruit, cocoa, and livestock industries, and in developing cost-effective methods of crop protection. In forestry, the reforestation program has been modified in the light of research results. Adequate support for research services is put forward as an essential component of the development process in the most recent policy statements of the government. In general, however, research appears to be seen as a luxury which Western Samoa cannot afford, yet every step of progress in agriculture has an element of research in it. Furthermore, while Western Samoa cannot be expected to conduct all stages of the research needed for its development, the adaptive stage of research immediately before application of results to the production process can only be done in Western Samoa.

The question of how to develop and pay for the services needed to do this work is secondary to the need to develop a clear research policy to meet national development needs. To promote a wider realization of the importance of a clear research policy it is recommended that:

the results of research which have been used to increase or to protect agricultural and forestry output in Western Samoa be reviewed as a matter of urgency; adaptive research should be emphasized to indicate how Western Samoa has benefited from work done outside the country.

While the general research policy can only be established at the ministerial level, some of the evidence necessary to emphasize the need for a well-defined policy can be provided by the researchers in DoA. At this level, policy guidelines may be expected to be broad but should include information on the resources to be made available.

Research Planning and Program Development

The broad policy guidelines and total resources available form a basis for the development of plans and operational programs. There are two essential parts: first, the formulation of a long-term master plan for research activities, and, second, the establishment of specific programs of work and individual projects in furtherance of the different components of the overall plan.

Research Planning

This is the stage at which research is seen as an essential component of agricultural development and at which its role is defined. Put in this way it is clear that it is not a function which concerns only researchers themselves, but which must include contributions from other groups involved in agricultural development if the results of the research work are to fit into the overall development plans.

The research committee established in the Ministry of Agriculture could not carry out the planning function effectively because its members were drawn only from the ministry and mainly from among the research and production staff. A more appropriate group would comprise representatives from:

- * national research and extension services;
- * the agricultural development planning unit within the government;
- * marketing agencies (cocoa, copra, bananas, and others);
- * producers at both estate and village levels;
- * DBWS;
- * USP, as representing a regional resource, part of which is applied to the problems of Western Samoa;
- * the Ministry of Finance.

This committee would be concerned with exploring ways in which research could contribute towards the attainment of development objectives. This would involve consideration of problems and opportunities, establishment

of criteria for setting priority areas for research, allocation of available resources, and definition of additional resources needed and how they could be obtained. It should be emphasized that this committee is not involved in establishing individual technical and scientific programs but in determining what kinds of research are needed (marketing, socioeconomic, agronomic, postharvest handling, to mention main areas).

It is recommended that:

- * a research planning committee be established having broad representation as indicated above; this committee should be charged with the development of a long-range plan for research as an essential component of agricultural development.

Initially, however, a task force supported by a professional adviser could draw up a draft plan for consideration. ISNAR would be prepared to assist in this work if so requested by the government.

Research Programming

In the main text it has been indicated that there is a considerable amount of research work in progress in crops and forestry. In crops, however, the balance of effort does not appear to be satisfactory, while research in livestock production has stopped. The main purpose of the planning and research committee system is to try to relate research efforts and expenditures as closely as possible to national needs and to avoid major deficiencies and imbalances.

Once the main lines in which research is needed and the priorities for action have been established, the next step is to examine in detail the scientific basis for attaining the general objectives which have been set. This should be the task of the research committee already established in DoA but which is not now operational. It should meet regularly, two or three times a year, to draw up specific programs of work. Initially a three- to five-year program should be designed; this should be reviewed and updated annually so that there is always a three- to five-year forward projection of activities.

To do this effectively, the present committee needs to be enlarged to include representatives from the extension service, producers, and USP. The purpose of including representatives from USP is to ensure that the regional and national programs are complementary when this is possible having regard to the regional responsibilities of USP. The committee should include forestry research within its terms of reference as well as crops and livestock, and should consider socioeconomic as well as agronomic and processing areas.

It is recommended that:

- * membership of the existing research committee should be widened to include extension, producer, and USP representatives; it should meet regularly to formulate research programs within a three- to five-year rolling program; these programs, which should be fully costed in terms of staff, funding, and other requirements, should relate directly to the objectives set by the planning committee and should be monitored on a regular basis.

The professional planning adviser suggested to assist the planning task force could also assist in drawing up the work plans for the research committee.

Research Resource Development

The three main areas considered in this report are staff, facilities and equipment, and capital and recurrent funding. Of these, the facilities and equipment component is considered to be adequate, subject to reservations about current use of out-stations. Funding for capital developments has been provided largely from external sources as either grants or low interest loans; there appears to be no serious difficulty in obtaining funds for these purposes. The main areas of concern are in staff development since there are few Samoans in research in relation to the numbers needed (the balance is now made up of expatriates), and in financial support to pay local operating costs including staff salaries.

Staff Development

The two main considerations in this area are the eventual replacement of expatriates by Samoans, and how this may be achieved.

There appear to be two major problems: the location of individuals within projects rather than in a cohesive research unit from which staff are seconded to projects, and the small numbers of Samoans relative to expatriates in the service as a whole. Losses of trained staff to more remunerative employment outside the public service (but still within the country) present problems especially in ensuring continuity of work and in developing the competence of the researchers themselves.

The development and implementation of a cohesive personnel and staff-development policy is made difficult by the location of research staff in individual development projects which depend heavily on external funding. These projects draw Samoan staff into them to balance and complement expatriate technical assistance personnel, often to meet the conditions attached to the loan or grant from the donor agency. A cohesive policy is essential to ensure that the training and experience gained by Samoan staff working in these projects are not lost when the external support for the projects ceases.

The position with respect to technical and support staff appears to be unsatisfactory in terms of continuity of tenure rather than of numbers. Training in laboratory skills, however, is very limited. One of the problems in this area seems to be the difficulty which some staff find in adapting to a highly disciplined and regular program of work, rather than a lack of ability to do the work.

Once a long-term research plan has been established it will be much easier to assess what the staff requirements are likely to be. For some years much of the work will continue to be done in externally funded projects within the long-term plan, but this should not be allowed to prevent the formulation of a staff-development plan. Care should be taken to include the range of disciplines needed to service the types of research indicated earlier. Currently socioeconomics, production economics, marketing, and processing are poorly represented.

It is recommended, therefore, that:

- * a systematic assessment of staff requirements be made to determine the numbers of staff likely to be needed and the range of subjects in which they will need to be trained; this would form the basis of a staff training and manpower-development plan, having as its main objective a substantial reduction in the present dependence on expatriate staff.

Formulation of this manpower-development plan can be started on the basis of what is known already about likely research needs. It may need modification once the long-range research plan is available.

Facilities and Equipment

The facilities for research appear, in general, to be adequate in terms of land, buildings, and equipment. This view may need to be revised when the long-term research plan is developed, but it is considered to be unlikely that any major additional units will be needed in the near future. It appears, however, that the crop development centres at Asau and Togitogiga, the extension centers which are being built in each district, and the livestock farms are not being fully used.

The crop development centers were intended to become focal points for adaptive research activities and for interaction between the research and extension services. The review team strongly supports this role for the centers and recommends that:

- * the crop development centers be developed as originally planned to become adaptive research and development centers -- in time their activities should be extended to include livestock and forestry so that all aspects of land use are included; all of the activities mentioned are important to the rural communities.

In terms of land, it may be necessary to increase the area available at the Nu'u agricultural research station. It is understood that WSTEC would be prepared to release land at Nu'u should the need arise. This does not cover all needs. WSTEC has estates in different parts of the country; these are being developed in different ways and research inputs are needed. Such inputs can best be provided by onsite work of a cooperative nature between research staff of DoA and the estate managers. The mission recognizes that, at present, such arrangements would not be possible because of serious managerial weaknesses in WSTEC at the individual estate level.

In the context of maximizing the use of national resources the mission recommends that:

- * the interaction between DoA and WSTEC in getting effective research done in the plantation and livestock industries be reexamined in the mutual interests of both parties.

Financial Support

The serious financial constraints under which the Ministry of Agriculture is operating are recognized. Given the great importance of agriculture to the national economy, support for the agricultural sector and for research in it is absolutely essential. The review team was not able to obtain reliable information on the amount of funds allocated to research, but it is clear that in 1983 specific items which had earlier been paid for from national resources (in forestry, the soils laboratory at Alafua, and staff in the cocoa project) were deleted from the budget. Capital resources continue to be available from assistance agencies.

The shortage of funds presents a particular dilemma for which it seems unlikely that there is any easy or early means of resolution.

There are several options open to the government. These include a reserved tax, contributions from potential beneficiaries, profits from production enterprises (these should be run by professional managers, not by the research staff), and contributions from external sources.

It is well known that assistance agencies are reluctant to commit resources to cover local operating costs. (It is often not realized at the country level that the agencies are themselves constrained by their operating rules.) It would be helpful if a reasonable forecast could be made of likely requirements for research on an ongoing basis. Without such estimates, which should be based on the long-range research plan, it is not possible to present a soundly based request for funding.

The World Bank (and others) has suggested an indicative figure for realistic research expenditure by governments. This is based on 1% of the agricultural GDP. For Western Samoa this would mean an annual expenditure of WS\$0.4 million. At current salary levels this would cover the operating costs of between 8 and 10 research scientists with supporting staff. It would not cover capital items or replacement of major items of equipment. It could be raised from contributions from major producers, the government, and assistance agencies in about equal shares. These are indicative figures for research only and are based on general considerations of adequacy rather than the needs of a specific country. Until a definitive research plan has been drawn up and the resource requirements to implement it have been estimated it is not possible to make specific proposals as to how the funds may be raised.

The government is encouraged to:

- * adopt a flexible attitude to the funding of research, while at the same time trying to ensure reliability and continuity of funding.

Research Organization

The organization of the research service should reflect what that service is expected to do. While at present the organization of research and extension appears logical in the national setting, the current fragmentation of research and extension efforts by projects causes problems in relation to the allocation and use of scarce national resources.

This should not be regarded as a short-term issue to be resolved by an immediate restructuring of the system; rather it is one which should be addressed in the longer term, based upon the research plans and programs and the role research will have in the work of the department as a whole.

One matter of immediate importance, however, is promoting general political support for research activities. It is recommended that:

- * The Ministry of Agriculture should develop and implement a process by which it communicates on a regular basis with producers, policy-makers, and consumers, the rationale for its research program and the results of that program.

The development of such a process, which could be implemented through the Communications and Information Section of DoA, would be facilitated if the research program had a clear identity and unified leadership.

It is recognized that the research program covers a wide range of subjects and areas. Once the program has been determined, it is recommended that:

- * an assessment be made of the organization of the research services to seek ways to provide unified leadership for the program.

Long-term Issues

Two items have been selected for special consideration. First, it is essential that there be assurance of continuity of funding at an operationally realistic level. The basis of this support and the determination of the level required can only come after at least some of the steps outlined in the recommendations have been taken.

The second item concerns making the maximum use of the varied resources in DoA, WSTEC, and USP in complementary research and development programs. The ways in which this may be done should become clear when the research plans have been formulated since the three parties will have been involved in the planning process.

General Conclusions

The recommendations made cover the main areas in which improvements appear to be needed. Though extensive, they do not imply any immediate major increases in the commitment of financial resources. Some shift in resource allocations within DoA may be needed. The marginal increases in funding which may be required to develop fully the crop development centers and for staff training can most likely be obtained from existing donor commitments. The principal need is for clear plans within which the resources can be used to maximum advantage.

Annex 1. Agriculture in the Economy of Western Samoa

Extensive published information is available on the economy of Western Samoa and of the dominant role of agriculture in it. Agriculture provides the bulk of the country's food, work for about 80% of the people, and about 90% of export earnings. Because of the availability of detailed documentation (to which references are made in the main text and in this annex), this annex contains only summaries of the major factors of relevance to the agricultural production situation and hence the agricultural research and extension needs.

NATURAL RESOURCE BASE

Western Samoa consists of two main islands, Upolu and Savai'i, and 20 small islands of which only 2 are inhabited. The islands, which are of volcanic origin, cover approximately 1,150 square miles. They are mountainous, and have relatively few areas of flat or undulating land. They are of geologically recent origin, and some areas, especially on Savai'i, are covered by historically recent lava flows. The basic material is deficient in potassium and relatively low in phosphorus, so that the derived soils are inherently low in both of these essential elements. There is an accumulation of nutrients in the surface soil under forest conditions, and this is the basis for the traditional subsistence cropping system. A general soil survey was carried out from 1956 onwards and published later (Wright, 1963); the climatic situation and the topography of the islands are described in Fox and Cumberland, 1962.

Soils

These are extremely porous and relatively shallow, except in depressions where there is some accumulation. The most important agricultural characteristic is that the soils are extremely free draining and, therefore, heavily leached under the prevailing rainfall conditions which in most places exceeds 100 inches per year. They are, consequently, deficient in bases, particularly potassium; they have a relatively low waterholding capacity in the surface layers. The additional major agricultural characteristic is that large areas, especially on Savai'i, are rocky or bouldery. Forest cover is dense, and trees of newly planted species grow extremely rapidly, while tree cash crops, especially cocoa, seem to be well adapted once they become established. The stones and boulders present an operational hazard in that they make access to the trees extremely difficult.

Under the traditional system of shifting cultivation, the accumulated fertility in the surface soil is exploited for two or three years; thereafter the land is abandoned and reverts to bush. Where tree crops have been grown, there has been a decline in soil fertility over time, and yields have declined. Observation by the mission members suggests that virtually all of the coconuts on both Upolu and Savai'i are deficient in potassium. This generally low level of fertility has implications for any major development programs and for research in finding ways of maximizing response to added purchased nutrients.

Climate

Western Samoa (latitude 13°S to 14°S) is tropical on the coasts and subtropical/tropical inland, with a mean daily temperature of about 27° centigrade. The average rainfall is about 100 inches, two-thirds of which falls between October and March. Average figures are misleading, however, since on the windward side of the islands the rainfall varies from 160 to 250 inches, whereas on the leeward side the more usual quantity is between 80 and 100 inches. The dry season is from May to August. The coastal areas of both islands have lower rainfall than the central mountainous areas. Within that general pattern the western ends of the islands have a lower rainfall and a more pronounced dry season than the eastern ends. See Annex 1, Figure 1 for details.

In the cocoa replanting program the areas indicated as being most suitable for the crop are in the median rainfall range and are in those areas which have the most pronounced dry season or a short (up to three months) dry season. The 1983 dry season has been exceptionally severe, and this has caused losses of newly planted cocoa up to the age of three years.

Combining these two basic parameters of soils and climate, approximately 500,000 acres of Western Samoa's land is regarded as suitable for agriculture and cattle grazing, but this total includes areas of marginal land which would have to be fertilized heavily to be productive, while there is a major restriction on cattle grazing over an altitude of 2,000 feet because of high rainfall, and as mentioned earlier, the stony nature of many of the soils makes cultivation extremely difficult. At the present time the government estimates that some 150,000 acres of land are in use, while residential areas in villages and urban centers occupy about 55,000 acres. No survey of land use has been carried out recently but the general consensus among extension workers is that although it is estimated that only some 200,000 acres of land are in use, either for cultivation or for residential purposes, there is very little accessible and reasonably good land that is not used. In the current subsistence pattern of cultivation, land which is under fallow and under secondary bush must be considered as being in cultivation.

Crops

Of the major crops, coconut occupies by far the largest proportion of the area. The table in the text gives the latest estimates as published by the government.

Table 1.1. Total area of land under major crops (acres).

	Village	WSTEC	Total
Coconut	113,014	10,097	123,111 ¹
Cocoa	9,738	2,526	12,264
Banana	8,594	210	8,804
Taro	<u>3,067</u>	<u>472</u>	<u>3,539</u>
TOTAL	<u>134,413</u>	<u>13,305</u>	<u>147,718</u>
Pasture			6,500

¹52,000 acres are planted with trees less than 12 years old.

When the estimated area of land occupied (approximately 205,000 acres) is compared with the 325,000 acres classified as suitable for intensive agriculture, and taking into account other users of land, the area available but not currently used seems likely to be comparatively small. One implication is the need to increase productivity per unit area in addition to extending cultivation of suitable crops into new areas.

Forestry

Forestry is a large foreign exchange earner in Western Samoa and trees must, therefore, be regarded as a crop, with a place in the overall cropping pattern of the country. Thus, agriculture should not assume a prior claim to areas which may be as productive economically under forest as under anything else. This situation may change if the currently satisfactory food production situation requires a substantial increase in the output of staple foods.

The development of the country's forest resources is becoming increasingly important to the economy, and major reforestation schemes are already in progress. Western Samoa is one of the very few nations which exports hardwoods and is also engaged in a significant program of replanting hardwoods. The increasing amount of logs processed in the country means that Western Samoa is deriving greater benefit from its exports of wood than was the case in the past. In addition to this, the country is also making strenuous efforts to use the waste products from the timber industry for electricity generation to save foreign exchange.

A detailed assessment of forest resources was made in 1977 and published as a national forest survey. The results show that there is a total of 256,000 acres of productive forest. In addition it was considered that there are large resources of wood which are currently not used. These could be used for increased export earnings or import substitution through different forms of manufacture, but the types of timber would not normally be acceptable on the export market purely as sawn logs.

The reforestation program is substantial and approximately 1,500 acres are being replanted annually at a rate of some 100 to 400 stems per acre. It is estimated that these will be in production in about 25 years. The country's objective is a sustainable output of quality timber. These large reforestation programs are being supported by external assistance, and in this the Government of New Zealand and the Asian Development Bank are playing a large part.

Fisheries

The potential for sea fisheries is not clear. The volcanic nature of the islands, surrounded as they are by coral reefs, means that the depth of water increases rapidly on the outer slope of the reef, so that the areas suitable for bottom fishing are limited. Outside this area there is a major reef within the territorial waters to the north of Samoa, but this has not been explored. Legislation exists for the establishment of an exclusive economic zone (EEZ) in the normal way of maritime countries. Samoa's geographical location, however, places it in a disadvantageous position, since it shares part of its surrounding waters with other territories. The South Pacific Commission has estimated that the sea area which could be included in this zone would be only approximately 62 thousand square miles, whereas for the South Pacific region as a whole the total is in excess of 11 million square miles.

Commercial fishing has not been of major importance to Samoa, although it is known that foreign vessels are fishing in some of the waters which would be covered by Samoa's exclusive economic zone. Recently the government has obtained a fish quota in New Zealand waters and has negotiated with a Japanese company to do the actual fishing in return for a proportion of the catch. In addition the Japanese company will fish certain Samoan waters on a license basis.

The potential for an increase of fish catches by inshore boats is not known. The report of a mission carried out under the auspices of the Australian CSIRO (Johannes, 1982), indicates that there would be little to be gained by attempting to do a stock assessment on the reefs or on the outward slopes because of the interchangeability of species in the local diet.

POPULATION

The total population of Western Samoa was estimated in 1981 to be 160,000, of which 21% were living in towns or large villages.

