



# BREAD AND BETTER THINGS

IDRC REVIEW



1974  
1975



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## Introduction

Several times during the last 30 years there has seemed more irony than promise in the motto of the Food and Agriculture Organization. "Fiat panis" — let there be bread. The words may have sounded like a god's blessing when they were first uttered in 1945 in Quebec City at the founding conference of this United Nations agency. But to a Bihari caught in the Indian famine of the mid-1960s or to a Tuareg in the drought that bleached the Sahel in 1972, they were sour words. The world had failed them.

Yet many who should know affirm that, even though the world's population doubles within 30 more years, there can be bread enough for everyone. The IDRC president, David Hopper, said recently: "Never before in human history has mankind been faced with such opportunity for food abundance".† Modern agricultural technologies offer this opportunity. Nor does the promise stop at an adequate basic diet. On the foundation of increased income for rural people derived from greater food production can be built a better life for the next generation. That is why this review of the research which the Centre is supporting in developing countries, research particularly focussed upon ways to improve the economic and social wellbeing of rural peoples, is called "Bread and Better Things". It is not a naive hope. Man's selfishness or lack of will may, to be sure, frustrate the hope, but the technology exists to assure abundance.

IDRC is organized, for purposes of administering research projects, into five program divisions. They are: Agriculture, Food and Nutrition Sciences; Information Sciences; Population and Health Sciences; Publications; and Social Sciences and Human Resources. In annual reports we have described the work done by the Centre by covering each of these program divisions in turn. We follow the same procedure in the 1974-75 annual report that is a companion volume to this booklet. For this review, however, it seemed more logical to take a different approach.

An ordinary reader is not interested, after all, in the administrative compartments of the Centre but in the problems that the Centre tries to help solve. So this review is problem-oriented. What is IDRC doing to help increase world food production? What is it doing to help tackle the problems of poor sanitation, contaminated water supplies, a lack of basic health care in rural communities? What is it doing to help countries that are on the path to industrialization, both with practical factory-floor advice and with broader assistance as they decide their policies on the transfer of technology? What is IDRC doing to help mobilize existing and new information connected with all such problems? In organizing the material to answer such questions, we can also bring out the pattern of purpose, and the main strands of concern, behind the 250 or more research projects which the Centre has supported during the last five years; and we can show the interweaving of the work of the different divisions in this pattern.

The year under review, April 1974 to March 1975, witnessed two major conferences on issues that are the main concerns of the Centre: the World Population Conference in August at Bucharest, and the World Food Conference in November in Rome. This review follows the same order, covering first the population issue and then the issue of food production. There follows a more wide-ranging section on modernization and change. In each section two or three detailed descriptions of projects are included, to add some color to the main narrative. They are set apart, short digressions from the main track, but intended as an integral part of the descriptive journey, nevertheless.

Before starting on the narrative, a reader may find that a few basic facts about the International Development Research Centre will be a useful guide. They follow.





## Some basic facts about IDRC

### When was the IDRC set up?

The Centre was established by an Act of the Canadian Parliament assented to on 13 May 1970. The first meeting of the 21-member Board of Governors took place in October 1970.

### Why was it set up?

It was set up (in the words of that Act) "to initiate, encourage, support and conduct research into the problems of the developing regions of the world and into the means for applying and adapting scientific, technical and other knowledge to the economic and social advancement of those regions".

It was established as a public corporation, to give it the greatest possible measure of flexibility and autonomy while still being accountable to Parliament. Its funds are in the form of "untied aid", which allows it to secure the best available professional skill, and to finance projects in the most appropriate way, regardless of the origin of the research workers and the source of equipment.

It has placed heavy emphasis on support for research workers indigenous to the developing regions. The great majority of projects are being carried out in those regions, and all of them are under the direction of a scientist or administrator of that region. Research financed by the Centre in Canada, at universities and elsewhere, is undertaken in support of field projects in developing regions. This emphasis has been taken to fulfill the objective of the Centre, as stated in the Act, "to assist the developing regions to build up the research capabilities, the innovative skills and the institutions required to solve their problems".

### How much has been done?

From October 1970 to March 1975 the Board approved support for 252 projects, which required appropriations of \$50.1 millions. A few projects involve expenditures of more than \$1 million, while others involved less than \$5000; the average has been \$200,000. Some 38 projects have been completed. Research has been taking place in 75 different countries.

### What are the principal sectors in which research has been supported?

Research to improve food production and nutrition has been a foremost concern. Crop research in the semi-arid tropical regions was a starting-point for this agricultural research. Improvement of health care in rural communities, and an understanding of the many variables that influence couples in deciding the size of their families. An understanding of the processes of modernization and change, and of the social, economic, political and cultural consequences of change. Improvement of the means of collecting and disseminating information for and about development.

### How international is IDRC?

The Board of Governors consists of 11 Canadians and 10 non-Canadians. Six Governors are drawn from developing countries.

In May 1975 the staff totalled 330, of whom 266 were Canadian. The 64 non-Canadians came from 26 different countries. The Centre has established four regional offices — in Singapore, Bogota, Dakar and Beirut (and a fifth soon in Nairobi) — and each is headed by a national of the region. Some 78 members of the staff work in these regional offices or at other places outside Ottawa.

### How does it fit in with the work of the Canadian International Development Agency?

IDRC has been the managing agent for CIDA's two largest grants in agricultural research (in triticales development and cassava-swine research). Staff from each organization attend the other's project review committee meetings. In principle, IDRC supports the more innovative and risky research, and passes to CIDA proposals for larger-scale support of projects incorporating proven new technologies.

†"To Conquer Hunger: Opportunity and Political Will". Address given at Michigan State University, 16 May 1975 (reprinted as booklet IDRC-048e).

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## People and Health

The World Population Conference took place in Bucharest in the middle of the year under review. It provided a yardstick by which to measure the work which IDRC had been supporting, and gave pointers to where support might go in the future. George Brown, director of the Centre's Population and Health Sciences Division, summed up on the lessons of the Bucharest Conference in these words:

"Over the past four years the Division has developed a research program that is broadly congruent with the recommendations of the World Plan of Action. This program places population concerns in the broader development context. It seeks to increase our understanding of the relationship between population variables — fertility, mortality and migration — and other development issues including economic levels, education, employment, agriculture, health, urbanization and the role of women, to mention a few of the most important".

The emphasis on breadth means that the research supported by the Centre in the area of population and health involves a wide range of disciplines, from the physical sciences (research on contraceptive technology, tropical diseases and sanitary engineering) to the social sciences (experimental health care delivery systems and investigations of the dynamics of population change). The sections that follow give some idea of this broad approach.

### Population Policies and Dynamics

The Centre's basic approach, of encouraging scientists in developing countries to identify their own research, fits well with the views strongly expressed at Bucharest that every country must elaborate its own policies on population and development. To help draw social scientists in developing countries into collaboration with decision makers on population issues, the Centre began supporting in 1974-75 a variety of programs in line with this aim. One of these

is the PISPAL program (Social Research on Policy-Relevant Population Problems in Latin America), which involves a group of Latin American institutions in a collaborative research program. With a similar objective, an awards program was launched in Southeast Asia to encourage young social scientists working in the population field, and the first 13 awards were made in January 1975, to candidates chosen by a selection committee of Asian scientists.

Investigating the factors that determine fertility behaviour involves many different approaches. Social scientists in Thailand, the Philippines and South Korea completed a study of the value of children to parents, in which they found some striking cross-cultural similarities, as well as some sharp differences in view between husbands and wives. A regional Committee on Comparative Behavioral Studies in Population (COMBEP), with headquarters in Seoul, was formed as a result of this collaboration; and an enlarged group, including Turkish researchers, is now starting to relate these findings to policy issues and family planning programs.

When patterns of population change differ between areas inside a single country, researchers are gathering demographic data that can help pinpoint the causes. Demographic surveys of this kind have been supported in Brazil, Tanzania and Zaire. [(See page 8, a description of the work done in the two African countries).]

Other population projects have focussed on a particular variable. The economic circumstances of families, the financial contribution and cost of children in a family's budget, are being studied by researchers in Senegal and Thailand. The various causes and effects of migration are being assessed in Central America and Upper Volta. Meanwhile, the Colombian Association for the Study of Population is coordinating a study of the changing role of women in the society of a country that is in transition to a modern indus-





trialized state, to analyze how these changes affect patterns of marriage and contraception — and in turn affect fertility rates and population trends.

Social scientists are also concerned about the other side of the coin: the effects of population change in terms of demand for jobs, housing and various services. Following the large study of rural-urban migration to eight metropolitan cities in Latin America and Asia, which ended in 1973, a smaller study of the same sort has been supported in Papua New Guinea; there the focus has been upon the job opportunities open to those who move from rural areas to the coastal cities. In Turkey data from the 1970 census is being analyzed to bring out the implications of the existing and projected population growth in all 67 provinces as it affects needs for additional housing, health care, food and employment and educational opportunities.

### **Contraceptive Technology and Family Planning Services**

Delegates at Bucharest readily acknowledged the need to develop new methods of fertility regulation, as well as better ways of delivering family planning services. Last year's annual report described the work being done on contraceptive techniques under the WHO Expanded Program of Research on Human Reproduction, to which IDRC made two contributions. It also mentioned the network organized in Central America to do biomedical research and to develop contraceptive methods considered most appropriate in that region. During 1974-75 the International Committee for Contraceptive Research, supported by an IDRC grant of \$500,000, undertook to evaluate promising leads in research on new types of contraceptives. The ICCR, a standing committee made up of researchers from six countries, is working with pharmaceutical companies so that proprietary materials are made available for testing and development.

Early in 1975 a new network of research on human reproduction was formed of doctors and scientists in universities in Singapore, Malaysia and Indonesia. Like the earlier one established between six institutions in Mexico and Costa Rica, it should lessen the dependency on research done in the developed world; and the Asian scientists will have the opportunity to concentrate on methods likely to be locally most acceptable.

Innovative approaches to the management and delivery of family planning services have been supported in several countries, including Mali and Thailand. The Thai experiment, seeking ways to integrate the country's 13,000 traditional birth attendants into the national family planning program, is described in the section on page 10. In Mali, the pilot project that began in 1972 to establish a family planning clinic in the capital, Bamako, was completed during 1974. The clinic was organized to offer health care services to mothers and children, as well as advice on family planning. The Malian authorities considered the pilot

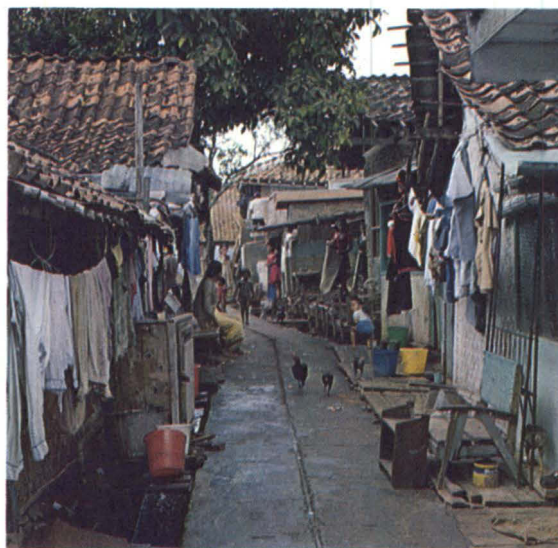
scheme so successful that they decided to extend the program to seven regional capitals, as well as opening other clinics in Bamako; they are thus shifting the pilot scheme into a national program of family planning, the first to be established in sub-Saharan francophone Africa. IDRC is contributing \$243,500 to this second phase.

