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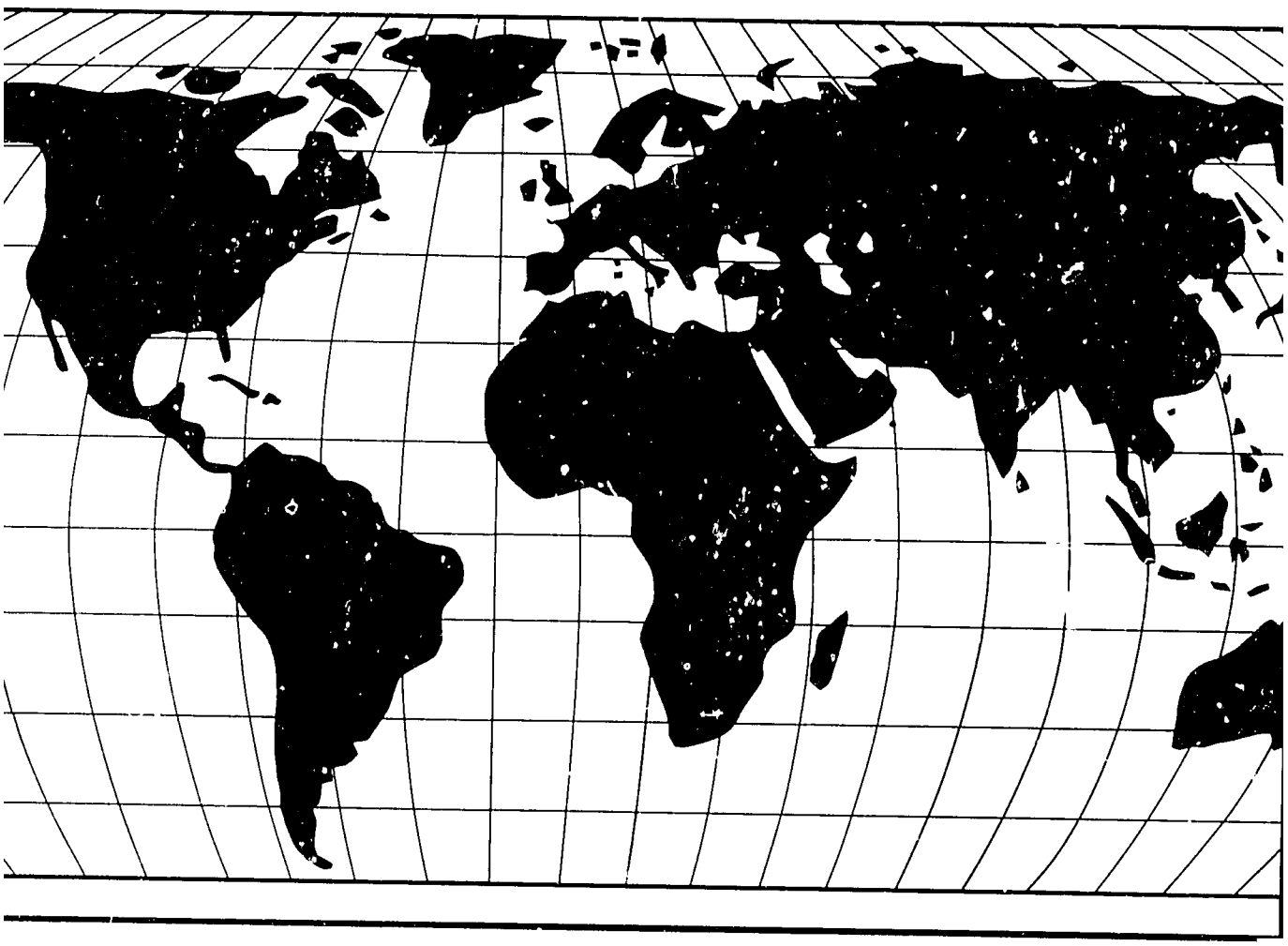
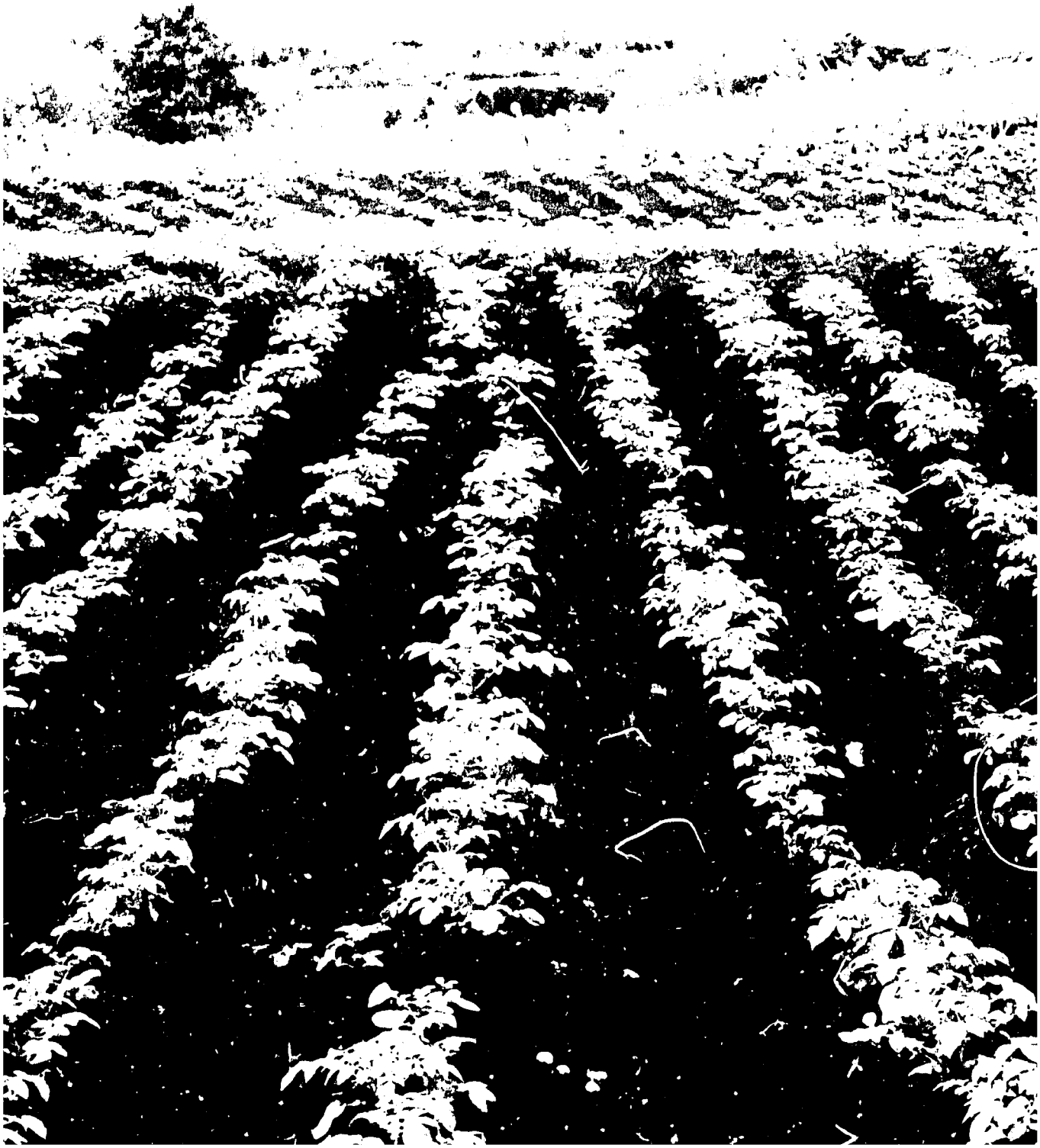


INTERNATIONAL AGRICULTURAL DEVELOPMENT SERVICE



Potatoes being grown in tropical highlands.

INTERNATIONAL AGRICULTURAL DEVELOPMENT SERVICE

Report/1983

Preface

IADS helps developing countries strengthen agricultural research and development institutions. It is an autonomous, nonpolitical, nonprofit organization that pursues a science-based approach to development activities.

IADS may receive funds from any source to assist any nation or to support developing nations collectively through programs of research, training, and information exchange. IADS is exempt from U.S. taxes under Section 501(c)(3) of the U.S. Internal Revenue Code.

The major event of 1983 was the IADS Board of Trustees' decision to take steps toward a merger of IADS with Winrock International and the Agricultural Development Council. Details on the prospective merger and on other IADS activities are given in the section "IADS in 1983."

During the year, over 50 resident specialists provided by IADS were working for national agencies in Bangladesh, Botswana, Ecuador, Indonesia, Pakistan, and Nepal. IADS also supplied over 90 short-term consultants to 16 developing countries and managed overseas fellowship activities for 116 scholars from Bangladesh, Indonesia, and Nepal.

The essays this year were written by Sir Charles Pereira ("Elimination of tropical forests: Some practical issues") and Leon Hesser ("Setting research priorities: Malawi as a case study"). Sir Charles is the former chief scientist of the British Ministry of Agriculture, Fisheries, and Food; he served over 20 years in the tropics and is the author of the book *Land Use and Water Resources* (Cambridge University Press). His essay is adopted from a paper prepared for the U.S. Office of Technology Assessment. Hesser is an IADS program officer who led the agricultural research review team that IADS provided to Malawi during the year.

We welcome comments and inquiries about the activities of IADS.

A. Colin McClung, *president*

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* Left during the year.

Elimination of Tropical Forests: Some Practical Issues

(facing) Plowing a terraced field in the hills of Nepal.

Of the world's next billion births, 800 million will occur in developing countries that are dependent upon subsistence agriculture. This human tidal wave will result in the destruction of many of the world's remaining tropical forests. Already they are vanishing at a rate of 11.3 million hectares each year.

Where the land in forest is suitable for the sustained production of food crops, clearing is inevitable. In such areas, the main concerns then must be for adequate soil and water management, for establishing an alternative supply of fuelwood, and, wherever possible, for saving the plant species that would otherwise be extinguished.

However, only South America still has significant areas of land under forest that have high agricultural potential. Elsewhere in the world, most land now being cleared is too poor to sustain food crops without heavy inputs of fertilizers, so that they are abandoned after a few years. In Asia and in Africa, forest is being stripped from steep slopes of

shallow rock-studded soils. Such forest has a vital function in stabilizing soils under violent tropical rainfall and torrential run-off. Continuous fuel-cutting and relentless overgrazing has prevented regeneration of either forest or herbage, resulting in erosion on a formidable scale. In India alone some 20 million hectares of communal forest have thus become wastelands.

Since the management needs and opportunities in humid evergreen forests differ from those in dry deciduous forests and since technological options depend essentially upon topography and accessibility, broad categories of climate, topography, and logistics structure this discussion.

Evergreen humid tropical forest in areas of difficult access

In the humid tropics, protection forest that is essentially inaccessible to humans because of its remote location, its steep topography, or, more rarely, effective guarding, usually needs no active management, having natural fire resistance and long-term stability. An exception is where such forests cover steep escarpments, above which areas are open to settlement. Runoff from the upper slopes may then overload the forest soils and lead to landslips on a large scale, especially on geological dip-slopes. Landslips under these circumstances are common in Nepal and in parts of Zaire. In Taiwan landslips on forested slopes are initiated by earthquakes. Reforestation to stabilize the damaged areas and cut-off drains to intercept and convey runoff to stable drainage lines are the necessary treatments.

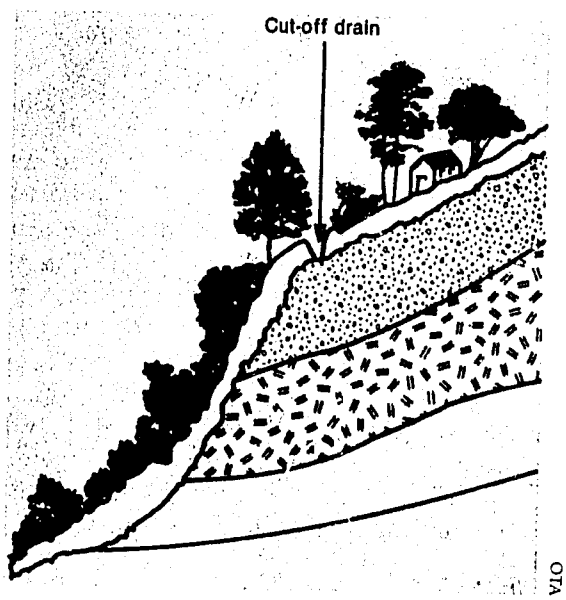
Accessible humid tropical forests on steep land

Most of the original evergreen forest covering accessible or gentle topography in the tropics has already been destroyed in converting land to agriculture or to wastelands. In peninsular Malaysia, for instance, out of the remaining 8 million hectares of high forest, most of the 3 million hectares of level terrain is scheduled for agriculture and plantation crops, while 5 million hectares on steeper land will remain

as forest estate. Of this, 4 million hectares will be opened to logging.

Management of logging. In gentle topography, soil and water management problems occur only as a consequence of improper harvesting. In the most extreme form of rotational clear felling, the sudden reduction of water use can lead to local flooding under monsoon conditions. This can be avoided by planning the size and location of the felling blocks with the help of a drainage engineer or hydrologist.

Clear felling is used mainly in those unusual areas in which a tropical forest is dominated by a marketable species, such as the "sal" forests *(Shorea robusta)* of the Nepalese terai, or where there is a market for industrial cellulose as in the Philippines. The more usual method is sale of logging rights for selective felling. This is difficult to control even in mild topography. In the extreme ecological diversity of tropical forests, only a small proportion of the tree species are well enough known commercially to command an ex-



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A cutoff drain can protect steep forested scarps from landslips.

port market. Because mature specimens of the desired species are widely scattered, selective felling leads to excessive track-making by heavy extraction equipment, severely damaging soils and destroying young trees. Poor regrowth has been a general experience, and logging on a sustained yield basis has had little success. The governments of Malaysia and the Philippines have both declared policies of restricting such harmful logging methods in recent years.

The appropriate action is to conduct operational trials with equipment designed to reduce soil damage. Cable ways, winching, and use of lighter machinery may be more costly but, in the interests of long-term sustained yield, governments should restrict the use of the more damaging heavy equipment to a limited number of prepared roadways.

Progress in the tropics is, at present, negligible in this aspect of harvesting. Technology from developed countries will need to be borrowed, tested, and adapted. Opportunities for a major improvement depend on a basic reorientation of the traditional selected-species management philosophy derived from the forestry of Europe. Growing consumption of timber by developing countries, in which a far wider range of species are acceptable, permits simultaneous harvesting of broad groups of species. This greatly shortens the access tracks and thus minimizes damage to soil and to regrowth.

If accessible forest is under pressure from populations short of fuel, security can be increased by establishing fuelwood plantations on forest borders with community involvement. Even where the pressure for land, fuel, and employment rules out the 70-year rotation necessary to grow natural stands of tropical hardwoods to logging size, it is important that governments recognize the high value of forest land as a natural resource where trees can be grown effectively. With soundly planned roads, terraces, and drainage, tree crops can successfully replace the hydrological controls of tropical forest. Well-engineered estate development such as the plantations of tea in Assam and in Kenya, rubber in Sri Lanka, and both rubber and oilpalm in Malaysia has demonstrated that soil can be kept stable for 50 years or more.

The disappearance of forests makes the daily search for fuelwood increasingly laborious.

Where industries are short of raw materials, as in Karnataka state in southern India, industrial finance for labor-intensive cellulose production (bamboo for paper, eucalyptus for paper-pulp or rayon, poplar for matches) has provided rural employment and local prosperity. In the Philippines, communities have benefited from the rational development of forest soils for tree crops, with support from the wood-processing industries, where *Albizzia falcatara* and *Eucalyptus deglupta* are the main species grown.

Karnataka state also demonstrates the acute dangers of opening tropical forest land to uncontrolled settlement by subsistance cultivators. In order to produce food crops, many forest soils require both fertilizers and sound soil conservation practices. Where forest clearing is followed by continuous cultivation without inputs, the initial fertility is rapidly destroyed. Tropical rainfall intensities then cause massive losses of topsoil by sheet erosion and rapid deterioration even in mild topography. Half of Karnataka's 3.5 million hectares of gazetted forest land has already been reduced to wasteland in this way.

Reforestation. Well-established technologies for propagating, planting, and tending fast-growing species of tropical trees and tree-crops have been demonstrated in all developing countries that have tropical forest resources, but there are two important caveats. First, it is an elementary management precaution to undertake preliminary trials or pilot schemes before embarking on large-scale development. The incidence of pests and diseases, the degree of soil deficiencies, and the frequency of labor shortages, livestock damage, or illicit felling may be unsuspected. Moreover, while closed evergreen forests are resistant to fire, new plantations are vulnerable in every dry season. Second, the tree species suitable for short rotations in the tropics have had little attention in the past and species differ widely in performance. Moreover, for eucalypts and for tropical pines, differences in provenance (seed source) can have more influence on growth rates and quality than do differences in species.

A continuous series of field trials comparing planting material and management practices are therefore profitable

as well as a prudent investment. Field production officers can supervise such trials, but they need support from experiment stations in procurement of seeds, design of trials, and computation of results. While resources for formal research are always limited, daily rainfall records and simple staff-gauge estimates of streamflow can give valuable guides to future planting policy and should be a routine responsibility of foresters on remote sites, with technical cooperation from the meteorological and water engineering departments.

Technologies for practical soil conservation have been demonstrated in all tropical developing countries. Contour planting, with graded hillside bunds or narrow-based terraces at suitable intervals leading runoff into prepared drainage lines, are understood by the technical departments though not widely enough accepted by farmers. Traditionally, trained foresters have taken little heed of such practices except in road alignments. Tree planting in grass or in forest litter is usually parallel to the slope for ease in control of labor. However, with the introduction of community forestry in which food crops are planted between tree seedlings, current forestry practices need change. For example, at a demonstration of "agroforestry" seen at a forest station in Southeast Asia, maize and pineapples were planted between pines straight up and down 20 percent (1/5) slopes. This practice will guarantee erosion under tropical rainfall conditions.

Soil erosion is minimized if the crops are planted across the slope and the duration of cultivation is limited: an example is the "taungya" or "shamba" system by which landless families are allowed to grow vegetables between newly planted trees in return for keeping them clean weeded in the 2 or 3 years before the tree canopies shade out the crops. A test of this system in East African hydrological studies showed that the forest soils were sufficiently rich in fibrous organic matter to suffer little damage over 3 years, and filter strips of the original bamboo forest left to guard the streambanks trapped much of the soil that moved. Suspended sediment sampling of streamflow showed losses of about 1000 kilograms of soil per hectare in the third year, which fell to 100 kilograms when cultivation ceased. These are negligible quantities.

Policies. Tropical evergreen forest can serve both as watershed protection and as a source of revenue if professional forest departments have the resources and the political support to make full use of existing technology. Sustained-yield management of logging, using conservation methods under supervision, requires support from governments in three major aspects. The first, and most difficult, is political support of the policing, which is essential to prevent illicit cutting, burning, grazing, or cultivation. The second is the effective control of the methods used by logging contractors, who tend to be wealthy and influential members of tropical communities. The third is financial support of forestry agencies for staff and vehicles and for the construction of roads necessary for supervision. Contractors who minimize extraction costs at the expense of the land have done severe damage by bulldozing excessively steep tracks in dry weather, by filling in deep drainage lines without culverts in order to cross them, by "dead-snigging" or dragging logs by tractor without lifting the butts, and by winching downhill to a loading point, which creates a radial pattern of furrows that concentrate runoff and initiate gulleys. Simple techniques to avoid such damage are well established in the USA and have been applied successfully in the tropics, e.g., in Queensland.

Farming on slopes. Forested slopes within easy reach of densely populated tropical areas have, in the main, been cleared for agriculture up to and beyond the slope limits for effective terracing, except where watershed protection areas have been policed in the public interest. Soil and water management on these cleared slopes is important and soil depth is here a particularly critical factor. Terrace construction has been a historical practice in the tropics. But the stable terraced systems that have survived—in eastern and southern Asia, in tropical America, and in small areas of Africa—have been limited to areas in which the soil is deep enough to build level, or backsloping terraces, in spite of extremely steep slopes.