The main characteristics of the population are:

- * a high proportion of young people, approximately 47% of the population is under the age of 15;
- * the birth rate is high -- more than six children per family, although this rate has declined rather slowly over the last 15 years;

- * mortality rates are low compared with those in other developing countries -- the life expectancy is approximately 63 years;
- * the high level of emigration estimated at 2,000 persons net per year.²

The high natural rate of population growth is estimated at about 3% per year, but the loss by emigration has meant that the net rate of increase of total numbers in Western Samoa has not exceeded 1% per year. However, the very large number of children about to enter the reproductive age group will ensure a continuing high natural growth rate and, with the gradually increasing restrictions being placed on emigration to other countries, notably New Zealand, this could well lead to a more rapid increase in total population than has occurred during the last 10 years.

Apart from its effect on population growth, emigration has other consequences for the economy of the country. In the short term, it reduces the number of persons who might otherwise be unemployed, but it also appears to have caused a shortage of male labor in some areas, particularly where this is needed on plantations and other commercial production units. In addition to that, with the increasing wage labor opportunities in the urban community in the country, the proportion of active males available in the villages has been reduced. On the positive side, persons living abroad remit large amounts of money to Western Samoa and help the economy in that way.

Of the total estimated labor force of approximately 75,000, the subsistence sector in its various forms provides work for about 65%, while the monetized sector employs about 25%, leaving 10%, according to official statistics, unemployed or unaccounted for.

In the government's view, shortage of manpower is among one of the major problems hampering Western Samoa's development. This is particularly important in areas where highly qualified staff are needed and where management skills are important. The planning of manpower skills is given high priority since the labor force is regarded as a main resource for development, whether in agriculture or elsewhere. Many employers are finding it difficult to find workers, especially on the island of Savai'i. This does not appear to be caused by an absolute shortage, but by other factors. In particular, in the Samoan culture a high value is placed on cultural and other traditional activities, and people will not easily sacrifice the time needed for them. Manual wage labor on the other hand has a low status, while low wages act as an additional disincentive. This presents severe problems to estates and to large organizations such as WSTEC, which must rely on paid labor to get their work done. Any agricultural development proposals, and the research work necessary to support these developments, must take these facets of the manpower supply into account.

The government has identified major areas where shortages of skilled manpower occur. These are in senior- and middle-level management,

²Taken over 10 years this amounts to 20,000 persons compared with a remaining workforce of about 75,000.

technical skills at all levels, and in accountants. Of these, the shortage of trained management staff is the most critical. Since an increasing demand for these types of persons is foreseen as a result of the many new projects which are scheduled to be implemented, the need to train staff in managerial and administrative skills is extremely pressing. At the present time, most of these posts are occupied by expatriates. While this may be necessary for the foreseeable future, it should not prevent the training of Samoans to take up these positions. Only in this way can the dependence on foreign experts eventually be reduced. There is recognition of the shortcomings in the supply of professional staff in agricultural engineering and architecture and also in technical staff at the subprofessional level. This applies also to skilled tradesmen -- mechanics, electricians, carpenters, plumbers, and others -- and since it is impossible to attract these people from overseas, there is a serious deficiency.

The secondary educational system in Samoa is extensive and good, and a large proportion of students attend secondary school. There has been a tradition of numbers of Samoans being sent overseas for training of various kinds. In 1979 for example, 113 went abroad for university undergraduate training, 14 for postgraduate training, and 79 for subprofessional-level training. Attention has been focused recently on degree-level training, rather than postgraduate training. This has implications for the staffing of the agricultural research service by Samoans for whom postgraduate training in research is essential.

LAND TENURE

Most of the land (about 75%) is held by villages as customary land. The control of this land is within the village group and administered by the chief matai for the benefit of the group. Ownership of customary land cannot be transferred, but recently the leasing of customary land has been allowed. The government has indicated that this could be one of the major ways in which an increase in land available for commercial production could be found. Approximately 11% of the total land is held by the government, while WSTEC has about 4%. This leaves about 10% in private hands, in large and small lots. Although this is a small proportion of the total, it is an important component in that it is freehold land, and can be used for a range of purposes not connected with village agriculture.

It is believed, however, that approximately 80% of all production takes place within the village system.

The traditional village groupings are the fono or village council, which comprises all the matais of the village. The matais are elected by the villagers, and are their representatives in local government. The fono is responsible for all village administration. It is usually headed by the matai with the highest ranking title, and can enforce its decisions on the villagers by fining, banishing, or ostracizing offenders.

The traditional system of land tenure in villages is perhaps more complex than is often realized or reported. From the development point of view, however, it appears that the matai system is extremely important in relation to what is possible and to the introduction of innovations in

village-level production. Once a matai is elected to the position by the family, he has control but not ownership of the land. He cannot sell it, but he virtually dictates who can use it and how it is to be used, and he is often responsible for the distribution of the produce from it. To use family land on an individual basis, men are obliged to render tautau or service to the matai in the form of produce, labor, or cash. Although there is increasing individual, rather than cooperative family use of land, those working it are controlled by or obligated to the matai, who in turn is responsible for distributing the produce. There is some evidence that the matai system functions in several different ways and also that there is a receptivity at the village level to new ideas and to the production of new crops, provided these are seen as being sufficiently advantageous. The rapid growth of the passion fruit industry during the past three years may be cited as an example. Thus there appears to be sufficient flexibility or receptivity within the system to allow modern developments to take place.

The government has recognized that it is only by working through the matais and involving them in the governmental and economic development process that progress can be made. This is reflected by the recent passing of the Internal Affairs and Rural Development Act in an attempt to speed up the rate of development through the production at the village level of exportable surpluses of traditional and new crops.

THE AGRICULTURAL SECTOR

The agricultural sector is based on few crops. The only crops of major significance are taro, which is the main staple food, coconuts, cocoa, and bananas. All four of these are cash crops and all except cocoa are major food crops. In terms of the overall economy of the country the traditional exports of copra, cocoa, and bananas amounted to 80% of the total export earnings in 1981, but nontraditional exports including coconut cream were approximately 20% in that year.

While the output of copra has remained essentially constant, with the building of the oil mill, the export of oil and meal and the processing of fresh coconuts into coconut cream, the price received per unit of coconuts grown is starting to increase.

For the other major export commodity, cocoa, yields have declined disastrously from 1962 onwards, and less than 1,000 tons of cocoa were exported in 1982, compared with over 5,000 tons in 1962.

Forestry has assumed a significant role in export earnings, mainly from the introduction of better milling techniques and the export of sawn timber instead of logs.

The export of taro increased steadily until, in 1981, the value of taro exported exceeded that of cocoa. This must be seen against a very depressed output of cocoa, which can hopefully be redressed in the not too distant future.

The contribution of the agricultural sector to the overall economy of the country can best be seen from Annex 1, Table 1 which gives the Gross Domestic Product (GDP) by main sectors for 1979 and the projections for

1980 and 1984. The GDP attributable to agriculture, forestry, and fisheries is about half of the national total. It is projected to grow at the rate of 3.2% in real terms over the next few years, but this depends on the prices for copra, cocoa, and taro over which the producers have little control. Heavy investments are currently being made in both the coconut and cocoa industries, but it will be some years before these are reflected in the export figures and contribute to the overall GDP. A more significant possibility for immediate improvement is in the banana industry, which from a very depressed level is starting to increase output. Markets have been secured in New Zealand and Hawaii dependent only on the regular supply of a reasonable quality material. It appears that transport facilities have been improved and container shipments of boxed fruits can now be made.

Despite the large contribution of the agricultural sector to the GDP there is still major importation of food items. The detailed breakdown of imports given in Annex 1, Table 2, indicates that in 1981 the total importation of food items was of the order of WS\$13 million, which was only marginally less than the total export of agricultural produce. This was caused by very low prices for export commodities in that year, but indicates nevertheless that the scope for improved agricultural output to make an impact on the national economy is not confined solely to the production of goods for export, but may also include substantial quantities of food to replace imports. The detailed breakdown by value of major imports for 1974 to 1981 indicates that meat and meat preparations, sugar and sugar preparations, and cereals and cereal preparations make up the greater part of the total imports, while beverages, including wine, spirits and beer, and tobacco were together almost equal to the cost of imports of meat. Since that time the setting up of the local brewery has reduced the import bill on this account and exports of beer and foreign exchange earnings in the last financial year balanced the cost of its imported materials. In the immediate future the potential for the replacement of imports appears to merit greater attention than it has received in the past.

However, Western Samoa is small and remote. It is far from any major industrial markets, being approximately 2,500 miles from Australia and Japan and about 5,000 miles from the United States mainland. It is closer to New Zealand at about 1,900 miles and there is a preferential market for some items in that country. While there would appear to be a substantial potential for increasing nontraditional exports to these markets, the value of these in relation to the total value of exports would be relatively small. For most of the crops which can be grown in Western Samoa, world markets are limited, except where small quantities can be moved into preferential markets.

The government is committed to a major improvement of the runway facilities at Faleolo Airport, Western Samoa. When this is done the possibilities for increased air freight shipments of produce, particularly to New Zealand, will be improved. Substantial amounts of taro are already air freighted to New Zealand, but higher value crops such as avocados and mangoes could take up part of the available space in the future. Good varieties of these are available in Western Samoa, and the potential for increasing their production and export is clearly present.

It is difficult, nevertheless, to see how the agricultural sector alone can support the development objectives of the government. There is substantial unrealized agricultural potential. On the basis of the modern technology, and the land which is available for redevelopment, agricultural production in terms of volume could be at least doubled within the next 15 to 20 years. This would take a most determined effort on the part of the producers, but it is possible. Even so, it would not meet the current total budget deficit of the country. While there is undoubtedly a high unrealized potential available within the agricultural sector, it clearly cannot be looked upon as providing all the export earnings which the country needs to pay for the major developments which are planned.

Village Production

The production situation in Western Samoa is characterized by the dominance of the village production sector. The large plantation holdings, now vested in WSTEC, have in the past contributed substantially to export earnings but, with the rundown of these estates and the deterioration of the management of WSTEC, the contribution from this component is much reduced. The village production system, governed by the senior matai and the fono or village council, was designed to supply the needs of the village or community. In this system any surpluses generated were used to raise cash or were exchanged for those items which the village required. The system was not, and still is not, geared to generating surplus production for purposes of raising general revenue to be used by the government for other development purposes. This problem is fully realized by the government and measures are being taken to try to change the system, so that it contributes more to general development funds.

Estate Production

The estates sector, the main part of which is WSTEC (a government-owned corporation), could, with dynamic management, make an early contribution to export earnings and to the general funds available to the government.

Livestock

The livestock sector appears to have stagnated during the last few years with no appreciable increases in the national herd numbers, either in cattle, pigs, or poultry. The stagnant or possibly declining numbers of cattle give cause for the greatest concern, since this is one kind of livestock which can use natural or improved pastures with minimum inputs and with virtually no demand on imported materials except for fertilizers. Pigs and poultry on the other hand, where these are produced intensively rather than in the free-ranging system in the village, require the import of considerable quantities of feedstuffs. With the construction of the oil mill to produce coconut oil a quantity of copra meal is now available which could form a protein source for use within the livestock industry. It needs to be supplemented, however, by locally grown sources of carbohydrates and possibly by some minerals before it can be fully utilized in providing a home-produced ration.

There is a feed mill in Western Samoa which can use whatever materials may become available. The possible production of carbohydrate feeds for incorporation into locally produced rations appears to be a neglected area.

Opportunities for Increased Production

Hence, there would seem to be major early opportunities for developments in livestock and in the plantation sector, with the village taking longer to develop into a production surplus situation.

Even so, there would appear to be a greater degree of flexibility in the village production system than would be apparent simply from a consideration of its historical structure. The production of passion fruit has increased substantially during the last two or three years in response to a demand from the food processing laboratory. This suggests that within the village and the private sectors there are people ready to seize opportunities for profitable production; this is an encouraging situation which the government would like to promote.

In the cocoa development project there are now approximately 1000 registered farmers taking part in redevelopment and replanting projects, although each of these has only a small area, they collectively will add a considerable amount to the total exportable surplus of cocoa in a few years time. It is not clear how these farmers have been encouraged to take up what amounts to a new crop (Amelonado cocoa being quite dissimilar from the Trinitario which has been grown traditionally in Western Samoa) and it will be interesting to see whether these small farmers can increase their area once they are satisfied that an economic production opportunity exists.

Marketing Agencies

The marketing of copra, cocoa, and bananas is handled by specialized boards managed by interministerial committees. The marketing of other crops, mostly taro, is handled by the produce marketing division of the Ministry of Agriculture. The Copra Board and the Cocoa Board act as final buyers of produce for export and determine the prices paid to producers and agents. Price stabilization programs have recently been introduced. From the figures given by the boards' representatives at a recent workshop, the prices paid to producers represent only about 60% of the revenues received by the boards. The Banana Board was responsible for collecting, packing, and marketing all bananas for export. The withdrawal of export quotas from village producers in 1982 reduced the board's activities, but it is actively promoting the commercial production of bananas for export in an improving market situation.

Credit: The Development Bank of Western Samoa

The Development Bank of Western Samoa was set up in 1974 with the assistance of ADB, which has been the largest source of finance for the bank and of technical guidance in its operations. It has developed into the major national credit institution serving the agriculture sector (among others) and is now managed entirely by Samoan staff. The emphasis

of its short-term lending is on cash cropping at the village level, but the task of managing a large number of small loans is placing a large workload on its good but limited staff. The bank is also active in promoting credit unions at the village level and various types of cooperatives to mobilize local savings and resources.

DEVELOPMENT POLICY AND PLANS

These have been set out both in the fourth five-year development plan which was issued in 1980 (Government of Western Samoa, Jan. 1980) and in the paper on the Socio-Economic Situation, Development Strategy and Assistance Needs (Government of Western Samoa, Dec. 1982). The latter paper (the section dealing with agriculture is reproduced in Annex 2) represents the most recent statement of government policy. It contains a clear statement of the government's development objectives and how, in the agricultural sector, some of these might be put into effect.

In several places in this document, the role of research and extension services is mentioned as being essential to the development of new methods of production for traditional crops and for supporting the introduction of new crops. The role which these services have played in developing the small but expanding passion fruit industry is given as an example. It is also indicated that for new developments such as mangoes and possibly bananas and other fruit crops for export, similar research support would be needed. While there is a realization of the role of research there is little indication as to how this service is to be provided.

A few of the statements in the report appear particularly important. First, there is a continuing theme of the need for export industries (whether in agriculture, forestry, or fisheries), to become highly competitive, to have good management, and to use improved technology if they are to survive and to compete in the world situation. In addition to research support this implies access to and support from external agencies, not necessarily in terms of personnel but in terms of information and materials and the ways that these may be used in the Western Samoan context.

Second, DBWS has "emerged as a major development credit institution of national importance. An important characteristic of DBWS is that it is directed, managed and run by Samoans with no expatriate technical help." The bank has replaced resident expatriate support by a vigorous program of interaction at the professional level with overseas institutions. This is possible once a nucleus of sufficiently qualified staff is available within the country and could be used as a model in other activities such as agricultural research.

It should be pointed out, however, that DBWS does not come within the public service regulations and is able, therefore, to reward staff on performance and merit rather than within the fixed and currently low scales of the public service.

Third, the question of management of large estates is raised in several places in the report. While there is a recognition of the need for good management, and some steps have recently been taken to strengthen the

management at WSTEC, there appears to be little realization of the size of the professional management structure needed to run effectively a business enterprise of the size and complexity of WSTEC.

Each of these three major items mentioned has implications for the design and functional effectiveness of an appropriate research and extension system for Western Samoa.

STRUCTURE OF THE GOVERNMENT

There is an elected assembly of 36 members; in the elections only the matais or titled persons can vote. There is no clear division into political parties; the two major groups within the assembly have almost equal numbers of members, so that the normal majority with which any government has had to work during the past few years has been small. There is a cabinet which has nine portfolios, of which the Prime Minister, in addition to his leading role, also handles financial affairs. The government structure is indicated in Annex 3, Figure 1. Within this framework the Ministry of Agriculture is responsible for all agricultural developments and the Ministry of Lands and Surveys is responsible for surveying land ownership but not for the agricultural development or use of land.

The Ministry of Agriculture was reorganized in 1977 and new structures were established (Annex 3, Figures 2 and 3). These have not been put into operation, and the chart given in Annex 3, Figure 4 of the structure of the Ministry of Agriculture reflect the current organization of the ministry.

The organization of research and extension services is of prime concern to the ISNAR mission. In the reorganization in 1977, the then College of Agriculture at Alafua, which was the research arm of the Department of Agriculture until that time, became the School of Agriculture of the University of the South Pacific. The emphasis of its work was changed from that of providing for purely national needs to one of providing for the region as a whole. It is felt within the government that this has reduced the benefits which Western Samoa derives from the activities at Alafua. The development of the Nu'u research station and the inclusion of research components in development projects indicates the extent of the government and donor concern to have appropriate research carried out.

RESEARCH ORGANIZATION

Research is being conducted on an ad hoc basis with little coordination between individual projects. There is still no part of the ministry structure which is referred to as a research unit, section, or division. The introduction of essential research components into major development projects such as the cocoa development project, the crop protection project, and the food processing laboratory activities has succeeded in getting some work done, but at the expense of further weakening of the function of the department in any cohesive research program. The establishment by DoA of a research station at Nu'u which to some extent must duplicate the work being done and the facilities which exist on the Alafua campus, indicates that the department feels a need for a research unit even if there is still some indecision as to what form it should take.

Research work has continued at Alafua within USP but, there has been insufficient programmatic interaction between USP and DoA for maximum benefits to accrue to Western Samoa.

While the mission was in the field, it was announced in a local newspaper that the government intended to set up a university or university college of Western Samoa which would be based on the Alafua campus. The mission has taken note of this announcement but the details remain to be worked out and the possible influence of this on the organization and conduct of agricultural research in Western Samoa have not been examined in detail.

The overriding problem in Western Samoa appears to be that there are very few Samoans trained in agricultural research. In the ministry as a whole there are very few graduates in agriculture or in the natural sciences. Of these, only three appear to be involved in full-time research activities (Annex 3, Table 1). It will be seen, therefore, that the organization of agricultural research is not strong and few Samoans are involved. This has resulted in the bulk of the adaptive work which is in progress being carried out by staff, mainly expatriate, in individual development projects.