### **Rural Health Care Delivery**

Many countries in the Third World have begun looking for alternatives to the physician-based, curative orientation of health care favoured in the rich countries. They are searching for ways of providing comparatively low-cost services to the largest number of people: this means, in effect, basic health care of a preventive nature being made available to rural communities.

Two publications, produced by the IDRC during 1974-75, illustrate this trend. One is a booklet *Doctors and Healers*, written by Alexander Dorozynski. The other is a bibliography compiled by Shahid Akhtar on *Health Care in The People's Republic of China*, which contains abstracts on 560 books, articles and unpublished papers written on this topic. The Chinese "barefoot doctor" program has aroused wide interest in the 16 years since it was first launched, and authorities in many developing countries have wondered how it might be adapted to the conditions of their own regions; this 182-page book should therefore prove a useful guide in many quarters. To ease the work of compilation, the author was able to make use of the Centre's ISIS computerized information system that has been installed for library management and information retrieval as participants in a worldwide network. Further volumes of bibliography, complete with abstracts, on rural health care in other developing countries will be published as they are completed.

In supporting action research in this area, the Centre's main focus has been on experimentation with rural





health care systems that are based on the use of auxiliary health personnel. An ambitious pilot project of this kind is now under way in hilly country south of Cali, in Colombia, where the training of auxiliary health workers is only part of an attempt to provide a complete health care system inside a rural development program. In neighboring Venezuela an evaluation was carried out during 1974 of the "simplified medicine" program that has been operating for 10 years and is built on a pyramid of health care whose base is the medical auxiliary running a village clinic and referring more difficult cases to doctors and nurses in health centres and district hospitals. The evaluation report will soon be available. Conferences on health manpower needs and the use of medical auxiliaries were sponsored at Medellin in Colombia for 50 Latin American government and university leaders who plan manpower programs, and in

Malawi for policymakers from 8 countries in East and Southern Africa.

In Asia, there were encouraging results from the project in southern Iran where the first village health workers have finished their training and are on the job in their home districts. A description of that project appears on page 12. A slower start has been made in Nepal, where the government with IDRC support is undertaking an analysis of the country's health needs and resources, as a basis for developing training curricula and a comprehensive health manpower plan. It is a dauntingly large task to make such a plan for 12 million people scattered over mountainous country; but the project is expected to continue during 1975-76.

Some areas in the Third World lack any means by

## Demography – data aids development plans

Demographic studies in the neighbouring countries of Zaire and Tanzania began in 1973 and neared completion during 1974-75. Although the projects in each country were different in several respects, they had the common purpose of providing data on population and fertility rates for national government use in further development planning. IDRC provided funds for the research and for the two teams to meet and compare notes.

Work in Zaire consisted of a survey of the population of three major cities: Lubumbashi, Kisangani and Kananga, (formerly known as Elisabethville, Stanleyville and Luluabourg). The survey was undertaken by the National Institute of Statistics (INS) under its scientific director, Nzeza Zi Nkanga. The interviewing teams used a questionnaire which covered details of migration, housing and employment as well as data for the calculation of fertility and mortality rates. The interviewing was completed in mid-1974. While the data for Kisangani had been tabulated by December, in general the work of data processing has gone more slowly than was expected because of a lack of programming skills and computer time.

Similar problems with data processing have slowed the progress of the national demographic survey in Tanzania. There the field work was very extensive, covering 112 sample areas in 18 regions, of which 70 were rural clusters. During the five months of data collection at the end of 1973, the 260 enumerators endured difficult conditions of travel and rough living in areas where food was often scarce. But they collected basic information on 268,000 individuals, including data on health factors that relate to fertility trends. During 1974, under the direction of Professor Roushdi Henin at the University of Dar-es-Salaam, the data was coded, punched and validated. Early in 1975 the first output from the tapes was available; it will be used in the final version of the 1975-79

### Five-Year Tanzanian Development Plan.

The two projects highlighted a problem that appears common throughout Africa: a lack of skills in data processing. However, advances were made in training and in future planning. In Zaire further demographic work is being done by INS staff in collaboration with the National University. In Tanzania five senior staff of the Bureau of Statistics and the University got valuable field experience which will be of particular benefit during the 1978 national census.

The Tanzanian Government also showed in a most tangible way the importance it attached to the project. Because of delays and other factors, there was an over-run of costs, which the government covered entirely. Its direct contribution to the project increased to \$171,430, while the IDRC grant remained at \$74,000.





which ideas can be exchanged at a popular level on a broad range of subjects from nutrition and hygiene to community mobilization for development. A gap of this sort was identified by people in the francophone states of West Africa, and the Centre sponsored a meeting in December 1973 in Dakar to explore how this gap might be filled. The 24 participants included doctors, health workers, teachers, members of trade union groups, district authorities and leaders of women's organizations. The meeting showed they favored the launching of a magazine which would focus on issues of family health including sex education and family planning, and would also cover wider issues of development to which these more immediate family concerns are related. Plans went ahead to produce a magazine *Famille et Développement*, published in Dakar and edited by Marie-Angélique Savané and Pierre Pradervand. A sample issue created much enthusiasm throughout the region, and a first issue (with a print run of 40,000 copies) was produced in January 1975, with the second issue following in April. The Centre has made a three-year \$644,000 commitment to support this periodical, which is starting as a quarterly and may become bi-monthly.

### Water supplies and waste disposal

A major cause of death among young children in developing countries is gastroenteritis, which can be traced to poor sanitation and contaminated water supplies. Prevention of sickness derived from these sources is a massive task, on which relatively little research has yet been done. The problem is often worse in rural communities. The Centre co-sponsored with the UN Development Program a meeting in Montreal in April 1974 to discuss the problems of

research and program development in rural potable water and sanitation. The keynote document for this meeting of representatives of seven international agencies was a report to the IDRC prepared by Professor Ian Burton of the University of Toronto. The agencies agreed to form a working group whose job it is to outline a 5 to 10-year program by which technological information can help speed up the provision of water supplies and sanitation services to rural communities in the Third World. Chairman of this working group is Dr. Myer Cohen, who was formerly Deputy Administrator of the UNDP and is now working as an IDRC consultant.

The working group has recommended the creation of a network of regional and national centres, which could promote projects and programs of adaptive research and training. The centres would also develop techniques and materials to promote community involvement and create a system for collecting and spreading information.

IDRC's involvement has now moved to the phase of helping design an information system and supporting projects. On the informational side the Centre published, as a by-product of Dr. Burton's work, an 82-page annotated bibliography *Rural Water Supply and Sanitation in Less Developed Countries*, by Anne U. White and Chris Seviour, and is now working to help set up the network's international information system. The first research projects supported were in Tanzania, where tests are being carried out on types of compost toilets to adapt them for tropical conditions; and in Peru, where the performance of a water treatment plant is being evaluated. It is likely that many future projects will be in Asia, where the benefits of Latin American experience in this field

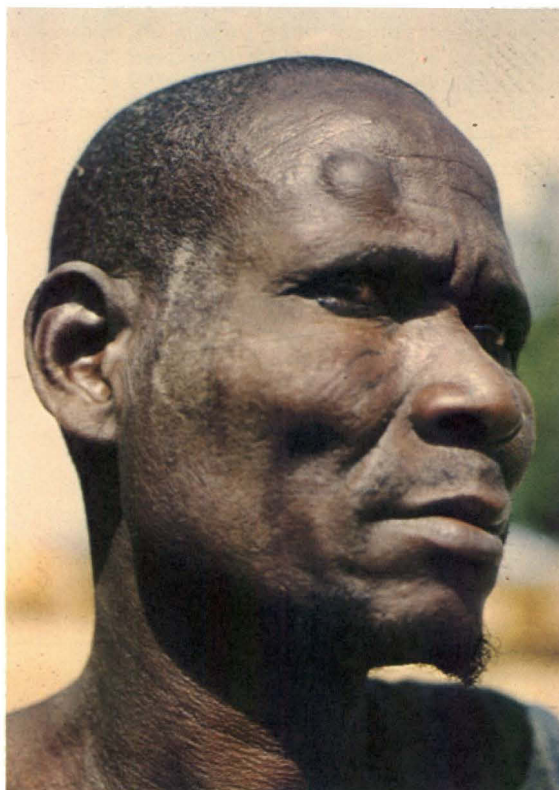




may prove useful.

### Disease prevention

The prevention of tropical diseases is a vast field, in which many specialists have worked for a long time. The Centre, arriving on the scene at a stage when there is rising concern about the effects on the environment of chemical pesticides, has concentrated its support on research into biological control of vector-borne diseases. The first of these was the work on the control of the blackfly vector of onchocerciasis, the scourge in West Africa known as river blindness, by means of a parasitic worm or mermithid. A section in last year's annual report gave details of the work being done in Ivory Coast and Upper Volta, as well as the collaborative research at Memorial University in Newfoundland. During 1974-75 this parallel research continued to make



## Thai midwives – updating traditional skills

The government of Thailand set a goal of reducing the country's rate of population growth from 3.2 percent to 2.5 percent during the period 1971-76. But nurses and government midwives are not numerous enough to organize health care and family planning services throughout rural areas, where 80 percent of Thailand's 42 million people live. A neglected resource in this campaign seemed to be the 13,000 mohtamyae, or traditional birth attendants (TBAs): ordinary village women, who spend their days farming or keeping house, but who are called upon once or twice a month to attend a mother in childbirth, having mostly learnt this skill from a grandmother. Many mohtamyae had been given training, by the Ministry of Public Health supported by UNICEF, to improve their delivery technique. But no study had been undertaken of the part they might play as motivators for family planning in their villages.

Staff from Mahidol University's Faculty of Public Health began such a study in 1973, supported by IDRC with a contribution of \$39,700. They chose four areas in central Thailand, and worked with a sample group of 136 TBAs. In three areas the mohtamyae attended a four-day training course, during which they were given talks not only on improved delivery methods (each of them was given a UNICEF delivery kit at the end) but also on broader population

questions and the part they could play in the national campaign by motivating the mothers to family planning during the appropriate period after childbirth. The fourth area was left untouched, as a control group. Further, in two of the areas where training took place, the mohtamyae were also offered an incentive of 10 baht (50 cents) for each new acceptor.

They were interviewed in 1973 before the training course and again a year later in mid-1974, to learn what effect the course had on them. The survey, directed by Dr Srisomang Keovichit, showed that TBAs who were over 50 years old (as were the great majority — 106 out of the 136 in the sample) were usually not keen to work on behalf of family planning: they were tired from other activities, or had difficulty in walking, or had other reasons. The younger and more literate group was far more interested, and about half of them became active motivators. The incentive scheme was only partially successful, since many mohtamyae were reluctant to spend a bus fare to travel to the clinic for their reward.

Yet the project has produced useful recommendations which Dr Srisomang is presenting to government. Chief among these is that, as is now the case in Malaysia, the government should become involved in



progress, particularly in the study of different chromosome types of blackfly and in the tracing of mermithids to the smaller rivers. The project is likely to move into a second phase of financing in the coming year.

Progress in the control of onchocerciasis, while slow, is encouraging enough to take a similar biological approach with other tropical diseases in Africa. These include trypanosomiasis, the sleeping sickness that is spread by the tsetse fly, and schistosomiasis, for which the intermediate host is a snail that lives in slow-moving waters. The World Health Organization has taken moves to create an international research program on these and other tropical diseases, and the Centre is cooperating in the planning phase of this endeavour.



seeing that younger mohtamyae are selected and trained, and that the working link between them and the government midwives is greatly strengthened. The government has taken a step in this direction by instituting a training program in four provinces of Northeast Thailand.

A 25-minute film was made of the mohtamyaes' training and work, and copies were printed with Thai and English narration. A travelling seminar on the role of TBAs in family planning, which drew together health officials from Indonesia, the Philippines and Malaysia as well as Thailand, took place in July 1974; and the papers were published by IDRC. Subsequently in 1975 IDRC has committed \$42,500 to a broader-based project in rural northeast Thailand through Khon Kaen University which involves the training of village volunteers as auxiliaries in health and family planning and as distributors of contraceptives.