Increasing population pressure in the last two decades has carried terracing far beyond the limits of prudence, as in Nepal, to create fields of less than 10 square meters on

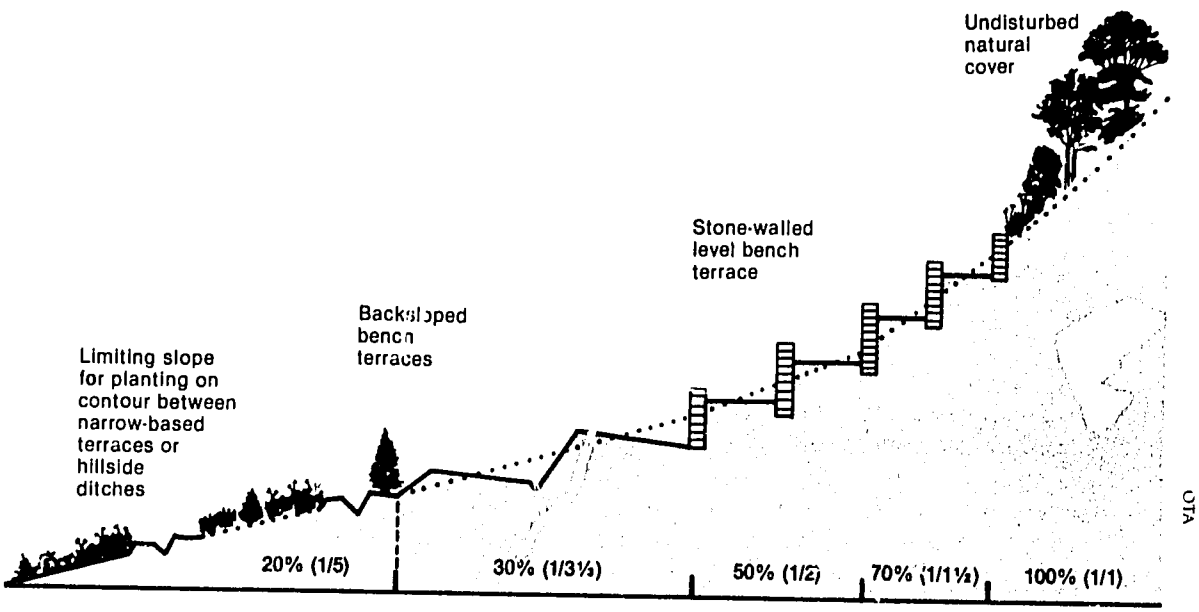
slopes of over 100 percent (1/1). Below an altitude of about 1500 meters, where rice is the main crop, the leveling necessary to retain water in paddies has given long-term stability. But, at higher altitudes, where maize, sorghums, and millets are grown, terraces have been built on such shallow soils as to make no effective reduction in the slope of the cropped surface. Sheet erosion, with declining fertility, on these outward sloping terraces is continuous and land degradation is prolonged when intensive grazing follows the abandonment of cropping. To protect the far larger rural and urban populations downstream, existing forest on all slopes over 100 percent must be maintained. Where steeper slopes have been cleared, they should be closed to livestock and stabilized by the planting of trees for fuel and fodder or merely protected to permit natural growth.

For slopes of less than 100 percent, arbitrary limits for agricultural use cannot be applied without exception to all tropical soil and climate situations, but a widely applicable guide is that on slopes between 100 percent (1/1) and 20 percent (1/5), land should not be opened to cultivation unless it is bench terraced. However under extreme land pressure where the soil is of stable type and deep, level or preferably backsloping terraces are feasible. Such terraces have been observed to survive, especially where the risers are constructed of stone.

For slopes of less than 20 percent, agricultural technologies for minimizing soil loss are well established and widely publicized. The continental climate of the USA produces some of the soil stresses experienced in the tropics and well-tried technologies evolved by the U.S. Soil Conservation Service have proved to be adaptable to tropical conditions. For small farms on hand-cultivated slopes, more intricate designs involving both food crops and fruit trees, such as bananas, jackfruit, or guavas, have been developed.

But remarkably few critical full-scale studies of terracing have been reported from the tropics. Many small runoff plot measurements have been made, but these are ineffective in reproducing the conditions of contour cultivation by oxen or tractor, which determine infiltration, runoff, and erosion on a practical field scale. For this reason, in developed countries, such small-plot runoff studies have been

Slope limits for cultivation vary with soil type and rainfall: Many tropical countries under population pressure successfully use terraces on slopes as steep as 70 percent.



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generally abandoned in favor of measurements on a larger scale. One fullscale study in Kenya, on the exceptionally stable "Kikuya red loam" latosol, showed that on a 12 percent slope, without terracing, not even contour ridging could maintain stability for eight successive crops. Moreover, "ties" to close the furrows into small basins greatly reduced, but could not prevent, gulley formation.

Preserving forests on steep slopes. Under pressure from population growth, the most critical areas for management of steep tropical forested watersheds are the forests immediately above the limits of cultivation. Foresters guarding the land above this boundary, along the whole range of the Himalayas from Pakistan to Assam, in the steep forested watersheds of Thailand, in the remnant forests of the East African highlands, and in the tropical Andes, have conceded to the agricultural communities the rights to collect fuel and fodder. Grazing rights within the forest have either been granted or illegal grazing has been tacitly ignored. Cultivation has usually encroached to the limit beyond which the land is too steep or the soil too shallow or rock-encumbered for cropping.

Above the cultivation boundary, a belt of wasteland has become characteristic, stripped by fuel-cutting and overgrazing, since every woodcutter and grazier competes for the maximum share of a common resource. It is from the overgrazed wastelands that the major gulleys begin, as a study of satellite photography supported by both aerial and ground truth surveys of Nepal has shown. This land can be restored, for high rainfall and high temperatures permit rapid revegetation, but the technology required is a difficult blend of social reorganization and physical restoration. Because roads are sparse and amenities of education, medicine, and markets are rudimentary in steep, rugged country, the educated cadres, both administrative and technical, rarely leave the valleys. There is little political interest in such remote constituencies. With an allocation of one forest guard to two or three villages, there is no realistic prospect of maintaining watershed management by law.

Community forestry. Recently, pilot projects initiated and funded by external aid agencies have demonstrated that subsistance farming communities can be convinced that tree planting is more profitable than overgrazing. Nepal provides an instructive example of a mountainous, subtropical country where forest destruction and consequent erosion and floods are major national problems and where successful technical solutions are developing. Two thirds of Nepal's 14 million people live by subsistance agriculture in rugged hill country that is seriously overpopulated Farms average 0.5 hectares per family. On terraces exhausted by continuous cropping, farmers no longer attempt to plant cereals unless cattle dung is available. Since inputs must be carried to villages by porters who trek for 1 to 3 days over rough, steep trails, fertilizer use is negligible. With declining yields and smaller farms, there is increasing reliance on livestock grazing communal and "forest lands." These are severely overstocked, so that government estimates put nutrient supplies for hill livestock at about half normal requirements in spite of over 1500 mm of rainfall. Foresters, trained to produce saw-timber, find their forest lands ravaged for fuel and fodder, in production of which they have scanty training and little interest.

In 1974 the Soil Conservation and Watershed Development Department was set up in the Ministry of Forests with help from an UNDP/FAO watershed management project. Encouraging progress has since been made in a heavily populated part of the Middle Hills. The basic move was to persuade hill communities in the Phewa Tal watershed to stall-feed all of their livestock. In return they were offered employment to plant fuel and fodder trees and tall fodder grasses on denuded common land and eroding gulleys. Seven of the first 10 "wards" of the panchyat rejected the proposals. But the three that accepted them prospered so rapidly that within 4 years all wards had applied to join.

Standard gulley-control structures of rock-filled wire-mesh gabions were built and the gulley walls were planted with vigorous fodder grasses *(Pennisetum purpureum, Cenchrus ciliaris,* etc.) and legumes *(Stylosanthes guianensis).* The steep denuded lands were planted with hardy, nitrogen-fixing *Alnus nepalensis* and fodder trees *(Artocarpus lakoochia)*

were issued to farmers. Grass cut from between the trees was surplus to requirements and was sold to neighboring wards. An even greater bonus was the increased supplies of cattle manure from stock stall-fed near the terraces. This enabled farmers to take a winter crop of wheat, after a summer crop of hill rice, from terraces that would have otherwise remained fallow.

An essential input has been funds to employ villagers to carry out the land restoration work: A major part of the funds have been directly channelled to the poorest section of the community.

Donors are being sought by the government of Nepal for wider implementation of this successful approach. International aid projects for rural development have proliferated since 1980 in an attempt to forestall a serious economic and logistic crisis in Nepal. Ten such projects, with a total investment of US$166 million now cover more than half of the hill districts, although only on a "pepper-pot" pattern of localized effort.

The essential lessons from the Nepalese examples are:

- That existing technologies are successful in restoring eroded hill slopes where rainfall and temperature support vigorous growth of vegetation, provided that free-range grazing ceases.
- That even the best-known technologies must be tested by the trained staff under local conditions before being implemented on a large scale.
- That even the most resistant subsistance farmers react positively when their neighbors show a profit, but an initial element of subsidy is needed to secure change.
- That farmers will plant, tend, and protect trees, and make substantial changes in their farming practices, when they are confident of sharing the benefits.
- That foresters in tropical developing countries have both historical and logistic responsibilities to supply fuel and fodder, and building timber.
- That in-service training in the necessary technology is an urgent requirement in forestry agencies.
- That the best prospects of protecting the remaining forests from destruction are to arrange for vital supplies of fuel,

Desert-like conditions in the wet tropics caused by improper clearing and subsequent erosion.

fodder, and building materials to be grown in cooperation with neighboring communities.

- That rural rehabilitation will endure only when a viable extension service is built up and trained. Improvements begun in earlier projects have lapsed when the project staff departed and government support dwindled.

Complementarity of fuelwood production and soil conservation. Direct steps by the Indian government to employ existing technologies of soil conservation and reforestation have led to cost-effective production of fuel and fodder. It is fortunate that the need for fuelwood and the need to reduce soil erosion in headwater areas for irrigation development are complementary, since the scale of action required in the tropics and subtropics is immense. The World Bank estimates the planting requirement at 2.5 million hectares a year. The need for fuelwood in India is estimated at 133 million tons a year, of which only 49 million tons are currently being produced. India has 17 million hectares of wasteland and a third of the 70 million hectares of forest land is effectively wasteland. India aimed to plant 2.1 million hectares in 1979-83, but much more is needed to meet the deficit. A major factor in preserving the remaining natural forest will be the provision of alternative sources of fuelwood. Yet, although the forestry sector is responsible for 70 million hectares as compared with some 150 million hectares of agricultural land, the staff provision is a very small proportion of that made for agriculture.

Tropical dry forests and open woodlands in areas of difficult access

In drier tropical climates, those with annual rainfall of 500 to 1000 mm, the options are more difficult. Protecting both natural forest and plantations from annual fires is an acute problem. Much savanna woodland in Africa has been destroyed for control of tsetse flies. Slower vegetative growth, sparse groundcover, intensive pressure from grazing animals, and, especially in Africa, termite attacks on newly planted seedlings, all present practical difficulties.

The major management problems are protection from

fires started by lightning or wandering parties of hunters. This is a familiar problem in the Chaparral of California. The flood peaks and sediment transport after fire are serious and damaging. A study in Arizona found that wild fire led to a sediment flow of 1500 tons per hectare.

The practical option is for permanent firebreaks to limit the spread of fire. These are costly, but sometimes essential for the protection of downstream irrigation developments. Such protection of headwaters should be accepted as a necessary part of downstream development programs.

Accessible tropical dry forests

Difficulties in the drier tropical areas are somewhat mitigated by the low human populations, but the scarcity of water tends to create concentrations of populations. Destruction of natural woodlands in the more favored areas has therefore been extensive. Restoration of tree production in steep terrain denuded from dry woodlands requires contour planting either in hand-dug contour furrows or in planting holes.

In Africa the success of such plantings, under the influence of foresters from Europe (e.g., by Italian foresters in Eritrea, by Belgian foresters in Rwanda, and by French foresters in Morocco) has been impressive. Tree species for fuel and fodder are described in three publications by the U.S. National Academy of Sciences, which are of outstanding value in this field. They are *Leucaena* (1977), *Tropical Legumes* (1979), and *Firewood Crops* (1980).

The use of plantations for fuel and building timber occurred earlier in the drier tropical climates than in humid areas, as the more vulnerable dry woodlands were destroyed. In Africa, plantings were begun by the German administration of Tanganyika in 1898 with eucalyptus, casuarina, and teak. Tanzania has now over 70,000 hectares of eucalypt and pine plantations in which the managerial difficulties mentioned above have been effectively overcome. These difficulties more strongly affect community forestry in the drier tropical savannas, which are swept annually by grass fires. Village woodlots were being actively promoted by the Tanganyika Forest Department in the 1950's and, in

spite of damage from fire, livestock, and termites, are now a familiar feature of the populated savanna, with eucalyptus species predominating. Maintenance of firebreaks and of stockproof fences, water supplies for tree nurseries, and chemical control of termites in the early stages of plantation growth are the main options of essentially standard forestry and soil conservation technology required, after the interest of the community in the success of the plantations has been secured.

Implementation of stable land practices

Enough is known in theory and in practice to achieve stability of land use under the whole range of tropical forest ecologies. The constraints are the lack of interest in remote areas by town-based administrators and technical specialists and the reluctance of the educated cadres to serve in isolated posts. The solutions, already demonstrated, are to give the mountain farmers responsibilities for establishing their own fuelwood and fodder resources and to assist them with guidance and initial inputs of seeds. Such work requires increased rewards and recognition for professional service in remote forests and offers useful opportunities for donor assistance.—*Sir Charles Pereira*

Useful reading

Chapman G.W. 1973. *A manual on establishment techniques in manmade forests.* F.O.:Misc/73/3. Rome: FAO.

FAO. 1977. *Guidelines for watershed management.* Conservation Guide No. 1. Rome.

Hudson, N.W. 1975. *Field engineering for agricultural development.* Oxford: Clarendon Press.

Lundgren, B. 1978. *Soil conditions and nutrient cycling under natural and plantation forests in Tanzanian Highlands.* Reports in Forest Ecology and Forest Soils No. 31. Uppsala: Swedish. Univ. Agr. Sci.

National Academy of Science. 1977. *Leucaena: Promising forage and tree crop for the tropics.* Washington, D.C.

National Academy of Science. 1979. *Tropical legumes: resources for the future.* Washington, D.C.

National Academy of Science. 1980. *Firewood crops: Shrub and tree species for energy production.* Washington, D.C.

Pereira, H.C. 1973. *Land Use and Water Resources.* Cambridge: Cambridge Univ. Press.

Pereira, H.C; McCulloch, J.G; Dagg, M; and Kerfoot, O.; et al. 1962. Hydrological effects of changes in land use of some East African catchment areas. *E.A. Agr. and Forestry J.* 27 (Special Issue).

Spears, J.S. 1979. Can the wet tropical forest survive? *Commonwealth Forestry Review* 58:165-180.

Sunder, S. Unpublished paper presented at the Banglalore conference on forestry and development in Asia.

Tejwani, K.G; Gupta, S.K., and Mathur, H.N. 1975. *Soil and water conservation research (1956-71).* ICAR Publication 68. New Delhi: Indian Council of Agricultural Research.

U.S. Department of Agriculture. 1954. *A manual on conservation of soil and water.* Agr. Handbook 61. Washington, D.C.

Setting Research Priorities: Malawi as a Case Study

(facing) A village chief examining an on-farm maize trial in Malawi.

Human, physical, and capital resources for agricultural research usually are limited. Thus it is imperative that they be employed to find solutions to the most important problems. But which ones are the most important? The answers given by farmers, scientists, administrators, and policymakers are likely to differ. Most people consider their concerns to be of "high priority." Therefore governments need rational procedures and logical criteria for allocating research resources to address the most important problems of farmers as a whole within the framework of national goals.

Malawi is in the process of rationalizing its agricultural research system, including the formalization of processes for establishing research priorities. Its experience may have relevance to other countries. This essay describes the role and functions of the Agricultural Research Council and the planned system for setting agricultural research priorities in Malawi.

Since Malawi gained independence in 1964, research has played a significant role in agricultural development. In

the belief that it could have even more influence, Malawi has recently reassessed the role, structure, and functions of the Department of Agricultural Research (DAR) of the Ministry of Agriculture and outlined a new strategy to maximize the contributions of agricultural research to the continued development of agriculture.

Key elements of the new strategy are:

1. Establishing the Agricultural Research Council, an entity made up of a cross-section of senior government officials and the private sector, with responsibility for defining national agricultural research policy, for periodically reviewing and establishing program priorities for agricultural research, and for reviewing and recommending research programs and projects.

2. Reorganizing the DAR with the focal points for research being commodity teams and adaptive research teams, rather than research stations.

3. Refining the research station network to reduce overhead by closing some stations and augmenting facilities where needed to support the new commodity-team approach to research.

4. Strengthening the technical capacity of DAR through additional graduate training to the M.S. and Ph.D. level, through short- and medium-term nonformal training at international agricultural research centers and other institutions, through on-the-job training conducted by a mixture of short- and long-term technical consultants from abroad and senior Malawi scientists, and through workshops and seminars.

5. Capitalizing on the technologies and services available from the international agricultural research centers, African regional research institutions, neighboring countries, and other nations.

6. Improving the system of planning, budgeting, financial control, monitoring, and evaluation.

7. Fostering close collaboration between education and research through grants-in-aid or contract research programs and, as soon as practicable, by facilitating graduate-level training of research workers in Malawi educational institutions, and by encouraging research scientists to teach formal courses at the colleges.

8. Ensuring that research is relevant to farmers' needs by establishing formal links among researchers, extension workers, and farmers.

The Agricultural Research Council. To function effectively, a national agricultural research system must operate with policy guidelines that reflect the goals of society and the realities of the national budget. The responsibility for these guidelines should be vested in an appropriate body composed of persons who have different viewpoints on agriculture and the general economy.

The goals of Malawi's Agricultural Research Council are to evolve a sound national agricultural research policy and to foster balanced research programs in which the vital needs of the economy are satisfied within the limits of available resources.

ARC is a policymaking and advisory body, but not an executing agency. It makes recommendations to the principal secretary of the Ministry of Agriculture, who is the responsible executive. Because the principal secretary serves as chairman of ARC, he will participate in the council's deliberations and be in a position to act on the recommendations.

ARC is to be made up of persons who, reflecting their positions in government or society, can bring to the meetings diverse perspectives on the nation's economic and fiscal policies and goals as a context for agricultural research. Initially, ARC will include:

- Principal Secretary, MOA, as Chairman
- Chief Agricultural Research Officer (CARO), as Vice Chairman
- Chief Agricultural Officer (Extension), MOA
- Chief Projects Officer, Planning Unit, MOA
- Chief Veterinary Officer, MOA
- Representative of the National Research Council
- Representative of Economic Planning Division, Office of the President and Cabinet
- Representative of Bunda College, University of Malawi
- Representative of Chancellor College, University of Malawi

Table 1
Malawi: Responsibilities in defining agricultural research priorities

Cabinet
Define national goals.

Agricultural Research Council
Establish agricultural research policy.
Establish research priorities broadly.
Approve research programs.
Approve projects in excess of K10,000.

Secretariat to ARC
Conduct analyses as a basis for ARC to establish research program priorities.

Chief agricultural research officer
Direct research programs and projects approved by ARC.
Approve projects under K10,000.
Supervise staff work of the Secretariat to ARC.
Preside over sessions with national research coordinators and commodity coordinators to establish priorities for research activities or projects within commodity programs.
Recommend research programs and projects to ARC.

National research coordinators
Interact with the adaptive research coordinators and commodity coordinators to be cognizant of problems needing research.
Recommend research programs and projects to chief agricultural research officer (CARO) and deputy CARO (research programs).

Commodity coordinators
Interact with the adaptive research coordinator and other members of the commodity team to define problems identified by the adaptive research teams.
Seek solutions to problems through literature search, through the international research centers, neighboring

continued

- Representative of the Estates Advisory Board
- Deputy CARO (Research Programs)
- Deputy CARO (Technical Services)

Representatives from other government units or private entities may be asked to serve on ARC as needed. In the interest of an effective size, an effort will be made to limit the membership to 14 persons. A secretariat will perform staff work for ARC.