EXTENSION SERVICES

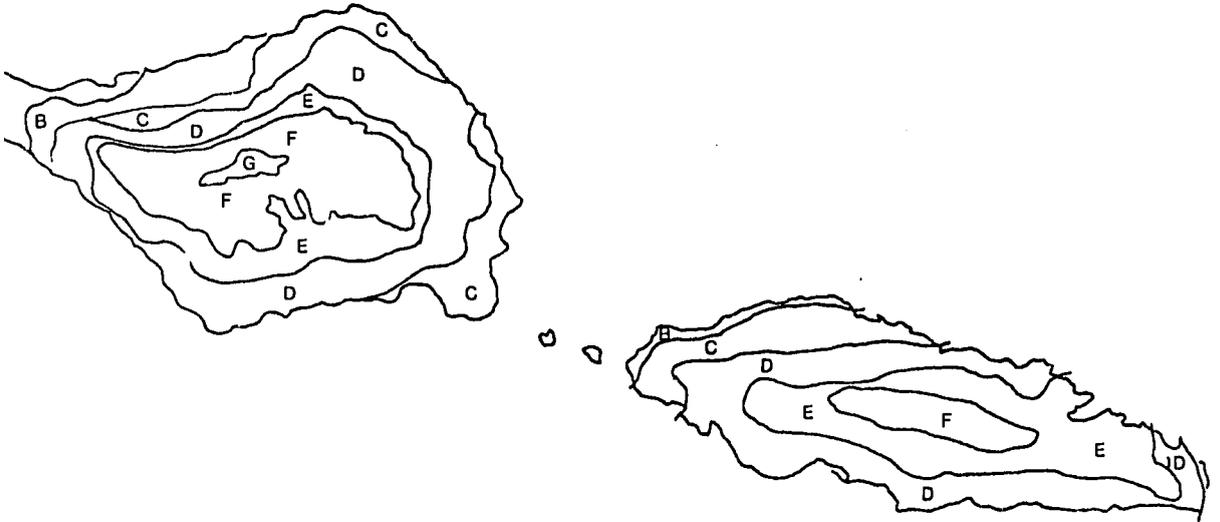
The extension services of DoA are headed by a chief agricultural officer supported by senior agricultural officers and others on Upolu and Savai'i. In addition, there are extension or field officers attached to the livestock division, the cocoa development and plant protection projects, and the food processing laboratory. While the mission was not specifically charged with investigating the organization of the extension services, it noted the possible adverse effects of the present fragmentation of efforts especially in relation to the interaction between research, extension, and producers at the farm level.

The list of staff positions given in Table 2 shows that there is approximately one professional officer per district. The numbers of support staff have recently been drastically curtailed. The major change introduced recently, from providing a practical service to farmers, e.g., spraying of taro to control caterpillars, to one of providing advice and guidance is proving difficult to implement.

With the building of an extension training center at Nu'u, the interaction of research staff who will do most of the teaching and the extension staff should be improved.

Table 1.2. Extension staff positions.

	Upolu	Savai'i
Chief Agricultural Officer	1	1
Senior Agricultural Officer	1	1
Agricultural Officer	3	2
District Field Officer	2	4
District Field Assistant	12	6



LOWLAND
(Mean annual temp. 78°F)

**A. MODERATE TO STRONG
DRY SEASON**

Mean annual rainfall
85-90 inches
3 months very dry
4-6 months moderately dry

B. MODERATE DRY SEASON

Mean annual rainfall
90-100 inches
2 months very dry
3-4 months moderately dry

LOWLAND AND FOOTHILL
(Mean annual temp. 78°-71°F)

C. WEAK DRY SEASON

Mean annual rainfall
100-130 inches
1 month very dry
3 months moderately dry

D. VERY WEAK DRY SEASON

Mean annual rainfall
130-175 inches
No very dry months
1-2 months moderately dry

E. NO DRY SEASON

Mean annual rainfall
130-175 inches

UPLAND
(Mean annual temp. 71°-67°F)

F. NO DRY SEASON

Mean annual rainfall
175- 200 inches

HIGHLAND
(Mean annual temp. 66°-60°F)

G. NO DRY SEASON

Mean annual rainfall
200 inches

Figure 1. Climate of Western Samoa; environmental classes of significance in soil formation.
(Adapted from Fox and Cumberland, 1962.)

Table 1.3. GDP by main sectors at producers' prices, 1979, and projected 1980 and 1984 (WS\$ 000 real).

Sector	1979	1980	1984	Average % increase per year
Agriculture, forestry, and fisheries	39,600	34,200	38,900	3.2
Manufacturing	3,000	3,600	5,650	12.0
Quarrying and construction	5,200	5,560	7,280	7.0
Electricity and water	410	600	1,000	13.5
Wholesale and retail trade, restaurants and hotels	6,900	7,170	8,380	4.0
Transportation and communication	3,700	3,900	4,700	5.0
Financial, insurance, real estate, and business services	4,600	4,780	5,590	4.0
Government services	10,200	10,500	11,860	3.0
Other services	2,000	2,060	2,320	3.0
GDP Total	75,610	72,370	85,680	4.2

Note: Allowing for an average inflation rate of 11% in 1979 over 1978, the 1979 estimates imply a real growth of 9%.

Table 1.4. Export earnings 1973 to 1981 (WS\$ 000).

	1973	1974	1975	1976	1977	1978	1979	1980	1981
Copra	1,643.3	4,658.0	2,603.1	1,873.8	4,607.8	3,535.9	8,018.4	8,404.8	3,923.6
Cocoa	1,703.0	1,871.1	1,179.8	2,220.6	5,875.1	2,687.9	3,468.4	3,012.6	1,436.4
Taro	355.9	318.4	94.9	363.4	336.5	993.7	1,512.2	1,048.3	2,136.2
Bananas	78.5	127.4	53.2	144.3	61.3	108.0	266.1	439.7	240.5
Timber	403.7	374.5	150.4	64.6	125.4	142.9	291.0	324.4	288.5
Subtotal (traditional exports)	3,554.4	7,349.4	4,081.4	4,666.7	11,066.1	7,418.3	13,556.1	13,229.8	8,025.2
Coconut Cream	-	0.1	82.1	204.4	222.3	251.1	427.3	594.7	635.5
Beer	-	-	-	-	-	-	252.1	349.6	464.1
Handicrafts	20.8	45.4	23.8	31.0	29.7	35.1	48.6	60.1	38.2
Subtotal (nontraditional exports)	231.6	214.6	403.9	466.4	440.6	599.1	1,213.7	2,084.3	2,271.5
TOTAL	3,786.0	7,564.0	4,485.2	5,133.1	11,506.7	8,017.4	14,769.8	15,314.1	10,296.7

Table 1.5. Structure of Imports (WS\$ 000).

	1973	1974	1975	1976	1977	1978	1979	1980	1981
Food									
value	3,969	4,946	6,714	6,158	9,027	8,548	12,414	12,353	13,199
percent	27.5	31.1	29.0	26.1	28.0	22.2	20.4	21.5	22.6
Beverages and Tobacco									
value	868	1,184	1,241	1,754	1,563	2,188	1,728	1,481	1,163
percent	6.0	7.4	5.4	7.4	4.8	5.7	2.8	2.6	2.0
Crude Materials									
value	116	107	123	226	760	829	925	1,575	628
percent	0.6	0.7	0.5	1.0	2.4	2.1	1.5	2.7	1.1
Minerals, Fuel, and Lubricants									
value	634	480	1,913	1,670	2,902	2,865	5,758	9,561	12,559
percent	4.4	3.0	8.3	7.1	9.0	7.4	9.4	16.6	21.5
Animal and Vegetable Fats									
value	33	49	73	239	200	308	412	423	396
percent	0.2	0.3	0.4	1.0	0.6	0.8	0.7	0.7	0.7
Chemicals									
value	803	1,094	1,129	1,283	1,439	2,370	2,715	3,450	3,077
percent	5.6	6.9	4.9	5.4	4.5	6.1	4.5	6.0	5.3
Manufactured Goods									
value	3,090	3,858	4,996	4,371	6,763	8,043	11,239	13,068	12,448
percent	21.4	24.9	21.6	18.5	21.0	20.8	18.4	22.8	21.3
Machinery and Transport Equipment									
value	3,253	2,696	5,160	3,730	7,446	9,872	21,918	11,708	11,716
percent	22.5	16.9	22.3	15.8	23.1	25.6	26.0	20.4	20.1
Miscellaneous Manufactured Articles									
value	1,668	1,358	1,741	2,523	2,123	3,545	3,513	3,808	3,113
percent	11.6	8.5	7.5	10.7	6.6	9.2	5.9	6.6	5.3
Commodities and Transactions n.e.c.									
value	-	138	49	1,673	30	1	225	12	56
percent	-	0.9	0.2	7.1	0.1	-	0.4	-	0.1

Table 1.6. Food imports 1978 to 1981 (c.i.f.) (WS\$ 000).

	1978	1979	1980	1981
Live animals	9	338	17	15
Meat and meat preparation	2,526	3,166	2,856	3,256
Dairy products	862	1,019	1,279	1,139
Fish and fish preparation	787	2,066	1,405	2,013
Cereals and cereal preparation	1,825	2,557	3,070	2,989
Vegetable and fruits	440	516	554	533
Sugar and sugar products	1,123	1,512	1,840	1,945
Coffee, tea, cocoa, spices	241	204	169	224
Animal feed	201	208	301	204
Miscellaneous edible products	534	821	860	820
TOTAL	8,548	12,414	12,352	13,199

Annex 2. Agriculture, Problems, Policies and Programs

A. CURRENT AND POTENTIAL

3.1. Until very recently, development efforts in Western Samoa tended to concentrate on the building of infrastructure. Agriculture received only secondary importance in implementation. This tendency was probably caused by two factors:

- (a) the rudimentary state of the country's infrastructure which needed improvement and expansion as a matter of priority;
- (b) predominant role of the village sub-sector which might have been perceived as something beyond the sphere of influence of governmental initiatives or action.

3.2. Only 22.9 per cent of development expenditure under DP1 (1966-70) went into the agricultural sector, though at that time the planned allocation was 61.8 per cent. Since then, DP2, DP3 and DP4 allocated respectively 20.7 per cent, 28.3 per cent and 32.4 per cent of total development expenditure to the agricultural sector. The actual expenditure was 21.9 per cent in DP2 and 24.1 per cent in DP3. In the first three years of DP4, about 31 per cent of development expenditure has gone to this sector, thus confirming the fact that agriculture has come to command a higher priority than was the case in the past.

3.3 This is only logical. Agriculture is not only the mainstay of the economy but also governs the development in the external economic front by virtue of the impact it has on exports and, to a lesser extent, on imports. The Government recognises this and there are concrete examples of major steps taken in recent years to improve this sector.

3.4. An obvious example is WSTEC. Its potential as the "leading edge" in agriculture was recognised. Domestic as well as external resources and efforts were therefore mobilised and used to modernise and expand its operations. Indeed, WSTEC's potential goes beyond land development and has, in fact, been involved in marketing operations and agro-industrial enterprises. It is unfortunate that at a time when this organisation's contribution was expected and needed most, its finances, management and operations went into disarray and development activities under it have come, more or less, to a halt. Among other things, it is saddled with the burden of a bank overdraft of US\$4 million with no readily available means to clear it.

Quoted directly from Western Samoa, Socio-Economic Situation Development Strategy and Assistance Needs, pp 25-42. Government of Western Samoa, December 1982.

- 3.5. A more successful step was the acquisition of Potlatch's timber operations by the Government. The declining activity has now been turned into a profit-making operation with valuable foreign exchange benefit accruing to the country due to exports of timber. Another success story is the Development Bank of Western Samoa which has emerged as a development credit institution of national importance. An important characteristic of the Development Bank is that it is directed, managed and run by Samoans with no expatriate technical help.
- 3.6. Apparently, however, the areas of successes have been too few and isolated to create a significant impact in terms of increased production of consumption in the households. As already emphasised, a chief concern now is the stagnant levels of production and exports sustained by a lack of improvement in productivity.
- 3.7. Yet the potential exists. A large portion of the country's agricultural land remains underutilised. This aspect manifests itself in terms of old trees awaiting felling and replantation, plantations impaired by overgrown bushes and weeds, shifting plantations with the objective of claiming the right to use rather than of harvesting crops for food or cash, etc.
- 3.8. The most important and promising commodity is coconut, where there is a productive base partially augmented by the planting scheme of the 1970's. The current area under coconuts is approximately 123,000 acres. Out of this, 40,000 acres are planted with trees younger than twelve years, and this area is considered as yet unproductive, the main problem being that yield per acre is very low by world standards. The productivity in the copra industry is reported to be 700 pounds of dry copra per acre. The technical problem of low yield is accentuated by waste in the form of unpicked or unharvested nuts. Senile plantations, poor cultural techniques, and inadequate fertiliser use are other reasons. Appropriate efforts in this direction can clearly lead to increased levels of productivity and output.
- 3.9. The case for cocoa is more difficult. First, it does not have the productive base mentioned in connection with the coconuts. Its reported acreage is 12,000. Both production and yields have declined since the early 1950's due to poor agronomic management, low soil fertility, poor planting material and highly unstable and declining prices. The field service team for implementing the cocoa planting project by assisting farmers with a package of improved varieties and husbandry methods was recruited only in mid-1982. WSTEC, during 1980 and 1981, planted approximately 100 acres in Savai'i, much of which followed traditional planting methods. The future of cocoa will depend upon, apart from an efficient research and extension programme, its price stabilisation.
- 3.10. Banana export volume and value has improved from the lows in 1977 and 1978. However, the market has dictated the virtual disappearance of the small producer packing in cases. The 200 acre, Government-owned, commercial banana plantation at Tanumalala, Upolu is the basis of the present export sector. But it is also of continuing importance as a prominent food item in the households. Adequate fertilisation, disease control and marketing services can form the basis for cautious rebuilding of the banana industry.

3.11. The production and export trend of taro, the staple of Samoan diet, is relatively better. Taro export volume and value doubled from 1980 to 1981. The 1982 trend is somewhat down, but taro appears to have temporarily displaced cocoa as the number two export earner. Again, given the rather stable growth in its export prices, efforts can be made for further improvement.

3.12. In fisheries, the aggregating devices have proved successful and Western Samoa is now catching sufficient fresh fish for local consumption. Progress towards import-substitution of canned fish is, however, not discernible. One problem is that the areas for bottom fishing are very limited and there is now a glut in the tuna market depressing the prices. Yet the price of local tuna is high enough to make it less competitive against imported canned fish, which mainly consist of lower value species. All in all, the fishing industry is becoming a highly competitive one, requiring good management and improved technology to survive. With this available, one can expect fisheries to become a more important long-term activity.

3.13. Efforts to develop the livestock industry have only met with limited success, and large quantities of mostly low-quality meat continue to be imported. Cattle raising is concentrated on few relatively large-scale commercial farms (including WSTEC), but a number of small village cattle units have been established during recent years. Nevertheless, the national cattle herd increases have hardly kept pace with population growth. Pigs and poultry usually roam free and establishment of commercial pig and broiler units is mainly constrained by unreliable and costly feed supply, lack of management skills and lack of suitable breeding stocks.

B. WESTERN SAMOA TRUST ESTATES CORPORATION

3.14. The Western Samoa Trust Estates Corporation (WSTEC) is a problem as well as a promise for the Samoan economy. It is the largest enterprise in Western Samoa. It is wholly owned by the Government and has the potential for influencing the course of the economy internally and externally. Its importance is evident from the fact that:

- * It dominates commercial agriculture with only a few other smaller government undertakings and limited private plantations outside its purview.
- * It owns 30,000 acres of the country's best agricultural land comprising eighteen per cent of the total cultivated acres, having fourteen estates in Upolu with approximately 20,000 acres of plantations and 10,000 acres in Savai'i.

It has 10,000 acres of coconut, most of which is grazed or undercropped with cocoa or coffee.
- * It has 2,400 acres under cocoa cultivation and over 300 acres of coffee.
- * Its livestock operation is next in importance only to coconut; it has 12,000 head of cattle comprising more than 40 per cent of the national herd.

- * Its activities extend beyond agriculture to the operation of a soap factory, a coconut stem utilisation plant, retail stores, a service station and an engineering shop.

3.15. It is in view of these resources and potential of WSTEC that the Government adopted the strategy of using WSTEC to spearhead the country's efforts to develop commercial agriculture. In 1978 the Government signed an agreement with Asian Development Bank involving a credit of US\$3 million for the rehabilitation of six WSTEC estates on Upolu. The purpose of the credit was to improve infrastructure and management practices, establish an agricultural research station, provide necessary product processing facilities for cocoa and copra and provide fellowships for overseas training of local staff. In 1979 the World Bank approved US\$8 million under an IDA credit for the development of WSTEC estates on Savai'i. In order to meet the total cost of US\$20.5 million for the project, co-financing arrangements were concluded with the Australian Government (US\$1.4 million), UNDP (US\$0.3 million). The project aimed at rapid and substantial increase in productivity, production and exports of copra, cocoa and coffee so as to help the resource gap in the short and medium term. In fact, this project aimed to make an impact beyond WSTEC by proposing to transfer improved technology through plantings in village areas and to help improve the standard of living of subsistence farmers as well. The activities under the project included improvements in nurseries, imported improved planting material and field development of about 2,400 acres of coconuts, 2,130 acres of cocoa and 200 acres of coffee in four WSTEC estates and villages of Savai'i. The project also provided for improvement in the marketing of village produced taro, technical assistance for diversification within WSTEC and estate-road construction and development.

3.16. There is another programme which also focuses on improvement and expansion of WSTEC. In November 1980, the Asian Development Bank approved a second loan of US\$3 million for agricultural development. At the same time, Australia (US\$2 million) and IDA (US\$2 million) agreed on a co-financing arrangement contributing towards the total cost of US\$10.8 million. WSTEC's share of the programme is US\$2.8 million. The purpose is to support the improvement of seven of the eight remaining estates in Upolu not included in the 1979 agreement. The proposed activities include replantation of 1,000 acres of senile coconuts; plantation of 1,000 acres of cocoa under coconuts, fertilisation of existing cocoa and coconuts; provision of infrastructure facilities such as roads, fences, storage, water, provision of livestock equipment and pasture improvement for cattle and many others including WSTEC's processing activities on soap, coconut stem, etc.

3.17. While the first ADB-financed project has made some progress, the remaining larger programmes have either lagged behind or not gotten off the ground at all (with the exception of South Coast road in Savai'i) depriving the country of the immense benefits that could have accrued from such large externally-funded activities. Presently, WSTEC is going through a consolidation phase to improve management and financial practices and to restructure its development programs. However, WSTEC suffers from a major cash-flow problem which makes it difficult to meet any sizeable local cost contribution to externally financed projects.

C. CONSTRAINTS

3.18. Prices. Commodity prices constitute the most important constraint to Samoa's agriculture. The present prices and future prospects for most of Western Samoa's traditional exports, including copra and cocoa appear most discouraging. Apart from two price hiccups in 1974 and 1979, copra and coconut oil prices in real terms have followed a declining trend over the past decade. Cocoa price projections to the end of the 1980's indicate that present-depressed prices will continue. Price stabilisation measures, unless strengthened by price support measures, will therefore allow only for a period of adjustment before following the expected trends. Price prospects for alternative tropical plantation crops, e.g., coffee and rubber are certainly no better and, apart from coffee, are unlikely to warrant the necessary redeployment of resources that would be required.

3.19. Services

With the very recent advent of agricultural research in Western Samoa and the consequent limited number of economically superior packages of technology available for extension to farmers, it is not surprising that the information and advisory services of the Extension Division of the Department of Agriculture are weak. Channels of communication from researcher to extension officer and hence to the farmers are not adequate. In addition, there is the problem of shortage of trained scientific staff.