## Iran's volunteer health workers win acceptance from all

Iran has about 10,000 physicians; but half of them practice in Tehran and another third in other big cities. That leaves some 1500 physicians to look after 23 million people in smaller towns and rural areas. The Rural Health Corps, in which medical and dental graduates do a two-year stint in national service, has set up 400 stations and provides mobile clinics. However, more than half Iran's 55,000 villages are not covered by any form of health care.

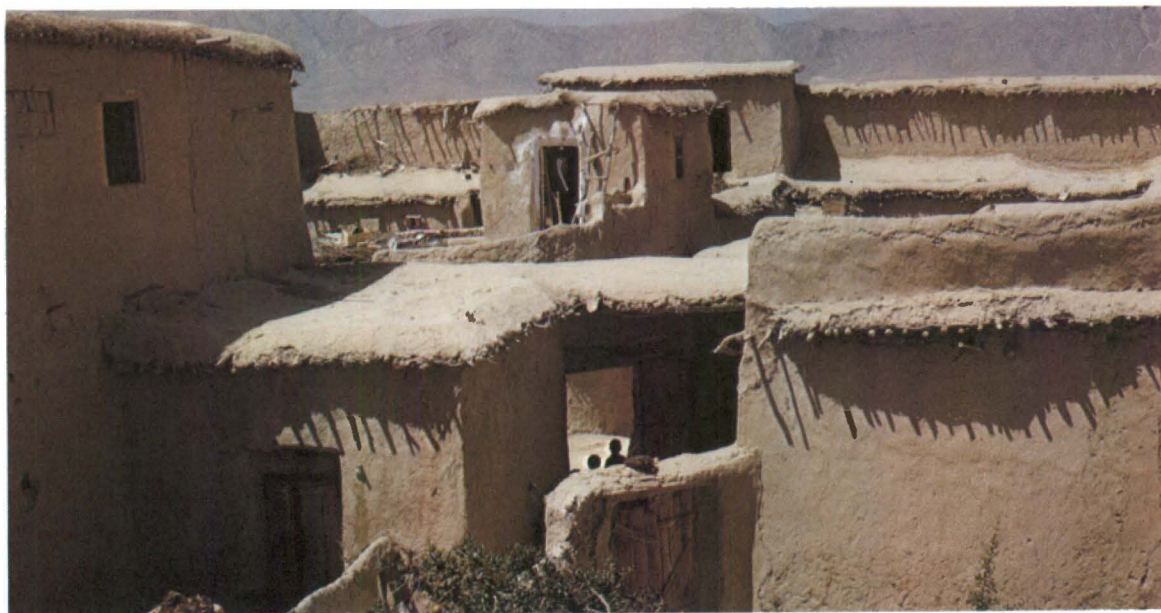
In 1973 the Department of Community Medicine at Pahlavi University, supported by an IDRC grant of \$147,600, began a pilot scheme to train village health workers in Fars province in southern Iran and to study their work over a two-year period. By early 1974 a group of 16 villagers, who were literate but did not have more than six years' schooling, had been selected and given six months' training in basic health care. They began their field work, back in their own villages, in April 1974.

The work has gone well. All 16 VHWs have stayed at their job (although one ex-farmer was briefly tempted away to work in a cement factory). In the first six months they treated 4,875 cases, and the number of patient visits was rising each month. About half the clients' complaints dealt with by the VHWs were gastrointestinal (childhood diarrhea has been a common cause of death here) and upper respiratory infections (colds, sore throats, gripe). Women, and

children under four have made particular use of VHW services. The health workers also visit up to four homes a day, for follow-up care of patients, examination of babies and talks on nutrition and sanitation. They also visit schools and examine students for personal hygiene and communicable diseases.

There have been problems. The number of forms on which VHWs had to record these activities increased to overwhelming proportions; so the record-keeping system was revised and streamlined. It has been difficult to follow through with projects of better sanitation, even though villagers became enthusiastic for improvements, because of lack of materials and funding. A rapid turnover in the post of physician in the area has hampered plans for regular supervision of the VHWs (Pahlavi University has provided its own supervising physician).

Nevertheless, the pilot scheme seems to have won acceptance both from the villagers and from the government, which has funded the training of a second group of 30 VHWs. Dr Hossain Ronaghy of Pahlavi University, who has been directing the project, is now concerned that this scheme be integrated with other similar health worker projects in Iran, in a coordinated effort to provide primary and preventive health care for everyone.





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## Food Production

Much of the public interest in the World Food Conference in Rome last November centred upon the response of the rich countries to the possibility of further famine in Africa and Asia and their readiness to contribute, in cash or grain, to a world food reserve. Canada took a lead at that conference in pledging 1 million tons of grain a year for three years. Such a reserve can be an insurance against calamity in countries with relatively small populations, like the states of Sahelian Africa. But food aid, however promptly provided by the four grain exporting countries (the United States, Canada, Australia and Argentina), cannot be of more than marginal help at times of shortage in the major populated areas of the world.

This point was underlined by IDRC President David Hopper when he addressed the Centre's Board of Governors in March 1974. He said:

"For India, Indonesia, Pakistan, Bangladesh and much of Southeast Asia, the only prospect for a true food reserve is the enhancement of their national agricultural capacities to produce minimal needs in a drought year. It is to their own agricultural economies that they must turn for protection."

But can they produce enough for their minimal needs? Because of the current world shortage of fertilizer and other factors, Dr Hopper could only be gloomy about the prospects for these large countries if a widespread drought such as that experienced in 1972 recurred during the next several years. About the longer term he was more optimistic, and concluded:

"Even for land not blessed with nature's largesse, modern agricultural technologies offer great opportunities to enjoy the benefits of a prospering agriculture. The irrigation technologies developed in Israel; the discoveries now being made in plant drought resistance and photosynthetic efficiency, in pest and

pathogen resistance, and in maximizing the product of the symbiotic interactions of plant, soil, water and sunlight; the improvements in the effectiveness of farm production inputs and in the elimination of waste in the processing and handling of farm products; and the work under way to upgrade the nutrient quality of the food produced — all these open vast new frontiers through science to provide an assurance that all can eat."

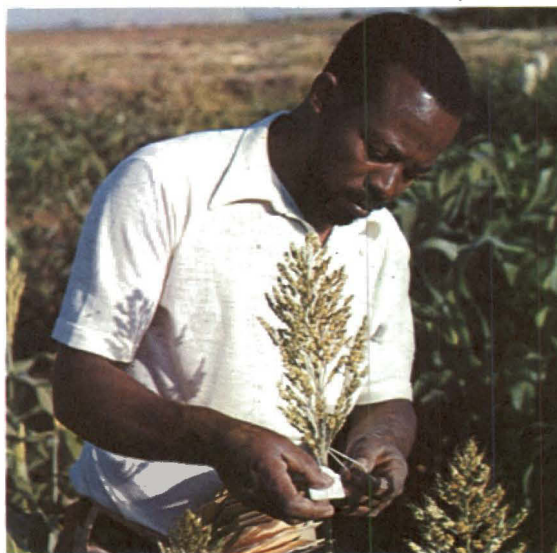
These are the varied areas of research which the Centre has been concerned to support in its efforts to help increase world food production.

### International Centres and 'Outreach' Programs:

Much of this work demands basic research of a kind that can only be done in large institutes. For this reason, the Centre has contributed to programs of crop research at the major international agricultural centres in tropical regions — in Mexico, Colombia, Nigeria, India, Lebanon and the Philippines — but it has also on occasions added linkages in two directions.

One direction is further back, to even more fundamental research at Canadian universities that is supportive of the work at these tropical centres. An example of this is the grant made in mid-1974 to the University of Saskatchewan to carry out studies on hormonal control of stress and other physiological factors that may be the key to breeding varieties of sorghum that will produce high yields under conditions of continuous or intermittent drought. This five-year study in Canada is closely linked with the collection and breeding of sorghum at two centres in Third World countries — the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and the Arid Lands Agricultural Development program (ALAD) in Lebanon.

The other direction is onward from the big research station to smaller liaison stations, where improved





varieties are tested in a range of climates and environments. To take the example of a different crop, triticale, a man-made cross between wheat and rye which has been shown to perform well on marginal lands where yields of wheat decline. Some fundamental research on triticale has been done at the University of Manitoba, backing up the major plant breeding program at the International Maize and Wheat Improvement Centre (CIMMYT) in Mexico. During 1974 IDRC funds totalling \$600,800 helped establish field trials across a network of testing stations — in northern India, in the Kenya highlands, in Algeria and in Chile. Each of these trials should have findings of interest to the other regions: the Kenya trials, for example, are concerned with breeding varieties resistant to "rust" fungus.

The crop research on the cereals triticale, sorghum and millet and on the rootcrop cassava has been described in some detail in earlier IDRC publications, either in annual reports or issues of the quarterly *IDRC Reports*. Both for this reason, and for the reason

that grain legumes can provide the protein needed to balance the bulk of these other staple foods of tropical regions, we are giving more space in this review to the work that has been supported in research to improve pigeon pea, chickpea and other legumes (see below). Research in grain legumes has involved breeding programs at regional centres and field trials in different countries.

Particular attention will also be given to a number of oilseed crops, including sesame, safflower, groundnuts and rape, which are both good sources of edible vegetable oil — of which there is a serious world shortage — and of edible protein.

### Post-Harvest Systems

There is a heavy loss, or wastage, of food between the point of harvesting and the time of consumption. Estimates of loss have run as high as 30 percent. Yet researchers have until recently concentrated on the problems of improving production in the farmers' fields, and largely ignored the companion problems

## Grain legumes – no longer a neglected crop

Legumes are important in the developing world because they are the cheapest available source of edible protein. Pigeon pea, a woody shrub that produces pods over a six to nine month period sometimes extending to two- or three-years, is grown from India (where the dried peas are cooked in the traditional pulse dish of "dhal") to the West Indies. Pigeon-pea and chick-pea, which though a very much smaller plant has a strong tap-root that allows it to survive drought conditions in India and West Asia, are major sources of protein in that region. Like the cereal grains of the semi-arid tropical regions, sorghum and millet, these grain legumes have been neglected by research scientists until recently. The yields have been low: the average yield for pigeon-pea is about 600 kilograms a hectare, and for chick-pea less than 400 kg. Yet experimental plantings have shown that they have a potential of 8 to 10 times that yield.

IDRC has been involved in the building of a world network of research in grain legumes, with focal points in India at the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and in Lebanon at the Arid Lands Agricultural Development program (ALAD). It has also supported research on a national basis elsewhere, for example in Trinidad and Algeria. In other countries, like Senegal and Tanzania, research on legumes is part of intercropping experiments with sorghum and millet. Here there is room only to bring out the highlights of this program, which has so far involved IDRC commitments of nearly \$3 million.

In **Trinidad** the main objective in the breeding of pigeon peas has been to select and cross for an early

maturing dwarf type for close spacing. Dr R. P. Ariyanayagam, of Sri Lanka, was recruited as plant breeder in December 1973 and he has been working with 200 varieties, some of which were introduced from India, Australia and the Sudan. A physiological study, tracing the plant's typical growth and development pattern, has been completed and this produced records of a low Harvest Index (the ratio of grain to total vegetative plant matter) of about 20 percent compared with as high as 70 percent with soybeans. This is a base from which improvements have to be made.