The responsibilities of the ARC are to:

- outline an agricultural research policy that supports national goals
- review, establish, and update priorities for agricultural research programs within the context of research policy and national goals
- ensure that the agricultural research strategy is consistent with the nation's agricultural development strategy
- recommend an appropriate level of expenditure in agricultural research, with the aim of eventually investing an amount equal to 1 to 2 percent of the annual agricultural gross domestic product
- approve annual research programs and projects for implementation by DAR, subject to availability of funds
- approve priority research activities to be implemented by colleges, and perhaps other institutions outside DAR, and to be supported through grants-in-aid funded by a DAR budget provision for "contract research"
- recommend project reporting and accounting procedures for DAR, in consultation with the chief agricultural research officer
- ensure that DAR operates within treasury's accounting and auditing regulations

ARC has two advisory subcommittees: a technical subcommittee to examine and review present and proposed research programs and a financial subcommittee to review the annual budgets and examine the estimates of program and project costs. Their recommendations are considered by the council in its general meetings.

Defining agricultural research priorities. Establishing agricultural research priorities is a continuing process in which many persons and groups share responsibility (Table

1). Priorities may shift gradually as changes occur in the economy, national goals, or the nature and severity of problems faced by farmers. However, the process of establishing priorities should take place within a consistent framework that facilitates reasoned judgments based on sound analysis.

In most countries, national goals are established by an interministerial body or perhaps by the cabinet. The national goals define the general parameters within which production targets and research priorities are set. National goals commonly are related to economic growth, equity among regions and income groups, balance-of-payments considerations (imports and exports), food security, and nutritional levels of the population. When goals conflict, the body that establishes the goals must indicate which ones should predominate.

The various groups and individuals that take part in establishing research priorities need guidelines. Following is an outline of suitable criteria:

1. Importance of the crop or animal
   - What is the total area of the crop or total numbers of livestock?
   - What is the total value of the crop or livestock product?
   - How well does the crop or livestock enterprise relate to national goals?
2. Potential of the crop or animal
   - Market: What is the projected domestic and international market potential?
   - Resources: Are land and water resources available to expand production, or will increased output depend mainly on productivity from the existing area?
3. Expected payoff from research
   - What is the probability that the problem can be solved, that production risks can be lowered, or that improved technology can be identified, imported, or developed?
   - What is the magnitude of the potential payoff from successful research?
   - How soon?

The investment in research on problems of, or opportunities for, a particular agricultural commodity should bear some relationship to its importance. A measure of impor-

Table 1, *continued*

countries, or other research institutions.

Make recommendations to the national research coordinator on the array of problems needing research; identify which may require outside assistance and which could reasonably be handled by DAR.

Adaptive research coordinator

Interact with adaptive research teams and the agricultural development division program managers to determine the array of problems important in each division and for the nation.

Agricultural development division program managers

Preside over sessions with adaptive research teams and extension agents of the divisions to arrive at priorities for each division.

Adaptive research teams

Interact with extension agents and farmers to identify the important problems in the division.

Farmers

Make production problems known to extension agents or the adaptive research teams.

tance might be, for crops, the proportion of cultivable areas occupied or, for livestock, total numbers. Table 2 indicates the area in Malawi planted to some of the major crops (excluding tobacco, tea, and sugarcane, which are outside the purview of DAR) and the numbers of livestock. Maize is obviously important, since it occupies approximately 1 million hectares. But perhaps a better measure of importance is value of production because the value per unit of area for some crops is much higher than that for others. Table 2 shows estimated values for some crops and livestock for 1978 and 1982. Again, maize dominates, but several other crops, or groups of crops, and livestock are also important by this measure.

How do the expenditures of DAR in research compare with the value of production of crops and livestock in the nation? The proportion of research expenditures for most commodities are in reasonable balance with their relative value in total national production. Maize and groundnuts however, receive a much smaller proportion of research funds than their importance to national agriculture would suggest.

Nevertheless there can be many good reasons for the difference. For example, research questions in maize and groundnuts may be easier to handle than those in cotton or rice. Or it may be that relatively more attention is warranted for cotton and rice because of their importance to certain national goals: to earn, or save, foreign exchange, for instance, while at the same time providing better incomes to smallholders or to poorer regions. Or, perhaps cotton and rice deserve more attention because of their anticipated potential. According to FAO, the market potential for cotton and cotton products, both domestically and internationally, is excellent. For rice, the market potential is expected to remain good and there is reason to believe that sufficient land and water exists in Malawi for additional production. In view of the favorable outlook for both these crops, relatively more research investment may well be justified. Furthermore, in the case of cotton, there is no organized international research effort or pool of technology on which to draw, unlike the food crops.

Table 2

Malawi: Relative values of output, research expenditures, and market prospects

	Area (1,000 Ha)	Output (mil. MK) 1978	Output (mil. MK) 1982	Relative value of 1978 output %	1983/84 research budget %	Expand output (FAO)	Expand output (EPD/PD)	Future market prospects (FAO)
Maize	1100	85	95	37	8	Cond	Yes	Good
Rice	23	9	7	4	15	Yes	Yes	Good
Other grains		2	3	1	4			
Wheat	1.3					Yes	Yes	Good
Millet	21							
Sorghum	20							
Groundnuts	135	24	25	11	5	Yes	Yes	Ex
Grain legumes	120	8	7	4	4			
Beans, lentils	114					Yes		Good
Guar	6					Cond		Mod
Oilseeds		NA	NA	NA	<1		Yes	
Sunflower	0.3	<0.5	<0.5			Cond		Ex
Soyabeans	NA	<0.5	<0.5			Cond		Ex
Fruits, vegetables, tree crops		55	59	24	17			
Coffee	1.7					Yes	Yes	Mod
Rubber	2.5					Yes		Ex
Roots and tubers								
Cassava	83	14	15	6	5	No		Mod
Sweet potato	45	13	14					
Cotton	38	8	3	4	21	Yes	Yes	Ex
Livestock				9	7			
Dairy (milk)		6				Yes	Yes	Ex
Beef		6						
Poultry		5				Yes	Yes	Good
Eggs		1				Yes	Yes	Good
Sheep		3				Yes	Yes	Mod
Pastures					1			
Services					13			
TOTAL				100	100			

Cond = Conditional, Ex = Excellent, Mod = Moderate

Another important set of criteria in setting research priorities has to do with the expected payoff from research. What is the likely magnitude of payoff, and how soon? Answers to such questions must come largely from the combined judgment of experienced scientists. A classic example is wheat in Bangladesh. In the mid-1960's, scientists saw an opportunity to expand wheat production by introducing improved varieties, and a modest investment was made in applied research on wheat. By 1980 average yield had increased threefold as a result of new varieties and practices. And area planted to wheat expanded from about 50,000 hectares in the 1960's to 430,000 hectares by 1980. The payoff from a modest original investment in research was handsome.

Two other considerations are important in establishing national research priorities. First, the priorities for each region or agro-ecological zone must be determined. In Malawi, the priority rankings among commodities are likely to differ from one agricultural development division to another. Administrators, scientists, and policymakers must then decide on a rational allocation of research resources to satisfy the needs in an equitable way. The criteria used for national research programs may serve as a guide, although each criterion may have a different weight than it would in an analysis for the nation as a whole.

Second, scientists making up each commodity team, with participation from research administrators, must decide on priorities for research activities, or projects, within the research program for that commodity. Generally, these priorities will be approved by the chief research administrator and the commodity-team leader will be responsible for the research.

The procedure for identifying priorities in Malawi is implicit in Table 1. A great deal of staff work and analysis must be carried out and made available to the ARC to supplement members' understanding of goals and priorities. Priorities at this level probably should not be changed more often than once every few years. At least initially, the ARC will likely want to review the program priorities annually, even though changes may not result, to see whether shifts may be warranted. For this review, the ARC should be pre-

sented with the latest and best information, in a form similar to Table 2, on area for each crop, numbers of livestock, value of production by commodity, and the proportion of the DAR research expenditure currently being allocated to each commodity or group of commodities. It would also be useful to have current information on market prospects for the commodities. Since most of this information is a matter of record, it could be assembled by the secretariat to the ARC.

At least as important, but perhaps more difficult to summarize, will be the combined judgments of scientists and administrators as to the expected payoff from investments in various research programs or projects. However difficult, these judgments should be articulated and made available to the ARC. Information about farmers' problems must also be available.

A model for setting program priorities. Because funding, scientific staff, and research facilities are limited, it is desirable in the short run to focus these resources on program areas that are of highest priority. As more staff are trained and as facilities are improved, research work can be increased in other program areas.

Figure 1 is a computer printout of a simplified model, or framework, for reviewing and establishing research program priorities in Malawi. The horizontal headings include sets of criteria that parallel those noted earlier: importance of the commodity (relative value), relationship to national goals, future potential of the commodity (market and resources), and expected payoff from research.

Within figure 1, approximations of values for Malawi are shown for each criterion for each commodity, as examples of how the model may be used. Commodities were assigned to four priority groups. Commodities were placed in Priority I if they tended to be rated "high" or "excellent" on several criteria, if the value of the commodity was relatively significant, and if the expected payoff from research was judged to be large and soon, taking into account existing knowledge and the importance of problems. At the other extreme, commodities that ranked low on most criteria, with a small likelihood of payoff from research, were placed in Priority IV. Other commodities were placed in Priorities II

NATIONAL AGRICULTURAL RESEARCH PROJECT

RESEARCH PROGRAM PRIORITIES. NEAR-TERM

	RELATIVE VALUE	-----RELATIONSHIP TO NATIONAL GOALS----- GROWTH	EQUITY	FOOD SEC	TRADE	NUTRITION	--POTENTIAL-- MARKET	RESOURCES	----EXPECTED PAYOFF---- MAGNITUDE	PROBABILITY	WHEN
PRIORITY I											
MAIZE	37	HIGH	HIGH	HIGH	HIGH	MED	GOOD	SMALL	LARGE	MED	MED
GROUNDNUTS	11	HIGH	HIGH	HIGH	HIGH	HIGH	EXCELLENT	MED	LARGE	HIGH	SOON
COTTON	4	MED	HIGH	LOW	HIGH	LOW	EXCELLENT	MED	LARGE	MED	MED
DAIRY	3	MED	MED	MED	MED	HIGH	EXCELLENT	LARGE	MED	MED	MED
WHEAT	<1	LOW	MED	HIGH	HIGH	HIGH	EXCELLENT	SMALL	MED	HIGH	SOON
RICE	4	MED	MED	HIGH	HIGH	MED	GOOD	MED	MED	HIGH	SOON
BEANS/GRAIN LEGUMES	4	MED	HIGH	HIGH	LOW	HIGH	GOOD	LARGE	MED	HIGH	MED
PRIORITY II											
CASSAVA	6	LOW	HIGH	HIGH	LOW	LOW	MED	MED	MED	HIGH	SOON
OTHER OILSEEDS	<1	LOW	HIGH	HIGH	HIGH	HIGH	EXCELLENT	MED	MED	MED	MED
PASTURES.NUTRITION&HUSBNDRY		LOW	HIGH	HIGH	MED	HIGH	LOW	LARGE	MED	HIGH	MED
POULTRY	2	MED	HIGH	HIGH	MED	HIGH	GOOD	LARGE	MED	MED	MED
AGROFORESTRY		LOW	HIGH	MED	LOW	MED	GOOD	LARGE	MED	HIGH	MED
IRRIGATION		MED	MED	HIGH	HIGH	HIGH		LARGE	MED	HIGH	SOON
SHEEP	1	LOW	HIGH	MED	HIGH	HIGH	EXCELLENT	LARGE	LOW	MED	MED
TREE NUTS		MED	MED	LOW	HIGH	HIGH	EXCELLENT	LARGE	MED	MED	MED
FRUITS		MED	MED	HIGH	MED	HIGH	GOOD	MED	MED	MED	MED
VEGETABLES & SPICES		LOW	HIGH	HIGH	LOW	HIGH	MED	MED	MED	MED	MED
COFFEE		LOW	MED	LOW	HIGH	LOW	MED	SMALL	MED	MED	MED
SORGHUM/MILLET		MED	HIGH	HIGH	LOW	MED	MED	MED	HIGH	HIGH	MED
SOIL & WATER MANAGEMENT		MED	HIGH	HIGH				LARGE	HIGH	HIGH	MED
MECHANIZATION. CROP STORAGE								MED	MED	MED	
PRIORITY III											
BEEF BREEDING	3	LOW	MED	MED	LOW	HIGH	MED /GOOD	LARGE	MED	LOW	DISTANT
PIGS	<1	LOW	MED	LOW	LOW	HIGH	GOOD	MED	LOW	MED	MED
GOATS	1	LOW	MED	MED	LOW	HIGH	MED	LARGE	LOW	LOW	MED
RABBITS	<1	LOW	HIGH	HIGH	LOW	HIGH	MED	MED	LOW	MED	MED
RUBBER		LOW	LOW	LOW	MED	LOW	EXCELLENT	SMALL	LOW	MED	UNKNOWN
SWEET POTATO		LOW	HIGH	HIGH	LOW	MED	POOR	MED	MED	MED	MED
IRISH POTATO		LOW	MED	HIGH	LOW	MED	MED	MED	MED	MED	MED
PRIORITY IV											
TUNG		LOW	LOW	LOW	MED	LOW	POOR		LOW	LOW	
OTHER FIBRES	LOW	LOW	MED	LOW	LOW	LOW	POOR		LOW	LOW	DISTANT
TOTAL	100%										

or III, depending on the preponderance of high, medium, or low values.

To some extent, the values attached to each criterion are subjective. The least precise are probably the estimates under "expected payoff." But, however subjective, the total profile of measures gives relative priorities. (The order in which commodities or problem areas are listed within each priority set in figure 1 is not intended to suggest priority rankings within a set.)

Because of the judgments used in formulating such priorities, it is well to have a group of persons who are knowledgeable about national goals, agricultural resources, and prices—perhaps economists in the planning unit—arrive at consensus on values for those criteria. In Malawi, this task might be coordinated by the research economist in the ARC secretariat. The council would then decide which commodities would be placed in each priority set.

In the near term, this implies that the commodity groups in Priority I should receive a substantially greater proportion of the research effort. Spreading the research resources too thinly over the entire spectrum of commodities and problem areas would likely result in less achievement than the suggested concentration.

This strategy puts a heavy responsibility on the commodity teams in Priority I to solve problems and to deliver improved technology. It also implies that senior personnel and support services would give extra attention to these commodity teams. The challenge to all concerned is to sharpen the definition of problems and opportunities for individual commodities and, in effect, to set priorities for near-term activities within each program. Such concerted attention enhances the chance of achievement.

The above is not to imply that work on lower priority program areas should necessarily slow down. Indeed, in some of the Priority II and III programs, an increase in activity in the near term may be indicated. Or, more likely, shifts in activities within a program area may be called for.

Priority IV includes commodity programs which, while they should not be ignored, probably do not warrant substantial research attention unless the market potential

Fig. 1. ***(facing)*** **A computer printout of research priorities in Malawi based on simplified criteria.**

changes or for some other reason the probability of payoff is enhanced.

Through time, as additional staff are trained and take up research positions, and as facilities are strengthened, some of the programs may be moved into a higher priority so that they receive relatively more attention and support. Other programs may be moved to lower priority. This indicates once again that priorities will need to be reviewed periodically in light of changes in research resources, national goals, market prospects, and farmers' problems.

Establishing priorities within research programs. Once program priorities are defined, it is at least as important to identify priorities for research activities within programs. First, the objectives of the research program must be clearly stated. Then, alternative approaches to achieving the objectives should be considered. Finally, from among all the possible activities to achieve the objectives, the one most likely to be cost effective and most likely to achieve the desired objectives should be selected.

To take Malawi's maize program as an example, the list of objectives for the research program might include:

- to increase yield per unit area without lowering palatability or grain quality (including ability to store with minimal losses due to insects)
- to identify improved combinations of crops to interplant with maize to supply the needs of smallholders
- to develop (or identify) alternative means of processing maize for home use that would be compatible with higher yielding, soft endosperm maize and that would be acceptable to villagers (in Malawi, villagers have been slow to take up new varieties of maize, even though substantially higher yielding, because they are more difficult to process into meal by hand pounding)
- to identify improved sets of agronomic practices (time and rates of seeding, spacing, weeding, fertilizer applications, etc.) that suit the needs of smallholders

Alternative approaches to achieving the objectives might include:

- maize breeding, either hybrid or open pollinated, or both

- screening of germplasm from both within and outside Malawi, possibly to include open-pollinated, composite, and hybrid lines
- testing of intercropping and relay cropping combinations
- testing of combinations of agronomic practices
- designing and developing improved village processing systems
- identifying and importing from outside Malawi a range of maize processing equipment that could be tested for local applicability, in the hope of finding one or more that would be acceptable and cost effective

From this partial listing of approaches, it is apparent that the possibilities quickly exceed the available resources—financial and scientific—and that the range of possibilities must be narrowed; priorities have to be established. This example also points out the need for collaboration among teams of researchers: the maize team must work with the grain-legume team on intercropping, for instance, and with the small-scale technology or food-processing team.

All of this requires an immense amount of planning, but it is probably the most important part of research. If the planning is done carefully, and priorities of research activities are carefully established from among the almost infinite number of possibilities, then the budgeting process and the execution of the research program will be relatively easy, and the payoff should be high. The responsibility lies with the commodity coordinators, the national research coordinators, and administrators to ensure that planning is an integral part of research.

One principle is worth emphasizing: For a small country, the payoff will normally be both greater and quicker from screening selections of existing technology or germplasm than from developing or breeding new ones.—*Leon F. Hesser*

IADS in 1983

(facing) Workers in Nepal clean seed with a locally built machine.

Potentially the most significant event of the year for IADS was steps taken toward a merger with two other organizations to form a single entity dedicated to world agriculture. In addition, during 1983, IADS continued the task of settling into its new location in the Washington, D.C. area and took further steps in the reorganization started in 1982 when it moved from New York.

The Prospective Merger

At its annual meeting in November, the IADS Board of Trustees approved in principle the merger of IADS with Winrock International and the Agricultural Development Council (ADC). Similar actions have been taken by the other two prospective partners.

Although informal discussions had taken place earlier, in May the three boards of trustees agreed to develop a prospectus for the proposed new organization. The draft proposal that emerged was the basis for the trustees' approval. The merged organization, as envisioned, can be more than the sum of the three existing ones. It will have a broader

Consultants arranged through IADS in 1983

Bangladesh
Anderson, Jock, *project review*
Barton, Donald, *research planning*
Bernardo, Fernando, *research planning*
Breth, Steven A., *publication preparation*
Bridges, Kent, *project review*
Byrnes, F.C., *training*
Daunys, Alexander, *financial management*
Fitts, J.W., *soils*
Hanratty, Martin, *economic analyses*
Harsh, Stephen, *computer systems*
Hesser, Leon F., *research review*
Howes, Richard, *irrigation*
Hunt, Joseph, *food policy*
Johnson, Lloyd, *irrigation*
Johnson, Duane Lee, *water management*
Levine, Gilbert, *water management*
McCarthy, Florence, *water management*
Oad, Ramchand, *water management*
Pearce, Stanley, *statistics*
Pray, Carl, *research evaluation*
Preston, T. R., *livestock*
Radosevich, George, *water law*
Rosentel, Edward C., *accounting*
Wallace, Ben, *anthropology*
Walter, Michael, *water management*

Dominican Republic
Byrnes, F.C., *organization development*
Flora, Cornelia, *organizational planning*

Egypt
Firebaugh, Francille, *research planning*
Haynes, George, *livestock*
Jensen, Merle, *horticulture*
Krezdorn, Alfred H., *research review*
McConnen, Richard, *livestock*
Moseman, Albert, *research planning*
O'Rourke, A. Desmond, *horticulture*
Preston, Rodney, *livestock*
Russell, M.B., *research planning*
Turk, Kenneth L., *research planning*
York, E.T., *research planning*

Honduras
Maner, Jerome, *swine*

Indonesia
Buyckx, E.J., *cotton pests*

continued

program, greater financial resources, and a stronger influence on critical development issues.

The prospective merger partners have considerable commonality of interests and operating philosophies. All are involved in selecting and training people and helping them to become productively engaged in their societies; all are concerned with raising the quality and productivity of agricultural research; all seek to improve understanding of critical food and agricultural issues. And, there are considerable complementarities in the scientific strengths of the three organizations: IADS in crop and soil sciences, ADC in social sciences, and Winrock in animal science.