3.20. The Development Bank of Western Samoa, which was set up in 1974, is now the most important institutional source of development credit. However without the adequate demonstration of new enterprises and techniques and the teaching of necessary skills, the programmes for providing credit and inputs will be limited in their impact. On the contrary, arrears can accumulate because farmers cannot repay.

3.21. Under Samoan conditions, inadequate marketing services act to limit the effectiveness of all the other services. Areas where marketing services are weak are in packaging and transport of fresh produce; in quality control and adequate feedback from the market to the producer through pricing; in processing methods for cocoa; in development and promotion of new markets and in advising extension officers and farmers of available opportunities; and in local marketing services for produce and livestock products.

3.22. The development of marketing services has been piece meal. The Copra Board, the Cocoa Board and the Banana Board, established respectively in 1948, 1972 and 1975, act as the final buyers of the respective commodities which are subsequently exported.² For other commodities, mainly taro, there is the Produce Marketing Division which carries out the same function. The Boards and the division purchase most of their produce from the small holders.

² With the commissioning of the Coconut Oil Mill, the Copra Board is expected to sell to the mill. But it is also directly exporting copra as before.

3.23. Price stabilisation schemes for cocoa and copra commenced in 1982. The minimum and maximum prices are determined by the calculation of a five-year moving average based on a given percentage (85 per cent for copra and 75 per cent for cocoa) of the average of the last four years' f.o.b. value and the expected f.o.b. value of the current year. The minimum price is set at 95 per cent of the moving average and the maximum at 110 per cent. With the operation having commenced only this year, it is too early to judge the impact of price stabilisation schemes. It has already been pointed out, however, that with the given declining trend of the prices of these commodities, the operation of these schemes as a price support measure is not likely to be sufficient to help the producers. In addition the marketing boards are presently faced with major deficiencies because of, among others, a lack of integration and coordination in their respective activities.

3.24. The other constraints are inadequate transport capacity which affects the supply of inputs as well as the marketing of products. There is also the problem of access roads to the village plantations that need to be constructed and maintained.

3.25. Land and the Producer. Customary constraints commonly alluded to seem to come down to inadequacy of rewards for efforts in production and insecurity of use rights over land, because of Western Samoa's traditional village land tenure systems. In particular, land disputes between and within villages cause valuable agricultural land to remain idle for extended periods. On the other hand, for a potential investor, the apparent unavailability of land for lease is a major difficulty. Freehold land under commercial plantations is only about three per cent of the total land and it cannot be extended. The possibility of expanding commercial plantations may therefore be limited unless the practical difficulties of leasing customary land for which a legislation already exists are resolved.

3.26. In the villages, the producer is not oriented towards the requirements of the monetised economy. The consumer goods to which the farmer aspires are not within reach without a quantum leap in income, something which he rarely sees as possible in agriculture. As such, families seek to deploy labour resources in wages earning employment in Apia and overseas. A major constraint is thus that village agriculture as practiced now is not economically competitive with the wage sector with returns to labour inputs of at least \$4 a day, the minimum daily wage.

D. OBJECTIVES AND STRATEGY

3.27. There is a clear and overriding need to augment agricultural output to increase exports and foreign exchange earnings, to substitute for significant quantities of imported meats and basic energy foods and to increase raw material supplies for processing and adding value. The constraints suggest that approach should be selective, emphasising those enterprises and methods that provide high returns to labour.

3.28. Briefly, the objective of the agricultural sector is precisely the objective of the national economic development effort in its entirety. It is to substantially increase productivity and output in the short and the medium-term to help alleviate the country's balance of payments difficulties. A related objective is to move towards self-sufficiency in meat and milk production. From a longer-term perspective one needs to add a third objective, which is to conserve the environment so as to preserve soil fertility, water sources and other factors contributing to the productive base of this sector.

3.29. The strategies to be deployed for the attainment of the above objectives will be:

- (a) To make maximum use of the existing productive base through the introduction of improved varieties and husbandry practices on the one hand and integration of various tree crops, root crops and livestock enterprises on the other.
- (b) To make maximum use of presently underutilised customary lands or any unused land through measures including leasing of such lands for commercial agriculture.
- (c) To give adequate practical research support and encourage selected crops for the further development of processing industry in the country.
- (d) To encourage investors in the private sector - at home or abroad, on their own or through joint ventures - in the expansion of an agro-industrial base including crop production and livestock.
- (e) To provide for better marketing services which will be based on an integrated approach within the Government and greater involvement of the private sector.
- (f) To use forest resources on a sustained yield basis and to encourage exports of processed forestry products.

The programmes and projects in the agricultural sector have been closely reviewed and revised to reflect the above strategies.

E. PROGRAMMES

3.30. For the purpose of conceptual clarity, the programmes to be implemented may be discussed under three categories: enterprises, resources and services and policies.

3.31. Enterprises. Soil and biological factors indicate productive advantages to tree crops, root crops and livestock enterprises and associations of these. In tree crops, coffee is to be added to coconut and cocoa to provide an alternative for wetter areas. The cocoa programme with improved varieties and husbandry practices will be the model for the development of coffee and for hybrid coconuts. Suspensory loans will be used to encourage planting according to recommendations including intercropping and replacement of existing senile plantations.

3.32. Under fruit crops/horticulture, passion-fruit developments have progressed under the close supervision and assistance provided by the processing factory concerned to ensure adequate supplies to fulfill orders for its products. Given adequate research support and the seconding of an extension officer, the processing factory has been able to cover the costs of all grower support services including subsidised fertiliser as a production incentive. It is proposed to develop selected crops using this integrated approach with growers of considerable export potential of mango as fresh fruit and in processed form, an integrated mango production project is being developed and its preparation will have progressed sufficiently for submission to the donors in 1983. Similarly, an integrated banana industry approach is under consideration.

3.33. The development of new markets and marketing services for taro based on research findings for container transport will capitalise on strong farmer interest in this profitable crop. The animal feedmill will be encouraged to develop reliable sources of alternative root crops and breadfruit.

3.34. In livestock, effective import substitution for meat products will only take place with a programme to provide increased commercial opportunities for livestock producer. Simple production packages are available to build on present subsistence output and can be adopted given available remunerative markets. Marketing services including slaughter and transportation for fat stock, and live animal markets to encourage small stock-fattening enterprises and larger specialist breeding units are to be provided. Registration of cattle producers, better stock identification and stricter inspection procedures will be implemented to overcome problems of illegal slaughter.

3.35. In fisheries, further consolidation and expansion is to be done to promote fisheries for local market. For this, operating cost of fishing will have to be reduced and marketing and distribution systems improved. The programme is to improve boat design and to procure and install additional fish aggregating devices. There is a potential for a large-scale fishing industry. The Government expects that foreign, private investment can be attracted to this venture.

3.36 The forest sector is the object of extensive development efforts that commenced with large scale reforestation in 1977 with the rate to be doubled from 1983 at some 3,000 acres per annum. This programme is mounted economically and effectively from the Department of Agriculture's Forestry Division together with associated research programmes community forestry aimed at smallholders based on agroforestry projects for fuelwood poles and logs, and a national parks and conservation programme to protect catchments, water supplies and other fragile environments. Complementary private sector activities in milling and wood processing are developing. Higher value uses, initiated with the recent commissioning of a veneer plant, are being encouraged. The ongoing afforestation programme will be continued. Lack of local cost support is, however, constraining the speed of afforestation activity. In addition, the Samoa Forest Products Limited timber mill forms a major component of this sector. Mill equipment purchased from a previous foreign operator is now badly in need of replacement to ensure its continued profitability.

3.37. Resources. There are three resources to be considered: land, labour and WSTEC. One problem with land is that senile coconut plantations continue to tie up some 50,000 acres of the country's valuable land. The proposed utilisation of coconut stems in steam powered electricity generation will thus be important from the point of view of land clearing as well. Other uses should also release smaller acreages for redevelopment. Stem utilisation and the redevelopment programme therefore need to be integrated into a project.

3.38. In addition, it is now increasingly evident that village land should gradually be put to more productive uses. At the same time, land being a sensitive matter in this society as in so many others, one has to be careful in approaching this subject. The emphasis should be on education, persuasion and demonstration. In any case, the process will have to be gradual and selective in the beginning, concentrating on particular villages, where the leaders are more receptive to the idea of making economic use of one's resources. That this is a viable proposition is evident from the fact that in some villages, the matais have already changed their roles to those of managers and have given ipso facto permanent rights of use to nuclear families.

3.39. In view of the very positive response of villagers to Government's approach of leasing village land for afforestation purposes, a similar effort is now to be undertaken to establish integrated commercial agricultural operations on yet unused village lands. These crops and livestock farms will be operated by village companies which will be joint ventures between the villages and a commercial organisation. The latter will provide the management for each village company.

3.40. Much of present management approaches to labour use are based on the cheap labour policies of pre-independence plantation agriculture. This assumes that the resource is plentiful. Such an assumption does not hold true and, as a consequence, low labour productivity, short intermittent periods of working and lack of development of skills is the observation pattern. Policies to encourage skill development and the introduction of labour-saving technology is a more accurate reflection of resource availability. The projects proposed for implementation are formulated with this consideration where necessary or possible.

3.41. The activities under WSTEC will be revamped and upgraded with the sole objective of maximising their contribution to Western Samoa's balance of payments. This company, as already pointed out, is the largest single concentration of high quality land resources in Western Samoa. To date, it has been unable to marshal the necessary management resources to develop the potential of that land resource. The Government recognises that a setting of enterprise priorities is urgently needed and is considering steps to require WSTEC to shed some of its activities and concentrate on maximising returns from its land resource.

3.42. Following the Interagency (the donors) Meeting of last June, there has been some progress. Most importantly, the accounting system has been reviewed and revised in a manner that will, among other things, make it possible for a monthly trial balance to be published together with trading results separating agricultural production and commercial ventures. The new system has already produced the trial balance for the first half of the current year and WSTEC management expects that the corporation will earn a net profit this year.

3.43. Without this profit, liquidity is WSTEC's principal concern and an impediment to further programming. At the moment, WSTEC is trying to convert the \$4 million bank overdraft into a term loan and to service it through the sale or leasing of its reportedly unproductive land near Apia. It is also taking steps to eliminate unprofitable ventures, e.g., the wood by-product project, vegetable project and the dairy farm. Other cost-cutting measures have been and are being undertaken. Twenty-four senior employees were either retired or removed in a period of three months. The casual and plantation labourers have been reduced by 25 per cent. More importantly, the Government is considering steps to streamline management at the top as well as at the plantation level.

3.44. The WSTEC development programme for its Savai'i estate is being consolidated and redesigned. The six months consolidation phase is to be completed by February 1983, but the lack of funds to meet the local cost burden is a major difficulty.

3.45. Subsequently, it is envisaged that the Vaiaata estate, which was originally included in the above project but later found to be unsuitable for tree crop production, will be developed into a cattle farm. Similarly, the possibility of establishing cattle under coconut on 2,000 acres at Lata is being investigated. Details on both projects will be available by mid 1983 but no source of financial assistance for their implementation has been identified yet.

3.46. In addition, the Vaiaata estate in Savai'i, which was originally included in the above project, needs to be developed separately. The possibility, however, seems to be limited to forest and pasture for cattle. In view of the possibility of developing this area for commercial livestock, and in view of WSTEC's own difficulties at the moment, WSTEC will lease such land for private sector or joint-venture operations.

3.47. It is also recognised that WSTEC has another programme¹ to be implemented in Upolu which has yet to get off the ground. If the policies and programmes previously stipulated materialise, and if WSTEC starts showing healthy profits once again, this project should be able to proceed on its own on the basis of financing arrangements as originally agreed.

3.48. Services and Policies. Agricultural services of themselves will mean very little unless they are delivered as an integrated package to the producers within the framework of a national policy that sets out sub-sectoral and regional priorities in agriculture. The Government recognises that this is an

area which calls for its serious attention. There are four essential services which farmers need and which are currently being provided separately, and more or less in isolation of one another, by several institutions in Western Samoa. They may be listed as follows:

See paragraph 3.16.

- A. Marketing Services: Copra, Cocoa, Banana Boards, Produce Marketing Divisions, Traders, Private Shippers and Firms (e.g., WSTEC)
- B. Credit Services: Development Bank, Prime Minister's Department Rural Development Fund, National Provident Fund, Bank of Western Samoa, Pacific Commercial Bank
- C. Research and Technical Services: Department of Agriculture, USP - School of Agriculture
- D. Agricultural Inputs: Agricultural Store Corporation, Private Firms

A proper coordination of the activities of these bodies is of crucial importance. The Government will reactivate and reorganise the Agricultural Advisory Committee so that specific projects are scrutinised and approved from the same policy perspective. This will also ensure better coordinated roles for specific institutions in implementation. The Agricultural Advisory Committee will include as members representatives from - in addition to the Department of Agriculture - the Development Bank, Agriculture Store Corporation, USP (School of Agriculture) and the marketing boards (or the National Marketing Authority to be formed).

3.49. Given this institutional framework, provision of necessary agricultural services to adopt appropriate approaches to providing information and credit have been in place and require only consolidation. The Department of Agriculture will take all necessary steps to consolidate its policies, to promote adaptive research followed by field trials and demonstrations and to establish practical links between research and extension. This effort will be concentrated in areas that need priority attention in support of the crop/horticulture/livestock programme just outlined. In this task, available financial resources for local costs to complement ongoing grant aid and soft loan assistance will become a serious limitation. Increased local cost funding from external sources is therefore necessary.

3.50. The Development Bank of Western Samoa is moving increasingly towards term lending in its role of not only a banker but also a catalyst in promoting new development projects. The bank is supported extensively by funds from the Asian Development Bank, among others. However, long-term lending has been a problem because a significant portion of agricultural projects requires local funds. With the availability of OPEC funds and the EEC line of credit and Australian assistance, this problem is partly resolved. The bank is also expected to play a major role in the promotion of vertical integration of production and in the processing and marketing of horticultural products - an activity in which it is already cooperating with the Food Processing Laboratory.

3.51 In the supply of inputs, it will be the policy of the Government to encourage the private sector and allow it to compete with the Agricultural Stores Corporation on an equitable basis. This means that

subsidies will be phased out. The fertiliser which the Government intends to request as a part of a commodity aid package from abroad will be sold to the farmers and the proceeds will be utilised to support the local cost needs of development programmes.

3.52. Price stabilisation schemes themselves will be strengthened with additional funds including external assistance requested solely for this purpose. The schemes will be operated in such a manner that the producers receive the intended benefits. It has already been noted that the stabilisation scheme will have limited impact under the present condition of declining trend in prices. It is therefore necessary to inject an element of price support for a short to medium term in those cases where there is a possibility that the world prices will pick up again.

3.53 As an efficiency measure, the Government intends to integrate all marketing boards into one operation with an input of top management which would ensure efficiency of the operation. Necessary studies will be carried out for the setting up of integrated marketing boards which may be called the "National Produce Marketing Authority" to be responsible for not only the domestic procurement, export and price stabilisation of important crops, but also for all matters related to market information, market development and packaging technology for existing as well as potential export products. The latter will include those commodities that can be processed and exported with higher value added in more secure markets. The Authority will provide such information service to the private sector, especially those engaged in the production and export of nontraditional items including processed agro-products. The Authority itself will undertake direct exporting only on the traditional items. A more desirable alternative may be to allow the private sector a maximum role in the export of all items. It is generally believed that additional foreign exchange can be earned in the short run through increased copra (or coconut oil) production by harvesting additional coconuts currently rotting under the trees. The private sector may be the logical instrument to bring efficiency into these operations. The tricky issue is how to ensure that the benefits of stabilisation schemes do reach the producers.

3.54. Facilities need to be created for the villagers who do not find it profitable to collect such produce and take them to the nearest depot for sale. Crop processing facilities and use of donkeys and baskets for coconut collection are expected to make copra a more attractive enterprise compared to low returns presently earned when processing copra individually. It is envisaged that integrated district crop processing centers, to be operated by suitable private enterprises, will be established to allow the application of uniform and efficient processing practices as well as appropriate quality control standards. The anticipated improvements in the cocoa and copra quality and marketing efficiency will not only result in higher farm and export prices but are also expected to lead to increased production due to the savings in labour input at the farm level. At a later step, this is to be complemented by the establishment of coconut processing facilities at the same sites for production of copra and the supply of steam from coconut waste to the cocoa fermentaries.

3.55. Similar marketing facilities need to be created for livestock products. Currently the production of livestock in Western Samoa is undertaken at the village level by WSTEC and other private commercial farms and some village-based commercial cattle farms. In the respect of beef cattle, the commercial farms are able to slaughter their own livestock and undertake their own marketing on a regular basis. However, cattle and pig slaughtering practices at present are somewhat inefficient and unacceptable from a hygienic viewpoint. Similarly, village pig and poultry rearing are believed to produce considerable surpluses which could be topped with appropriate marketing arrangement. Therefore, the Government will implement a project to develop appropriate livestock and meat marketing facilities including an abattoir in Apia and a slaughterhouse in Savai'i.

F. TARGETS

3.56. With the implementation of the above programmes and policies, the Government expects that the contribution to increased production exports and balance of payments will begin to materialise. Though the effect can be seen only after some years, if the programme is followed with the same vigour and continuity, the following are indicative targets set for the major agricultural activities.

1. Coconut

Increased production of coconut oil should increase export earnings as follows:

	<u>1983</u>	<u>1984</u>	<u>1985</u>
<u>Coconut Oil</u>			
Export volume (tons)	13,200	15,400	16,600
Value (thousands of tala)	5,940	6,930	7,470
. . .assuming a price of \$450/ton			
<u>Copra Meal</u>			
Export volume (tons)	7,260	8,250	8,910
Value (thousands of tala)	653	742	802
. . .assuming a price of \$90/ton			

2. Cocoa

Export volume (tons)	1,000	1,200	1,500
Value (thousands of tala)	1,500	1,800	2,250

3. Banana

The projected export and earnings are as follows:

Volume (40-lb. cartons)	100,000	120,000	220,000
Value (thousands of tala)	570	800	1,260

4. Taro

The objective is to maintain 1981 levels. An increase in earnings is expected due to increased shipments to the U.S. market as a result of savings from the use of containers. The projection is as follows:

Export volume (cases)	150,000	150,000	150,000
Value (thousands of tala)	2,000	2,500	2,500

(other items cannot be quantified at present.)