In **India** more than 4000 varieties of pigeon pea have been collected at ICRISAT headquarters in Hyderabad, and are being crossed and tested (through cooperation with five other agricultural stations) in a wide range of latitudes and altitudes. Two crops are being grown each year, and samples of the most promising progeny of the many crosses made are being supplied to legume breeders in 10 other countries. The ICRISAT program is concentrating on breeding for resistance to wilt and insect damage, which are the main limiting factors in preventing higher yields in India. Measurements of cooking time are being made, a very important factor where food supplies are limited and difficult to obtain.

The collection of chick-pea varieties at ICRISAT is even larger: it numbers more than 9000 lines collected from 32 countries. A small army of local villagers has been trained in the technique of hand-crossing selected varieties for planting in the 18 hectares set aside for chick-pea at Hyderabad; other off-season nurseries have been established in **Lebanon**

of how to protect and transport food crops from the fields to the needy consumers. This can involve both taking crops from regions of abundance to those of scarcity, and preserving crops from seasons of abundance to those of scarcity.

The Centre sponsored two studies into this problem, in order to identify the weakest links in the chain of threshing, drying, storage, processing, transportation and marketing. One team under Dr Dante de Padua of the University of the Philippines studied the shortcomings in post-harvest rice technology in four countries of Southeast Asia, and as a result a number of projects are beginning to take shape in Indonesia, Thailand, Singapore and elsewhere. Also in 1974 a mission from the University of Alberta spent five weeks analyzing the food grains industry in semi-arid Africa, studying particularly the systems in Senegal, Nigeria, Ethiopia, Kenya and Tanzania. The topic was given prominence at the Commonwealth Ministerial Meeting on Food Production and Rural Development in March 1975, when J. H. Hulse, Director of the



and North India, in order to grow two crops a year and accelerate research. Work has also begun on selecting varieties on the basis of cooking qualities.

The ALAD program is many-sided. It is primarily aimed at improving the yields of three crops: chick-peas, broad beans (which is a particularly important food in **Egypt**) and lentils. It has involved collection trips, the most dramatic being a five-week expedition to **Afghanistan**. After screening this germplasm collection, a group of 168 chick-pea entries was sent for evaluation to a dozen countries of North Africa and West Asia in 1974, and the same procedure will be followed with the other crops in 1975. IDRC has contributed to this regional cooperation further by financing a training program for young plant scientists to spend a growing season in **Lebanon**, and return home with varieties they themselves have selected for further breeding. In 1974-75 the ALAD food legume training course brought 16 plant scientists from 10 countries to Lebanon for a five-month stay.

Another IDRC initiative in grain legume research has been the support of tests, under ALAD auspices in Lebanon and Egypt, of chemical compounds that can cause the parasitic weed orobanche (or broomrape) to germinate prematurely in the laboratory. Normally orobanche seeds lie dormant in soil until stimulated by chemicals exuding from a host plant such as lentils and broad beans, which the orobanche weed then proceeds to infest. The development of these "synthetic dormancy breakers" has taken place at the University of Sussex during IDRC-supported research on a chemical means to control striga, a weed that lives

off sorghum; fortunately, the compounds developed in the striga research appear from laboratory tests to be even more potent in stimulating orobanche to germinate. At present, there are difficulties to overcome in the application of germinators in soil. The next stage are field trials at Giza and in Lebanon.

A further contribution to the grain legume network has been the IDRC grant of \$222,500 to the International Institute of Tropical Agriculture (IITA) in Nigeria to help meet the first three years' costs of setting up a grain legumes information centre where documentation will be gathered on cowpeas, the minor groundnut species and various beans.



Agriculture, Food and Nutrition Sciences Division, presented a paper on the subject.

It seems likely that a great deal more work of methodical research into improving post-production systems will start in many tropical countries during the next few years. The Indian Council of Agricultural Research, for example, is coordinating a study being undertaken by five institutes to improve post-harvest systems for a variety of food crops and in a wide range of climates in India. Teams of agricultural

engineers will be working with small farmers to test and adapt different kinds of threshers, dryers, dehul- lers, cleaners, milling and other processing equip- ment. IDRC is contributing \$360,000 to this particu- lar study over a three-year period.

Meanwhile, the pilot grain mill set up at Maiduguri in northeast Nigeria (which was described in some detail in last year's annual report) has produced results sufficiently encouraging for the Government of Nigeria to decide to set up 15 similar mills across

## Aquaculture – it's all a question of breeding

At present only about eight percent of the world's fish production is derived from aquaculture. But as a plateau is reached in capture fisheries of about 68 million metric tons a year and warnings become clearer that many of the most valuable wild stocks (such as herring) are being over-fished, more atten- tion is being paid to aquaculture, or fish-farming. This is particularly true of Southeast Asia where already 4 million tons of fish and fish products are raised each year through aquaculture. They range from milkfish and mullet bred in coastal waters; shrimps, prawns and oysters cultivated by various means; to carp and other native fish raised in inland waters. The question has been how to increase this production many times over.

IDRC's involvement began with the sponsoring in April 1973 of a seminar at Malacca in Malaysia, where representatives of 11 Southeast Asian coun- tries stated their priorities and needs. From this semi- nar began to flow proposals for projects. By 1975 the Centre had moved to support research in the breeding of carp in West Malaysia and India, in milkfish in the Philippines, and in oysterculture in Sabah (East Malaysia). Since the last two projects were only starting in mid-1975, the rest of this section is de- voted to a description of work done collaboratively in British Columbia and Malaysia on research into the induced spawning of grass carp.

The shortage of fish seed supplies was a problem pinpointed at the Malacca seminar. This has been a particular problem with Indian and Chinese carp, which will normally only deposit eggs within their natural spawning grounds and only at certain sea- sons. Malaysia, moving to increase fishpond produc- tion of carp, faced a grave shortage of seed and was continually having to import fish fry at heavy cost in foreign exchange.

In British Columbia scientists of the Fisheries and Marine Service of Environment Canada had prepared gonadotropin, a hormonal extract from the pituitary glands of salmon taken when spawning. This gonad-otropin was to be injected into female and male carp, when the female was ripe for spawning, to induce her to lay her vast numbers of eggs (and the male to

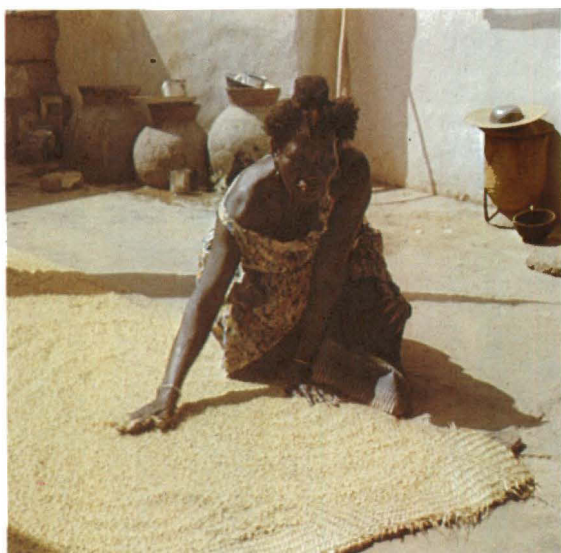
fertilize them) in controlled conditions where few would be lost.

Late in 1973 thousands of salmon were taken from Spring Creek in Washington state, from a spawning channel on Vancouver Island and from the canneries in Vancouver. While the salmon went to the canneries, the pituitary glands (weighing about 60 milligrams each) were removed and turned into a purified extract after being placed in a "fraction collector" machine to separate the gonadotropin. The final product of the glands of 10,000 salmon was a white freeze-dried powder filling three small vials. In all, about 18 grams were prepared for spawning experiments in Malaysia, enough (it is thought) to inject into 500 large carp.

In further research in Vancouver early in 1975, experiments were carried out to measure the effec- tiveness of the gonadotropin after storage in tropical conditions. Day-old chicks were injected with tiny amounts of gonadotropin, (which had been either kept absolutely dry or stored in varying degrees of humidity, and temperature) were later dissected to measure the growth of their gonads. Goldfish were similarly treated to test for ovulation.

In Malaysia the research station at Malacca has some of the best facilities in Asia, with fishponds and well-equipped laboratories. A major need during 1974 has been to give further training to the young staff of researchers. Studies on the improved nutrition of the carp being used for spawning experiments are necessary. A consultant from the University of Guelph visited Malacca in January 1975 to advise on nutrition, and Dr. H. Chaudhuri of India's Central Inland Fisheries Research Institute and coordinator of the IDRC assisted project in India which works on composite culture of carp, also spent a month in Malaysia as an adviser. He brought encouraging word of having stocked ponds in West Bengal with six compatible species of carp and other fish, and having harvested as much as 10,000 kilograms per hectare. Two Canadian advisers, an endocrinologist and a nutritionist, have been posted to the three-year project, which is expected to get fully under way during 1975.





the country. Research backing up the Nigerian project is under way at the Prairie Regional Laboratory in Saskatoon and at the College of Home Economics of the University of Saskatchewan, and principles developed at Maiduguri are being applied for small-scale processing industries in Lebanon and other countries in that region.

### Animal Science

The Centre has supported for some time research into converting energy, that was normally unused from cash crops, into animal protein. A first project of this sort was the work being done in Guatemala to develop economic rations for cattle and swine based on the use of high levels of coffee pulp. It was followed in 1974 by work undertaken in six institutes in Mexico on processing sugar cane as feed for both beef and dairy cattle. Pioneering work has been done in Cuba and Barbados on the utilization of sugar cane as cattle feed; the Mexican scientists will carry further the work on technical questions of processing, and also do a special study of the social and economic implications of this change in sugar cane utilization.

Most of the cassava research supported by the Centre, both at the International Centre for Tropical Agriculture (CIAT) in Colombia and in the network of projects that now extend across Africa and Asia, is concerned with improvement of this starchy rootcrop as animal feed rather than as human food. During 1974 the Centre published a booklet *Current Trends in Cassava Research* (IDRC-036e) in which Barry Nestel, associate director for animal science, summarizes the great amount of research now being done on this crop. Since it was published, other institutes have joined the network with major projects: among them Khon Kaen University in northeast Thailand and the Malaysian Agricultural Research and Development Institute (MARDI).

Work on animal diseases has centred on East Africa where trypanosomiasis, the parasitic disease transmit-

ted by the tsetse fly, is a major scourge among cattle. It has been estimated that 4 million square miles of potential grazing land in Africa is covered with tsetse fly, which excludes the use of improved breeds of cattle. Most previous research on trypanosomiasis has emphasized applied solutions, such as pesticides, rather than a comprehensive understanding of the basic relationship between animal and disease characteristics which would indicate the type of control methods, drugs or vaccines, that would offer the best hopes of success. During 1974 the Centre began putting substantial funds, therefore, into biological and immunological research. Part of the more basic research work is being done at the University of Guelph in Canada, but the main research is in Kenya where a strong project team has been gathered.

### Forestry and Fisheries

These two separate sectors are grouped here under one heading to emphasize that the Centre's main concern in both cases is research that can increase the livelihood of rural communities, rather than improve the profits of large industries. As well, during 1974-75 the forestry research supported with IDRC funds tended to emphasize the use of plantations to reclaim land for food production.

The description, carried elsewhere in this booklet, of two earlier forestry projects shows only secondary concern for encouraging food production. Later projects that were approved during 1974-75 put this as the central concern. These projects include land reclamation in the Sudan and plantations in Nigeria, where lines of trees will serve as windbreaks or shelterbelts to protect agricultural crops on irrigated and rainfed lands. In Kenya a different approach is being taken: there the research is designed to find species that will grow well on marginal soils and provide enough timber resources for the country so that high rainfall areas at present under forest plantation can by stages be released for agricultural production.