ADC is known for its work with social scientists in Asia through support for research, dissemination of research findings and teaching materials, organizing and assisting networks of teachers and analysts, the convening of seminars, and the provision of fellowships to young researchers. Winrock International conducts programs of research, training, and technical assistance with particular emphasis on animal agriculture. Its activities are grouped into three broad and interdependent programs: international, U.S., and public policy.

The proposed merger would create a new, publicly supported, nonprofit organization with an endowment that would permit the undertaking of activities not now possible for the individual organizations. The merged organization, which would be named "Winrock International Institute for Agricultural Development," would include program themes of human capital development, the improvement of animal agriculture and farming systems, agricultural research systems development and management, renewable resource use, and food policy analysis and strategies. The institute's contributions would be through research and analysis, education and training, technical assistance, information services, and mobilization of resources.

The two prospective partners of IADS are both private, nonprofit organizations. ADC was established in 1953 with the support of John D. Rockefeller, III, to stimulate and support economic training and analysis related to human welfare in Asia. It receives its support from grants, special projects, and earnings on its limited reserve fund.

Winrock was founded in 1975 in response to the wishes of the late Winthrop Rockefeller, former governor of Arkansas. Committed to long-term development in agricultural production, human, economic, and institutional potential, Winrock underwrites a portion of its work from its unrestricted (endowment) income and supports the balance through cost-reimbursable contracts, grants, and fees.

Following the completion of the merger, the high level of activities in ongoing IADS programs will continue and all obligations to individuals and the countries in which they work will be met.

Relocation and Reorganization

The decision to move the IADS headquarters from New York to the Washington D.C. area in 1982 has proven to be eminently sound. IADS has found Washington to be an effective base of operations that allows for the development of an efficient staff and system of operation. Close proximity to the headquarters of several major donors affords frequent opportunity to talk informally with key administrators. In addition it is easy to meet with field officers of these organizations when they visit their home offices. Although most of the specifics of contractual arrangements are worked out in host countries themselves, Washington is a secondary site for such negotiations. Over a year's time, literally hundreds of development specialists who were in Washington on other matters paid visits to IADS. No place in the world has as many people who are keenly interested in development questions as Washington, D.C.

The IADS headquarter's offices in Rosslyn, Virginia, across the Potomac River from Washington, D.C. are exceptionally well suited to present operations. IADS has sufficient space at present and the opportunity to gain additional space if needed.

New and Ongoing Programs

Country program activities, both short- and long-term, continued to accelerate during 1983. Programs that had been agreed upon and initiated earlier were operating at es-

Consultants, *continued*

Byrnes, F.C., *agriculture education*
Carpena, A.L., *plant breeding*
Chong, Kee-Chai, *fisheries*
Delavier, Hans J., *sugar research*
Etheredge, Robert, *agricultural education*
Gonsalves, Dennis, *citrus*
Hechanova, Ricardo, *experimental ponds*
Hernandez, Teme P., *vegetables*
Jones, Keith R., *cotton*
Jones, Jr., J.B., *laboratory equipment*
Kirtisingh, D., *tea*
Marvin, E. Paul, *agriculture education*
Maxwell, Robert H., *agriculture education*
Miller, Alwin, *manpower planning*
Neeley, Douglas, *biometrics*
Nichols, Fred E., *farm equipment*
Scholz, Ulrich, *agriculture planning*
Sison, O.F., *agriculture teaching*
Traywick, Jack D., *irrigation*
Whitmore, Timothy, *forestry*
Yamanishi, Tei, *tea*
York, E.T., *agricultural education*

Malaysia
Cushing, Robert, *research review*
McClymont, Gordon, *research review*

Morocco
Antoine, Pierre, *research evaluation*

Nepal
Brewbaker, James L., *forestry*
Douglas, Johnson, *seed programs*
Finfrock, Dwight, *station development*
Freeman, Wayne, *research planning*
Kaplan, Paul, *economics*
Koirala, Dharma N., *evaluation*
Neeley, Douglas, *biometrics*
Plusje, J.M.G.A., *irrigation*

Pakistan
Bolo, Inocencio, *research review*
Freeman, Wayne *research review*

Panama
Fridlind, Ron, *research review*
Laird, Reggie, *research review*
Maner, Jerome, *research planning*
Rigney, Jackson, *research review*
Venezian, Eduardo, *research review*

continued

Consultants, *continued*

Peru
Gomez, Gustavo, *policy and planning*
MacVicar, Robert, *agriculture planning*
McDermott, J.K., *policy and planning*

Philippines
Barker, Randolph, *research planning*

Southern Africa
Baird, Guy B., *research planning*
Kyomo, Martin, *research planning*
Martinez, Eugenio, *research planning*
Mughogho, Lewis, *research planning*
Robinson, J.B.D., *research planning*

Sri Lanka
Baird, Guy B., *agriculture planning*
Crowder, Loy V., *research planning*

Swaziland
Downs, Richard E., *irrigation economics*

Zaire
Antoine, Pierre, *agriculture planning*

IADS Services to USAID

Objectives: To provide the U.S. Agency for International Development with short-term advisory services in agricultural development, including the fields of agricultural economics/sector planning, crop production, soil management and irrigation, fisheries/aquaculture, livestock, agribusiness, development of institutional services, and appropriate technology.

Magnitude: The 2-year contract was effective from September 1982 to December 1983 and permitted USAID to call on IADS for up to $350,000 of services in each year.

Basis: An Indefinite Quantity Contract between USAID and IADS.

sentially the anticipated level of effort. Monthly expenditure levels in 1983 were about 50 percent above those of corresponding months in 1982. By contrast, the level of indirect activities, which are largely grant funded, was reduced. The category of activity classified as "liaison," which basically consists of establishing and maintaining links and collaborative relationships, approximates its former level except that special activities, such as conferences, were undertaken only when special funding was available.

Among the various activities were several that tended to break new ground for IADS. Notable among these was one in Indonesia dealing with agricultural education. Under contract with the Asian Development Bank, an eight-person IADS team made a study of vocational agriculture education and training in Indonesia and prepared a detailed project paper for the expansion and improvement in the quality of agricultural education at secondary and post-secondary (polytechnic) schools and universities under the Ministry of Education and Culture.

In Indonesia, as in many developing countries, one of the greatest constraints to achievement of agricultural development goals is the shortage of well-trained agricultural technicians.

The proposed project, to be carried out by the government of Indonesia and partially funded by a loan from the Asian Development Bank, will increase and improve the vocational agriculture schools. It also will equip Indonesia to train higher level agricultural technicians than those being graduated from the secondary schools. This will be achieved through the development of agricultural polytechnic programs in association with faculties of agriculture at six universities.

The following pages give some specifics on this and other current programs.

BANGLADESH

In 1983, the Bangladesh Agricultural Research Council (BARC) celebrated its tenth year as the leadership and coordinating agency for the national agricultural research system. Today it is one of the best-equipped agricultural re-

search systems in the developing world. Since 1979 IADS has worked with BARC, supplying resident specialists, consultants, and other services.

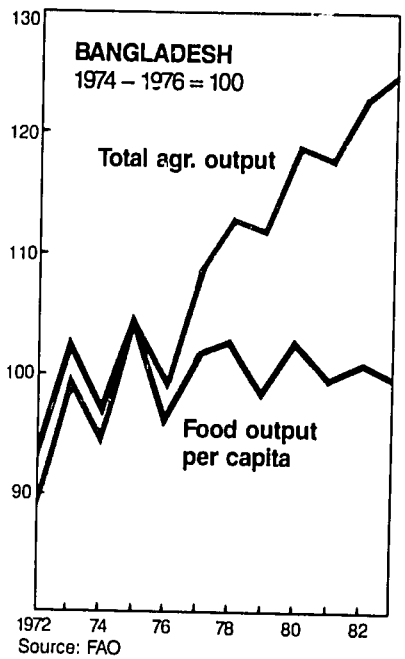
Since the founding of BARC, a major effort has been made to reorganize and integrate the numerous research activities that were scattered among various ministries. The dispersal of research units caused duplication of effort and a disunified research policy. Now the government has brought nearly all research organizations into the Ministry of Agriculture and placed them within the BARC constituent group.

The research program in Bangladesh is closely tied to national goals as defined in the Second Five-Year Plan. Food self-sufficiency is a top priority, along with raising export earnings from agricultural products and improving the livelihoods of rural people who make up about 90 percent of the country's population. This means maintaining a research system that can solve the problems of the small farmers and establishing means to transfer the new technology quickly and efficiently from the researchers to the farmers.

IADS's activity in Bangladesh is funded by the U.S. Agency for International Development. IADS also aids other donors, such as the World Bank and the Canadian International Development Agency, by helping in administering several of their grants to the Bangladesh agricultural research system.

The IADS team in Bangladesh grew to 19 persons during 1983. David M. Daugherty became the project supervisor/adviser in January. Others joining the project in 1983 were Theodore Hutchcroft, information specialist; Carlos Garces, agricultural engineer; Dale Krigsvold, plant pathologist; Edward Loomis, horticultural specialist; Hugh Henderson, livestock specialist; and Harvey Carr, maintenance specialist. Ending their assignments during the year were Murray Dawson, project supervisor; Raphael Semmes, administrative specialist; Robert Drew, associate production agronomist; and Jan Gerards, water management specialist.

The IADS project covers nine program areas, each supporting an important element of Bangladesh's research activity. Technical assistance is provided in crops (including



Source: FAO

Farmers in Bangladesh using a traditional water-lifting device to irrigate their fields.

agronomy and horticulture), economics and social science, livestock, soil management, water management, and pest control. Research in these areas has direct application, as well as being utilized in farming systems research, another program area. All these groupings are supported by other specialists in the program areas of research systems management and technical support (including farm development, equipment maintenance, training, and communication). The IADS contract has funds for supporting research projects in different program categories. IADS specialists participate in developing and evaluating the research projects.

A four-person external evaluation team conducted a mid-term review of the 5-year project. The report commended the national agricultural research system, and the work of IADS, while at the same time making several recommendations for improving the project and its implementation.

BARC prepared the National Agricultural Research Plan for 1984-1988. This is the second national 5-year plan prepared by BARC. It will provide a focus for coordinating research resources to meet national needs. Dozens of Bangladeshi scientists and administrators contributed to developing the plan, assisted by IADS specialists and consultants.

The commemoration of BARC's tenth anniversary was an opportunity to call attention to the many benefits resulting from the nation's investment in agricultural research. A 200-page book, *Agricultural Research in Bangladesh*, was compiled featuring articles describing research achievements in 24 categories. The book was released during the National Symposium on Agricultural Research, the major anniversary observance. In addition to distinguished guests, the symposium was attended by some 300 agricultural scientists who presented over 85 technical papers on 11 research topics. It was an opportunity for the researchers to exchange ideas with their colleagues from different institutions and disciplines.

BARC has initiated several other activities to bring scientists into a closer working relationship. A newsletter,

IADS services to Bangladesh

National agricultural research

Objectives: Under the phase II contract, IADS is helping the Bangladesh Agricultural Research Council increase the effectiveness of the national agricultural research system in developing appropriate agricultural technologies by raising capabilities for on-farm research, by strengthening research in selected disciplinary and multidisciplinary programs, by improving coordination of research among institutions, and by improving links with nonresearch agencies. The phase I contract, which IADS held, was completed in 1981.

Magnitude: The contract, effective July 1981, is for 5 years. It provides for up to 20 resident specialists for terms of up to 5 years, training of 84 individuals in both degree and nondegree programs, and procurement of research and laboratory equipment. The estimated cost of the phase II contract is US$21.8 million.

Basis: Contract between the People's Republic of Bangladesh and IADS.

Funds: USAID grant to Bangladesh.

David M. Daugherty, *project supervisor*

Potato specialist

Objectives: Under a separate contract, and in collaboration with the International Potato Center, IADS provides a potato specialist to work with the Bangladesh Agricultural Research Institute in research and training.

Magnitude: The term of the potato specialist began in July 1982 and will end June 1985. This specialist has worked with IADS in Bangladesh, under a prior contract, since April 1980. The total value of the contract is $692,000.

Basis: Contract between the People's Republic of Bangladesh and IADS.

Funds: Australian government grant to Bangladesh.

AgResearch News, was launched. It is designed to keep scientists better informed on activities and achievements within the agricultural research system.

The national coordinated cropping systems program, a special emphasis of the research network, sponsored the first national cropping systems workshop. It brought together researchers from a half-dozen institutions to report on their work to develop improved farming systems for Bangladeshi farmers.

An anthropologist, Ben Wallace, spent 6 months studying the conditions that influence farmers' adoption of new technology, including such constraints as tenure, availability of water and other inputs, and rural employment opportunities.

The IADS agronomists assigned to the four regional research stations of the Bangladesh Agricultural Research Institute have given special impetus to organizing field days and other demonstration events for transferring new technology to farmers.

The economic and social sciences work of IADS has emphasized studies on farming systems, such as the economics of fertilizer efficiency. Training materials have been developed and courses have been given to improve the ability of cropping systems site researchers to collect and analyze their data.

New equipment for research laboratories, experimental plots and administration has been made available in the project to upgrade the Bangladesh research capability. IADS was instrumental in planning a central soils laboratory with greenhouse and arranging for procurement of equipment. New journal subscriptions are improving the ability of research libraries to serve scientists. New motorcycles and motorscooters are making it possible for field researchers to visit their experiments and make contact with the nearby farmers more frequently. IADS is providing training in maintenance and servicing so equipment will be in proper working condition when needed by researchers.

The water management activity has expanded in BARC. Training has been a top priority. Several consultants came to Bangladesh to review and advise on irrigation and water management research. A significant portion of the

contract research funding is committed to water management research.

A major advance in BARC training work was the development of a formal procedure for selecting participants based on objective criteria and a weighted rating scale for selection. It was employed in choosing 48 persons for degree studies in Bangladesh and abroad. A *Handbook for Research Manpower Development* was published to orient Bangladeshi researchers to the new system.

IADS administers the potato research and development project which operates with funding by Australia and technical support by the International Potato Center. The potato has become increasingly popular in Bangladesh and may soon be one of the staples of the national diet.

Significant progress has been made in growing potatoes from true potato seed rather than tubers, which greatly reduces disease problems in production. Research in nonrefrigerated storage has led to the design of simple on-farm structures that allow potatoes to be stored for as long as 6 months after harvest. This means farmers can greatly extend their marketing period, and the food is available to consumers over a longer period. The new technology is being disseminated to farmers through extensionists and primary school teachers, over 800 of whom attended 11 courses in potato production and consumption. Other courses in post-harvest technology and in potato seed production in tropical climates are being conducted.

BOTSWANA

Low and erratic rainfall in the first half of the 1983/84 season suggests that the 2-year-old drought will continue. The strains are now fully felt in agriculture and by the rural population. In one of the farming systems research areas, cattle mortality during last winter's dry season amounted to 45 percent.

Based on study of the cyclicity of annual rainfall in Botswana, researchers had predicted that the 1980's would be a period with below average rainfall. This is perhaps the first time in history that drought is being experienced against

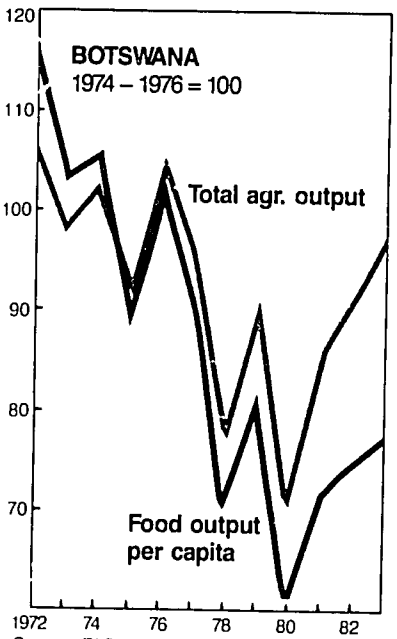
IADS services to Botswana

Objectives: To assist the government of Botswana in furnishing leadership to the agricultural research organization. In this unique arrangement, the Norwegian Agency for International Development (NORAD) provides the services of the director of agricultural research for the Botswana Ministry of Agriculture. At the same time, the director is an IADS representative, and IADS furnishes him with supporting services and a small amount of discretionary funds used to support research in Botswana.

Magnitude: NORAD has posted the director of agricultural research for approximately 5 years. IADS provides a small contingency fund in addition to support activities by the IADS headquarters staff.

Basis: The government of Botswana and IADS agreed to cooperate with this project through personal visits and exchange of letters.

Kristian Oland, *representative*

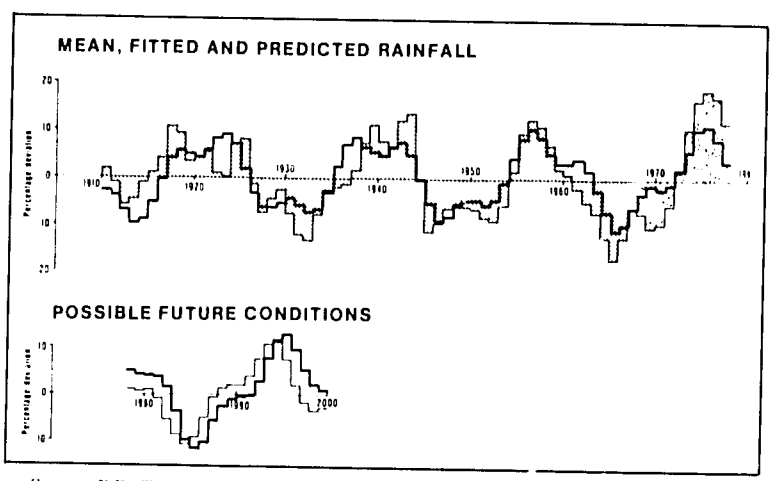


Source: FAO

this type of background knowledge. As the certainty of the cyclic rainfall pattern increases, the scope for application of research data is being considerably broadened.

With average cereal yields below 300 kg/ha, Botswana is a textbook situation in which the only research recommendations that have any chance of being adopted by the farmers are those that seem likely to give a several-fold increase. Such a recommendation is now at hand. The practice of broadcasting seed on untilled land followed by plowing must bear a major blame for the low yields. Row planting in one way or another will substantially increase yields. It is thought to be effective because it facilitates timeliness of planting relative to moisture availability, makes adequate weeding easier, increases plant population and improves the conditions for control of plant population, and encourages appropriate tillage practices because tillage is no longer linked to seeding.

Botswana is a member of Southern African Development Co-ordination Conference (SADCC), a grouping of nine countries committed to cooperation. Botswana was given the responsiblity for coordination of regional cooperation in agricultural research. Decentralized regional agricultural research is the overall design used in the development of cooperation.



Source: P.D. Tyson. Southern African rainfall: Past, present and future. In *Symposium on Drought in Botswana*. Worcester, Mass.: Clark University Press, 1979.

The 10-year cycle of above-average and below-average rainfall in eastern Botswana. The shaded area shows the smoothed regional rainfall series for 1910-67 and the solid line is the fitted curve extrapolated to 1977. Also, shown is a comparison of predicted and observed rainfall for 1968-77 and an estimate of the 1978-2000 rainfall pattern.

In outline, regional research will initially have the following elements:

- Southern African Center for Co-operation in Agricultural Research (SACCAR), in Botswana, with a staff of three professionals. Main responsibilities will be keeping an inventory of research activities in SADCC countries and being a secretariat for research cooperation, dissemination of research results through publication of a journal, research reviews, etc., and assisting young SADCC researchers in career development
- a regional sorghum and pearl millet improvement and training program in Zimbabwe
- a grain legume improvement program in Malawi
- a land and water management research program in Botswana

The two commodity programs and the land and water management program are all being designed to have sufficient professional staff for effective coverage of a reasonable set of program objectives.

DOMINICAN REPUBLIC

The 3-year contract with IADS for consultation and technical assistance to Plan Sierra was completed in 1983. Under the contract, IADS provided consultant services in organizational and leadership development for this integrated rural development project in mountainous areas of the country.

ECUADOR

The IADS contract with the national research agency, INIAP, was completed. From 1979 to 1983, IADS supplied resident specialists and short-term consultants to help improve national research on food legumes, fruit, poultry, and rice programs. This project was supported in part by a loan from the Inter-American Development Bank.