G. ASSISTANCE NEEDED

3.57. In addition to the external support to the ongoing projects, external assistance is necessary for the following:

- * Cocoa Suspensory Loan Scheme
- * Coffee Development Project
- * Livestock and Meat Marketing Development
- * Development of Commercial Agriculture on Village Lands
- * Support to Copra and Cocoa Price Stabilisation Schemes
- * Local cost support to the Agricultural Research and Extension Project
- * Local cost support to Upolu and Savai'i Afforestation Project
- * Samoa Forest Products Limited: Capital Development Programme

In addition, external assistance is necessary for the following schemes which will be submitted later in 1983 for the donors' consideration:

- * Intergrated Mango Production Project
- * Commercial Banana Development
- * Cattle Development (WSTEC)

Annex 3. Structure of Government

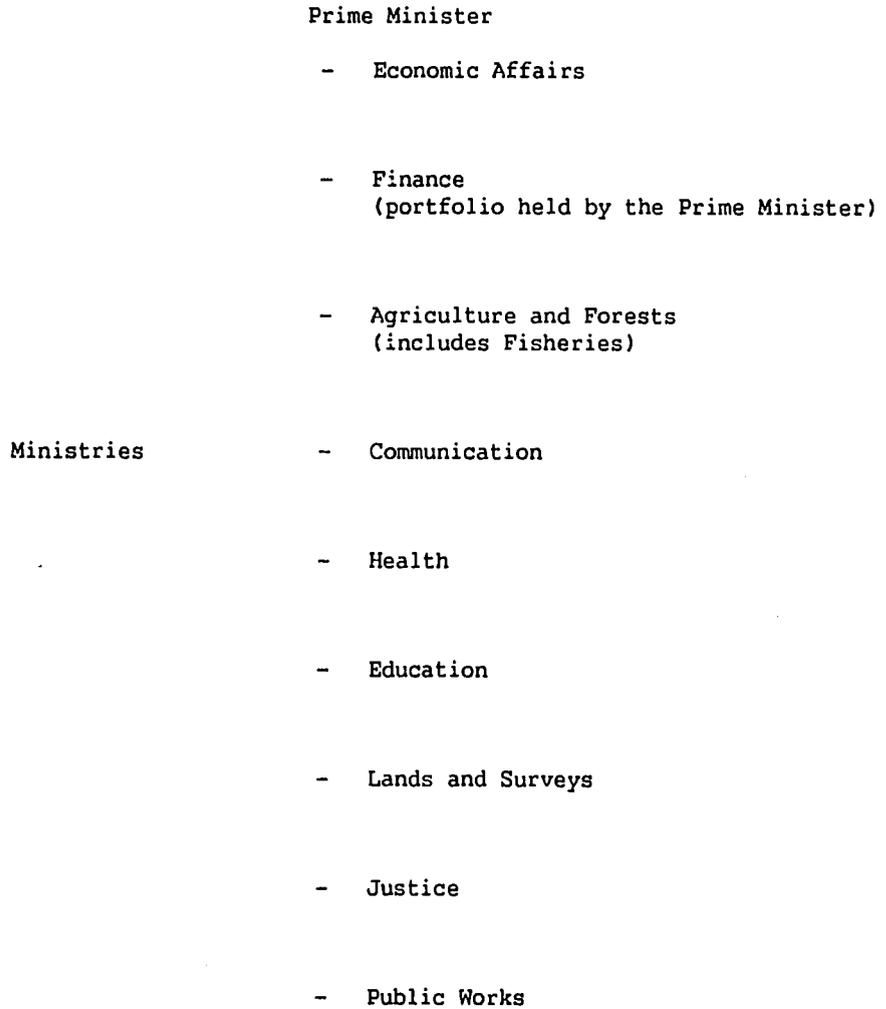


Figure 1. Structure of government.

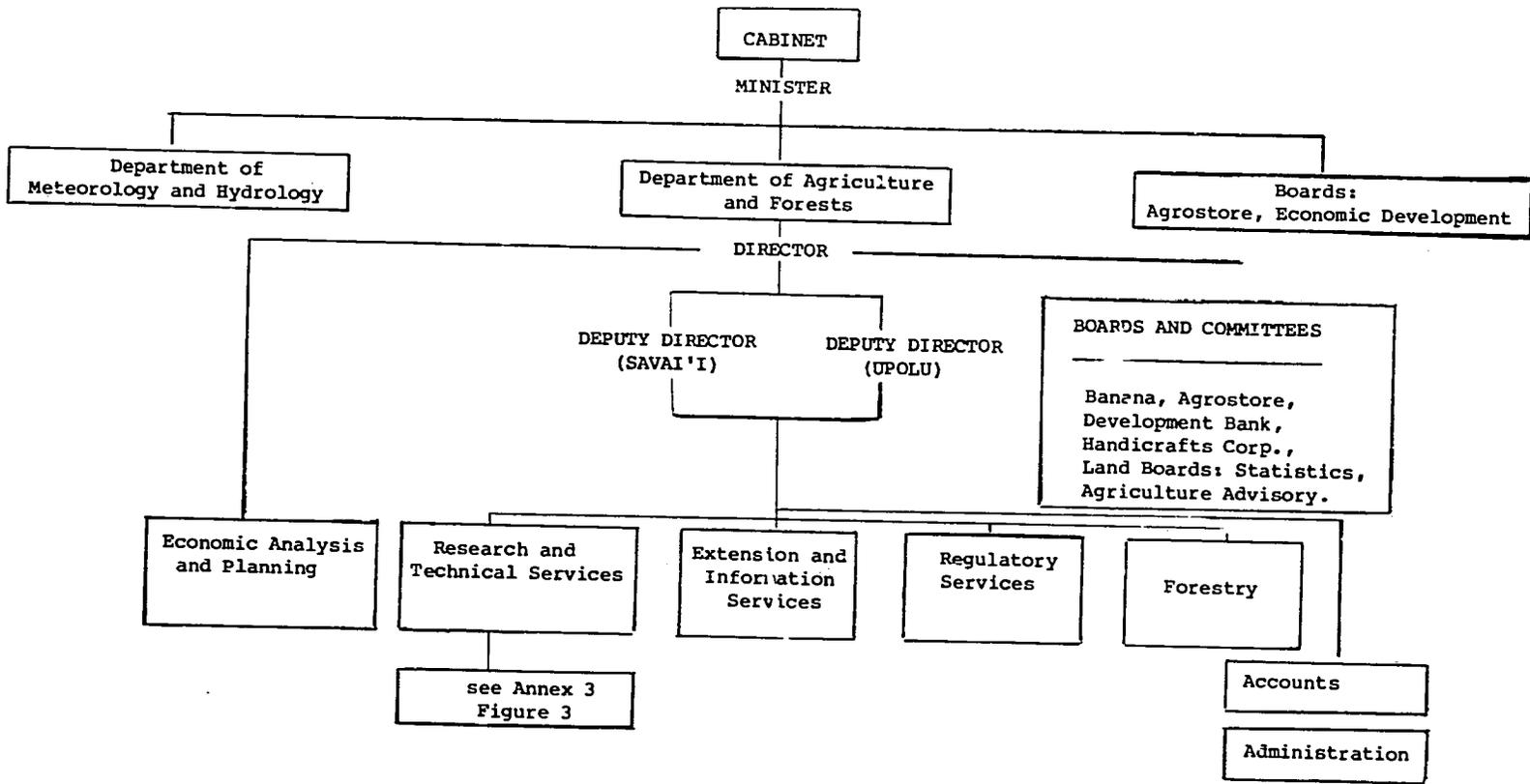


Figure 2. Approved Organization of the Department of Agriculture and Forests

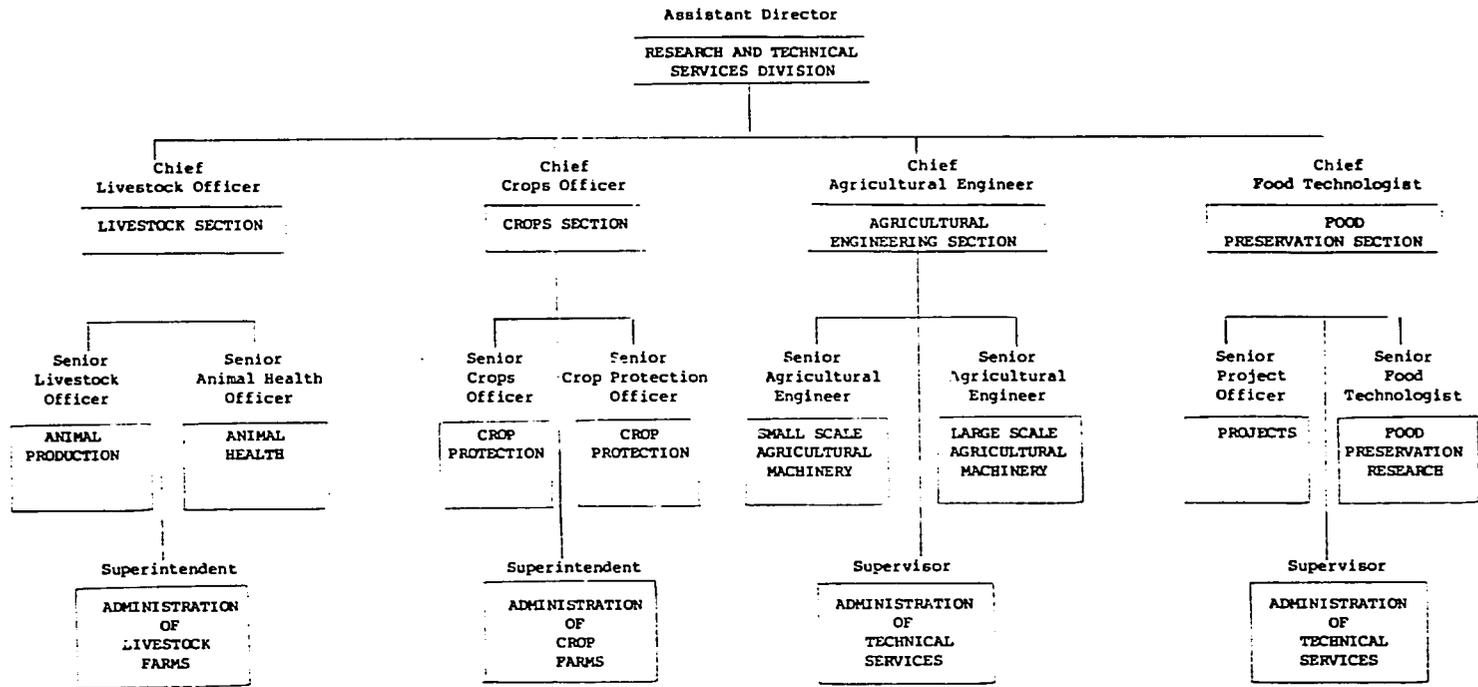
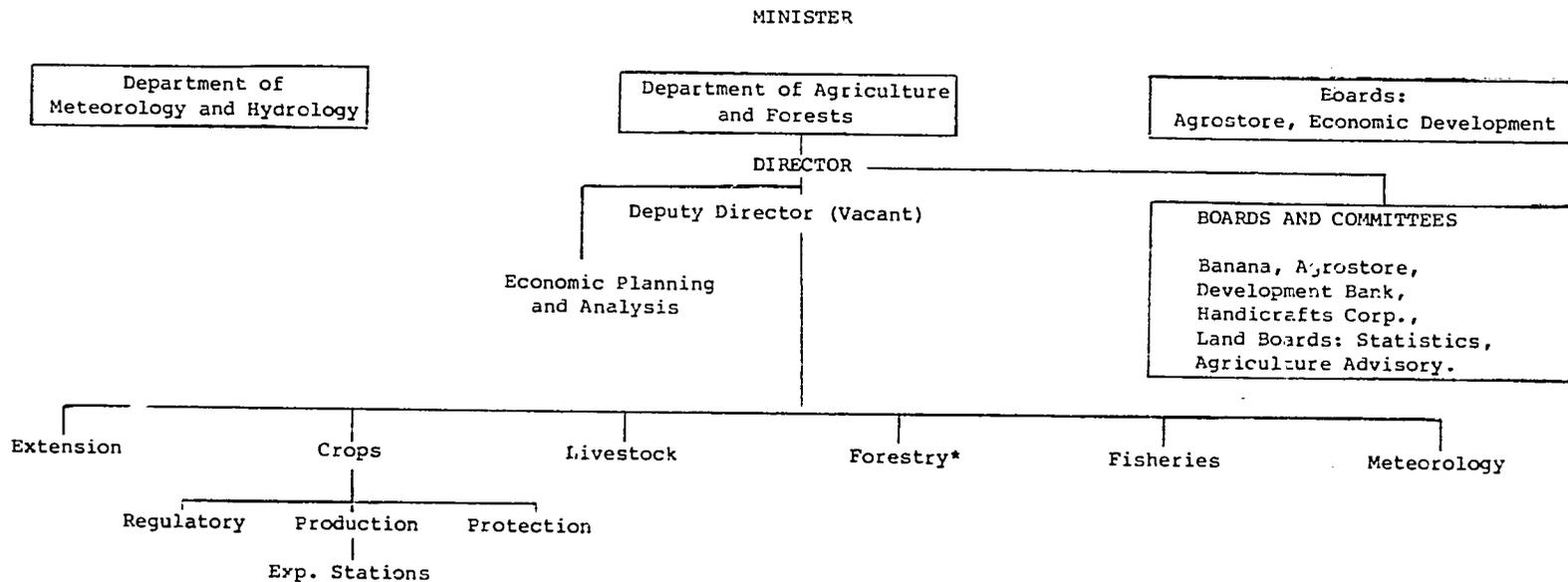


Figure 3. Approved organization of the Research and Technical Services Division



* Only forestry has a named research section

Figure 4. Ministry of Agriculture -- Organization in use in August 1983.

Table 3.1. Graduate staff having some research duties.

	Ph.D. (or Vet)		M.S.		B.S.	
	Samoa	Expat	Samoa	Expat	Samoa	Expat
CROPS						
Coconut Rehabilitation	-	-	-	-	1	-
Cocoa Development	-	-	-	1	2	1
Plant Protection	-	4	1	1	2	-
Food Processing Laboratory	-	-	-	1	1	-
LIVESTOCK	2	-	-	-	4	-
	(+ 2 in 1983)					
FORESTRY	-	-	-	-	3	2
FISHERIES	-	-	-	-	2	1
TOTALS	2(vet)+ 2(in 1983)	-	1	2	15	4

Table 3.2. Current salaries of selected officers (WS\$ per year).

Director of Agriculture	11,015		
Deputy Director (post vacant)	8,865		
Chief Officers	7,045	to	7,480
Superintendent Meteorological Services	7,930		
Senior Officers	5,000	to	6,000

On this basis a research worker with post-graduate training receives between WS\$6,000 and WS\$7,500 per year; diploma-level field and laboratory staff receive from WS\$3,000 to WS\$4,500 per year.

Annex 4. External Support for Technical Services in Agriculture

Most external support has been related directly to practical production problems or opportunities rather than to strengthening technical services per se. The amount of resources applied to specific technical services cannot be estimated other than in the context of the projects of which they form a part.

The main recent and ongoing projects and programs in the agricultural sector being implemented with assistance from multilateral or bilateral sources are listed under assistance sources. Only projects having a research and/or extension component are included.

ASIAN DEVELOPMENT BANK

In December 1977 the bank approved a loan of US\$3.0 million to Western Samoa for the rehabilitation of six WSTEC estates on Upolu. One of the components of the project was the establishment of an agricultural research station at Nu'u and the provision of fellowships for overseas training of local staff.

This project component has not been implemented in the way that was intended in 1977.

In 1981 a second loan also of US\$3.0 million was approved as one part of an agricultural development project funded jointly by ADB, the Government of Australia through ADAB, and the International Development Agency (IDA). In this UNDP also has a role through the FAO/UNDP Coconut Hybrid Seed Production and Plant Protection Project and its co-financing of part of the 1979 project led by IDA for developments on Savai'i.

Part B of the 1981 ADB project is concerned with support for the research and extension services of DoA. A summary of the details, taken from the ADB appraisal report is quoted below. The total cost of Part B was estimated at US\$3.022 million of which US\$2.0 million was for foreign exchange costs.

This part of the project provides facilities and expertise to strengthen the country's agricultural research capabilities and to improve its agricultural extension services on both Upolu and Savai'i islands. Its components are:

Agricultural Research

1. Crop Experimentation Centers

. . . . The project provides for the strengthening of facilities for adaptive research and for demonstration plots at the crop experimentation centers at Togitogiga on Upolu and at Asau on Savai'i. The research activities to be provided will complement any efforts now being undertaken by DoA, WSTEC or any bilateral agencies and are directed to national needs since the regional requirements are being met by the School of Agriculture of USP at Alafua.

2. Consultants' Services

A tree crop agronomist will be provided for 36 manmonths to undertake the research work into coffee and to investigate the potential for other crops such as rubber, palm oil and spices and a banana agronomist will be provided (also for 36 manmonths) to conduct agronomic investigations on bananas and other fruit crops.

Extension Services

1. National Extension Training Center

An extension training center, including dormitory facilities for 25 people and housing for the extension program organizer, will be provided at the Nu'u agricultural research station. Short term in-service training programs . . . will be conducted for field extension workers, agricultural officers and key farmers.

2. Field Extension Centers

It is proposed to construct 21 new extension centers, to upgrade the facilities at two centers and to provide transport (motorcycles) to improve the agricultural extension service.

3. Consultants' Services

An extension program organizer will be provided for 48 manmonths to conduct suitable training programs and to orientate the activities of this essential agricultural development support service to farmer education.

Training Fellowships

Because of the shortage of trained staff, provision is made for 120 manmonths of training at various suitable levels in fields not available at USP. In addition 15 manmonths for short-term training at specific locations will be provided.

This component of the project is behind schedule. The extension training center has been built but no consultants were in post at the time of the mission's field work.

THE INTERNATIONAL DEVELOPMENT AGENCY (WORLD BANK)

In 1979 the World Bank approved a credit of US\$8.0 million for the development of WSTEC estates on Savai'i. The total foreign exchange cost

of the project was estimated at US\$13.7 million. Co-financing of the project was provided by the governments of Australia and Japan, UNDP, and the EEC special fund.

The project consists of investments in nurseries; imported planting material; field development of coconuts, cocoa and coffee; technical assistance for the above crops (this contains a research element); diversification of cropping on WSTEC estates and in villages; taro marketing; and infrastructure developments.

FAO/UNDP

Several projects funded by UNDP have adaptive research components in them.

1. Animal Health and Production. This project started in 1977 and included a pasture agronomist to continue earlier work (also supported by UNDP) on applied research on pastures. Training for professional and technical staff was also included.

The pasture work has now stopped. Interim funding until the end of 1983 has been provided to continue the animal health component. Negotiations are in progress for the Government of New Zealand to finance work in the future.

2. Coconut Hybrid Seed Production and Plant Protection. The plant protection component, approved in 1977, provided for the construction of physical facilities at Nu'u Agricultural Research Station and plant quarantine facilities at Vaea and elsewhere. A 45-acre seed garden of dwarf mother palms has been established at Olomanu to provide hybrid seed nuts.

GOVERNMENT OF AUSTRALIA

The Australian government has a 10-year agreement with the Government of Western Samoa to undertake research and provide extension services for the production and processing of cocoa. (The co-financing of the IDA loan mentioned earlier comes under this agreement.) A well-equipped laboratory, plant propagation unit, office accommodation, and two staff houses have been built at the Nu'u agricultural research station. A central cocoa fermentary has been built and an extensive field program has been established. The project provides for a variable number of Australian specialists (there were four in 1983) and for training of Samoan staff.

Assistance has been provided to expand the post-entry plant quarantine facilities at Vaea by the construction of an additional screen house.