In the fisheries sector, the weight of IDRC support has been placed behind research into aquaculture (or fish husbandry) rather than into improving methods of fish capture and processing. The only project in the latter category is one among coastal fishermen in Ghana. Another section in this review describes the aquaculture network that is taking shape in Southeast Asia, and in particular the collaborative work between British Columbia and Malaysia on the induced breeding of carp. Elsewhere, the work on improving the culture of oysters (a food eaten by local villagers, rather than exported to luxury markets) in the coastal waters of Sierra Leone progressed well during 1974-75.

### Social Science and other Research

So far, this section has dealt almost entirely with research that is being carried out by the physical scientists. It is also important to mention the role of

social scientists and information scientists. The study of social and economic implications of agricultural research, and the methodical organization of agricultural information, are elements that the Centre has done its best to promote.

A major project in this area that neared completion in 1974-75 was the study of the impact, in social and economic terms, of the changes in rice farming that had followed the introduction of high-yielding varieties. The study, carried out through the International Rice Research Institute and a number of Asian institutions, covered 36 villages (more precisely, 2,428 rice farms) in 14 separate areas of six Asian countries. The findings will have the effect of modifying the more extreme interpretations that have circulated on the effects of the "green revolution": they show, for instance, that both family and hired labour actually increased despite the adoption of tractors on several study sites. The research has been edited into a book by Celia Castillo and Randolph Barker, to be published in 1975.

Other social science projects in support of agriculture and rural development include a study in Senegal of how changes in the land tenure law and the establishment of rural community councils have affected agricultural production; and studies in Sri Lanka and eastern Nigeria of how well rural communities and local governments are equipped to react to new technologies and modernization. All three studies advanced during 1974-75.

There was considerable progress in the enormous task of putting into operation, under the auspices of the Food and Agriculture Organization, the international agricultural information system known as AGRIS. The Centre not only contributed \$30,000 to the costs of central processing of the AGRIS file, but also helped establish through a contribution of a further \$125,000 to a small FAO unit in Vienna that accepts input from developing countries on worksheets or paper tape, rather than the magnetic tape required by the AGRIS central processor. The unit is converting this material to magnetic tape, and thus helping the developing countries play the fullest possible part in the system from earliest days. On a regional basis, the Centre helped Latin America to participate in the system by contributing \$250,000 to the setting up of a regional centre at the Inter-American Institute for Agricultural Sciences in Costa Rica where Latin American documents are being gathered and a Spanish-language bibliography is being produced. There has also been support for the setting up of an Agricultural Information Bank for Asia, and the preparatory work on this has resulted in linking the Philippines into the AGRIS system.

The FAO put AGRIS into regular operation early in 1975, and a bibliography of the output, known as *Agrindex*, is now being published monthly.

At a different level of information collection and dissemination, the Centre helped during 1974-75 to add to the number of specialized agricultural information centres. The first among these had been the cassava information centre at CIAT in Colombia. During 1974-75 two others were established: the grain legumes centre at IITA in Nigeria, mentioned elsewhere, and a centre for information on irrigation science and technology in Israel. These centres vary in sophistication. However, they will all collect the literature on their subject, produce bibliographies, perform specific literature searches on demand and operate question-and-answer services anywhere in

## Forestry – trees for people

The long drought in Sahelian Africa has left the people of the region more conscious than ever of their need for healthy forest plantations and woodlots — at a time when this resource has been dangerously reduced. The drought itself destroyed many trees; but, even before those years, the growth of human population had put heavy demands on the forests for firewood, while their herds of livestock in greater numbers than before damaged or ate many young trees.

Two projects of forestry research which began in 1973 in Senegal and Niger were designed to help restore and improve this resource. The first is concerned with improving the quality of gum arabic, the product of acacia trees that has many uses as a stabilizer or thickener in foods, pharmaceuticals and paints. The second is an attempt to establish woodlots near villages so that the women can find fuel for cooking without either spending hours walking long distances for firewood or else burning up millet stalks and animal dung which could better be used as fertilizer on the fields.

The main work on gum arabic is taking place at M'Bidi in northern Senegal, which has been a centre for this export trade for many years. Acacia seeds have been collected from three other countries besides Senegal which have been traditional exporters of gum arabic — Niger, Chad and the Sudan — because it is hoped that the research into improving the species of *Acacia senegal* and *Acacia laeta*, which is being undertaken with the assistance of the IDRC technical adviser Daniel Robert, will be of benefit to the whole line of countries which verge on the Sahara. The seedlings were grown in nurseries for five months before being planted out over some 16 hectares in August-September 1974. The planting season, which has to follow the first rains, is short; and a large effort is being made in 1975 to plant out 34 more hectares in order to reach the agreed figure of 25 hectares a year. In any case, the 9,500 trees planted out in 1974 have nearly all survived healthily; and the plantation has, after some delay, been enclosed with barbed wire as well as thorn tree



the world. The International Irrigation Information Centre has already begun commissioning state-of-the-art reviews, and also has a heavy emphasis on equipment specifications and performance.

The IDRC publications program has been particularly active in producing booklets and volumes related to agricultural research. A full list of publications during 1974-75 is given later in this booklet. Particular mention might be made here of the Centre's first hardcover book, *Nutritive Value of Triticale Protein* by J. H. Hulse and Evangeline Laing.

branches to keep away animals that would damage the young trees.

A vegetable garden has been started inside the enclosure at M'Bidi which can serve to provide nearby villagers with fresh vegetables through the year. The villagers are semi-nomadic, moving to the Senegal river at certain seasons. If the acacia plantations are successfully established and provide gum arabic in regular enough supplies and steady enough quality to compete with synthetics in the industrialized countries and find new markets in other developing countries, the production will create an important source of income for these herdsmen-villagers. Proving that vegetables can also be grown in this district will encourage the villagers to expand the areas under plantation and cultivation.

A start to the woodlots experiment was made in the Zinder region of south-central Niger in July 1974, when some 18,000 trees were planted on parcels of land near six villages in Matameye district. Since this was to be a community project, a good deal of preliminary discussion took place between foresters,

rural animation teams and villagers to make sure the villagers wanted to participate and could agree on what land should be used. Village headmen have subsequently said they are happy with the project and want to put more land under trees, such as neem and cassia, which have been planted in these lots.

Some 10 hectares were planted during the first year, and the original proposal foresaw 150 hectares being planted to woodlots during the five-year project. Much, therefore, remains to be done both in further planting, in training of forestry staff and in the full involvement of villagers in keeping the woodlots weeded and well protected from animals.

The government of President Seyni Kountche took power during 1974, and it is encouraging to see the strong emphasis that the new government is placing upon achieving advances in rural development throughout Niger. Results from forestry work come necessarily slowly, but this scheme has all the official encouragement that could be expected.







## Modernization and Change

As is clear from the two previous sections, on People and Health and on Food Production, the Centre is strongly committed to improving the welfare of people living in rural areas. A commitment of this sort involves an acceptance of the need for change and modernization in the best sense. What is of course more important is that the people themselves must be convinced of the need for change — and, whenever possible, must be able to identify alternative ways of change, so that their policy-makers can set about choosing the way that is most appropriate, or least disturbing, to culture and society. This section, therefore, will concentrate on the support that the Centre has been giving to research designed to ease the process of modernization and change, and to offer developing countries the widest choice of alternatives.

The boundaries of this work are less clearly defined than research in agriculture or health care, or even

population dynamics. Some projects are closely related to food production and rural development (such as the land tenure study in Senegal, mentioned in the last section). Others in sectors such as the movement of people from countryside to cities may have an important indirect impact on the "sending areas" (i.e. the countryside), even though the immediate concern is to improve the situation of the migrants who have arrived in the cities.

A project of this sort is the study of low-cost housing needs in eight Asian countries, which is described on page 22. Another is a study of the role that the hawkers and vendors of cheap goods and cooked foods play in the economy of six cities in the Philippines, Indonesia and Malaysia. This study, which has raised an unusual amount of attention in Canada as well as Asia, is now complete. As well as the country reports and a comparative study, a general booklet and a slide-presentation have been prepared for a conference of mayors and city administrators in Kuala Lumpur, Malaysia, in September, when municipal authorities will discuss with researchers a set of recommendations to improve the conditions of these street traders and their working relationships with authorities.

A major reason for the movement of young people, in family groups or singly, from the countryside to town has been to seek better opportunities of schooling. To gain even a full primary education meant being better equipped to face the challenges of change. What are the chances that primary education can be delivered effectively in rural areas to the increasing number of children there? The answer heard from parts of Asia is: "The chances are not high, so long as the total cost of teachers' salaries is disproportionate to the number of students being taught". In response to this view, the Centre has supported in its program of applied social research an experiment in rural districts of Java and the central Philippines into ways to speed up the learning rates of students with self-instructional mod-





ules, and to alter the ratio of teachers to students. The first year of experiment with students of Grade 4 level has been encouraging, although according to some researchers that particular level is an awkward age for transition from a local language to a national or international language. The project teams are producing modules for other levels, and working out ways in which parents and the community can participate more actively. In the Philippines, links are being made with another experimental system known as In School Off School.

Another project of applied social research supported by IDRC in the field of the economics of education began in Latin America in 1974-75. This is an ambitious study, involving 18 institutions throughout Latin America and costing nearly \$3 million, into the relations between education and the economic and social development of these countries. The IDRC contribution of \$125,000 is supporting pilot studies in urban and rural areas, to assess the importance of

education in finding employment, distributing income and prompting migration.

Two noteworthy publications in the field of education were sponsored by the Centre in 1974-75. The first was *Whilst Time is Burning*, a description and personal assessment of a variety of innovative ideas in education gathered in his wide travels by J. Roby Kidd, of the Ontario Institute for Studies in Education. The other was a booklet, *Study-Service — a Survey* by Diana Fussell and Andrew Quarmby. This was prepared as a working-paper for a conference in Asia of educationalists and leaders of study-service programs, a term coined to describe the broad movement to involve university students, the young élite in developing countries, in a period of rural development work as an integral part of their education. Interest in this movement has spread from Asia and eastern Africa to West Africa, the Caribbean and Latin America. Although this type of program falls largely outside the Centre's main concern in educational





research — the effective delivery of mass primary education — it has a close relationship to the improvement of life in rural communities. The Centre has, therefore, contributed \$492,360 to a collaborative analysis, in six countries where varying kinds of study-service programs have been pioneered, of the impact of these programs and the best structural arrangements to allow small pilot projects to grow into national programs.

The process of modernization and change is affected

by a range of decisions taken by policy-makers in developing countries on how they intend to use modern technologies to fit the development objectives of their particular countries, and on what sort of science and technology program can make best use of the talents of their own trained people. Again, it becomes a matter of seeking to identify alternatives and (going back one further stage) of providing information to policy-makers about where alternatives can be found. This information allows the policy-makers to be selective about what parts of the technology

## Low-cost housing – study seeks solutions to city overcrowding problems

Migration from countryside to cities and continued high population growth rates in urban areas have put many strains upon urban services. A chief problem has been the shortage of housing for lower income groups. The problem is as acute in Latin America as in Asia, as was made clear in the general study of rural-urban migration to eight metropolitan cities which the Centre supported in 1971-73. A project focussing upon the housing problem in Southeast Asian cities began in 1973 as a collaborative effort among institutions in eight countries. A similar study undertaken in seven Latin American countries began towards the end of 1974.

In the Southeast Asian project, the main emphasis has been upon individual country studies. This is partly because the eight countries were at very different stages of handling the problem: Laos, for instance, was just beginning to face the issue of postwar resettlement and housing, while Singapore and Hong Kong are far advanced in their specialized programs of highrise construction. Even so, for all eight countries it was a first analysis of their experience in everything from the financing and physical design of low-cost housing to estate administration. By April 1975 the country monographs were all in final form, and will soon be disseminated not only in English but in several national languages (Indonesian, Sinhala and Thai, for example). The monographs pay strong attention to questions of land policies and program management, but deal also with a range of issues from the social aspects of housing to the cost of sewage treatment. The Philippine study includes a projection of housing needs to the year 2000. Decision-makers, administrators and scholars combined in these country teams to a point where there is every hope that there will be the least possible delay in translating many of the recommendations into policy decisions.