IADS services to the Dominican Republic

Objectives: To assist the management and staff of Plan Sierra in organizational development, training, and related activities. Plan Sierra, an area development program in a mountainous central region of the Dominican Republic, brings together the government agencies working on health, agriculture, and education. It is administered by the Secretariat of State for Agriculture.

Magnitude: IADS provided up to 30 days of consultant services a year beginning in 1980 and ending in 1983, at an actual cost of US$14,000.

Basis: Contract between the Dominican Republic and IADS.

IADS services to Ecuador

Objectives: To assist INIAP, the national agricultural research institute, in strengthening its research programs in food legumes, rice, fruit, and poultry, and to assist the government of Ecuador in a regional project in the Guayas River Basin where rice is the principal crop.

Magnitude: Under the 3.5-year research contract with INIAP, amounting to US$2.6 million, IADS provided 22 person-years of services by specialists in residence and as consultants since May 1979. The contract was completed in February 1983. IADS personnel had worked in Ecuador since 1976 under previous agreements.

Basis: A contract with INIAP for technical assistance.

Funds: Inter-American Development Bank loan to INIAP for contract technical assistance.

Gustavo Morales, *project supervisor*

IADS services to Egypt

Objectives: To outline strategies for accelerating agricultural development; to assist the Agricultural Economics Research Institute in analyzing agricultural policy issues and, in the process, to strengthen the analytical capacity of AERI.

Magnitude: A contract with the Ministry of Agriculture, Arab Republic of Egypt, amounting to $651,168, calls for 60 months of short-term consultants' time over a 3-year period, beginning June 1982.

Basis: A contract between the Ministry of Agriculture, Arab Republic of Egypt, and IADS.

Funds: U.S. Agency for International Development grant to the Arab Republic of Egypt.

Leon F. Hesser, *coordinator*

Egypt agricultural research team

Francille Firebaugh, *Ohio State Univeristy*
Alfred H. Krezdorn, *University of Florida*
Albert H. Moseman, *IADS*
M. B. Russell, *private consultant*
Kenneth L. Turk, *Cornell University*
E. T. York, *University of Florida*

EGYPT

Under a 3-year contract with the government of Egypt, IADS is helping the Agricultural Economics Research Institute of the Ministry of Agriculture to strengthen its analytical capacity. Under a subcontract with IADS, Gotsch Associates, Inc., assists in assembling teams of economists and agricultural scientists, and helps carry out the analyses. As part of this work during 1983, IADS provided a two-man team to identify and analyze policy issues related to the potential for increasing exports of horticultural products to Arab markets. The study was particularly concerned with road transport.

In a related marketing study, a three-man team examined the economics of providing fresh red meat to Egyptian markets. The team, which consisted of an animal nutritionist, a junior livestock economist, and a senior livestock economist, studied the economics of feeding, feedlot management, and nutrition; it developed computer models with which Egyptian analysts will be able to do further analyses; and it prepared a report on the models and the analysis.

* * *

For USAID, IADS provided a six-person team that surveyed the Egyptian agricultural research system to determine specific needs and to suggest ways to make the scarce resources invested in research more responsive to the circumstances of farmers. The team was responsible for making practical inventory, developing recommendations, and formulating a national research plan.

The team studied Egypt's entire agricultural research effort with specific reference to high value crops. The team recommended ways the existing research establishment could best develop integrated working relations among the agricultural research stations of the Ministry of Agriculture, the institutes of the Agricultural Research Center, and the 13 agricultural faculties of Egyptian universities.

HONDURAS

For USAID, an IADS program officer spent 4 months in Honduras to develop a strategy for small farmer swine

production in the San Pedro Sula region. This work was in support of a project paper for a small farmer livestock development project, which had dairy, beef, and pig production components. Four weeks were spent studying the production-marketing-consumption chain for pork at both the commercial and small farmer levels and a report detailing feeding, management, and breeding techniques and strategies for increasing production and productivity for 1- to 10-sow units was prepared.

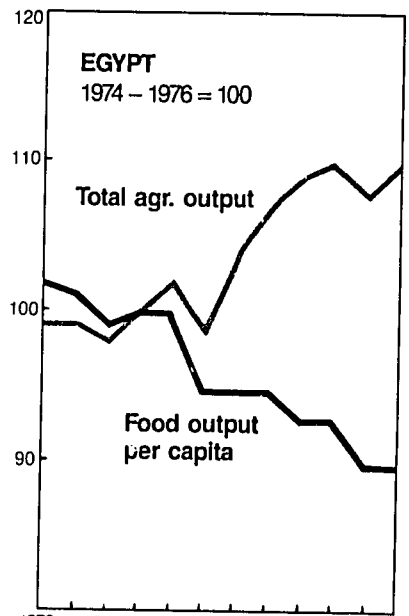
INDONESIA

During 1983, the final year of Indonesia's third 5-year development plan, rice production reached about 23.5 million metric tons, 15 percent above the third plan target, despite a continued drought. With current rice stocks some 2 million tons in excess of domestic consumption needs, it is expected that progress toward the fourth plan rice production target of 28.6 million tons by 1988/89 will be sustained. Under the fourth plan, which starts in 1984, emphasis on maize, cassava, sweet potatoes, legumes, and horticultural and estate crops will increase in order to foster an integrated agricultural production system. The plan's major objectives are to improve nutrition domestically, increase farmers' incomes, provide agricultural raw materials for domestic industries, generate gainful employment opportunities, and improve foreign currency earnings, all within a comprehensive framework of natural resources and environment utilization and conservation.

National agricultural research

IADS provides technical assistance and training support to Indonesia under the National Agricultural Research Project (NAR-II) through the Agency for Agricultural Research and Development.

Several organizational changes in the Agency for Agricultural Research and Development (AARD) took place during 1983, in line with the national development plans. Presidential Decree no. 24 created the Central Research Institute for Horticultural Crops to include the already established



Source: FAO

IADS services to Indonesia

National agricultural research

Objectives: The services provided to the Agency for Agricultural Research and Development (AARD) by IADS during Phase II of the National Agricultural Research contract include technical assistance and administration of overseas training for AARD staff. Technical assistance involves a set of priority research activities concerned with agricultural economics, estate and industrial crops, vegetables and fruits, forestry, fisheries, and support for transmigration. Also, IADS assists in strengthening research management, information services, civil works, and the institutional framework. Under phase I, completed in 1982, IADS provided AARD with technical assistance and services to improve national production-oriented programs of research on rubber, vegetables, and agricultural economics. IADS also helped with overseas and in-country training.

Magnitude: The Phase I contract at a cost of US$5.0 million provided 39 person years of specialist services from February 1977 through July 1982. The estimated cost of the Phase II contract is $13.5 million in foreign currency and $1.7 million in local currency. The contract is for 5 years effective August 1982 and provides for 58 person-years of long-term specialists and consultants, training of 70 persons at the Ph.D. level and 50 persons at the M.S. level, and provides nondegree training for 75 persons.

Basis: Contract between Republic of Indonesia and IADS; subcontract between IADS and Cornell University.

Funds: World Bank loan to Indonesia and local currency from government of Indonesia.

William Young, *project specialist.*

Research in Sumatra

Objective: To help the Sukarami Research Institute for Food Crops develop

continued

National Vegetable Research Institute in West Java and made provision for a National Fruit Research Institute in West Sumatra. The decree also combined the Center for Research Programming with the AARD secretariat, moved agricultural quarantine under the Office of the Minister, and transferred forestry research and development to a new and separate ministry. The agriculture ministry is now making further adjustments within the AARD structure to increase efficiency and more clearly define the national mandates of its 28 major research centers and institutes and their research programs.

AARD intensified research management training activity for its institute directors, many of whom recently completed Ph.D. studies under the NAR-I Project, by organizing week-long training programs in Bali and South Sulawesi. At the sessions, presentations were made by specialists from abroad and the directors of various institutes, followed by extensive discussion. Also, to orient 31 scientists who have recently received Ph.D. or M.S. degrees, a training program was held during November in Bali. Each scientist prepared a project proposal in advance, which was presented and discussed in small groups and in a plenary session that included participation of senior researchers.

The year end marked the completion of the first 15 months cooperative AARD-IADS training and technical assistance activity under NAR-II. During this period, 51 person-months of overseas short-term training were completed. In addition, there were 19 master's and 46 doctoral candidates from the AARD staff studying abroad, while 6 master's and 8 Ph.D. degrees already had been completed under NAR-II. Overall, AARD had 78 Ph.D.'s and 283 master's degree holders in active staff positions in October 1983 compared with 27 Ph.D.'s and 44 M.S. degree holders 4 years earlier. The English for Agricultural Training classes were continued for selected AARD staff before their departure for overseas degree training.

In technical assistance, 14 short-term consultancies to AARD were arranged during the year, including specialists in sugar technology, research institute management, vegetable and wheat breeding, cotton entomology and seed technology, aquaculture engineering and economics, forest

botany, plant virology, and laboratory and field equipment procurement.

New long-term specialists were Ralph H. Retzlaff, as training coordinator; David G. Hill, as scientific information specialist; and Saul E. Camacho B., as tropical fruit specialist. A.C. Nebab completed his assignment as procurement specialist.

Agricultural research in Sumatra

The low population density of Sumatra combined with a high year-around rainfall provides vast opportunities to bring new lands into cultivation since only a small fraction of the land area is under crops. For this reason, the government has promoted the transmigration of poor, landless farmers from the overpopulated islands of Java, Bali, and Madura to the outer islands, especially Sumatra.

Despite Sumatra's generally favorable rainfall and temperatures, crop growth yields can be greatly increased through more effective plant protection and multiple cropping (two or more crops per year). Transmigration areas are largely confined to the fertility-depleted, red-yellow podsolic soils of the central plains where annual food crops often yield poorly because of nutrient and moisture deficiencies and elemental toxicities, especially aluminum, in addition to pest attack and weed problems. Hence there is an urgent need for an active food crops research network in Sumatra.

The Sumatra Agricultural Research Project (SARP) is supported by USAID and executed through a contract between the Indonesian government and IADS for technical assistance and manpower training. It aims to develop a cohesive network of experiment stations devoted to the improvement of food crops throughout Sumatra with the Sukarami Research Institute for Food Crops (SARIF) as the central station. The original contract signed in 1979 ran to 1984, but early progress was slow owing to several startup problems. Therefore, the government has requested an extension to April 1986 to allow the SARP to achieve its revised goals.

IADS services to Indonesia
continued

nine research stations and strengthen research in important food-crop production zones of Sumatra. Also IADS administers training of Indonesian scientists.

Magnitude: A US$2.98 million contract, as amended in 1984, provides 25.5 person-years of professional assistance from October 1979 through April 1986 and 29 person-months of consultant services. Fellowships for study in Indonesia and abroad plus nondegree training and conferences will cost an additional $0.5 million.

Basis: Contract between the Republic of Indonesia and IADS.

Funds: USAID grant and loan to the Republic of Indonesia; local currency from the government of Indonesia.

Kenneth O. Rachie, *project specialist*

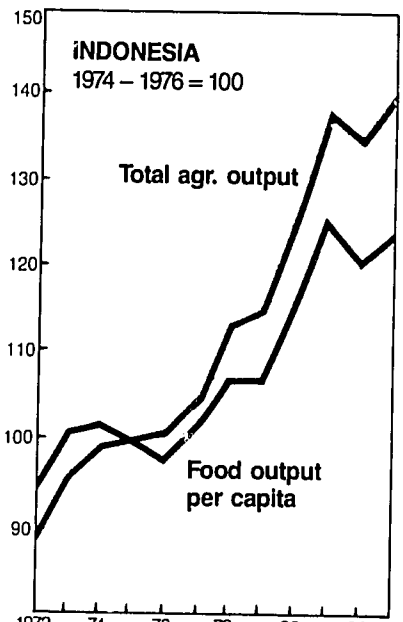
Three-tier cropping in Indonesia: soybeans under papaya trees and coconut trees.

The project extension proposal, approved at the national level, has modified construction plans for seven stations (rather than the original eight) and transferred all long-term overseas training to the National Agricultural Research-II Project, supported by the World Bank. Short-term overseas training has been increased by about 100 person-months, and short-term consultancies from 24 to 29 person-months. It also involves an increase of resident technical assistance from the original 22 person-years to 25 person-years.

Experiment station development. Recent organizational changes in the AARD's Central Research Institute for Food Crops (CRIFC) has involved the transfer of the two high elevation fruit and vegetable crops stations to the Central Research Institute for Horticultural Crops and deferral of the development of another station. This action reduces the number of SARIF stations to nine and allows more effective focus on annual staple food crops. Considerable progress was made on construction at the Sukarami headquarters, and several other sites.

The USAID loan has made it possible to procure urgently needed equipment and vehicles for the nine-station network. The first foreign order, including 13 tractors, was partially cleared through customs by the end of the year. Portions of the second order including a large amount of laboratory and research equipment have been shipped and will arrive early in 1984. The availability of tractors, hand tools, and instruments will expedite research activities, which have been seriously hampered by lack of equipment.

Training. In addition to the SARP contract funds allocated to overseas training, the government committed $511,000 for in-country training. During 1983, 11 SARIF staff members were sent to five overseas institutions for short-term training. In addition, six trainees are completing work on advanced degrees in agronomy, plant breeding, plant physiology, and entomology in the Philippines and two trainees gained admission to a U.S. university to study for master's degrees in plant science. The handling of these long-term trainees has been transferred to NAR-II. In-



Source: FAO

country academic training sponsored by the government supported 13 master's degree and 3 Ph.D. candidates during the year. In-service training of SARIF counterpart staff is carried out by IADS resident specialists. A month-long workshop on field plot design and statistics was conducted by a consultant.

Research. The SARIF research program achieved solid progress during the year. Some significant developments are discussed below.

The agricultural economics group studied local farming practices to find high payoff strategies. Three production areas were identified as having the greatest potential for high payoff research—the "transmigrant zone" (peneplains), the coastal zone, and the mountain zone. For transmigrants, upland rice was found to be unprofitable due to very high labor requirements and severe yield losses. To reduce labor requirements, the use of bullocks or tractors was recommended. Net returns from peanuts and cassava were found to be substantial, and more research attention on these crops was recommended. In the lowlands a new maize technology featuring an early maturing disease-resistant variety was shown to be economically attractive. Only the availability of the maize seed package itself appeared to limit the regional spread of this practice. A related finding was that Sumatra maize and soybean markets are closely linked to the Jakarta demand center. Jakarta offers a long-term market for Sumatra producers while also stabilizing local producer prices. In the mountain zone, profitable rental markets in rice threshers and small tractors were discovered, and a study of the spread of this cost-reducing mechanism to the transmigrant zone was recommended.

Some important research advances were made by SARIF despite severely limited facilities, equipment, training, and experience. Particularly noteworthy was the selection of a cold-tolerant rice, Batang Agam, for high elevation areas (above about 800 meters), which was released to seed producers and farmers during the year. Another significant development was contributions to the technology of soybean production as a second crop following paddy rice near the coast of Aceh Province.

Jack Traywick, left, and K.O. Rachie, right, of the IADS Sumatra project staff, discuss building plans at the Sukarami Research Institute for Food Crops with A. Syarifuddin K. (in sweater), director of the institute, and Laurence Stifel of the Rockefeller Foundation.

Seedlings of the nitrogen-fixing tree Leucaena interplanted with upland rice to improve fertility and reduce erosion.

An exciting exploratory development was observational trials of tropical wheats, which were planted at five elevations as part of a thesis study. The three higher elevation plantings made in May were so successful that a field day held to acquaint local politicians and extension personnel from other agriculturally related agencies with this potential new crop. Seven out of 25 entries, yielded over 2500 kg/ha; four of them exceeded 3000 kg/ha.

A vast amount of information is being accumulated on cultural practices of upland crops for the transmigration areas. Since newly-cleared, forested lands are often fragile and easily degraded by run-off, several soil and water management studies are under way on the use of contouring, terracing, and alley cropping of perennial legumes. Among the latter is the interesting discovery that Leucaena, a highly productive nitrogen-fixing tree, can be successfully grown on low pH, high aluminum soils in association with upland rice and maize if it is planted with deep placement applications of phosphorus and lime (Sumatra has abundant lime deposits).

Agricultural education

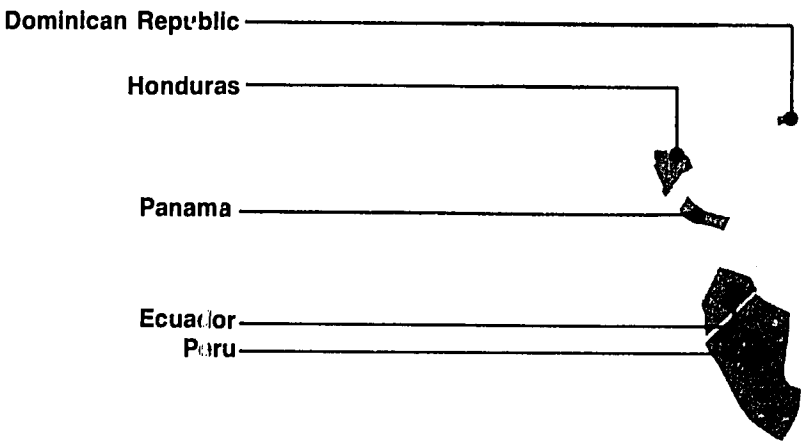
IADS, under contract with the Asian Development Bank, made a 3-month-long study of agricultural education and training in Indonesia and prepared a detailed project paper for expansion and improvement in the quality of agricultural education at the secondary and post-secondary (polytechnic) levels within the Ministry of Education and Culture. An IADS program officer served as the home office coordinator. A team organized by IADS included specialists in educational management, manpower planning, agricultural education, teacher training, space planning, and farm development and irrigation.