FEDERAL REPUBLIC OF GERMANY

Substantial assistance is being provided in plant protection, and four expatriate officers are involved. The laboratory at Nu'u Agricultural Research Station have been completed and provide good physical facilities.

Funds have been provided for the construction of an agricultural complex at Salelologa on Savai'i. This has been completed and when fully staffed will provide a focus for the interaction of all agricultural services and farmers on Savai'i.

NEW ZEALAND

The New Zealand bilateral program has provided technical and material support for agricultural projects for many years. These include the WSTEC feed mill, the pig and poultry units at USP, the Agricultural Store warehouse, the DoA livestock project, agricultural engineering, and the food processing laboratory of DoA.

There is ongoing major support for forestry activities, including research on nursery techniques, the introduction and testing of non-native fast-growing hardwoods, and sawmilling and timber processing.

THE INTERNATIONAL FUND FOR AGRICULTURAL DEVELOPMENT

The fund is supporting a livestock development project in DoA. The facilities at the Alafua campus are being used for this work and the staff of the livestock section of USP are also involved.

General position

Substantial assistance has been provided and continues to be available from several sources.

The rate of implementation of the various projects has been limited mainly by the capacity of WSTEC and DoA to use effectively the support which has been provided. Limitations are imposed by lack of trained staff especially of research and estate managerial personnel and by serious shortfalls in funding of local costs by the Government of Western Samoa.

Annex 5. Research on Crops

The main crops grown in Western Samoa are coconuts, cocoa, bananas and taro. All except cocoa are regular food crops, and all of them are exported in considerable quantities.

COCONUTS

Despite the dominance of copra and, recently, coconut oil in the export earnings of the country, there has been remarkably little systematic research on coconuts in Western Samoa.

At present, research work is in progress in three main areas:

- * the production of hybrid seednuts from selected Rennell Tall x Malayan Dwarfs (Red, Green, Yellow) and the testing of these at different locations -- the latter part of the work is now starting, since the first hybrid units are becoming available;
- * investigations into the incidence and control of blast disease on coconut seedlings, the causal agent of which is believed to be Marasmiellus cocophilus;
- * control of rhinoceros beetle (Orcytes rhinoceros) and the coconut leaf beetle (Brontispa longissima), using predominantly biological control measures and improvements in plantation sanitation procedures.

The recent recruitment of a coconut agronomist by the Department of Agriculture, using funds made available by WSTEC (from the ADB loan), should permit an intensification of research activities and their expansion to other components, of which nutrition and the economic use of fertilizers would seem to warrant high priority. The soils of Western Samoa are known to be deficient in potassium; there is evidence from the results of leaf analyses done over the years (especially in the FAO-supported Hybrid Seed Garden Project) that leaf potassium levels are low in many areas, the palms have the appearance of being short of potassium (no leaves below the horizontal and poor nut set on well grown trees) and responses to nitrogen and potassium fertilizers are visible in the area of palms from which pollen is being collected for the hybrid nut production program. These observations are not new. The need for fertilizers was recognized by the Department of Agriculture in its Instructions to Growers 1978, and the appraisal teams for the IBRD and ADB projects in 1977 and 1979, respectively, which made provision for large-scale trials and use of fertilizers in the projects. The applications did not begin until late 1982, yet there is little doubt that the use of fertilizers will increase yields dramatically. What is

needed more than anything else is a benefit/cost analysis of the use of fertilizers and research work to ensure efficient use of the economically optimum quantities.

In the Samoan-German Crop Protection Project (which is continuing and expanding the work of the earlier UNDP/FAO Crop Protection Project) there are two Samoan and four expatriate staff. Their duties are in general crop protection rather than in research only. Control of the insect pests of coconut and of rats, which affect coconuts, cocoa, and other crops, forms a large part of their program. It is the agronomic and nutritional side of the growing of the crop which appears to have been neglected so far.

There is some grazing of cattle under coconuts, but there appears to have been no work done to investigate ways of improving the ground cover under the palms, e.g., by using leguminous species which would, in time, improve the overall nitrogen status of the soils. Where fertilizers are used on the coconuts, forage production might also be improved (except where the coconut stands are too dense) and increased revenue might be derived from the cattle. This is only one form of intercropping. Others, and especially the coconut/cocoa system are in urgent need of investigation. The economics of fertilizer use in mixed-cropping situations deserves early attention.

COCOA

Despite exhaustive reports on the rapidly deteriorating cocoa industry, no appreciable amount of research work was done before the start of the ADAB-supported Cocoa Rehabilitation and Development Project in 1979. This project is scheduled to last 10 years in the first instance and is a major effort to try to provide a sound and comprehensive basis for the development of an industry able to earn substantial foreign exchange.

Most of the cocoa presently being produced is derived from Trinitario or near-Criollo types of cocoa. These suffer serious losses from Phytophthora palmivora (black pod and canker) and from Phanerochaete salmonicolor (pink disease) infections. The major pests are Adoretus versutus (rose beetle) and rats. Other potentially serious diseases appear to be absent. One clone (Lafi 7), which is reported to be resistant or immune to black pod and canker, was selected many years ago, but its potential does not appear to have been fully investigated.

The Trinitario and Criollo types produce premium quality cocoa if well grown and correctly fermented and dried. While Samoan cocoa had a reputation for fine flavor in the past, the extent to which this reputation has been lost may be judged from the low price obtained for Samoan cocoa in recent times. Ghana No. 1 CIF Europe was about £1,100 per ton in the last quarter of 1982 while the Cocoa Board of Western Samoa sold cocoa on an FOB Apia basis for shipment during December 1982 to March 1983 at WS\$1657 per ton (=£708). Allowing for freight charges and insurance, this is a poor return for so-called quality cocoa (Cocoa Board of Western Samoa, August 1983).

- The ADAB-supported project has the task of assisting the industry in three general areas:

- * improvement of planting materials and techniques;
- * improvement of processing and storage;
- * provision of technical services and training through the field extension teams.

Improvement of planting material and techniques. Guidelines for the program of work, which is directed at improvement of planting material through the introduction of material from overseas, development of local selections, and improvements of cultural practices by experimentation and demonstration, are indicated as follows:

- * establishment of seed gardens for the supply of higher yielding black-pod-resistant types such as Amelonado;
- * introduction and establishment of clones with known resistance to Phytophthora and vascular streak dieback;
- * selection and testing of local Trinitario and introduced material showing resistance to black pod, canker, and pink disease; the introduction of suitable clones for the production of hybrids and the progeny testing of such seed together with the seed from local Trinitario selections;
- * agronomic trials to compare shade densities, spacing, pruning treatments, and fertilizer treatments and their interactions under Western Samoan conditions;
- * introduction and testing of leguminous species suitable for permanent and temporary shade and the establishment of nurseries for supply to growers of shade tree cuttings and seeds;
- * establishment of cocoa plots for trials on cultural and chemical control methods for the major pest and diseases;
- * development of nursery techniques and practices for the multiplication of clonal material by buddings and cuttings.

All of these programs have been started, and it is evident that the Amelonado types of cocoa grow well under many conditions in Western Samoa. They are highly tolerant to black pod disease, giving a pod infection rate of less than 15% as compared with well over 70% for the Trinitarios. They will, however, require careful processing, and that is the second part of the project's endeavors.

Processing and storage. Because of the many problems associated with processing and storage of cocoa beans in Western Samoa, the project aims to establish central processing facilities where fermentation and drying can be controlled to allow the production of good quality cocoa beans. The facilities would also allow for some experimentation on fermentation and drying techniques.

The first of these central processing facilities has been established and permission has now been received from government for it to be used. Why the government should need to give specific permission for what will undoubtedly prove a major advance in processing of Western Samoan cocoa is rather a puzzle.

Technical services and training. The replanting of old areas and the planting of new ones must be vigorously encouraged if the production of cocoa is to increase rapidly. The project has established precise conditions under which farmers are eligible for inclusion in cocoa planting schemes. These have been adopted by the government and the Development Bank of Western Samoa as conditions for the operation of the cocoa suspensory loan. Under this, farmers carrying out the practices regularly on an annual basis, and subject to regular inspection, will have a large part of their initial planting loan cancelled when their areas of cocoa come into full bearing. It will be the task of the project to supply the staff to supervise this initially and to train an adequate number of field officers to monitor the development of these new areas.

The program being developed is a comprehensive one and should bring substantial benefits to Western Samoa. It is disturbing to report, therefore, that the project appears to be receiving little government support, either in the payment of the salaries of the Samoan staff engaged in this project or the provision of adequate local operating costs for the field teams to work efficiently and effectively. The deficit is being made up by the Australian government, but considering that major benefits will undoubtedly accrue to Samoa as a result of this project, it is very difficult to see why the government itself is not prepared to make some investment in it. The part of the cocoa suspensory loan account which is to be written off by government is being underwritten by the New Zealand government; thus the whole scheme is being carried at negligible cost to the Government of Western Samoa.

While the ISNAR team was in the field it was observed, particularly on Savai'i, that newly planted cocoa up to two or three years old was being severely affected by drought. The dry season of 1983 was exceptionally severe, but an additional factor in causing the death of many trees may have been the high density of shade trees which some of the areas carried. These trees compete with the young cocoa trees for the limited supplies of soil moisture. On examination of the detailed specifications for the replanting of cocoa set out by the project and adopted by DBWS and the government, it is clear that in these areas the shade was not being managed to the specifications laid down. (It should be mentioned, however, that some areas where the shade trees had been removed completely were also suffering severely from the effects of the dry weather, but cocoa from which shade trees have been removed rather suddenly often suffers badly from exposure to sunshine.) It cannot be emphasized too strongly that the careful management of shade trees in relation to cocoa, especially on soils of low water-holding capacity and under dry conditions, is of the utmost importance. This comment is made to reinforce the need for farmers and plantations alike to carry through the detailed instructions which are being provided, if they are to obtain the benefits from replanting with improved materials.

The old method of planting Trinitario cocoa, widely spaced with relatively little shade, was most likely a satisfactory response to growing cocoa under wet conditions to minimize the incidence of black pod and canker. The method of growing Amelonado, relatively closely spaced and under carefully controlled shade, must be regarded as a different system of growing cocoa and be treated as such. It cannot be regarded as

a minor variation of the old theme; from the extension point of view, it may well be more useful to try to demonstrate it as a completely different system of cocoa production.

BANANAS

The banana industry of Western Samoa was reviewed recently in a paper presented to a small-farmer workshop held at USP (Wickramasekera, 1983). At the same meeting the production of export-quality bananas on the government-owned Tanumalala plantation was described (Tasi Neru, 1983).

Production of bananas is predominantly a small-farmer enterprise with comparatively few growers having more than 10 acres. Of the large growers, WSTEC and the Tanumalala plantation supply the export market as well as the local market in Apia.

The history of the production of bananas for export, the rise to a dominant position providing 34% of all export earnings in 1958 and subsequent decline in 1980 to only a few percent of the production levels attained in 1958, and lately a gradual rise in exports following the establishment of the government plantation and increasing interest in the crop, are set out in detail in the references given.

A comprehensive guide for growing, harvesting, and packaging bananas was published by the department in 1979. This was based on a general knowledge of the requirements of the crop rather than on the results of extensive adaptive research done in Samoa. Crop protection aspects had received some research attention, and the bunchy top disease control program had proved effective although difficult to implement.

There is a 10-acre block of bananas at Nu'u which is used for agronomic and fertilizer trials and for crop protection experiments. There are major pest and disease problems in bananas and the control of bunchy top disease is an important issue. The main trials over the last few years have been confined to measures to control banana leaf spot disease, which has become more complicated because of the possibility of the development of resistance to benomyl in the causative organism Mycosphaerella fijiensis (already reported from the Philippines). Other fungicides and mixtures can be used as alternatives, but often these are less effective and because of the high rainfall conditions are more easily washed off. It is extremely important, however, that the leaf diseases are controlled, both from the point of view of increasing yields and of maintaining the quality of the fruit for export.

Spraying on the commercial estates is done by aircraft, but in the trials at Nu'u, hand-operated equipment has to be used. This is difficult to do effectively, but even under these less than optimal methods of application fungicides have been found which give good economic control, allowing the production of good yields of export-quality fruit. This appears to be the only research currently in progress, but since there is a good knowledge of the agronomic requirements of the banana crop in general, for the time being it may be adequate.

There is increasing interest in the crop, both as fruit exported in the near-ripe condition, and as green fruit to three major markets in American Samoa, Hawaii, and New Zealand. A banana export industry

authority is being established, which will try to make fuller use of existing facilities, such as the cold store and the spraying-airplane, both of which are underused.

The export markets require high quality fruit packed in cartons. The input requirement per acre for this quality of fruit is large, so the government must be prepared to face up to the reality of using substantial foreign exchange to produce the crop. A cabinet paper prepared by the Minister of Agriculture in 1962 indicated that there would be no need for additional internal subsidies to the crop, but that the industry would require government support for nurseries to provide disease-free material, in the registration of production services to all plantations to ensure compliance with the necessary rules for the production of good fruit, and in the monitoring and control of transport, packaging, storage, shipment, and marketing. If these functions were taken over by a banana export industry authority, this could relieve DoA of additional expense. Initially it seems unlikely, however, that the relatively small total production could bear the cost of these services without additional government support.

There is a clear need for research on economically viable systems of banana production, since current development proposals would not be viable at current yields, according to government estimates (cabinet submission from the Minister of Agriculture, October 1982). At present, yields of about 20,000 pounds per acre of export quality, with an additional 7,000 to 9,000 pounds per acre for local consumption, can be obtained; at these yield levels, using present production methods the crop is not viable either internally or as a foreign exchange earner. These yields are not low by comparison with those obtained in other banana-producing countries under climatic conditions similar to those found in Western Samoa. The efficiency of production, as well as research to maximize the returns from purchased inputs, would seem to merit urgent attention.

The soils in Western Samoa are freely drained and of low water-holding capacity. The water requirement of the banana crop is higher than that of most other crops. The effects of supplementary irrigation during the short but intense dry season in Western Samoa need to be assessed both in terms of yield and economic viability. To obtain the high yields needed to attain economic viability, all the agronomic components will need to be investigated to develop suitable production packages.

To develop the area required to meet existing export demand, an additional area of some 1,300 to 1,400 acres would be needed, and this would require an investment in excess of WSS\$3.0 million. With this area of production and an estimated gross revenue in excess of WSS\$6.0 million per year envisaged after the sixth year, the employment of at least two agronomists to control both the production and the experimentation on the crop would be justified. This would represent less than 1% of the gross revenue and could not be considered excessive.

The agronomists should be attached to the recommended research unit of DoA, since it would be necessary for them to keep in close contact with the plant protection officers in the department and with their other scientific colleagues. Thus, while they would be working in a particular area, their professional background and their professional backup would come from the department itself.

So far in the banana industry, the interest has been on the export of bananas, but bananas are also an important item of food in Samoa; in this perhaps the cooking banana is more important than the ripe fruit. There is a potential export market in Hawaii for these types of bananas, which could lead to an impetus to do more research on the cooking banana, an area which has been neglected in the past. Since preferences based on taste differ from one country to another, taste would be an essential element in any research program on this crop.

This emphasizes one major research survey area, now poorly served, which permeates the whole of the export and potential export situation. It is the need to assess the market preferences and the market possibilities for all potentially exportable materials before large scale production is entered into. For coconuts and cocoa, these markets are fairly well known and the requirements are well specified. With bananas for the main dessert-fruit markets in New Zealand and American Samoa, these are also well known, but for the green-banana market for cooking, this may be less well defined. Marketing also assumes prime importance for speciality crops occupying relatively small areas, particularly where new crops are involved.

TARO

Taro is the staple food of Western Samoa, grown in every village on a considerable scale. The normal method of growing is to clear the forest and to plant the taro for one or two years before allowing the forest to revert to bush. The demand from Western Samoans living in New Zealand and in other areas has led to the development of a major export industry in taro. The total revenue from this is approaching that from cocoa (now at depressed production levels). Much of the taro is exported by air; this is only possible because of the relatively low airfreight charges currently levied between Western Samoa and New Zealand. However, consumers report a change of taste where the crop is stored for more than two weeks, so airfreight is the only way to get the produce to the market in acceptable condition.

At the present time DoA has no research program on taro. There is a major program of work within the Faculty of Agriculture of USP which has the benefit of the involvement and guidance of specialists who have worked on root crops at IITA. Research is also in progress in other parts of the Pacific in the FAO/SPC crop protection and root crops program based in Fiji (this replaces an earlier UNDP/FAO root crops project). One component of the regional project is the breeding of taro with resistance to taro leaf blight caused by Phytophthora colocasiae, which does not appear as yet to be a problem in Western Samoa. The project component in the Solomon Islands has collected together a wide range of taro varieties and germplasm. This collection and program must be regarded as a regional asset, so that materials developed in the Solomon Islands would, if needed, be available in Western Samoa.

A considerable amount of work has been done on taro, and some is still in progress at Alafua, but it is questioned whether this is sufficient to cover the needs of the major food crop of the country. The only major problem seems to be the taro cluster caterpillar, Spodoptera litura. Research on biological (fungal pathogens), chemical, and physical methods of control has resulted in an integrated pest control recommendation to minimize the damage caused by this pest.

Some work has also been done on the cooling of taro prior to export, but there appear to be no reports on the results of these trials.

Of the other major root crops which could be grown in Western Samoa, and one or two of which are grown on a fairly wide scale, there appears to have been little work of any kind. The exception is in the giant taro ta'amu (*Alocasia* spp.) on which some work has been done at Alafua in the soils department.

PASSION FRUIT

The growing of this crop has developed rapidly following the success of the food processing laboratory in securing export orders for juice (and pulp) of passion fruit, both alone and mixed with that from some of the citrus species. The industry is expanding rapidly, and in 1982 the total foreign exchange earnings approached WS\$0.5 million. The crop has few problems at present, but no research investigations have taken place in Western Samoa on what may happen once the scale of production is increased. From the commercial point of view, it appears that there is scope for varietal assessments to obtain both higher yields and a higher pulp content in the fruit. At present the cost of pest and disease control is too high for small operators to carry without government support. This could perhaps be reduced by some research investigations which are currently in progress at Nu'u, but also by increasing the scale of the individual operations so that the cost of the spraying equipment is spread over larger areas.

Although production has increased substantially, there is a large element of government subsidy in the production process; some services, including the supply of fertilizer, are either provided free or at less than cost. If the industry expands further, this cannot continue without a large charge on the government resources. As with other export crops, however, the question of internal costs is perhaps less important than that of external cost-benefits. If there is a net earning or saving of foreign exchange, this may be valuable to the government.

OTHER CROPS

With the assistance of an FAO project, a collection of tree crops was established near Asau (on Savai'i) at what is now the crop development center. These trees are planted on an extremely rocky area, but have grown satisfactorily. Many of the different kinds of citrus, the mangoes, and the avocados are growing well. A duplicate set of plants was transferred to Upolu to the Togitogiga crop development center on the wet, windward coast; these are also growing extremely well, although the fruiting characteristics have not been recorded. It is understood that this move was made so that the plants would be available for providing planting material for Upolu; it does not imply that the fruit tree crops should be grown on the windward side of the island.