At the regional level, the country project coordinators and deputies have met four times to compare the results of their individual studies and look for common lessons. Papers on comparative aspects of housing have been prepared. These nine aspects comprise: housing conditions and housing needs; housing finance; the economic and social impact of

housing; housing administration; planning and design for low-cost housing; locational aspects of housing development; land policies; squatter area and slum development programs; and rural housing. The papers will be edited into a book later in 1975.

Beyond these studies, writings and policy decisions lies a broad benefit from building a network among the eight countries. Stephen Yeh, coordinator of the whole project, has called this process the creation of "solidarity and esprit de corps that is useful for future cooperation". Radinal Mochtar, of Indonesia, has said the project has created "continuity of contact between the real executives in each country". He thought these links would endure long beyond the lifetime of the project.





“package” can be manufactured locally, to the greatest benefit of their own people, and what parts need to be imported. A separate section gives some details of the program supported by IDRC to provide information to policy-makers on these subjects.

Moving from the offices of policy-makers to the factory floor (or even the small industry in a side-street), the Centre has been concerned to strengthen the flow of information that can improve the management and operation of medium- and small-scale industries. Technonet Asia, a network linking industrial extension services in eight countries to a coordination centre in Singapore and to sources of specialist information in Canada and elsewhere, was IDRC's first venture in this field. During 1974-75 the foundations for cooperation between the participating institutions were consolidated at the Technonet Council meeting, held in October, and the agreed program emphasized the training of extension engineers. A newsletter, published in Singapore every three months, provides a regular link between the organizations. Another venture in the same field was taken with the support for the establishment of an Industrial Technical Information Service in Bolivia. This service, run by a unit in the Ministry of Industry, Commerce and Tourism, will provide coordination for some 1000 small-scale and medium-scale industries in La Paz, produce a technical newsletter and operate a question-and-answer service. It is seen as a step towards participation in wider regional services in the Andean region.

This review cannot end without mention of two other large programs. The first is the Centre's part in promoting the creation of DEVSIS, a worldwide system designed to collect and disseminate information about projects and programs of economic and social development by the same type of structure and means as AGRIS works in the field of agricultural knowledge. The IDRC has not only seconded senior staff to the team which is defining a central operational structure for DEVSIS in Geneva, but has also contributed to institutions in Latin America and Asia which are being developed as potential regional centres for this system.

The second is the Human Resources program of awards to scientists and younger scholars in both Canada and developing countries. This program has grown year by year in numbers as new categories of awards have been added to fit the purpose of broadening the base in Canada of people with a balance of scholarship and practical experience in the problems of development, and the companion purpose of providing opportunities for professionals in developing countries. A special effort is made, during the design of any project supported by the Centre, whether in agriculture or health or social science research, to make sure that young scientists of the region benefit in training and experience as a result of the project. Other training programs are also supported by the Centre. The IDRC's own Human Resources program is intended to be complementary to these other efforts, and be flexible enough to fill gaps in training needs as they become visible. Details of the names of those Canadians and non-Canadians recommended for awards in the period under review are given in the annual report.

## Technology – the best of both worlds

The first research project of the science and technology policy program was the study undertaken by the Junta of the Andean Pact Commission, in order to support the formulation of a regional science and technology policy for the six countries. A description of this project, when it was still in progress, was included in the 1972-73 IDRC annual report.

The research team, under Dr Constantine Vaitsos, studied the experiences of a variety of countries in the use of such financial instruments as tax and credit policies for stimulating technological development, and other policies for encouraging innovation in particular industrial sectors. They studied, for example, the pharmaceutical industry in Italy and the copper industry in Yugoslavia, and the factors affecting the selection of labor-intensive technology in the Indian electronics industry.

Some common characteristics emerged. Technology tended to be transferred in package form, and it was standard policy for these importing countries to "disaggregate" the package into the parts which could be manufactured locally and those for which importation would have to continue. By separating the elements of a technology package, a country could also begin to understand and improve the imported parts of the technology. The Japanese, it was noted, had become exporters of technology by disassembling plants and machines, improving their design and operation, and then selling this technology to other countries. A second common characteristic was that these countries had learnt to reduce the cost of importing technology by searching international markets for alternative suppliers of technology.

In 1973 the Junta presented to the Commission of the Andean Pact (the policy-making body of the Andean Common Market) a document entitled "Bases for a Sub-Regional Policy on Technological Development". Decision 84 of the Commission, a regional science and technology policy, was adopted in June 1974 and was based on the team's research efforts. A second decision, concerning industrial property legislation, was also passed. The regional policy statement notes that research is only one activity in a government's science and technology program, and that the building up of support services (such as training schemes and information systems) is an essential part of putting any program into practice.

The "Summary of the Studies on Technology Policy" and the document, referred to above, on which the Commission based its policy decisions are being published during 1975 in Spanish and English versions.

From this original project have stemmed two other

projects in the Andean region. One of the detailed studies undertaken inside the region during 1971-73 was concerned with the commercial utilization of the tropical rain forests; this was done with the help of two Canadian forestry experts who were provided under a CIDA contract. As a result of this work, the Commission has launched a study of the technological properties of about 100 species of timber to be found in the Andean forests. Testing of these species is being done in laboratories in Peru, Ecuador, Colombia and Venezuela. The objective of this research is the more efficient use of forest resources in the housing and furniture industry, and increased job opportunities in the saw-milling and lumbering sectors. In March 1975, the Centre made a \$988,420 commitment to this project — the largest forestry venture it has so far supported — while the Andean countries contributed the equivalent of \$735,350.

Another grant, to the Junta of the Andean Pact Commission, is to help continue until mid-1976 the work on a strategy for industrial development begun in the original project and summarized above. At this stage, the team under Dr Vaitsos is concentrating on detailed studies of the specific technological requirements of particular sectors. These include agribusiness, the petro-chemical industry, the automotive industry and low-cost housing.

Another significant project is being undertaken by participants in a 10-country network which is assessing the different policy instruments available for implementing science and technology policies. Six institutions in this network are from Latin America (Argentina, Brazil, Colombia, Mexico, Peru and Venezuela) and they are working with others in Egypt, India, Macedonia and South Korea. A project field coordinator, Dr Francisco Sagasti of Peru, assists the teams with the common methodological aspects of the research and coordinates the international, comparative aspects of it. A coordinating committee composed of the country project directors and Dr Sagasti meets twice a year to review the progress of the research and decide policy matters. The third such meeting, held at the mid-point of the project, took place in Cairo in November 1974.

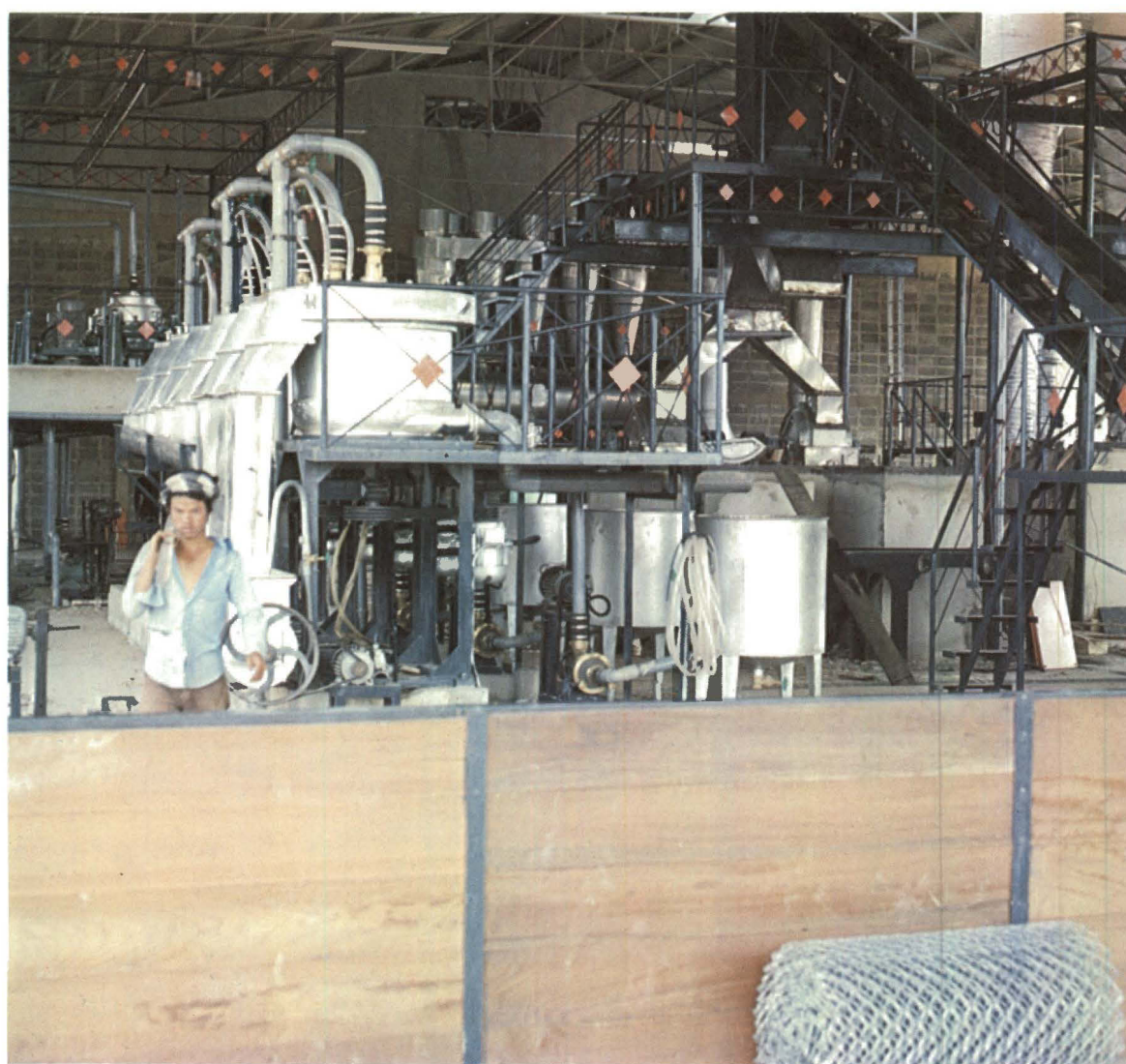
The research in each country is divided into four phases. First, a general diagnosis of the present state of science and technology in each country, to assess the effectiveness of existing policy instruments. Second, an examination of the government's role in the formulation and implementation of science and technology policies, both by direct and indirect policy-making. Third, a series of empirical studies to test the effectiveness of alternative mechanisms and instruments, including mechanisms to provide a linkage between a productive unit's demand for



technology and the indigenous capability for producing it. Finally, studies of the effect that policies have on the behaviour of organizations and research institutes that produce scientific and technical knowledge.

Individual teams have been doing case studies of particular interest to their own countries: the South Korean group has investigated the metal processing industry, while the Brazilian researchers have been analysing state enterprises.

When the project is completed in July 1976, among the results will be not only 10 country reports to assist policy-makers in the individual countries, but also reports comparing four or five different industrial sectors studied by several teams, and consultants' studies commissioned by the coordinating committee on such topics as engineering design and the technology policy of China. These reports will represent an important contribution to the literature published on science and technology policy.









1974  
1975

## Publications and Texts

### Centre Publications

IDRC-003/74e,f

*IDRC Annual Report 1973-74/CRDI Rapport Annuel 1973-74*: Ottawa 1974. 81p.