The report noted that one of the greatest constraints to achievement of agricultural development goals is the shortage of well-trained agricultural technicians. And as the complexity and technological orientation of Indonesian agriculture increases, even greater numbers of more highly trained technicians will be needed. At present, the secondary agricultural schools responsible for training middle-level techni-

Indonesian agricultural education team

F. C. Byrnes, *IADS*
Robert W. Etheredge, *private consultant*
Robert P. Marvin, *University of Minnesota*
Robert H. Maxwell, *West Virginia University*
Alwin V. Miller, *private consultant*
Obdulia F. Sison, *University of the Philippines at Los Banos*
Jack D. Traywick, *IADS*
E. T. York, *University of Florida*

DEVELOPING COUNTRIES SERVED BY IADS, 1983



Organizations contracting with IADS in 1983

Bangladesh
- Bangladesh Agricultural Research Council
- Government of Australia

Botswana
- Department of Agriculture

Dominican Republic
- Government of Dominican Republic

Ecuador
- Instituto Nacional de Investigaciones Agropecuarias

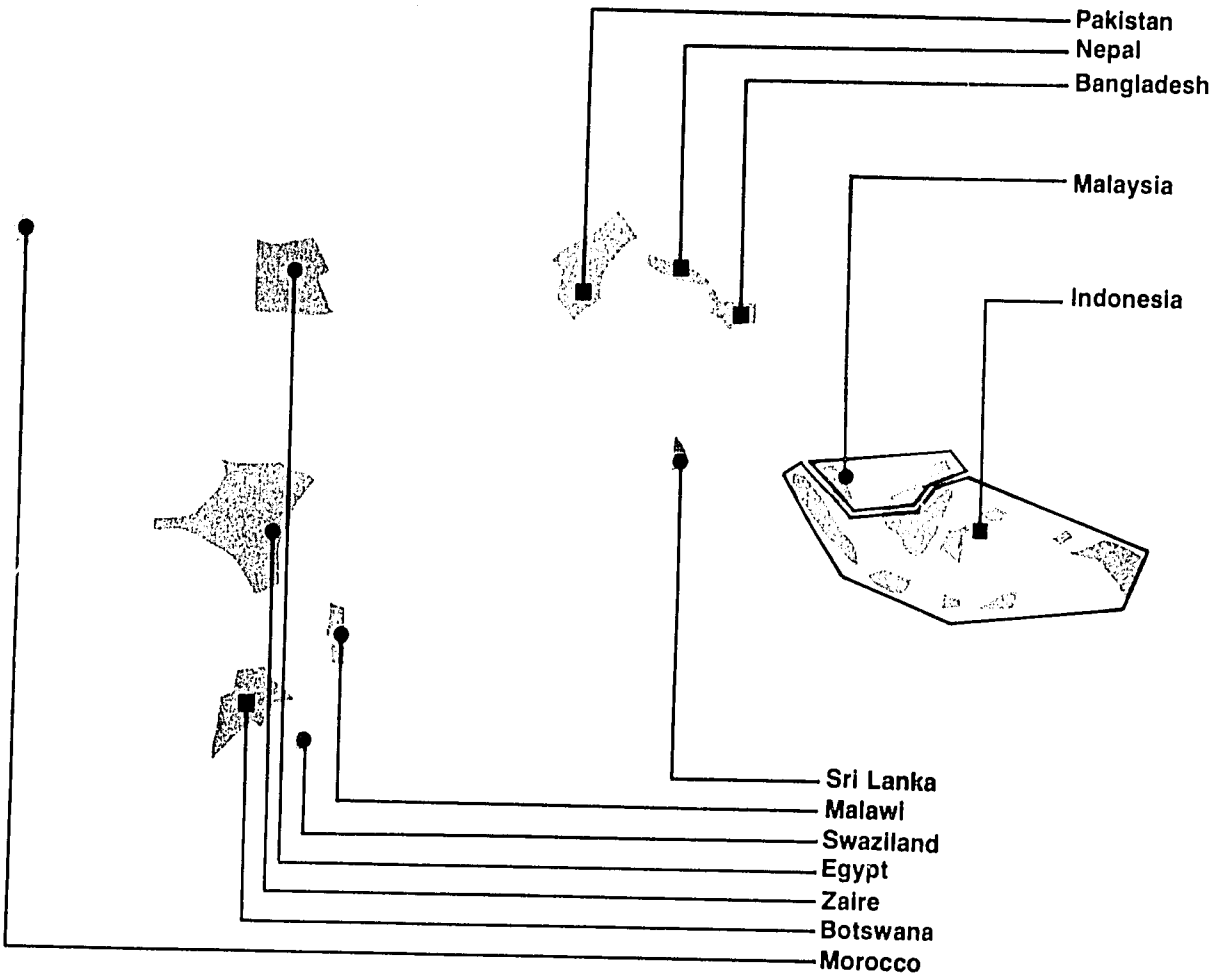
Egypt
- Government of Egypt
- U.S. Agency for International Development

Honduras
- U.S. Agency for International Development

Indonesia
- Agency for Agricultural Research and Development
- Asian Development Bank
- Sukarami Research Institute for Food Crops

Malawi
- U.S. Agency for International Development

Malaysia
- Malaysian Agricultural Research and Development Institute



Morocco
- International Service for National Agricultural Research

Nepal
- Agriculture Inputs Corporation
- Department of Agriculture
- World Bank

Pakistan
- Pakistan Agriculture Research Council

Panama
- U.S. Agency for International Development

Peru
- U.S. Agency for International Development

Sri Lanka
- U.S. Agency for International Development

Swaziland
- U.S. Agency for International Development

Zaire
- International Service for National Agricultural Research

■ Resident IADS personnel assigned to national programs.

Malawi agricultural research review team

Leon F. Hesser, *IADS*
George E. Hull, *private consultant*
Alwin V. Miller, *private consultant*
Fred E. Nichols, *private consultant*

cians are generally weak. Many of the teachers have limited agricultural background and training and the facilities and equipment with which they work are inadequate.

One objective of the proposed project to be carried out by the government of Indonesia with support from the Asian Development Bank is to expand and improve the agricultural schools under the Ministry of Education and Culture. A second objective of the project will be to develop the capacity to train higher level agricultural technicians than those being graduated from the secondary schools. This will be achieved through the development of agricultural polytechnic programs in association with existing faculties of agriculture in universities. These diploma-level, post-secondary, non-degree programs will emphasize practical experience and the application of knowledge rather than theoretical studies.

In the proposed project, particular attention will be given to expanding educational opportunities for personnel in the outer islands. Such emphasis will support the government's transmigration program as well as its goal of more equitable distribution of development efforts in the country. In addition it will lessen the need to induce trained personnel from the inner islands to live and work in the outlying provinces.

The proposed project has two major components: (1) the construction and development of 15 new secondary schools and the upgrading of 7 others—along with the creation of the Rural and Agricultural Vocational Education Development Center, and (2) the development of five new agricultural polytechnics along with a Polytechnic Education Development Center for Agriculture. The two centers will be concerned with teacher training, improvement of school administration, curriculum development, and overall program leadership and guidance for the two groups of institutions.

MALAWI

IADS Operations, Inc. (the wholly owned subsidiary of IADS) provided four persons who spent 5 months helping to prepare an agricultural research strategy for the De-

partment of Agricultural Research (DAR), Ministry of Agriculture, and a master plan for executing the proposed research effort covering research organization, planning and management, research station planning, manpower and training, and agricultural extension. The team was led by an IADS Operations program officer. In collaboration with a local preparation team, the IADS Operations team drafted a 5-year project document for the World Bank and USAID, which would provide a phased start for the agricultural research strategy for DAR.

MALAYSIA

With funding provided through a World Bank loan, IADS provided two consultants for 2 months to review the performance of the Malaysian Agricultural Research and Development Institute (MARDI). The consultants made recommendations on functions and objectives; organizational structures; future research priorities and strategies; allocation of financial, manpower, and other physical resources; and the role of MARDI in the nation's efforts for future agricultural development.

MOROCCO

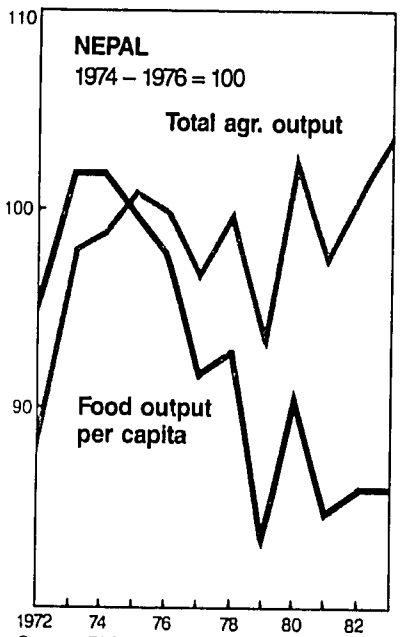
In preparation for a mission that will help Morocco prepare a research masterplan, an IADS program officer evaluated the needs of INRA, the national agricultural research agency, and reviewed basic constraints in the agricultural research system. The work was supported by the International Service for National Agricultural Research.

NEPAL

The rains in Nepal and weather in general were highly favorable during the year. Wheat production set a record and other winter crops (such as maize, pulses, and mustard) were generally good. The spring crops were fair to excellent. Although a delayed summer monsoon reduced yields of maize, conditions were highly favorable, once the monsoon

Malaysia research review team

Robert Cushing, *Hawaiian Sugar Planters' Association*
Gordon McClymont, *University of New England*



Source: FAO

started, especially in eastern Nepal, and rice yields were good to excellent.

Integrated cereals project

Among the major achievements of 1983 was the release of K-39 rice for rainfed areas of the Hills region. Because of its earliness, this new variety can be harvested before the period of severe hail risk, and it permits planting winter crops sooner, allowing them to utilize residual moisture better. This planting schedule also gives more time for spring crops like maize and mungbean. The possibility of planting mungbean in the spring before rice in rainfed areas will boost productivity.

Crops-livestock-fodder work was started at Pumdi Bhumdi. Fodder trees and oats for fodder are receiving attention. In Sukchaina, the project found outstanding performance of chickpea after early maturing rice varieties in rainfed situations. A 7-hectare chickpea production program is being started in the 1983/84 winter season. Work at the cropping-systems tubewell site continues to underscore the potential for high grain yields (8 to 13 tons per hectare per year), which give a high return on expenditures for fertilizer, labor, power, and irrigation.

The Integrated Cereals Project has completed 7 years of activities. The chief objective now is to accelerate the transfer of new technologies to farmers by means that can be duplicated by production projects and integrated rural development projects. Therefore, a great deal of effort is devoted to transferring the results obtained from on-farm testing and component technology at the six cropping systems sites to pilot production programs with the assistance of pre-production verification trials (multilocation testing) and other techniques used in cropping systems methodology.

Government staffing for ICP has markedly improved over the past year. Permanent site coordinators have been named for each of the six cropping systems sites, which provides greater stability and continuity. Additional posts have been filled. The economist on the IADS project staff, Marlin G. Van Der Veen, departed to accept a position with IRRI.

Cropping systems workers in Nepal examine wheat that was seeded before the preceding maize crop was harvested.

IADS services to Nepal

Integrated cereals project

Objectives: To provide technical assistance and services to Nepal for strengthening national production-oriented agricultural research and extension activities related to cereal crops and cropping systems.

Magnitude: Estimated contract costs are US$7.7 million for work to be completed by September 30, 1984. IADS will provide up to 52 person-years of specialists (in residence, and as consultants). The training component includes approximately 45 person-years of advanced degree training and 50 person-years of other training.

Basis: Contract between His Majesty's Government of Nepal and IADS.

Funds: USAID grant to Nepal.

Carl N. Hittle, *project supervisor*

Seed production and input storage

Objective: To establish a labor-intensive system for producing, testing, processing, storing, and distributing seed of major food crops, and for storing and distributing other inputs used in the production of these crops.

Magnitude: The contract is funded for 5 years ending August 1984 at a total cost of US$2.6 million. It provides for 9 person-years of specialist (resident and short-term) services. Other services include training and procurement of equipment. Ten Nepalese will receive training at the master's degree level and 20 will receive nondegree in-service training abroad.

Basis: Contract between His Majesty's Government of Nepal, acting through the Agriculture Inputs Corporation, and IADS.

Funds: USAID grant to Nepal.

Sharanjit S. Bal, *project supervisor*

Hill food production

Objectives: To provide technical assistance needed to implement the hill food

Evaluation. A USAID evaluation conducted during 1983 found that ICP has made a significant contribution to improving agricultural research in Nepal. Among the recommendations of the evaluation team:

- Input delivery systems, credit facilities, and extension services must be further improved if Nepal is to realize the full benefits of ICP accomplishments in technology development and transfer.
- The government should decide upon and implement a plan to strengthen agricultural research management.
- The commodity and disciplinary research divisions should be strengthened to improve the ability of the research system to generate new technologies and deal with second generation issues.
- If the government wishes the cropping systems program to grow, steps to institutionalize the program before the ICP concludes in 1984 must get high priority.

Production campaigns. This is the second year of pilot production activities in cropping systems sites using the *Badhi Utpadan Kayakram* approach ("More Production Program"). The program has demonstrated that production campaigns can be successful in Nepal with a strong extension program and support from various other agencies. During the winter of 1982/83, the program covered 640 hectares of wheat. The following summer, there were 1,275 hectares of rice, 35 hectares of maize, 12 hectares of dhaincha (a green manure crop), and 2.5 hectares of mungbean. Based on the success of these activities, the government launched a full-scale production program in five districts starting with the winter crop of 1983/84. The actual planting was 13,665 hectares somewhat less than the target of 17,000 hectares, because of slow delivery of fertilizer.

Site description surveys for pre-production verification trials (PPVTs) and pilot production programs were conducted for several rural development projects. Personnel in these projects are being trained to conduct their own surveys.

During the year, the cropping systems program's involvement in PPVTs has been modified. The emphasis is now on helping government agricultural development offi-

cers improve their abilities to conduct PPVTs in their area. The cropping systems program trains the staff associated with these entities to give them the knowledge needed to conduct the trials.

Farm women. ICP is initiating a study on extension for farm women. This project seeks to determine how female farmers can most effectively be reached, what are the important areas about which they need more information, and who are the most appropriate candidates for serving as extension agents.

Mini-kits. A government evaluation of mini-kit performance published during the year, indicated that the mini-kits (sample packs of new seed and appropriate inputs) have been fairly successful in that 50,000 farmers have been exposed to improved crop varieties. The Department of Agriculture is assuming increased responsibility for the cost of the mini-kits with reduced assistance from USAID.

Other activities. For the first time, a separate annual report on the cropping systems program of the Integrated Cereals Project has been prepared. The report summarizes results of cropping systems research, pre-production verification trials, and production programs.

The summer crops workshop was held at the Rampur Maize Station and a winter crops workshop was held at the Bhairahawa Wheat Station. The attendance, discussions, and quality of papers presented at these workshops are commendable.

Due to budget limitations, fewer participants were sent to training courses, study tours, etc. than in previous years. Of the 33 scholars sponsored by ICP, all but seven have completed their degrees.

Seed project

The aim of the Seed Production and Input Storage Project is to overcome the difficulties that rugged terrain, a small road network, and isolated communities impose on the distribution of seed and other inputs. The national agen-

IADS services to Nepal

continued

production project, which will improve agricultural extension and on-farm research, livestock development, input supply services, and infrastructure in four districts in the Hill region. The project is supported by the World Bank through an International Development Association credit to Nepal. UNDP has provided a grant for consultants' services through a contract between the World Bank and IADS.

Magnitude: Estimated contract costs are US$586,000. Between December 1981 and June 1985, IADS will provide periodic services by foreign and local consultants, totalling up to 94.5 man-months.

Basis: Contract between World Bank and IADS.

Funds: UNDP grant, with World Bank as the executing agency.

F.D. Gorrez, *supervising agronomist*

Agricultural extension and research

Objective: To provide technical assistance to the agricultural extension and research project. The project is designed to strengthen extension services and upgrade applied and adaptive research in 11 districts in the Terai (plains). The project is supported by the World Bank through an International Development Association credit to Nepal. UNDP has provided a grant for consultants' services through a contract between the World Bank and IADS.

Magnitude: Estimated contract costs are US$386,000. For work between December 1981 and January 1985, IADS will provide, on a periodic basis, up to 35 man-months of consultants.

Basis: Contract between World Bank and IADS.

Funds: UNDP grant, with World Bank as the executing agency.

H.K. Qamar, *extension communication specialist*

Nepalese farmers attending a meeting on seed growing methods.

cies involved are the Agricultural Inputs Corporation (AIC) and Department of Agriculture. IADS provides technical assistance.

The infrastructure being laid at 35 sites consists of seedhouses, warehouses, a seed testing laboratory, and a genetic seed storage unit. Construction has been completed at 13 sites, and is under way at the remaining sites.

Small seed production units, called mini-seedhouses, are being created to serve pockets of farmers in a vast area extending about 800 kilometers from the east to west. Twenty seedhouses are in various stages of development. At all locations, seed production activities have been started by small farmers who have been trained in producing quality seeds of wheat, maize, and rice. After another year's operational experience, the entire system may be capable of producing 1000 tons of seed annually for local farmers.

The participating seed growers receive a small quantity of foundation seed, which they multiply in their fields following recommendations as to land requirement, isolation, agronomic practices, roguing, harvesting, threshing, and handling. The raw seed they produce is pooled at the seedhouse where it is dried, fumigated, cleaned, graded, treated, weighed, bagged, and labelled. The seed is also sampled for laboratory testing to determine its planting value. Finally the approved seed lots are moved to the safe storage chamber. With the onset of the planting season several months later, the farmers of surrounding areas can buy the seed from the seedhouse or from a village cooperative selling inputs as a dealer of the AIC.

Operating strategies. To test different operating strategies, two pilot sites have been established. At one farmers sell the raw seed they produce to a public-sector organization (AIC) and at the other farmers manage the entire business privately, with official backstopping and assistance. Given the advantage of local decision making, a farmer-managed system is able to effectively respond to field problems and changing market trends and is therefore easy to operate in isolated areas. Consequently, impressed by the pilot site experience, farmers at four other sites are preparing to take in their own hands the business of running their seedhouses. It is likely that after a period of moti-

vation and demonstration, the majority of the 20 seedhouses will go private.

Buyers have appreciated the superior quality and ready availability of wheat seed sold by some seedhouses for the first time. With the improvement in seed supply, farmer support is rising for crop research aimed at breeding varieties specifically for the hills, for launching special production programs, and for improving fertilizer supply to maximize the return from the use of good seed. Thus, as a side-effect, the emerging hill seed program is beginning to stimulate support for improved agricultural technology.

Training. Fifty AIC and DOA officials are undergoing training abroad or have already been trained. Eleven are currently working for master's degrees. A group of junior technicians, who supervise the field sites and who rarely have an opportunity for foreign training, took part in a 2-week observation tour of the seed facilities in India. In addition, 235 officials have participated in 11 local courses and 724 farmers have received training in 21 sessions. The emphasis on training and manpower development has proved highly beneficial. For example, inspection reports from AIC seed godowns indicate a distinct improvement in the quality of stored seed. To extend this approach further, a course was held exclusively for managers of the retail cooperatives to create awareness of the care needed in handling of seed as contrasted with fertilizer.

The first National Seed Seminar held at Kathmandu was an important event that brought 150 planners, administrators, seedsmen, scientists, seed producers, and technicians together. One of the key recommendations pertains to creation of a seed board to guide the policies and oversee developmental activities. The seminar papers and recommendations have since been published.

Agricultural extension and research project

The Agricultural Extension and Research Project covers eight districts of Nepal's Terai (the plains region). The project, now in its third year, has brought about a better understanding of the training and visit system of transfer-

ring technology. The project improves the quality of extension by systematic training of staff for their scheduled contacts with farmers, by strengthening the working relationship between agricultural extension and research, and by establishing adaptive research trials under farmers' conditions through "research outreach."

IADS has supplied several short-term consultants in the areas of agricultural extension, communication and training, research mangement, and farm development. Recently, an agriculture research specialist assisted in improving research stations and research outreach through frequent field visits and discussions.

An extension communication specialist assigned by IADS to the project assists in preparing extension materials and organizing in-country and overseas training of the project staff. Two workshops were organized covering the training and visit system, training skills, and plant protection.

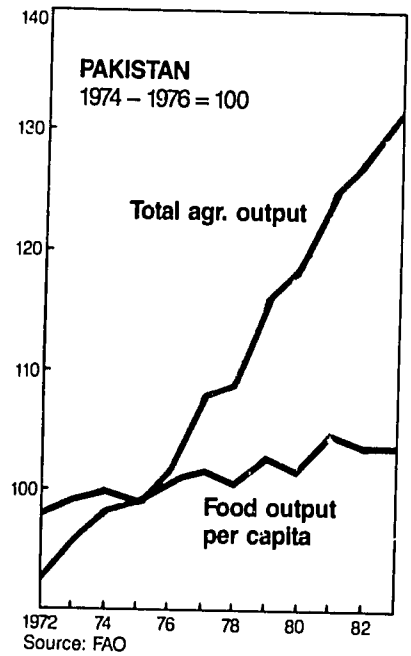
Hill food production project

The Hill Food Production Project focuses on increasing food output in four Hill districts in western Nepal. The project, now in its third year, employs a slightly modified version of the training and visit system of extension, covering components of agriculture, irrigation, and livestock. Monthly training of extension agents takes place at agricultural services centers, after which the agents contact farmers to provide technical advice.

During 1983 IADS has provided expatriate consultants in extension agronomy, irrigation engineering, extension communication, and a national consultant in monitoring and evaluation. The technical assistance has resulted in organization of in-service training courses and production of a variety of extension materials, and a monitoring and evaluation plan for the project.

PAKISTAN

Agriculture accounts for almost a third of Pakistan's gross domestic product and employs half the nation's labor force. It earns 80 percent of the country's foreign exchange.



IADS services to Pakistan

Objectives: To help the Pakistan Agricultural Research Council strengthen the institutional capability of the National Agricultural Research Center in policy formation, program planning, implementation, and evaluation, and program management. IADS provides an advisor to the director-general of NARC.

Magnitude: The 2-year assignment became effective February 1983; the estimated cost of the contract is $286,000.

Basis: Contract between USAID and IADS.

Murray D. Dawson, *advisor*

Consequently a principal objective of the Fifth Five-Year Plan (1978/79 to 1982/83) was to expand agricultural output by 6 percent a year, thus outpacing population growth (now 3 percent a year) and permitting increases in per capita consumption and raising foreign exchange earnings. Annual agricultural growth over the 5-year period, however, averaged just above 4 percent and was more the result of increases in area than in yield.