With the proposed developments at the airport on Apia, the possibilities of exporting high value fruit crops need to be explored. Some agronomic investigations of the varieties of tree crops which are already available is a matter of urgency. Modern horticultural techniques, which make it possible to bring these tree crops into bearing at a comparatively early age, need to be explored. It seems likely that papayas could be grown well in some areas and would form an additional potential export crop.

There have already been inquiries to the food processing laboratory about the possibilities of supplying chillies of various kinds, especially the very small bird chili. Some introductory work and initial observations would seem justified at Nu'u on this type of crop.

Little work appears to be in progress on coffee. It is likely that this crop would grow well, but the conditions will probably be too wet for other than the Robusta types. This possibility was explored in the appraisal report of the Asian Development Bank mission in 1979, and it is a possibility which could be taken up on a small scale without any serious expenditure. The joint ADB/IBRD-funded project made provision for two agronomists to work on tree crops, but so far those positions have not been filled. A coconut agronomist was appointed recently, but this does not meet the requirement of a tree crops agronomist to examine the possibilities of a range of other crops which can undoubtedly be grown, but whose commercial potential of which is not known.

The importation of coffee seed material for field testing has begun through the post-entry quarantine station at Vaea. The seedlings were growing well at the time of the mission's visit.

Annex 6. Research on Livestock (with Bibliography)

Livestock are an important component of agricultural production within Western Samoa. Pigs, poultry, and more recently cattle, form an important part of the traditional village social system. They are popular gift items and tend to be consumed on special occasions, rather than being sold for cash or consumed as a standard item of diet. Commercial cattle, pig, and poultry enterprises have been established to supply urban markets. Under traditional village systems, pigs receive little animal husbandry input, and must scavenge for most of their food. Two-thirds of rural households keep some poultry; as with pigs these are free-ranging and receive little attention. Most village cattle are found in the coconut belt on unimproved pastures under coconuts, while some of the commercial herds owned by WSTEC and DoA are run on specially developed pastures cleared from forest.

LIVESTOCK NUMBERS

There are limited statistics available on livestock numbers in Western Samoa, but it appears that over the last three or four years the livestock industries have been stagnating. Cattle numbers have remained constant or dropped slightly to around 25,000 head. This is considerably below the prediction made in 1977 by the Department of Agriculture that cattle numbers would rise to 45,000 by 1986. Reasons for the slow growth in the national herd may be in part reflected in recent killing figures which show a low average carcass weight (Table 1) and an increase in the proportion of females slaughtered, indicating that the present offtake level may be excessive.

The population of dairy cattle breeds is estimated to be approximately 800, of which about half are milked in commercial dairies. The pig population has fluctuated between 110,000 and 120,000 in the past few years, but there has not been a significant population increase. Similarly, poultry numbers at around 270,000 have not shown increasing trends although there have been a number of commercial poultry units recently established and these may have a significant influence on poultry numbers in the near future. There are very few goats or other domestic animals.

LIVESTOCK PRODUCTION

Traditional or Village Sector

Productivity in all three of the major livestock industries in the village sector is generally low due to poor animal husbandry, and stems partly from animals being considered socially, rather than economically important, and from a lack of understanding of basic husbandry techniques. The availability of relatively cheap imported meat products is a distinct disincentive to the production of livestock. The

inadequate development of cash markets, particularly for meat and live animals, means that villagers are reluctant to invest money to improve productivity. Shortages of breeding stock also restrict development, and the practice of slaughtering productive female cattle significantly reduces the breeding base. There is an apparent lack of understanding of the difference between female animals as investment goods and male animals as consumption goods. In the case of pigs and poultry, local feed supplies limit expansion, and imported feed, though subsidized, is considered by the villagers to be expensive.

Table 6.1. Beef production in Western Samoa.

	1979	1980	1981	1982	1983
Predicted herd size	26,000	27,900	28,800	29,700	30,500
Actual herd size	-	-	-	-	25,000
Number of animals slaughtered	3,748	3,590	2,171	3,128	-
Average dressed wt.(1)	319	320	319	339	-
Predicted beef(2) production	-	1,277	1,434	1,501	1,523
Actual Beef(2) Production	1,196	1,151	693	1,060	-
Shortfall(2)	-	125	740	440	-

(1) pound

(2) 1,000 pounds

Commercial Sector

WSTEC is a government-owned corporation, the largest business in Western Samoa. Apart from extensive coconut plantations and other manufacturing and trading interests, WSTEC owns more than one-third of the nation's cattle. At present this amounts to approximately 9,200 head; a breakdown of cattle numbers on the various WSTEC farms is presented in Table 2.

Table 6.2. Cattle numbers on WSTEC farms, December 1982.

Farm	No. of Cattle
Aleisa	1,725
Abattoir holding yards	32
Olo	1,141
Faleata	453
Kasala	120
Magia	1,178
Tanumalala	761
Tuanaimato	41
Vailele (Dairy)	259
Vailele	47
Tausani	689
Yaipapa	997
Ologoga (Savai'i)	1,005
Lata (Savai'i)	706
Total	9,154

WSTEC cattle are run mainly on pastures under coconuts and on upland ranches. At present, breeding operations are undertaken on 10 of the farms including Aleisa, an upland farm of approximately 2,800 acres sown predominantly to Brachiaria brizantha. Other farms such as Vailele (pasture under coconuts), Faleata (pasture under coconuts) and Tanumalala (open pastures) are used for fattening, the first two presumably because they are near Apia. WSTEC has had plans to expand its cattle production activities for some time, although details of how this is to be done appear not to have been adequately defined and their total herd has declined in recent years.

In addition to WSTEC there are some individual farmers and groups with cattle herds of over 100 head, who could be considered in the commercial sector.

WSTEC also operates a modern 50-sow piggery and a national feedmill which prepares animal rations for general distribution. The feedmill was constructed with New Zealand aid and commissioned in 1979. Almost one-half of the mill's protein requirements come as a copra byproduct from the WSTEC soap factory or from the new copra mill. Most of the carbohydrate content of the feeds is imported. Due to irregularities in the supply of the raw materials, the feedmill has difficulty in maintaining consistent ration composition. This has serious effects on animal performance, particularly egg production.

Government Farms

The Department of Agriculture has established three farms at Avele, Togitogiga, and Lemafa principally to provide young breeding stock for

distribution to the village and commercial sectors. Up until 1981 these farms carried approximately 1,100 head including 550 breeders, with an annual offtake of 70 breeding heifers and 220 slaughter cattle. A small dairy herd of approximately 50 cows is run at the Avele farm.

Livestock production from all three sectors (village, commercial, and government) has been declining over the past few years. If cattle are taken as an example, the number of animals slaughtered and the resultant beef produced have been well below the levels predicted in the fourth development plan (Table 1). In 1981 there was a shortfall in excess of 0.7 million pounds. This means an increasing dependence on imported meats; in 1981 imported meat products cost WS\$3.2 million, which represented 24% of total food imports.

MARKETING

In Western Samoa local demand for livestock products creates a market for produce that is surplus to subsistence requirements. Marketing channels are not always available, however, to enable the surplus to move into the commercial sector in the Apia area. The problems are greatest in the case of beef. The only abattoir is owned and operated by WSTEC. The abattoir is primitive and does not contain chilling facilities -- meat is transported hot to retail outlets. Other cattle owners "bush kill" cattle and transport the meat hot to the point of sale. The marketing problems with other livestock products are less severe because most of the pigs, chickens, and eggs are consumed in or near the village where they are produced. The possibility of establishing a modern abattoir was being investigated by a specialist from New Zealand at the time of the mission's visit.

A recent livestock marketing innovation was an auction held by the livestock division in January 1980, at which 32 cattle and a number of pigs were sold. The stock for those sales were provided by WSTEC and DoA so the willingness of smallholders to sell livestock by auction remains unknown. However, the success of this auction suggests that a marketing system for live animals could be developed.

LIVESTOCK DEVELOPMENT PROGRAMS

In recognition of the need to supply stock to local farmers, the government farm project commenced in 1969 with the establishment of a cattle breeding unit at Togitogiga where an area of rainforest owned by the government was identified as suitable for cattle development. A second upland unit was established in 1974 at Lemafa on the southeast coast of Upolu.

The original aims of the project were to:

- * develop a breeding cattle farm for the production of quality breeding stock to sell to beef cattle farmers;
- * conduct research into pastures, fertilizers, and related husbandry matters;
- * experiment with various cattle breeds and breed classes, and develop a nucleus breeding herd;

- * demonstrate, on a farm scale, improved cattle breeding and farming practices;
- * provide training facilities to extension workers, beef cattle farmers, and farm managers.

A number of serious problems mainly arising from poor management (there was no full-time farm superintendent) were encountered during the implementation of this project. These included high mortality rates among the first group of calves; insufficient information about the sites' topography, soils, water supplies, and rainfall which resulted in only 200 ha of the 400 ha being developed; inadequate provision for recruiting and training local staff; lack of effective project supervision; unsatisfactory land clearing and poor construction of fences and stockyards; and improper handling of imported cattle upon arrival in Western Samoa.

The problems encountered and the mistakes made in this project serve as valuable guidelines for future livestock projects in Western Samoa. In particular, the project highlighted problems which can be expected in developing the large areas of highland country designated suitable for cattle. The high cost of land development in these areas may make them less attractive than the improved utilization of customary land under coconuts where no clearing costs are involved.

By 1979 most of the difficulties facing the farms had been overcome. They were beginning to function reasonably well in providing breeding stock to farmers, although there was a considerable backlog of orders.

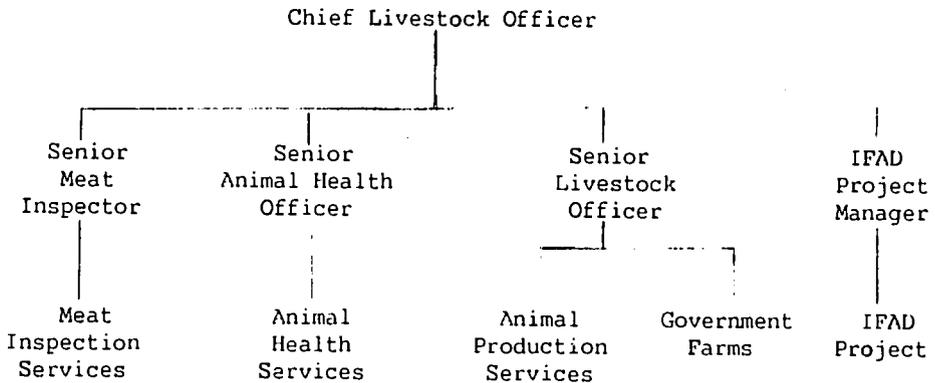
In early 1981, the animal health subsection of the division commenced a brucellosis eradication program in Western Samoa, and positive reactors were found on all three government farms. This resulted in quarantine restrictions being placed on the farms so that distribution of stock has temporarily ceased. In addition, there had been a number of abuses of the subsidized price scheme, and a cessation of stock distribution was necessary to enable the livestock division to review and revise the scheme.

The Rural Development Program (RDP) was one of the government's major instruments for assisting village-level development, and was managed by the prime minister's department under the direction of the Rural Development Committee which comprised senior representatives from a number of government departments. One of the aims of the RDP was to increase agriculture and livestock production. The RDP provided funds for communally owned village projects in conjunction with loans from the Development Bank of Western Samoa (DBWS). Of the 475 village projects approved by 1979, 47% were animal enterprises, (20% pigs, 16% cattle, and 11% poultry). RDP cattle projects consisted mainly of assistance for the purchase of breeding stock, fencing, stockyard construction, and water catchment materials. Although approval had been granted for 76 cattle projects, the shortage of female cattle permitted only 20 projects to be implemented by October 1979. RDP pig projects mainly involved supplying fencing materials to keep pigs out of food gardens. Poultry projects provided chickens, feed, and materials to construct housing for the birds.

The recently initiated IFAD livestock development project has taken over the responsibility for pig, poultry, and goat projects from the RDP. In this project the plan is to start with small farm units and encourage the farmers to breed their own stock. For example, with pigs, the project provides five sows and one boar, and the farmer is obliged to repay in kind after a number of years, so that the provision of stock is financed by a revolving fund of animals rather than cash. Costs of animal housing, fencing, etc. are met by loans provided by DBWS as in the original RDP. The IFAD project currently utilizes facilities at USP, Alafua for breeding pigs and poultry for distribution to farmers. A nucleus goat herd is being developed by the project, but distribution of goats to farmers has not yet commenced.

Recent initiatives which will be implemented by the government and referred to in a report on the socioeconomic situation in Western Samoa (Government of Western Samoa, 1983) are the provision of marketing services including slaughter and transportation of fat stock, and live animal markets to encourage small stock-fattening enterprises and larger specialist breeding units. Registration of cattle producers, better stock identification, and stricter inspection procedures will be implemented to overcome problems of illegal slaughter. Simple production packages will be made available to build on present subsistence output. In effect, the government recognizes that effective import substitution for meat products will only take place with a program to provide increased commercial opportunities for livestock producers.

The present organization of the livestock division is shown below.



The division is under the direction of the chief livestock officer and is divided into animal health, animal production, and meat inspection subsections. The IFAD project is also attached to the division as a subsection. The Animal Health Services Unit was established in 1966 at Alafua to complement the work of the animal production team. It was originally intended to concentrate on research and teaching, but recently emphasis has moved towards providing clinical services to livestock producers and initiating disease-control programs. An expatriate

veterinarian funded under a UNDP/FAO project currently heads the animal health subsection.

The UNDP/FAO-funded pasture and animal production project was scheduled for completion at the end of 1982, and the pasture agronomist left in that year. Under an interim funding arrangement, however, the veterinarian will continue until the end of 1983. There may also be a possibility of New Zealand providing assistance for a further two years. This extension will be necessary if the Samoans who are currently on overseas training awards are to gain the necessary practical experience once they return.

At present there are approximately 40 staff (not including casuals) in the livestock division. There are a number of vacancies, and some personnel are at training programs overseas. In 1979 the chief livestock officer stated in an annual report that the work of the division was hindered because nearly one-quarter of the staff were away on study leave. This situation still exists and is exacerbated by current government policy, since vacancies which arise within the division cannot be filled. The complement of 40 (6 graduates) represents a considerable manpower resource for a country the size of Western Samoa.

RESEARCH IN THE LIVESTOCK SECTOR

At present, livestock research in Western Samoa has virtually stopped. The research work being done in the livestock division relates mainly to the identification of diseases by the animal health subsection. Research on livestock production has lacked a national focus; research activities have been related to the needs of specific projects. Attempts to establish a livestock advisory committee to provide the much needed national focus for livestock development and hence the research needs have so far failed.

In the past the main research effort was undertaken through the UNDP/FAO-funded pasture and animal production project in the livestock division of DoA and also through the livestock section at USP.

A substantial pasture research program was undertaken in Western Samoa through the UNDP/FAO project from 1974 to 1982. Many detailed reports, papers, extension booklets and other documents¹ were compiled which describe the research and the results obtained.

Soils Research

Western Samoa is fortunate in that many of the soils below 1,500 feet are of moderate to good fertility (in their natural state) and that a good basic study of soil distribution and general nutritional status was undertaken by Wright (1963). From 1972 to 1976 a series of pot and field trials were carried out by the pasture research group to investigate the nutritional status of a number of soils using *Siratro*, *Macroptilium atropurpureum*, as an indicator plant. As well as confirming the above

¹See attached references.

relationship between altitude and soil fertility, the studies demonstrated the widespread nature of potassium (and to a lesser extent sulphur) deficiency, especially on old lowland coconut plantations. On more heavily leached soils such as on the Togitogiga farm, pot trials demonstrated major deficiencies of nitrogen, phosphorus, and potassium as well as deficiencies of calcium, molybdenum, boron, zinc, and copper. In general a good response has been found in both grass and legumes to an application of 200 pounds/acre of 30% potassic superphosphate, in two applications at establishment and six months later. This was the general recommendation for fertilizer use developed by the pasture research group.

Pasture Species Research

Extensive species evaluation trials were conducted to screen grasses and legumes primarily for use in pastures under coconuts. Grass species which were identified as being most suited to the coconut environments included the stoloniferous types such as Brachiaria brizantha, B. humidicola, B. miliiformis, Ischaemum aristatum, and Panicum maximum var. Embu. Common guinea grass (Panicum maximum) often outyielded the stoloniferous grasses, but it was found to compete with coconuts for water and nutrients, particularly when unfertilized. This resulted in significant reductions in coconut yields. In most of the trials establishment of legumes appeared to pose some problems, and comparisons between species were often difficult because of low yields. However, species such as Centrosema pubescens, Pueraria phaseoloides, Desmodium heterophyllum, Macroptilium atropurpureum, and Leucaena leucocephala showed some promise. Mimosa pudica is a naturalized legume which is widely distributed throughout Western Samoa. It is often regarded as a weed, but plays an important role in nitrogen fixation, especially in pastures under coconuts. It will remain of major significance while management levels remain low.

A number of grazing trials were conducted both in open conditions and under coconuts or in reforestation areas. At an average stocking rate of 3.3 animals per acre, projected beef production on open unfertilized pangola grass, Digitaria decumbens, was 823 pounds/acre per year, and 962 pound/acre per year on elephant grass, Pennisetum purpureum, pastures. These production figures were achieved over a six-month period only; maintenance of these levels would require regular fertilizer use. It was recommended that stocking rates on these pastures should be set at 2.5 animals per acre, given that animal liveweight was between 400 pounds and 600 pounds.

Several grazing trials with a range of objectives were conducted on pastures under coconuts. One simple trial demonstrated that provision of suitable drinking water had a marked effect on liveweight gain. Over 118 days animals supplied with water gained 47.9 pounds/head while those without water gained 1.1 pounds/head. Another trial compared beef production from guinea grass (Panicum maximum)-Centrosema pastures with that from natural pastures. The guinea grass pastures outyielded good local pastures, and although crude protein levels were higher in the local pastures due to a high Mimosa content, higher liveweight gains per acre were achieved on the guinea grass pastures. A projected yearly gain from guinea grass was 355 pounds/acre compared to local pastures at 252 pounds/acre.

Pasture dry matter yield and beef production from five improved grasses, Panicum maximum, Brachiaria miliiformis, B. brizantha, B. mutica, and Ischaemum aristatum sown with a common legume mixture of Macroptilium atropurpureum, Centrosema pubescens, Pueraria phaseoloides, and Ca'opogonium mucunoides were compared with the production from local pastures. The improved pastures outyielded local pastures by 28% to 50% with highest yields produced on B. miliiformis paddocks. Higher weight gains were also recorded on the improved pastures with Ischaemum, B. miliiformis, B. mutica, and P. maximum all outyielding local natural pastures by 69% to 116% on a weight gain/acre basis.

Over three phases of grazing trials from August 1974 to February 1977 liveweight gains on good local pastures averaged 181.4 pounds/acre per year compared with 340 pounds/acre per year on improved pastures -- an increase of 87.5%. At a stocking rate of two animals per acre this represents an additional 80 pounds of beef per head per year.