IDRC-023e (revised)

*Directory of food science and technology in South-east Asia*:

compiled by E. V. Araullo. Ottawa, 1975. 267p.

IDRC-024e

*Triticale*: proceedings of an international symposium, El Batán, Mexico, 1-3 October 1973, Reginald MacIntyre and Marilyn Campbell, ed. Ottawa 1974. 250p.

IDRC-033e

*Interaction of agriculture with food science*: proceedings of an interdisciplinary symposium, Singapore, 22-24 February 1974, Reginald MacIntyre, ed. Ottawa 1974. 166p.

IDRC-034e

*Tsetse control: the role of pathogens, parasites and predators*: report of a scientific advisory group convened at the Memorial University of Newfoundland, St. John's, Canada, 25-29 March 1974. Ottawa 1974. 22p. Also available in French (IDRC 034f).

IDRC-035e

*Whilst time is burning*: a report on education for development, J. Roby Kidd. Ottawa 1974. 120p.

IDRC-036e

*Current trends in cassava research*: Barry L. Nestel. Ottawa. 1974. 40p.

IDRC-037e

*Study-service — a survey: prepared as a background paper for research into various aspects of study-service*, Diana Fussell and Andrew Quarmby. Ottawa 1974. 43p.

IDRC-038e

*Health care in the People's Republic of China*: a bibliography with abstracts, Shahid Akhtar. Ottawa 1974. 182p.

IDRC-039e

*Role of traditional birth attendants in family planning*: proceedings of an international seminar held in Bangkok and Kuala Lumpur, 19-26 July 1974, J. Y. Peng, Srisomang Keovichit, and Reginald MacIntyre, ed. Ottawa 1974. 107p.

IDRC-040s

*Triticale*: resúmenes de los ensayos presentados durante un simposio internacional, El Batán, México, 1º al 3 de octubre de 1973. Ottawa 1975. 31p.

IDRC-041e

*Stable tropical fish products*: report on a workshop held in Bangkok, Thailand, 8-12 October 1974, Marilyn Campbell. Ottawa 1975. 27p.

IDRC-042e

*Low cost rural health care and health manpower training*: an annotated bibliography with special emphasis on developing countries, Shahid Akhtar. Ottawa 1975. 168p.

IDRC-043e

*Doctors and healers*: Alexander Dorozynski, Ottawa 1975. 64p. Also available in French (IDRC 043f)

IDRC-044e

*Hawkers and vendors in Asian cities*: report on a study supported by IDRC. Ottawa 1975.

IDRC-045e

*Family planning in Mali*: André Laplante, Faran Samake and George Brown. Ottawa 1975 (in press). Also available in French (IDRC 045f).

IDRC-046e

*Population and health*: IDRC program directions. Ottawa 1975. (in press). Also available in French (IDRC 046f).

IDRC-047e

*Projects 1975*: Claire Veinotte, ed. Ottawa 1975. (in press). Also available in French (IDRC 047f) and Spanish (IDRC 047s).

IDRC-048e

*To conquer hunger: opportunity and political will*: W. David Hopper. Text of a lecture delivered in the John A. Hannah International Development Lecture Series, Michigan. Ottawa 1975. 24p.

**IDRC-049e**

*The international exchange and testing of cassava germ plasm: proceedings of an interdisciplinary workshop, CIAT, Palmira, Colombia, 4-6 February 1975, Barry L. Nestel and Reginald MacIntyre, ed. Ottawa 1975. (in press)*

**IDRC-LP1**

*Corporate author list/Répertoire collectivité-auteur: IDRC Library/Bibliothèque du CRDI. Ottawa 1975. 123p.*

**The IDRC Reports/Le CRDI Informe**

(David Van Praagh, ed.)

Vol. 3, no. 2 — June 1974 (focus on food and population questions and on Latin America)

Vol. 3, no. 3 — September 1974 (focus on the world energy crisis and its influence on developing countries)

Vol. 3, no. 4 — December 1974 (focus on the population question after the Bucharest Conference)

**The IDRC Reports/Le CRDI Explore/El CIID Informa**

(Bob Stanley, Editor-in-Chief)

Beginning with vol. 4, no. 1 *The IDRC Reports* has been produced in English only, with companion editions in French, *Le CRDI Explore*, and Spanish, *El CIID Informa*. In its new format the publication takes a more general "news-magazine" approach to the work of the Centre and related development topics, rather than relating each issue to a specific theme. Madeleine Vaillancourt Wagner has been responsible for the French edition; Susana Amaya Puerto, of the Latin America Regional Office in Bogota, is responsible for the Spanish edition; while the English edition, together with coordination and production, is in the hands of Bob Stanley, Editor-in-chief.

**Publications/Research supported by IDRC**

An international centre for manatee research: report of a workshop held 7-13 February 1974, Georgetown, Guyana. The National Science Research Council, Georgetown, 1974. 34p.

**Agrindex:**

Food and Agricultural Organization of the United Nations, Rome, vol. 1, no. 1, 1975. 132p. (First of a series)

**DEVSIS Newsletter:**

DEVSIS Study Team, c/o International Labour Office, 1211 Geneva 22, Switzerland, no. 1, April 1975. 8p. (First of a Series)

**ISIS Newsletter:**

IDRC, Ottawa, vol. 1, no. 3, July 1974. 32p. vol. 1, no. 4, October 1974. 23p. vol. 2, no. 1, January 1975. 23p.

**Technonet Newsletter:**

Asian Network for Industrial Technology Information and Extension, no. 1, March 1974. 8p.

**Demografi Indonesia:**

Demographic Institute, Faculty of Economics, University of Indonesia, Jakarta, no. 1, June 1974; no. 2, December 1974.

**Study-Service Newsletter:**

Published by Diana Fussell and Andrew Quarmby, Singapore, January 1975. 10p. (This issue supported by IDRC)

A preliminary study of consumer preference in the choice of cowpeas:

Western and Kwara States Headquarters and Areas of Nigeria, Caroline Eibun Williams. Department of Agricultural Economics and Extension, University of Ibadan, Nigeria, June 1974. 103p.

**Population and development planning:**

Report on a workshop held by the Inter-Governmental Coordinating Committee, Southeast Asian Regional Cooperation in Family and Population Planning, Penang, Malaysia, 27-29 September 1973. 42p.

**Sub-fertility and infertility in Africa:**

Report of a workshop held at the University of Ibadan, Nigeria, 26-30 November 1973, B. Kwaku Adadevoh, ed. The Caxton Press (West Africa) Ltd., Ibadan, 1974. 114p.

**Institutionalizing research management in Asia:**

Proceedings of a seminar-workshop, Laguna, Philippines, 10-19 December 1973. Sponsored by the University of the Philippines at Los Baños, and the Southeast Asian Regional Centre for Graduate Study and Research in Agriculture. 1974. 222p.



#### The social sciences and development:

Papers presented at a conference in Bellagio, Italy, on the financing of social science research for development, 12-14 February 1974. 238p.

#### Social and psychological aspects of fertility in Asia:

Proceedings of the technical seminar, Choonchun, Korea, 7-9 November 1973, Henry P. David and Sung Jin Lee, ed. Korean Institute for Research in the Behavioral Sciences, Seoul, and Transnational Family Research Institute, Washington, 1974. 128p.

#### The 1973 national demographic survey of Tanzania:

A new approach to national demographic surveys in Africa, Roushdi A. Henin, Ian D. Thomas and James E. Kocher. Paper prepared for the meeting of the Population Association of Africa, Ibadan, Nigeria, 10-14 May 1974. 51p.

#### América Latina: distribución espacial de la población:

Ramiro Cardona, ed. Corporación Centro Regional de Población (CCRP). Bogotá, Colombia, Abril 1975. 550p.

#### Experiencias en desarrollo rural:

K. G. Swanberg, C. A. Zulberti y H. G. Zandstra. Instituto Colombiano Agropecuario, Bogotá, Colombia, Febrero 1975. 100p. (Resultado del trabajo interdisciplinario del grupo ICA/CIID)

#### Famille et développement:

CRDI, Dakar, Sénégal, no. 1, janvier 1975. 32p.

#### Publications by staff and consultants

Allsopp, W. H. L.

*African fisheries: their problems and opportunities and their role in the Sahelian famine.* United Nations, New York, ST/SSO/30\*, July 1974. 27p.

*Problèmes et perspectives de la pêche en Afrique; son rôle dans la famine au Sahel.* Nations Unies, New York, ST/SSO/30\*, juillet 1974, 39p.

Armstrong, Gregory

*Domestic factors in aid policy.* International Perspectives, Ottawa, March/April 1975. p. 44-48.

*Du plan de Colombo à l'ACDI: Les politiques d'aide: reflet des préoccupations fédérales.* Perspectives internationales, Ottawa, Mars/avril 1975. p. 49-53.

Beltran, L. R.

*Rural development and social communication: relationships and strategies.* Paper presented at the International Symposium on Communication Strategies for Rural Development, Cali, Colombia, 17-22 March 1974. Centre for Rural Development and Land Reform, Bogota, 1974. 55p.

Brown, George F.

*IDRC in health and population: a review of international research.* Paper presented to the Canadian Public Health Association, 2nd Annual Meeting, Tropical Medicine and International Health Division, Toronto, 29-30 November 1974. 11p.

Burton, I.

*Domestic water supplies for rural peoples in the developing countries: the hope of technology.* Paper presented to the Symposium of Human Rights in Health, London, 4-6 July 1973. In Human rights in health, Amsterdam, 1974. p. 61-79.

Cummings, F. H.

*Migration and regional development: implications for planning in Indonesia, Thailand and the Philippines.* Ph.D. Thesis, Clark University, Worcester, Mass. 1974. 299p.

Dobson, W.

*Objectives and Principles of World Population Plan of Action.* World Population Conference, Bucharest, 19-30 August 1974. United Nations, New York, 1974. 29p.

*New directions in population.* World Population Conference, Bucharest, 19-30 August 1974. 16p.

*Population: Was Bucharest a bust?* Montreal Gazette, 16 September 1974. p.7.

*Women and rural development.* Rural societies and participation of women. IDRC, Ottawa, 1974. 7p.

Doggett, Hugh

*New directions in world cereals research: crops of the semi-arid tropics*. Paper presented at a symposium sponsored by the American Association of Cereal Chemists and IDRC, Montreal, 22 October 1974. 10p.

*Sorghum bicolor* (Linn.) Moench — Gramineae, Andropogoneae. International Crops Research Institute for the Semi-Arid Tropics. Hyderabad, India, 1974. 15p.

Dorozynski, A.

*Sirènes de Colomb* (article sur le lamantin). Québec Science, Québec, vol. 12, no 9, mai 1974. p. 7.

*Le climat de la terre est en train de changer*. Science et Vie, Paris, no 680, mai 1974. p. 84-92.

*Médecins aux pieds nus*. Science et Vie, Paris, août 1974. p. 80-82.

*Une ferme pour "veaux de mer"*. Science et Vie, Paris, vol. 125, no 680, mai 1974. p. 46.

*Climat plus froid*. Science et Vie, Paris, vol. 125, no 681, juin 1974. p. 84.

*Médecins aux pieds nus pour pays pauvres*. Science et Vie, Paris, vol. 125, no 683, août 1974. p. 80.

*Stop à la génétique?* Science et Vie, Paris, vol. 125, no 685, octobre 1974. p. 35.

*Un enfant de 1974 passera 5 ans de sa vie à la Télé*. Science et Vie, Paris, vol. 125, no 685, octobre 1974. p. 112.

*Le premier congrès de la faim*. Science et Vie, Paris, vol. 125, no 686, novembre 1974. p. 43.