National research center. To strengthen the agricultural research system, a major USAID program of loans and grants to the Pakistan Agricultural Research Council, has, since 1974, supported coordinated national research programs for major commodities and disciplines, which are operated in cooperation with provincial institutes. USAID, and the World Bank also provide funds for construction of the National Agricultural Research Center at Islamabad, which will be inaugurated in 1984. The training and conferences center at NARC is essentially complete and in operation. Most of the staff residences have been constructed. The administration and office building and the main laboratory block are expected to be in operation in 1984.

The farm service center has been remodelled and improved. Facilities have been developed for the plant genetic resources unit and for coordinating units of several national research programs. Good progress has been made on land shaping and development of the irrigation system for the portion of the 500-hectare site scheduled to have permanent irrigation.

Coordinated research. National coordinated programs, the major vehicles for center/provincial cooperation on research projects of national importance, have been instituted in nine areas. Those involving (1) wheat, barley, and triticale, (2) maize, sorghum, and millet, (3) rice, (4) food legumes, and (5) oilseeds are furthest advanced and are developing patterns of operation that serve to guide other projects. Trials on farmer fields are being carried out by most research institutions. The Pakistan Agricultural Re-

Bong Bolo, of IADS, meeting with farmers in Sind province, Pakistan.

Pakistan applied research review team

Inocencio C. Bolo, *IADS*
Wayne F. Freeman, *IADS*

search Council is involved in production-maximization campaigns for major crops, and the "traveling seminars" initiated under the coordinated programs featured cooperation between scientists and extension workers. A seminar on farming systems research was held at NARC this past year. It was well attended and there was considerable interest, but so far little work has been done in this area.

IADS advisor. The IADS contract is primarily concerned with improvements in research mangement. Articulating the purpose, organization, and role of National Agricultural Research Center in strengthening the national research system together with developing the center's 5-year research plan have been a major activity of the IADS advisor. Since NARC embraces livestock and farm mechanization as well as crops, it has been necessary to develop a system to facilitate an easy flow of ideas, instruction, and transactions among its many units. Publication of the 5-year research plan with defined strategies, objectives, and research approaches has been accomplished. It includes formats and a set of procedures for developing and reviewing research proposals as well as for research monitoring and evaluation.

Development of the program and mangement of the NARC training institute has continued. Seminars, conferences, and workshops covering a variety of topics have been initiated. These include the outstanding scientist series, key theme symposia, research conferences, and workshops on topics ranging from tissue culture and weed control to research management. Manpower development and support services to serve the provinces such as library, computer, laboratory instrument repair and maintenance, and the germplasm bank are major functions of NARC.

* * *

Two consultants were provided by IADS for several weeks to help the Sind Agricultural Extension and Adaptive Research Project develop an applied research program and to establish a working relationship between extension and research. Funds were provided by the World Bank.

PANAMA

IADS provided five consultants to USAID to assess the progress of the Agricultural Technology Development Project administered by IDIAP (Instituto de Investigaciones Agropecuarias de Panama). An IADS program officer was responsible for evaluation of the animal science research and technology transfer programs and effectiveness of interinstitutional communications and technical assistance. The team's report identified technical, administrative, and procedural problems; evaluated the appropriateness and progress of crop and livestock research; and reviewed the status and effectiveness of IDIAP's on-going technology diffusion efforts and how these efforts can be integrated with those planned by the Ministry of Agricultural Development under the new extension activity.

Panama agricultural technology evaluation team

Ron Fridlind, *private consultant*
Reggie Laird, *Colegio de Postgraduados, Mexico*
Eduardo Venezian, *Universidad Catolica, Chile*

PERU

Three consultants, including an IADS program officer, prepared material for a USAID project paper. The topics covered during the 3-month assignment were an advanced training program for the Ministry of Agriculture, a program for strengthening graduate education at the National Agricultural University, a management component for national agricultural research and extension, and an institutional analysis of the Agricultural Sector Planning Office and farm organizations.

Peru agricultural planning team

Gustavo Gomez, *private consultant*
Robert MacVicar, *Oregon State University*
J. K. McDermott, *IADS*

SRI LANKA

For USAID, an IADS program officer led a five-member team that spent 6 weeks in Sri Lanka preparing a project paper on agricultural research. The team submitted its final report to the USAID mission before leaving the country.

SOUTHERN AFRICA

For nine southern African countries that are cooperating in agricultural research, IADS organized a team that reviewed the need for a coordinating center. The countries are

Southern Africa research planning team

Guy B. Baird, *IADS*
Martin Kyomo, *University of Dar es Salaam*
Eugenio Martinez, *Rockefeller Foundation*
Lewis Mughogho, *ICRISAT*
J. B. D. Robinson, *University of Bristol*

Indonesia is expanding coconut production by extensive plantings of new hybrid trees.

Angola, Botswana, Lesotho, Malawi, Mozambique, Swaziland, Tanzania, Zambia, and Zimbabwe. An IADS program officer served as team leader. A report was prepared and submitted in August to USAID/Zimbabwe, and is being considered by the national directors of agricultural research.

SWAZILAND

An anthropologist provided by IADS carried out a socio-economic assessment of a pilot small-farmer irrigation project for the USAID mission in Swaziland. During the 3-month assignment, the consultant collected and analyzed data from farmers in group irrigation schemes and from other knowledgeable sources to assist in the design of the proposed project. The consultant made recommendations on land rights and responsibilities of farmers in group irrigation schemes, the roles played by the chiefs, means for obtaining financial contributions from participant farmers, and ways to encourage farmers to participate.

ZAIRE

An IADS program officer helped the International Service for National Agricultural Research develop an applied agricultural research project for Zaire. His responsibilities included designing an appropriate organizational structure and determining the relationship of the project to INERA, the national agricultural research instititue, to international organizations and private and public entities. The assignment was funded by USAID.

OTHER

IADS provided consultants to a variety of development organizations. For the Technical Advisory Committee of the Consultative Group on International Agricultural Research, an IADS program officer led a team that conducted the quinquennial review of ICARDA (the International Center for Agricultural Research in Dry Areas). The final report was presented to TAC and the CGIAR during the annual Centers' Week. Another IADS program officer served as

Fellowships

Individuals under programs administered by IADS in 1983, their field of study, and degree pursued.

Indonesia

Univ. of Arkansas (USA)
Mansur Lande, plant breeding, Ph.D.
Sugiono Moeljopawiro, plant breeding, Ph.D.

Auburn Univ. (USA)
Taufik Ahmad, fisheries, Ph.D.
Fuad Cholik, fisheries, Ph.D.
Sweta Rabegnatar, fisheries, Ph.D.
Achmad Rukyani, fisheries, M.S.

Univ. of Florida (USA)
Rusli Harahap, forestry, M.S.
Yoyo Taryo-Adiwiganda, soil science, Ph.D.

Univ. of Georgia (USA)
Akhamad Gozali Nataamijaya, poultry science, M.S.

Univ. of Hawaii (USA)
Alimin Djisbar, horticulture, M.S.

Iowa State Univ. (USA)
Bahtiar Saleh Abbas, statistics, M.S.
Budiman Hutabarat, agr. economics, Ph.D.
Wahyudi Sugianto, agr. economics, Ph.D.
Mohammad Anwar Wardhani, agr. economics, Ph.D.

Univ. of Kentucky (USA)
Yusuf Jafarsidik, forestry, M.S.

Univ. of Maryland (USA)
Masdiar Bustaman, botany, M.S.

Michigan State Univ. (USA)
Sulaiman Effendi, food science, Ph.D.
Agus Pakpahan, forestry, Ph.D.

Univ. of Minnesota (USA)
Esther Mulyani Adhi, plant pathology, M.S.
Memed Gunawan, agr. economics, Ph.D.
Soesilowati Hadisoesilo, entomology, Ph.D.
Tri Hutomo, plant breeding, M.S.
Kosasi Nasir, forestry, M.S.

continued

Fellowships, *continued*

Muhammad Kosim Kardin, plant pathology, Ph.D.
Charil Rasahan, agr. economics, Ph.D.
Toga Silitonga, forestry, Ph.D.
Achmad Sudjana, plant breeding, Ph.D.
Winarno, crop production, Ph.D.

Mississippi State Univ. (USA)
Kaomini, entomology, M.S.

Univ. of Nebraska (USA)
Ahmad Dimyati, agronomy, M.S.
Kabul Pamin, agronomy, Ph.D.

North Carolina State Univ. (USA)
Nong Alwi, statistics, Ph.D.
Hariyatno Dwiprabowo, operations research, Ph.D.
Sukarsih Fatchurochim, entomology, M.S.
Budi Haryanto, animal science, M.S.
Mohammad Fatchurochim Masyhudi, crop science, Ph.D.
Akhmad Prabowo, animal science, M.S.
Imam Prasadja, entomology, M.S.
Tahlim Sudaryanto, agr. economics, Ph.D.
Achmad Suryana, agr. economics, Ph.D.

Ohio State Univ. (USA)
Novianti Sunarlim, agronomy, Ph.D.

Oklahoma State Univ. (USA)
Kaman Nainggolan, agr. economics, Ph.D.
Ato Suprapto, agr. economics, Ph.D.

Oregon State Univ. (USA)
Asril Darussamin, biochemistry, Ph.D.
Yono C. Raharjo, animal science, Ph.D.
Sumaryono, crop science, M.S.

Sam Houston State Univ. (USA)
Firdhaus Kasim, agronomy, M.S.
Muhammad Jusuf Yakub, agronomy, M.S.

Univ. of Washington (USA)
Soetarso Priasukmana, forestry, Ph.D.
Djaban Tinambunan, forestry, Ph.D.
Johanes Widodo, fisheries, M.S.

continued

consultant to the farming systems support project of the University of Florida. A team of nine consultants was assembled by IADS to write country development strategy statements for the U.S. Agency for International Development.

LEADERSHIP DEVELOPMENT

Fellowships

The IADS headquarters assumed direct responsibility for the management and monitoring of fellows funded through country contracts with IADS. Previously, the Rockefeller Foundation fellowship officer handled these responsibilities under the overall supervision of IADS. IADS has appointed an administrative associate for fellowships and it is facilitating the work in the field, principally in providing information for university selection and short-term training courses. Fellowship records are being placed on a computer to increase record-keeping efficiency.

One hundred fellows at nine universities in the United States and four universities in the Philippines were visited by IADS officers during the year. Such visits provide opportunities to strengthen professional ties between IADS program officers and the fellows and their academic advisors at universities in the United States and abroad.

Agricultural conference

Under a contract with AID, IADS arranged for four specialists to write papers for the 1983 Agriculture/Rural Development conference held by the AID Asia Bureau at ICRISAT in Hyderabad, India. One paper gave an overview of rainfed agriculture in Asia and there were discussion papers on rainfed agriculture in Thailand, in Sri Lanka, and the Philippines, and on AID's role in assisting private enterprise in agriculture. An IADS officer helped AID manage the conference and produce a daily summary of the discussions. The 50 participants included USAID rural development officers, agricultural development officers, and officials from Washington.

Professional register

IADS continues to develop and make extensive use of its computerized register of professionals. The register helps IADS identify individuals for possible assignment as long-term or short-term consultants.

During the year, 320 persons were added to the register, bringing the total to 2200. Sixty percent of the individuals in the register have had over 5 years' experience working in developing countries. The academic backgrounds of the register participants are agricultural sciences, 1579; biological sciences, 282; physical sciences, 134; social sciences, 517; economics, 522; and business administration, 209. Over 60 percent have doctoral degrees and another 25 percent have master's degrees. More than two-thirds of the registrants are fluent or competent in one or more languages other than English.

PUBLICATIONS

During the year IADS published *Managing fruit tree nurseries* in its occasional paper series. Written by Saul Camacho, fruit specialist in the IADS Sumatra project, it explains the crucial importance of well-run seedling nurseries to the ability of farmers to make trees a profitable source of income.

A brochure describing IADS was written and published. It covers the interests, capabilities, and experience of IADS in helping developing nations accelerate the growth of agricultural productivity.

Several short publications were produced under contracts with outside organizations. For ICARDA, IADS developed an illustrated booklet, *Better harvests in dry areas*, which describes the activities of the cereals research program.

For the Bangladesh Agricultural Research Council, IADS edited and printed two publications: *Agricultural research in Bangladesh: Costs and returns*, written by G. J. Gill of the Agricultural Development Council, and *Agricultural research project II: Report of the May external evaluation team.*

An IADS officer also helped the BARC produce *Agricultural research in Bangladesh: Contributing to national develop-*

Fellowships, *continued*

Univ. of Wisconsin (USA)
Ridwan Dereinda, extension, Ph.D.
Adi Widjono, agr. journalism, M.S.

Univ. of Adelaide (Australia)
Djiman Sitepu, plant pathology, Ph.D.

State. Univ. of Ghent (Belgium)
Zulkarnain Poeloingan, land evaluation, Ph.D.

Institut Agronomique Méditerranéen de Montpellier (France)
Endang Setyawati Thohari, agr. economics, Ph.D.

Univ. of the Philippines at Los Banos
Abdulgani, agronomy, M.S.
Made Oka Adnyana, M.S. statistics
Rasidin Azwar, agronomy, M.S.
Adi Hanafi, soil science, M.S.
Nusyirwan Hasan, M.S. entomology
Iswandi Hasanbasri, agronomy, Ph.D.
Abdul Rasyid Marzuki, agronomy, M.S.
Henny Mayrowani, economics, M.S.
Imam Muhadjir, horticulture, Ph.D.
Sjaifullah, horticulture, Ph.D.
Sunarwidi, horticulture, Ph.D.
Roosmani Tirtosoekotjo, horticulture, Ph.D.
Mohammad Soedibyo Tirtosoekotjo, horticulture, Ph.D.
Doah Dekok Tarigans, horticulture, Ph.D.
Zulkifli Zaini, botany, Ph.D.

Univ. of the Philippines at Leganes
Alie Poernomo Tirtoredjo, fisheries, M.S.

Univ. of the Philippines at Quezon City
Surya Mansjur, library science, M.S.

Univ. of Aston (UK)
Eddy Amir, chemistry, M.S.
Ridha Arizal, chemistry, M.S.
Suharto Honggokusumo, chemistry, Ph.D.

Univ. of Edinburgh (UK)
Hobir, seed technology, M.S.

London School of Polymer Technology (UK)
Oerip Siswantoro, polymer science, Ph.D.

continued

Transplanting rice in Sumatra.

ment for the 10th anniversary of BARC. The 190-page book reviews research progress in Bangladesh.

Sustained sales of books in the IADS development-oriented literature series led the publisher, Westview Press, to reprint three of the books: *Wheat in the third world* by Hanson, Borlaug, and Anderson, *Small farm development* by Harwood, and *Successful seed programs* by Douglas. *AID Resources Report*, a newsletter for AID personnel and individuals in developing nations, purchased 500 copies of the Harwood book for distribution to its clientele.

A French edition of A. T. Mosher's *Three ways to spur agricultural growth* was published by the International Service for National Agricultural Research. Of the seven books published so far in the IADS development-oriented literature series, four have been translated into Spanish, one has been translated into French, and two have been published in local English editions.

LIAISON

IADS took steps in 1983 to build on earlier efforts to develop an understanding of program development potentials in the People's Republic of China. One was a trip by the IADS president to China in May. Another was, the "Colloquium on Agriculture in China: Today and Tomorrow," conducted in cooperation with the Association of Chinese Soil and Plant Scientists in North America.

The 1½-day colloquium, was held in Washington, D.C. under a grant from the Rockefeller Foundation with more than 100 persons attending. He Xiu-Yin, director, bureau of education, Ministry of Agriculture, Animal Husbandry, and Fishery, People's Republic of China, was the keynote speaker. Several agencies reported on present and projected programs in China, including the World Bank, Rockefeller Foundation, U.S. Department of Agriculture, UNDP, FAO, National Academy of Sciences, and National Science Foundation.

IADS continued to explore the potential for activities in agricultural education. In addition to completing the Indonesian project preparation mission for the Asian Development Bank, program officers added names of educators

Fellowships, *continued*

Univ. College of North Wales (UK)
Achmad Fauzi Mas'ud, forestry, Ph.D.

Univ. of Southampton (UK)
Nana Supriana, entomology, Ph.D.

Bangladesh

Colorado State Univ. (USA)
A.J.M. Siragul Karim, agronomy, M.S.
Chowdhury Khan, water mgt., Ph.D.
Parvin Sultana, pest mgt., M.S.

Cornell Univ. (USA)
Harun-or-Rashid, research mgt., M.P.S.
Rafiqul Islam Mondal, agronomy, M.S.

Univ. of Florida (USA)
Md. Abdul Q. Parvez, agronomy, Ph.D.

Univ. of Hawii (USA)
Monomahan Biswas, horticulture, M.S.

North Dakota State Univ.
Kazi Murtaza Kabir, plant breeding, Ph.D.

Central Luzon State Univ. (Philippines)
Liakat Ali, plant breeding, M.S.
Abdul Aziz Palwhan, agr. extension, M.S.
Azizur Rahman, agronomy, M.S.
Subjal Uddin, agronomy, M.S.

Univ. of the Philippines at Los Banos
Joynal Abedin, agr. economics, M.S.
Ashraf Khan, plant pathology, M.S.
Syed Salehuddin Kibria, animal science, M.S.
Muslem Uddin Miah, soil science, Ph.D.
Abdur Razzaque, agronomy, Ph.D.

Nepal

Univ. of California, Davis (USA)
Ram Narayan Sah, soil science, M.S.

Univ. of California, Riverside (USA)
Rajendra P. Singh, agribusiness, M.B.A.

Iowa State Univ. (USA)
Maheswar Prasad Bharati, agronomy, Ph.D.

continued

Fellowships, *continued*

Kansas State Univ. (USA)
Madhusudan P. Upadhyay, agronomy, M.S.

Mississippi State Univ. (USA)
Chandra Darshan Acharya, seed tech., M.S.
Rajeshwori Basnyat, seed tech., M.A.
Ramesh K. Mishra, seed tech., M.A.

North Dakota State Univ. (USA)
Mauje Lal Jayaswal, agronomy, M.S.

Ohio State Univ. (USA)
Ram C. Munankarmy, agronomy, M.S.

Utah State Univ. (USA)
Jitendra Dhojrana, agr. engineering, M.S.

Univ. of Wisconsin (USA)
Dip Narayan Sah, plant pathology, M.S.
Ganesh Lall Shrestha, seed storage, M.S.

Gregorio Araneta Univ. Foundation (Philippines)
B.R. Shakya, agronomy, M.S.
R.R. Sharma, agr. engineering, M.S.
C.B. Shrestha, agronomy, M.S.
K.K. Shrestha, weed control, M.S.
M.N. Shrestha, agronomy, M.S.
S.K. Shrestha, agr. engineering, M.S.

Philippine Christian Univ.
Basu Dev. Parajuli, agribusiness, M. Admin.

Univ. of the Philippines at Los Banos
Nabin K. Rajbhandari, agronomy, M.S.
S.L. Shrestha, cropping systems, M.S.
Basnet B.M. Singh, agronomy, M.S.

to the professional register, participated in agricultural education meetings, and corresponded widely on the subject. The meetings included an AID workshop on Research Priorities in International Training (Washington, D.C.), a seminar on Utilization of Secondary Agricultural Educational programs for Rural Development in Third World Countries (Sam Houston State University), and the Inter-Sector Workshop on Agricultural Education (World Bank).

Liaison with the United States university community continued through visits, correspondence, participation in meetings, and cooperation in preparation of project proposals. A program officer presented a paper at the annual meeting of the Association of University Directors of International Agricultural Programs on the role of the private sector in staffing the United States contribution to technical assistance in international agriculture. In preparation for the paper he collected data and information from some 20 private organizations.

For the secretariat of the Consultative Group on International Agricultural Research, an IADS officer attended a meeting of the information officers of the international agricultural research centers held in West Germany following the Frankfurt Book Fair. He spoke on publication promotion and distribution techniques.

Memoranda of cooperation were completed with the University of Florida, in relation to the Farming Systems Support Project, and Michigan State University, as a subcontractor in the Philippines Rainfed Resources Development Project.

A Memorandum of Understanding was signed between IADS and Virginia State University. It established a basis for the two institutions to participate jointly in research, training, and development projects in agriculture.

An IADS program officer participated in a mission sponsored by CIMMYT to evaluate progress and potential for increased production and utilization of quality protein maize in swine, poultry, and human nutrition. Visits were made to the People's Republic of China, the Republic of China, Thailand, Senegal, Guinea, Upper Volta, and Ivory Coast.