These figures should be viewed with caution as the trials from which they were derived were of short duration. In no case did a trial run for more than 12 months and most of the calculated gains are projected from sometimes as little as six months data.

Research on pastures under coconuts in Samoa has not yet reached a stage where an optimum package of species, fertilizer, and stocking rates can be recommended with reasonable assurance. The work that has been done has laid a solid foundation for future work in this area.

An observation trial pilot scheme was established in a reforestation block at Asau on Savai'i to determine the feasibility of grazing cattle under trees. There were a number of problems in this trial, not the least of which was the damage caused to the trees by the cattle, and it was abandoned after approximately 18 months. No formal records of pasture production, stocking rates, or liveweight gains were kept, so no comparisons could be made with productivity from other areas.

As a result of the species-evaluation trials and the grazing experiments, a village pasture nursery project was established by the pasture agronomist and staff from the livestock division. Planting materials of the most promising pasture species were distributed to villages and assistance provided to help them establish their own nurseries for later planting into larger paddocks. Species used included Brachiaria brizantha, B. mutica, B. miliiformis, and several legumes. One of the major problems with the project was that division staff, rather than the village people tended to do all the work. In addition, the purpose of the nurseries was not fully understood so they were often used as intensive grazing areas rather than as sources of planting material. The nursery project is continuing at present but in a reduced form because of the lack of staff.

The initial enthusiastic response from villages to the nursery project indicates, however, that there is widespread interest in cattle in the smallholder village sector. This interest should be cultivated to bring about increases in livestock production.

Research on Production of Carbohydrate Feed Sources

Apart from the research on pastures most of the other research on livestock in Western Samoa has been conducted by staff at the USP School of Agriculture.

Some research was done on evaluating locally grown carbohydrate crops such as cassava and breadfruit for use as energy sources in pig and poultry rations. Results indicated that cassava could be used successfully in a balanced ration, but that breadfruit had a lower energy value than cassava and only limited amounts could be used in commercially formulated diets. In addition some research has also been undertaken on the relative performance of different exotic pig and poultry breeds in comparison with local types.

Organization of Research

There has been little formal collaboration on livestock research between USP staff and staff of the livestock division of DoA, but interaction has occurred through individual initiatives.

Thus, in general, research efforts on livestock in the past were fragmented and uncoordinated, and lacked effective focus on the major problems confronting the industries.

Mechanisms for research programming and research project formulation should be developed so that appropriate adaptive research can be effectively implemented to best serve livestock industries. This could, perhaps, best be achieved by reforming the livestock advisory committee, with a clear definition of its duties and responsibilities, as a subcommittee of the national research committee (see pages and).

FUTURE RESEARCH WITHIN THE LIVESTOCK SECTOR

At present all livestock development and service programs are seriously constrained by the inadequate data base on livestock production systems. Some data are available (Reynolds, 1974 to 1978) on the productivity of local and improved pastures and the influence of environmental factors on productivity. However, few reliable data are available on mortality rates, herd composition, reproductive performance, growth rates, and offtake rates. In addition, few socioeconomic data have been collected on village livestock production systems and how livestock fit into the traditional way of life.

Information on markets and prices and the provision of adequate marketing facilities are also lacking. Such information is fundamental to the entire sector, and this overall lack of reliable data will severely constrain the planning and ultimate effectiveness of any livestock development efforts.

The livestock division in conjunction with the Economic Planning Unit (EPU) and perhaps the staff of USP could undertake surveys to collect much of the required information. The registration of cattle owners which is soon to be implemented by the government will also provide useful information in this context. Once this information has been gathered and collated, research programs could be formulated to serve the industries.

There are a number of obvious problem areas, however, which should be considered in any overall research program formulation. These include:

- * The definition and demonstration of techniques for improving the management skills of farmers in both the estate and smallholder sectors. This involves the management and utilization of both fodder and animal resources. For example, at present many of the natural pasture areas under coconuts are being used for fattening cattle, while the open, better quality pastures are being used for breeding. Since the distances to market from many of the open-pasture farms are not great, they may be better utilized as fattening areas, and the pastures under coconuts used for breeding stock.
- * The definition and evaluation of goat husbandry and herd management practices appropriate for Western Samoa. Since goat production is to be promoted in the recently established IFAD project and there is currently little information on their management in Western Samoa, this topic should receive some priority. Information on goat production and management in Fiji will be relevant to the situation in Western Samoa and should be reviewed before any local research programs are developed. In association with this, the mixed grazing of cattle and goats should be evaluated as a possible means of increasing effective utilization of pastures, particularly under coconuts.
- * Evaluation of cover crop legumes such as Pueraria and Centrosema as pastures under coconuts. The potential of these species has not been fully exploited in Western Samoa. If properly established and managed they will provide high yields of good quality forage; they will have a significant positive effect on the nitrogen nutrition of the coconut/pasture system; and their twining, smothering growth will give some control of many of the weeds associated with natural pastures under coconuts.
- * Evaluation of shrubby and tree legumes as forage sources. Many shrub legumes such as Leucaena leucocephala, Albizia spp., Glyridicia maculata, and Sesbania grandiflora grow well in Western Samoa and could be exploited as sources of high protein forage for some classes of livestock. At present, the FAO root crops project based at Alafua is conducting a research program evaluating leguminous trees in alley-cropping systems and also as the principal fallow species after a cropping cycle. Some forage evaluation work could be conducted in association with this program. This type of integrated project would give an indication of how these species could best fit into the basic farming patterns operating in Western Samoa. The selection of low-mimosine strains of Leucaena may be important (IDRC, 1982).

In association with these specific research requirements, it is felt that a good plant introduction and demonstration nursery should be set up on one of the farms. This could be used as a preliminary evaluation site for new materials being introduced into Western Samoa. It would ensure that introduced materials were not lost, and could also serve as a collection center for local species with possible potential as forage plants.

- * More research is needed on the control of weeds, a major problem both in establishing and maintaining pastures. While it is accepted that chemicals often provide a rapid and relatively easy means of weed control, they can be expensive, they can have undesired effects on other crops (through drift), and their long-term effectiveness may not be great. It is desirable, therefore, to evaluate cultural weed control methods using strategic applications of chemicals combined with good pasture establishment and management techniques, appropriate fertilizer use, and the use of pasture species which compete well with weeds. The most serious weeds now present in Western Samoa are Navua sedge (Cyperus aromaticus) which occurs mainly in open pastures and Elephant's foot (Pseudoelephantopus spicatus) in pastures under coconuts. These species should receive priority in determining effective control measures. Other weeds for which control methods should also be evaluated include guava (Psidium guajava), rat's tail (Stachytarpheta spp.), Sida spp., Nephrolepis and other ferns, peanut weed (Cassia tora), and blackweed (Blechnum pyramidatum).
- * Further evaluation of locally produced sources of carbohydrates for use in nonruminant feeds as replacements for costly imported energy sources such as maize. The economics of this replacement needs to be thoroughly examined, because even if the local energy sources are slightly inferior, a lower rate of weight gain may be acceptable if the foreign exchange cost of the feed is substantially reduced. The year-round availability of the local carbohydrate sources, particularly cassava, needs to be examined. Methods must be devised for overcoming any seasonal shortfalls that may occur, so as to ensure a reliable supply to the mill. In addition, research is required on the suitability of feeding these carbohydrates directly to livestock without the need for processing. This applies particularly in the case of pigs. Simple balanced rations, the ingredients of which can be obtained locally, need to be formulated and evaluated against imported feeds. Associated with this is the need to evaluate intensive, semi-intensive, and extensive methods of raising pigs and poultry under the prevailing Western Samoan socioeconomic conditions.

This last research requirement emphasizes the need for the livestock division to maintain close links and to collaborate with the USP livestock staff. Research on pigs and poultry, and the evaluation of feeds can best be undertaken using the facilities at USP. In addition, these facilities can be utilized to produce stock for distribution to village farmers as is now occurring in the IFAD project. The IFAD project has strengthened the links between the two units, and these links should be further developed for the mutual benefit of both parties. Perhaps the best method of doing this would be to reestablish the livestock advisory committee, which would have as one of its major tasks the coordination of research effort on livestock throughout the country.

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Annex 7. Communications and Information Management

Analysis of communications activities of an organized system can be structured around three types of communications: (1) the receipt and processing of information from sources outside the immediate system; (2) the preparation and delivery of information to potential users outside the system; and (3) the exchange of information within the system, among its units and personnel. Two members of the ISNAR review team gave special attention to this analysis of the agricultural research system in Western Samoa, although their short time in the country and the diversity of other responsibilities permitted less than an exhaustive analysis.

Incoming Communications

An agricultural research system needs to receive three main categories of information from sources outside its own structure:

1. Information from policy-makers: clear signals on policy goals for agriculture, what is expected from the research system, and resources available to support agricultural research.
2. Information from the agricultural production sector concerning problems that may be the focus for research activities -- sources may include the extension service, development organizations, private or parastatal companies, and -- of special concern -- farmers themselves.
3. Information from the world community of agricultural research workers.

Agricultural sector goals are set out reasonably well in national planning documents of the Government of Western Samoa. These are broad goals; they need to be more specifically defined before they are directly useful in defining objectives for agricultural researchers. The review team found generally that researchers in a single commodity had a good grasp of the problems, constraints, and potential contribution to Western Samoa of improved production in that commodity. However, they did not seem to have confidence in their own perception and understanding of the policy-makers' expectations (if any) of either the commodity or possible benefits of research on that commodity. Relatively little interaction seemed to occur between researchers and policy-makers; the team did not find specific examples of written communication or events carried out to enhance mutual understanding.

A similarly low level of interaction was found among researchers working in different commodities, although all were dealing with production problems that would be experienced by many of the same farmer-users. Agricultural research activities are carried out under various organizational units; there are few imperatives to stimulate interaction across unit, discipline, or commodity lines. Section heads attend meetings on a quarterly basis; however, their agendas were reported to be devoted mainly to administrative and policy topics rather than research concerns.

Opportunities for direct researcher-producer contact were found to vary widely. In some cases (such as in plant protection), research staff also performed extension functions; these staff could thus be expected to have firsthand awareness of farmers' problems and constraints. In other cases (such as in cocoa rehabilitation), research and extension functions were carried out by separate staffs, but there appeared to be regular interaction between personnel, so farm problems could be brought up. Recent extension training has been based on a monthly meeting attended by the national and provincial extension leaders, who in turn train their field subordinates. In some cases, researchers have been involved in these training sessions. This practice has stimulated interaction among the researchers and representatives of the field extension officers, who are in a position to have contact with on-farm situations. The team found few evidences, however, of deliberate and aggressive efforts by either extension or research staff to bring farmers into a dialogue that would help define farmers' problems, or to increase researchers' understanding of the complex cropping systems in which Western Samoans may apply the results of research.

The present level of contact of research workers with information from their counterparts in other parts of the world is relatively low. The review team found the Department of Agriculture library to be small and limited, and the librarian post vacant. Individual researchers appeared to maintain their own shelves of references, and the extent of works available varied by subject (and probably by the level of external funding related to the researcher's project).

However, there is opportunity for Western Samoan researchers to have a reasonably good point of access to general references and the more important periodical literature in their agricultural fields. That is through the library of the nearby School of Agriculture of the University of the South Pacific (USP). Librarians there have offered to use their arrangement with the USP library (in Suva, Fiji) to obtain searches of current scientific data bases (but reported that only a few researchers have used this service.) Attendance of professional meetings and visits to leading research institutions are important in linking researchers to the body of knowledge in their field. However, foreign exchange pressure in Western Samoa, and relatively low levels of funding for research support, have meant that few researchers have been able to make such trips.

Delivery of Research Information

Primary audiences for the results of agricultural research include (a) political or government personnel concerned with social, cultural, and economic policies for agricultural development; (b) potential users of findings -- producers and input suppliers, for example -- and organizations which disseminate technologies and advise users, such as extension services; and (c) researchers working in the same areas of science.

Information staffing and organization

Information services for the ministry are provided by the communications and information section, administered under the chief agricultural officer. The staff provides services throughout the agricultural departments, and comprises seven posts with creative information responsibilities: radio, publications, audiovisuals, information officer, librarian (vacant), artist-illustrator (vacant), and the head of section, who serves as acting senior agricultural officer for extension in Upolu. The section head was trained to the baccalaureate level, some staff hold diplomas in tropical agriculture, and most had only short courses or special short-term training in their area of production.

As noted earlier, the review team did not find much evidence of interaction between research officers and policy-makers. The most recent annual report to the parliament consisted of summary statements of activities by divisions. Little attention was devoted to the substance of research, either in terms of problems under study or results. A route was found to exist by which research concerns could be brought to the attention of policy-makers -- that is through quarterly division head meetings, through department channels to the minister, and through the minister to cabinet and other officials. Numerous person-to-person links exist among research officers and policy-makers; the review team did not identify or describe these informal ties, since they are usually not linkages that can be managed or manipulated in a planned program sense.

The diverse nature of research-extension-farmer relationships was noted in the section on incoming communication; it is not restated here. The result of the diversity is that no single line of communication was found for linking these elements. In all cases, there was found to be main reliance placed on person-to-person communication -- generally the most effective method, but also the one requiring the most resources. Analysis of the use of some other media of communication disclosed further diversity.

Information services

Radio programs appeared to be the most regular and most used carrier of farm information (including reports from research) to the largest audience of producers. Three weekly programs are produced within the Department of Agriculture Communications and Information Section. A staff member of that section is primarily responsible for programming; each division has dates assigned for programs, and each has the opportunity to select its subject. The radio specialist works with the division to help add interest and listener appeal.

Publications. In recent years, the review team was told, 7 to 10 publications and a quarterly magazine were prepared for use in the agricultural sector. With restricted operations budgets, 1983 would see only two publications and two issues of the magazine. Five hundred copies of each publication would be run (in the Samoan language), and there would be no money for reprinting. Such a limited supply will reach only a tiny fraction of the Samoan farmers (literacy in Samoan is between 80% and 90%).

Usefulness of published material was attested to by experiences reported from the cocoa rehabilitation project: Three printed pieces for that project -- two publications and a poster -- had been distributed in respective quantities of 5,000, 10,000, and 8,000. The cocoa materials were prepared with some graphics assistance in the Communications and Information Section and printed commercially. Attractive in appearance, these materials contrasted sharply with some of the section's publications -- which were typically duplicated from stencils prepared on a worn manual typewriter. (An electric typewriter and a small office offset duplicator were cited as principal needs in the Communications and Information Section -- needs with which the review team concurs.) The magazine and some reports, such as the annual report to the parliament, went through the government printery -- with considerable delay involved, it was said.

Publications offer the main channel by which Western Samoan researchers may communicate their results to scientists in other parts of the world. The review team found little evidence of an organizational concern for this activity. Individual scientists may, largely on their own initiative and without formal review, write and submit material for journals of their choice. The Communications and Information Section has provided some assistance in illustration and photography; it has not played a significant editorial role.

Audiovisuals. The main work in audiovisuals has related to annual field days at research stations, most notably at the Nu'u station. A volunteer provided under a grant from Japan has established a good standard of quality in photographic work; he also has received training for and worked in production of two videotape programs. Videotape has been popular, as indicated in requests for use of the programs, especially from schools. At least one educational slide set has been prepared. The staff member has also assisted the cocoa project staff by preparing graphics for their publications.

Newspapers. Three newspapers are being published in Western Samoa: Two are private enterprises (weekly) and one is a government paper (monthly) which functions mainly as an information service of government to matais. The Communications and Information Section reported that it responded to requests from the private papers, but that most of its initiative went into a regular column in the government paper.

Observations

The number of staff and the range of posts appeared to be reasonable in relation to the size and needs of the organization to be served. Prime constraints seemed to be limited professional training for most staff (both prior to appointment and in-service), lack of efficient equipment, and shortage of support funds to purchase needed materials and services. Although clear lines of responsibility must be established for information support for the research program, it is doubted that any structural changes are needed at this time. However, this section should be seen clearly as a vital support element, and as such should be considered carefully in any plans for development and enhancement of the research effort.

Relationships between the section and other groups were found generally to be informal. Although the rule is that all publicity releases go through the section, it was reported that this rule is frequently broken. No formal review procedure, other than final approval by the agricultural director, was involved for manuscripts for publication or submission to scientific journals. Informal channels appeared to be appropriate for the present, but this area should have attention as development and change occur.

Exchange of Information Within the Department of Agriculture

Research activities were found to be carried out in a number of separate units and projects, which differ organizationally. Some are relatively autonomous projects based on external grants (such as plant protection) in which research staff members also perform extension functions; some are special projects combining their own research and extension staffs (cocoa rehabilitation, for example); and some are department functions with either (a) persons assigned research responsibility (crops) or (b) with persons serving varied roles in development and extension as well as research (livestock).

Quarterly meetings of divisional heads seemed to be the primary means of information exchange. As noted previously, substantive matters in research were seldom included on those agendas, nor were individual researchers usually directly involved in the meetings. Coordination and interdisciplinary efforts appeared to be left mainly to personal initiatives and informal lines of communication.

Annex 8. List of Persons Met

Ministry of Agriculture, Forests and Fisheries

Hon. Jack O.T. Netzler	Minister of Agriculture, Forests and Fisheries
Tupuola Tavita	Director of Agriculture
Sofara Aveau	Acting Chief, Economic Planning Division
Semisi T. Semisi	Chief Crops Officer (in charge of Nu'u Experiment Station)
Seve T. Imo	Chief Agricultural Officer, Extension
Iosefatu Reti	Chief Forestry Officer
Metai Faaifo	Acting Chief Livestock Officer
Savali Time	Senior Fisheries Officer
Kesi Ale	Senior Agricultural Officer, Savai'i
Mase R. Kamu	Agricultural Officer, Savai'i
Aiolupo K. Fiu	District Field Officer
Ioane Fasavalu	Senior Agricultural Officer, Information and Communications
Sealiitu Sesaga	Agricultural Economist (Economic Planning Unit, Department of Agriculture)
Fui Fui Uati	Livestock Officer (Pastures)
Fa'amau Lui	Administrative Officer, Nu'u Experiment Station
Ron MacDonald	Horticulturalist, Vaea Plant Quarantine Station
Nemaia Teku	Manager, Vaea Plant Quarantine Station
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Dr. H. Hammans	Team Leader, German-Samoan Crop Protection Project
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	R. Wall	Second Secretary (Dev. Assistance), Australian High Commission, Apia
	D. Will	Second Secretary, New Zealand High Commission, Apia
	A. Hutchison	Financial Secretary, Ministry of Finance
	P. Coolen	East-West Center/ISNAR Project

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Department of Economic Development. Cash Crop Production Policy and Planning.

Fau, Suisala, S. The Agricultural Store Corporation.

Fernando, L.H., M. Asghar and F. Opio-Edongocha. Small-scale Production and Marketing of Coconuts in Western Samoa.

Fiti Fiti. An Increased Role for Airlines in the Transport of High Value Fresh Produce to Overseas Markets.

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Semisi, S.T. Crop Protection and Smallholders.

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