*Mercure: des taux alarmants dans les poissons de la Méditerranée*. Science et Vie, Paris, vol. 125, no 687, décembre 1974. p. 52.

*La médecine et les médicaments en question*. Science et Vie, Paris, vol. 126, no 688, janvier 1975. p. 12.

*La famine au Sahel: un drame prévisible*. Science et Vie, Paris, vol. 126, no 690, mars 1975.

*Mediterranean poison fish forecast*. Nature, London, vol. 254, no. 5501, 17 April 1975. p. 549-551.

Gauthier, Hervé and Jacques Henripin  
Canada, in *Population Policy in Developed Countries*, B. Berelson, ed. McGraw-Hill, Toronto, 1974. p. 403-426.

Gauthier, H. et K. D. Le Thi

*Observations permanentes pilotes réalisées dans les pays de l'UDEAC 1971-1974; projet de coopération*. Secrétariat Général de l'UDEAC, Bangui, Congo, 1974. 85p.

Gordon, J. King

*U Thant: He served the cause of peace and of the common man*. Ottawa Citizen, 30 November 1974. p. 7.

Hillel, D.

(IDRC Research Fellow) *Soil and water science in an arid environment*. International atomic energy agency bulletin, Vienna, October 1974. p. 56-61.

Hillel, D., C. H. M. Van Bavel, and H. Talpaz  
*Dynamic simulation of water storage in fallow soil as affected by mulch of hydrophobic aggregates*. Paper prepared for IDRC, 1975. 28p.

Hopper, W. David

*Esquisse d'une solution de rechange aux problèmes de la faim dans le monde*. Revue de la Société d'études et d'expansion, Liège (Belgique), no 262, octobre-novembre-décembre 1974. p. 531-537.

Hulse, Joseph H. and David Spurgeon

*Triticale*. Scientific American, New York, vol. 231, no. 2, August 1974. p. 72-80.

Hulse, Joseph H. and W. Douglas Daniels

*Economics of Transfer*. Paper prepared for Western Hemisphere Nutrition Congress, Bal Harbour, Florida, 20 August 1974. 23p.

Hulse, Joseph H.

*The new "miracle" grain/Triticale: la nouvelle céréale "miracle"*. Cooperation Canada, no. 16, September/October 1974. p. 18-23.

*Problems of nutritional quality of pigeon pea and chickpea and prospects of research*. Paper presented to the ICRISAT Workshop on Grain Legumes, Hyderabad, India, 13-15 January 1975. 24 p.

Hyder, Syed S. and F. Richer

*The theory and design of a system for printing and communication in Arabic-Urdu-Farsi languages* (IDRC-supported project). Institut de Programmation, Université de Paris, July 1974. 37p.

Jeanes, C. W. L.

*Health services: Kidney machines versus nutrition and hygiene/La santé du tiers-monde: Esculape doit céder une large place aux auxiliaires médicaux*. Cooperation Canada, Ottawa, no. 14, May/June 1974. p. 20-22.



Laquian, A. A.

*Slums of hope . . . slums of despair/L'urbanisation "sauvage" à la croisée de l'espoir et du désespoir.* Coopération Canada, no. 16, September/October, 1974. p. 3-11.

Leatherdale, Donald und Siegfried Schrader

Konzeption einer Dokumentationssprache für das internationale Agricultural Informationssystem (AGRIS). Sonderdruck aus Mitteilungen der Gesellschaft für Bibliothekswesen und Dokumentation des Landbaues, Heft 22, 1975, Seite 41-49. Stuttgart-Hohenheim, West Germany.

Nestel, B. L.

*Battling to fill 4 billion bellies.* Sunday Times, London, July 1974. p. 63-64.

*Role of the IDRC in strengthening agricultural and livestock research in and for the developing countries.* IDRC, Bogota, 1974. 14p.

Oldham, C. H. G.

(Participant) Draft Code of Conduct on Transfer of Technology, by a Working Group of the Pugwash Conference on Science and World Affairs, convened at Geneva, 1-5 April 1974 20p.

Plumptre, A. F. W.

*The International Development Research Centre and the role of L. B. Pearson, in Freedom and Change; essays in honour of Lester B. Pearson, M. Fry, ed. McClelland and Stuart, Toronto, 1975. P. 152-170.*

*Maynard Keynes as a Teacher, in Essays on John Maynard Keynes, Milo Keynes, ed. Cambridge University Press, 1975.*

Povey, George, D. Uyeno and I. Vertinsky

Social impact index for evaluation of regional resource allocation. Health Status Indices, Robert L. Berg, ed. Hospital Research and Education Trust, Chicago, 1973. p. 104-119.

Pradervand, P., M. Carder, M. Henry and K. Horsely

*Emerging population alternatives: an annotated bibliography.* American Freedom from Hunger Foundation, Washington, D.C. 1974. 13p.

Pradervand, P.

*Population and the Third World: the population control explosion or the resurgence of Malthus.* Transnational perspectives, Copenhagen, vol. 1, no. 1, April/July 1974. p. 10-20.

Rao, M. S.

World Food Council, In World Food Conference, Rome, 5-16 November 1974. 3p.

*Some comments on the World Food Conference.* World Food Conference, Rome, 5-16 November 1974. 6p.

Sanger, Clyde

*A Way Through the Morass.* Echange Canada Exchange, Canadian Bureau for International Education, Ottawa, vol. 2, no. 2, 1974. p. 6-7.

*Canada's help to the world's rural poor.* Canadian Geographical Journal, Ottawa, vol. 88, no. 5, May 1974. p. 14-21.

There has been a significant increase in the production of wheat, rice and maize in Latin America and Asia . . . The Guardian (Special Supplement published during the World Food Conference), London, 1 November 1974. p. 14.

*The rich get richer.* Canadian Consumer, vol. 4, no. 6, Ottawa, December 1974. p. 25-27.

*Our research in world food drive.* New Straits Times, Kuala Lumpur, 31 January 1975. p. 14.

*IDRC'S Projects in Indonesia.* The Indonesia Times, 29 January 1975. p. 4.

*Learning by doing to help Third World countries.* Straits Times, Singapore, 14 March 1975.

*Worldview: Club of Rome.* The Presbyterian Record, Toronto, July-August 1974. p. 21.

*Worldview: Fish (in the Sahel).* The Presbyterian Record, Toronto, September 1974. p. 9.

*Worldview: Colombia.* The Presbyterian Record, Toronto, December 1974. p. 9.

*Worldview: Children.* The Presbyterian Record, Toronto, March 1975. p. 9.

*Worldview: Southeast Asia.* The Presbyterian Record, Toronto, April 1975. p. 9.

Seward, S.

*Evolution of the International Development Research Centre: an Interpretation.* IDRC, Ottawa, 1974. 55p.

Siegel, A.

Development, acceptability, and nutritional evaluation of new high-protein rice-based foods for Thai children. Ph.D. Thesis, Kansas State University, 1974. 177p.

Spurgeon, David

*Strategy for survival: the green revolution.* Nature, London, vol. 252, 20-27 December 1974. p. 624-625.

*How Manila's water supply will be saved.* Gemini News Service, London, 1974.

*Farming the seas.* Alumni Gazette, University of Western Ontario, vol. 51, no. 2, Winter 1974. p. 12-15.

*Do developing countries need a new kind of science journalism?* Science Forum, Toronto, vol. 7, no. 5, October 1974. p. 12-15.

*Science calls up an army of microbes to make protein.* Gemini News Service, London, 1974.

*The Arab World science revival.* Nature, London, vol. 254, 6 March 1975. p. 10.

*Club of Rome associations.* Nature, vol. 249, 31 May 1974. p. 403.

*Back to square one on tsetse fly.* New Scientist, London, 13 June 1974. p. 683.

*Can Manatees help solve problems of tropical water weeds?* Science Forum, Toronto, vol. 7, no. 4, August 1974. p. 10-11.

*Making the most of Ghana fish.* African Development, London, vol. 8, no. 8, August 1974. p. G.21-23.

*Sea cows eat their way to domestication.* New Scientist, London, vol. 63, no. 908, August 1974. p. 238-269.

*More food crisis.* The Globe and Mail, Toronto, 10 April 1975. p. 43.

*Updating the green revolution.* Nature, London, vol. 254, 24 April 1975. p. 642-643.

Taylor, D. R. F.  
(IDRC Research Associate) *Spatial organization and rural development*, in *Freedom and Change*; essays in honour of Lester B. Pearson, M. Fry, ed. McClelland and Stuart, Toronto, 1975. p. 217-241.

Wagner, Madeleine Vaillancourt  
*Quarante millions de victimes.* Québec Science, décembre 1974, vol. 13, no. 4. p. 28-33.

*La foresterie au Sahel.* Québec Science, février 1975, vol. 13, no 6. p. 18-24.

*Aquiculture — la mer à manger.* Québec Science, mai 1975, vol. 3, no. 9. p. 38-41.

*Science et développement: La fatalité du chiffre trois.* L'Information médicale et paramédicale, Montréal, 5 novembre 1974.

*Science et développement: À propos d'autre chose.* L'Information médicale et paramédicale, Montréal, 19 novembre 1974. p. 39.

*Science et développement: L'opération corne d'abondance.* L'Information médicale et paramédicale, Montréal, 3 décembre 1974. p. 14.

*Science et développement: Une charade pour le congé de Noël.* L'Information médicale et paramédicale, Montréal, 17 décembre 1974.

*Science et développement: Pour que reverdisse le Sahel.* L'Information médicale et paramédicale, Montréal, 4 février 1975. p. 28.

*Science et développement: Le pour et le contre de l'agriculture savante.* L'Information médicale et paramédicale, Montréal, 18 février 1975. p. 49.

*Science et développement: Au Mali: le planning familial au service des valeurs traditionnelles.* L'Information médicale et paramédicale, Montréal, 18 mars 1975. p. 20-21.

*Science et développement: Un long divorce* (article sur la femme et la science). L'Information médicale et paramédicale, Montréal, 1er avril 1975. p. 14.

*Science et développement: L'opération Caqueza.* L'Information médicale et paramédicale, Montréal, 15 avril 1975. p. 14.

*La femme et la science.* Dateline Canada 75. p. 43-44.

*À besoins nouveaux, formule nouvelle.* Le Consommateur Canadien, juin 1975, vol. 5, no. 3. p. 26-29.

*Third World: Research a Solution?* Canadian Consumer, June 1975, vol. 5, no. 3, p. 26-29.

Wild, K. and J. Woolston  
*Social and economic development: How DEVSIS would link into the emerging network of international information systems.* Paper presented to the 5th World Congress of the International Association of Agricultural Librarians and Documentalists, Mexico, 14-18 April 1975. 8p.

Woolston, J. and M. Brandreth  
*Some thoughts on a world information service related to rural water supplies and sanitation in developing countries:* paper presented to the Ad Hoc Working Group on Rural Potable Water Supply and Sanitation, Geneva, 13-14 February 1975. 11p.

Yeung, Yue-man  
*Hawkers and vendors: dualism in Southeast Asian cities:* paper presented at the Association of American Geographers annual meeting, Milwaukee, U.S.A., 20-23 April 1975. 16p.



Zandstra, Hubert G.

*Expected benefits of fertilizer recommendation strategies based on chemical soil tests.* Paper presented at the 66th annual meeting of the American Society of Agronomy, Chicago, Ill., 10-15 November 1974, 27 p.

Zandstra, Hubert G. y Roberto Gonzalez

*El pequeño agricultor: filosofía de la investigación en producción de pequeño agricultor.* Instituto Colombiano Agropecuario, vol. 1, Bogotá, 1975. 36p. (Proyecto en cooperación con el personal de desarrollo rural del ICA y el Centro Internacional de Investigaciones para el Desarrollo).

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