The conjunction of the China colloquium with the 1983 annual meeting of the American Society of Agronomy, which was held in Washington, D.C., gave IADS an opportunity to invite a large number of agricultural specialists to meet the staff and see the headquarters' offices. About 100 persons attended a reception held by IADS.

Agriculture in China
Coloquium
August 19-20, 1983
Washington, D.C.

Francis C. Byrnes, IADS
H. H. Cheng, Washington State Univ.
H. C. Chiang, Univ. of Minnesota
Alexander DeAngelis, National Science Foundation
Frank Farner, World Bank
S. Geng, Univ. of California, Davis
Robert Geyer, National Academy of Science
Clarence C. Gray III, Rockefeller Foundation
Xe Xiu Yin, Ministry of Agriculture, Animal Husbandry, and Fishery, People's Republic of China
P. H. Hsu, Rutgers Univ.
Donald C. Kimmel, FAO
S. D. Kung, Univ. of Maryland
G. H. Liang, Kansas State Univ.
Charles Y. Liu, U.S. Department of Agriculture
A. Colin McClung, IADS
Nicholas Raymond, FAO
William T. Smith, World Bank
William Tai, Univ. of Manitoba
T. C. Tso, U.S. Department of Agriculture
Joan S. Wallace, U.S. Department of Agriculture
Steve Yen, Dairyland Research International
T. L. Yuan, Univ. of Florida

Administrative Developments

(facing) **A Nepalese farmer returns home from delivering milk produced by his water buffaloes.**

IADS installed an IBM System 34 computer during the year. It is being used for word processing and data handling. The professional register, which had been on a time-sharing computer, plus fellowship records and a large portion of the accounting records are being shifted to the in-house computer. Having a computer has improved the accessibility of records and has given IADS substantial cost savings.

Trustees

At its annual meeting in November, the Board of Trustees voted to enlarge the size of the board by one member and it elected **Clarence C. Gray** a trustee. He is a retired Rockefeller Foundation staff member and is now on the faculty of Virginia Polytechnic Institute. He has been chairman of the board of the International Rice Research Institute since 1977.

U.S.-based staff

The post of vice president was created by the Board of Trustees and **D.S. Athwal** was promoted to it. **Guy B. Baird** was designated senior program officer. The board also changed the titles of the other officers, deleting the specific geographic and disciplinary terms in recognition of the broad range of assignments that staff members undertake. **Francis C. Byrnes**, who reached retirement age, was named an associate. He continues to work nearly full-time for IADS. **Steven A. Breth** became the corporate secretary and treasurer of IADS.

Four new representatives were appointed: **Wayne Freeman, Reeshon Feuer, Harold Jones,** and **Tom Niblock.** A representative undertakes specific assignments in the development of IADS programs, preparation of proposals, and negotiations with other parties. Freeman had been the IADS project supervisor for the Integrated Cereals Project in Nepal. Feuer is on the faculty of Cornell University and worked for many years in the Philippines. Jones was the IADS program officer for Africa. Niblock has been USAID mission director in Indonesia and the Philippines.

Pierre Antoine joined the headquarters' staff during the year. He worked in Rockefeller Foundation programs in Zaire and Morocco and has been on the faculty of the University of Minnesota.

J. Kenneth McDermott left IADS to join the farming systems support project of the University of Florida.

Field staff

During 1983 the number of IADS resident specialists working in developing countries expanded by 25 percent.

In Bangladesh, **David M. Daugherty** took the post of project supervisor and research management specialist. He was an international research administrator for the U.S. Department of Agriculture and USAID. The position of information specialist was filled by **Theodore Hutchcroft.** He has worked in Latin America and Africa and most recently was vice president of the Council for Agricultural Science and Technology in the United States. **Hugh Henderson** joined

the project as livestock specialist. He has worked in Yemen, as well as with Colorado State University, where he was director of agricultural and natural resources extension, and with Michigan State University. The position of plant pathologist was taken by **Dale Krigsvold,** formerly postharvest research pathologist for a private company in Latin America. **Carlos Garces** was appointed agricultural engineer. He has worked with CIAT and IRRI. The position of maintenance specialist was taken by **Harvey Carr** who has previously worked in Bangladesh and the mideast on major development projects. **Edward Loomis** filled the post of horticultural specialist. He has been a crops research specialist with Clemson University.

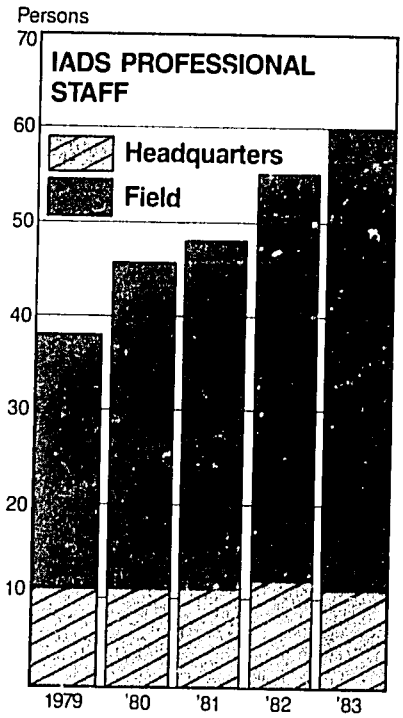
In Indonesia, three new staff members joined the national agricultural research project. **Saul Camacho** became the fruit specialist. He had held a similar position in the IADS project in Ecuador. **David G. Hill** assumed the position of scientific information specialist. He had been previously a communications specialist with the University of Tennessee. The post of training specialist was taken by **Ralph Retzlaff.** He had been with the University of California at Berkeley and served for several years in Asia with the Agricultural Development Council.

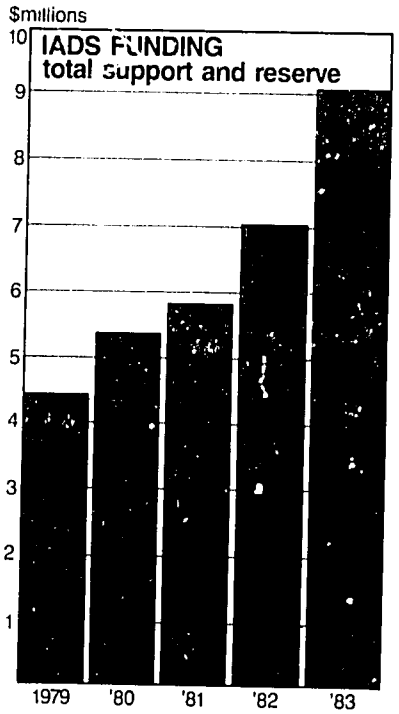
In Nepal, **Francisco D. Gorrez** was appointed supervising agronomist in the hill food project. Gorrez has participated in production projects in several Asian and Pacific countries. **Kalim M. Qamar** took the post of extension communication specialist in the hill food project and in the agricultural extension reseach project, as well. Qamar has conducted extension training programs in Indonesia and Papua New Guinea. **Robert Iltis** joined the Nepal seed project as field supervisor. He had previously worked with the project as a Peace Corps volunteer.

Murray Dawson shifted from the IADS project in Bangladesh to Pakistan where he serves as IADS research advisor to the National Agricultural Research Council.

Budgetary procedures

The IADS program is supported by a "core" budget and by "special project" funds. The core budget is calcu-





lated to meet the basic costs of maintaining the headquarters' group at a level necessary to arrange programs but not to implement them.

In any project that may be undertaken, all direct costs are charged to the special project concerned, along with a fair share of indirect or overhead costs. If a headquarters' officer undertakes specific work for a special project, the time spent is recorded and costs assigned accordingly. The objective is that each special project activity will be fully self-supporting but with no excess charges.

Funding

During 1983, the major sources of IADS funds were the following:

Contracts and service arrangements	
Bangladesh Agricultural Research Council	$3,353,000
Agency for Agricultural Research and Development (Indonesia)	2,159,000
Department of Agriculture (Nepal)	935,000
U.S. Agency for International Development	624,000
Central Research Institute for Food Crops (Indonesia)	581,000
Agricultural Inputs Corp. (Nepal)	536,000
World Bank/UNDP	316,000
Asian Development Bank	188,000
Government of Egypt	96,000
Government of Ecuador	88,000
Grants	
Rockefeller Foundation	15,000
Other	
Interest income	106,000

Financial Statements

ARTHUR YOUNG

1025 Connecticut Avenue, N.W.
Washington, D.C. 20036

The Board of Trustees
International Agricultural
Development Service, Inc.

We have examined the accompanying consolidated balance sheet of International Agricultural Development Service, Inc. at December 31, 1983 and 1982 and the related consolidated statements of support and revenue, expenses and changes in fund balance and changes in financial position for the years then ended. Our examinations were made in accordance with generally accepted auditing standards and, accordingly, included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances.

As more fully described in Note 4, International Agricultural Development Service, Inc. has material transactions with The Rockefeller Foundation.

In our opinion, the statements mentioned above present fairly the consolidated financial position of International Agricultural Development Service, Inc. at December 31, 1983 and 1982 and the consolidated results of operations, changes in fund balance and changes in financial position for the years then ended, in conformity with generally accepted accounting principles applied on a consistent basis during the period.

Our examination has been made primarily for the purpose of expressing an opinion on the consolidated financial statements, taken as a whole. The consolidating information is presented for analysis purposes and is not necessary for fair presentation of the financial information referred to in the preceding paragraph. It has been subjected to the tests and other auditing procedures applied in the examination of the consolidated financial statements mentioned above and, in our opinion, is fairly stated in all respects material in relation to the consolidated financial statements taken as a whole.

Arthur Young & Company

March 28, 1984

CONSOLIDATED BALANCE SHEET

December 31, 1983 and 1982

ASSETS	*1983*	*1982*
Current assets:		
Cash (including invested cash)	$1,789,449	$1,234,486
Accounts receivable including unbilled of $949,000 in 1983 and $856,000 in 1982	1,341,473	1,359,155
Advances	350,811	258,972
Total current assets	3,481,733	2,852,613
Office furniture and equipment less accumulated depreciation of $42,504 in 1983 and $23,042 in 1982	154,478	65,389
	$3,636,211	$2,918,002

LIABILITIES AND FUND BALANCE		
Current liabilities:		
Accounts payable	$ 337,845	$ 333,695
Contract advances	1,322,929	1,359,947
Deferred grant support (Note 4)	1,160,141	516,670
Total current liabilities	2,820,915	2,210,312
Commitment and contingency (Note 6)		
Fund balance:		
Designated	660,818	642,301
Undesignated	154,478	65,389
Total fund balance	815,296	707,690
	$3,636,211	$2,918,002

See accompanying notes.

CONSOLIDATED STATEMENT OF CHANGES IN FINANCIAL POSITION

Years ended December 31, 1983 and 1982

	1983	*1982*
Source:		
Operations:		
Excess of support and revenue over expenses	$ 107,606	$ 37,076
Charge not involving the use of cash during the period:		
Depreciation	19,462	8,812
Cash provided by operations	127,068	45,888
Decrease in accounts receivable	17,682	—
Increase in accounts payable	4,150	97,616
Increase in deferred grant support	643,471	25,475
	792,371	168,979
Application:		
Increase in accounts receivable	—	138,217
Increase in advances	91,839	28,184
Decrease in contract advances	37,018	40,664
Purchase of office furniture and equipment	108,551	51,646
	237,408	258,711
Increase (decrease) in cash	554,963	(89,732)
Cash, beginning of year	1,234,486	1,324,218
Cash, end of year	$1,789,449	$1,234,486

See accompanying notes.

CONSOLIDATED STATEMENT OF SUPPORT AND REVENUE, EXPENSES, AND CHANGES IN FUND BALANCE

Years ended December 31, 1983 and 1982

	1983	*1982*
Support and revenue:		
Contracts and service arrangements	$9,158,896	$6,374,126
Grants (Note 4)	15,382	639,525
Investment income	105,484	105,789
Other	927	2,170
Total support and revenue	9,280,689	7,121,610
Expenses:		
Contracts and service arrangements	7,667,386	5,426,463
Non-contract programs and projects:		
Service to individual countries	25,679	39,806
Development-oriented literature	10,703	40,771
Relocation costs (Note 1)	—	335,466
	36,382	416,043
Program support:		
Leadership development	55,448	45,310
Liaison and interchange	56,656	89,808
Country programs	512,323	367,981
Communication	136,978	67,502
	761,405	570,601
General administration	707,910	671,427
Total expenses	9,173,083	7,084,534
Excess of support and revenue over expenses	107,606	37,076
Fund balance at beginning of year	707,690	670,614
Fund balance at end of year	$ 815,296	$ 707,690

See accompanying notes.

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS

December 31, 1983 and 1982

1. Organization

International Agricultural Development Service, Inc. (IADS) was incorporated as a not-for-profit organization in 1975. In 1982 IADS Operations, Inc. (IOI), a wholly-owned, for-profit corporation, was established. Both organizations provide services, primarily in the form of technical assistance, in agriculture. Services are provided on a contractual basis and generally involve locations outside of the United States.

From the date of incorporation through June 1982, IADS maintained its headquarters in New York City. In July 1982 the headquarters was relocated to the Washington, D.C. metropolitan area.

2. Summary of accounting policies

Consolidation - The consolidated financial statements include the accounts of IADS and IOI. All significant intercompany accounts and transactions have been eliminated.

Contract revenue and advances - All contracts provide for reimbursement of costs incurred up to specific limits and include provision for overhead expenses or management fees. Revenue is recognized as related expenses are incurred.

Advances received on contracts are used to finance contract operations. These advances are used to offset billings at various stages of each contract. Certain contracts require the maintenance of separate bank accounts for advance funds not immediately required for operations. Funds on deposit in these interest-bearing accounts totaled $215,000 at December 31, 1983 and $58,000 at December 31, 1982.

Recognition of grant support - Grant awards to IADS are recorded as receivable and deferred support when formal notifications of such awards are received from grantors. Deferred support is recognized as revenue when program costs and administrative expenses supported by grant funds are incurred.

Designated fund balance - The Board of Trustees of IADS has designated a portion of fund balance to meet temporary cash flow needs and possible future obligations.

Office equipment and furniture - Office equipment and furniture are depreciated on the straight-line basis over the estimated 10-year useful life of the assets.

3. Tax status

IADS is exempt from U.S. federal income tax under Section 501(c)(3) of the Internal Revenue Code.

IOI, which uses the cash basis of accounting for tax reporting purposes, has a net operating loss carryforward of $180,000 for financial reporting purposes ($300 for tax reporting purposes).

4. Grant support

During 1983, IADS was awarded grants amounting to $678,000 ($665,000 in 1982) by the Rockefeller Foundation for program and administrative expenses. The Rockefeller Foundation 1983 grant plus deferred support of $513,674 from 1982 were available for use in 1983. Of these combined grants, $31,533 was spent, committed, or refunded in 1983 leaving a balance of $1,160,141 unexpended at December 31, 1983. The Rockefeller Foundation has authorized the use of this amount in 1984; accordingly, it is shown as deferred support in the balance sheet.

Also available in 1983 was $2,996, the balance of a 1979 publication grant from Centro Internacional de Mejoramiento de Maiz y Trigo (CIMMYT). Of the funds provided by CIMMYT, $449 was spent in 1983 leaving $2,547 unexpended which was refunded to CIMMYT during the year.

The Rockefeller Foundation provides certain services, primarily personnel, and makes disbursements on behalf of IADS. The Foundation charged IADS $307,432 in 1983 and $693,440 in 1982 for these services and expenses. Amounts payable to the Rockefeller Foundation at December 31, 1983 and 1982 were $11,317 and $93,369, respectively.

5. Subsequent events

Merger negotiations are in process between IADS, Winrock International, an Arkansas-based not-for-profit organization, and the Agricultural Development Council, a New York-based not-for-profit organization. The merger is subject to certain conditions which remain to be resolved and is not, at this point, assured.

6. Commitment and contingency

IADS leases office space under an operating lease. Rent expense for 1983 was $124,000 ($127,000 in 1982). Minimum rental payments under the lease aggregate $1,012,000 and are as follows: 1984 - $171,000, 1985 - $194,000, 1986 - $194,000, 1987 - $194,000, 1988 - $194,000, thereafter $65,000.

Costs under U.S. government contracts and grants are subject to audit by the cognizant U.S. government agency. Management believes that cost disallowances, if any, arising from audits of costs charged to government contracts and grants through December 31, 1983 would not have a material effect on the consolidated financial position of IADS.

7. Pension

IADS contributes from 6 to 20% of all full-time permanent employees' base salaries to a defined contribution pension plan. Upon termination, death or retirement, employees are entitled to the current value of the contributions in their account. Pension expense was $317,398 in 1983 and $220,380 in 1982.

CONSOLIDATING INFORMATION

CONSOLIDATING BALANCE SHEET

December 31, 1983

ASSETS	Consolidated	Consolidation Adjustments	IADS	IADS Operations Inc.
Current assets:				
Cash and invested cash	$1,789,449	$ —	$1,779,735	$ 9,714
Accounts receivable	1,341,473	(195,287)[A]	1,518,567	18,193
Advances	350,811	—	345,791	5,020
Total current assets	3,481,733	(195,287)	3,644,093	32,927
Office equipment and furniture less accumulated depreciation	154,478	—	154,478	—
Investment in subsidiary	—	170,151[A]	(170,151)	—
	$3,636,211	$ (25,136)	$3,628,420	$ 32,927
LIABILITIES AND EQUITY				
Current liabilities:				
Accounts payable	$ 337,845	$ (195,287)[A]	$ 330,054	$ 203,078
Contract advances	1,322,929	—	1,322,929	—
Deferred grant support	1,160,141	—	1,160,141	—
Total current liabilities	2,820,915	(195,287)	2,813,124	203,078
Equity:				
Fund balance:				
Designated	660,818	—	660,818	—
Undesignated	154,478	—	154,478	—
Capital stock $1 par value, 1,000 shares authorized, 100 issued and outstanding	—	(100)[A]	—	100
Capital in excess of par value	—	(9,900)[A]	—	9,900
Deficit	—	180,151[A]	—	(180,151)
Total equity	815,296	170,151	815,296	(170,151)
	$3,636,211	$ (25,136)	$3,628,420	$ 32,927

[A]Elimination of intercompany investment, receivables and payables.

CONSOLIDATING INFORMATION

CONSOLIDATING STATEMENT OF SUPPORT AND REVENUE, EXPENSES, AND CHANGES IN FUND BALANCE (DEFICIT)

Year ended December 31, 1983

	Consolidated	Consolidation Adjustments	IADS	IADS Operations, Inc.
Support and revenue:				
Contracts and service arrangements	$9,158,896	$ (201,255)[A]	$9,254,129	$ 106,022
Grants	15,382	—	15,382	—
Investment income	105,484	—	105,484	—
Other	927	—	927	—
Total support and revenue	9,280,689	(201,255)	9,375,922	106,022
Expenses:				
Contracts and service arrangements	7,667,386	(97,958)[A]	7,666,656	98,688
Non-contract programs and projects:				
Service to individual countries	25,679	—	25,679	—
Development-oriented literature	10,703	—	10,703	—
	7,703,768	(97,958)	7,703,038	98,688
Program support:				
Leadership development	55,448	—	55,448	—
Liaison and interchange	56,656	—	56,656	—
Country programs	512,323	(97,161)[A]	511,798	97,686
Communication	136,978	—	136,978	—
	761,405	(97,161)	760,880	97,686
General administration	707,910	(6,136)[A]	707,771	6,275
Total expenses	9,173,083	(201,255)	9,171,689	202,649
Excess of support and revenue over expenses (expenses over support and revenue) before equity in net loss of consolidated subsidiary	107,606	—	204,233	(96,627)
Equity in net loss of consolidated subsidiary	—	96,627[B]	(96,627)	—
Excess of support and revenue over expenses (expenses over support and revenue)	107,606	96,627	107,606	(96,627)
Fund balance (deficit) at beginning of year	707,690	83,524[B]	707,690	(83,524)
Fund balance (deficit) at end of year	$ 815,296	$ 180,151	$ 815,296	$ (180,151)

[A]Elimination of intercompany revenue and expense.
[B]Elimination of equity in net loss of consolidated subsidiary.