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Future in the past

Modern agriculture threatens to destroy the very means by which it developed. The recent establishment of the International Board for Plant Genetic Resources will help to coordinate international efforts to conserve the rapidly diminishing genetic resource represented by traditional varieties of crops grown for generations. Eleanor Lawrence looks at some of the projects now under way.

MOST of the staple crops grown today were first brought under cultivation thousands of years ago. Cultivated plants have spread out from their original centres of cultivation until they can be found today growing in conditions very different from those in which they originated. In the process they have diversified into innumerable genetically different local varieties, each showing some adaptation to the climate and general environment in which they now flourish.

This reservoir of genetic raw material has in the past been of inestimable value to the plant breeder. Over thousands of years of evolution and selection, genes for resistance to many threatening and economically damaging pests and diseases have arisen. Useful qualities such as cold and drought tolerance have developed in varieties growing at the limits of their range. Plant breeders have constantly returned to the older strains for useful genes which can often be found only in a very few varieties or in their wild relatives. Now, however, this invaluable genetic resource is fast disappearing as a result of replacement of traditional crops by the generally more productive newer varieties.

The small fields of primitive agri-

culture bear little resemblance to the monocultures of industrialised developed countries. Several varieties of the same crop are often grown together, and the individual plants differ greatly from each other. The wild relatives of the cultivated plant may well be present either as weeds in the field or growing along pathways and field margins.

This variability sometimes results in relatively low yields. Indeed, peasant farmers have often selected for reliability rather than high performance, on the basis that in a bad year a small but dependable yield is better than no yield at all. But it is the genetic mixture itself which makes possible the emergence of desirable new forms by fortuitous crossbreeding. These forms may then be selected simply by their superior ability to cope with local conditions, or directly by the farmer.

Agriculture in the developed countries, where intensive plant breeding has been practised, now depends on a comparatively few varieties of the major crops. When grown with modern aids, such as fertilisers, pesticides and herbicides, these produce yields far greater than those possible with the older highly diverse 'landraces'. The gene pool represented by these highly

bred crops, however, is restricted by comparison with that represented by the older varieties. The widespread introduction of new strains into hitherto undisturbed areas of genetic diversity, such as the massive introductions of the Mexican-bred semi-dwarf wheats into India and the Near East, actually poses a grave threat to the continued existence of many primitive strains, which are now found only sporadically and in remoter regions.

Where the introduced crops mean higher yields and a better standard of life for the farmer, the disappearance of the older varieties from the fields is inevitable. But the potentially valuable genes which they contain must be preserved, for they will certainly be needed in future crop breeding programmes. Nobody yet knows the full extent of variation available in traditional crops, and many qualities which could be overlooked now might be the very ones desperately needed in the future.

Although the disappearance of traditional varieties is unlikely to slow down, for many crops a reasonably representative sample of the variation in any population can be conserved easily and economically as seed. Seeds of many species remain viable for years if they are kept dry and cold. The optimum conditions for storing many types of seed are now well-known, and gene banks for most important crops have been established in centres all over the world. The old varieties and their wild relatives have been a fruitful source of genes resistance for pests and disease; moreover, they will always have an important part to play in the never-ending race to breed new resistant varieties before the pests themselves progress.

Unusual cultural characteristics sometimes found in primitive varieties have had a revolutionary effect on plant breeding. The semi-dwarf habit in rice, which formed one of the basic traits of the rices of the Green Revolution, was introduced from a primitive variety found in Taiwan. Scientists at the International Rice Research Institute in the Philippines, where the first dwarf rices were bred, are now attempting to combine high yield with the 'floating' characteristic of rices grown for generations in the deep water rice areas around the great rivers of India and South-east Asia.

International efforts to conserve the rapidly vanishing reservoir of genetic diversity began some 15 years ago when the Food and Agriculture Organisation of the United Nations (FAO) convened a technical meeting on plant introduction and exploration. In 1963 an FAO panel of experts on plant exploration and introduction was established, and in 1968 the Crop

Primitive wheat in Afghanistan, showing variability (FAO photo by E. Bennett)

Ecology and Genetic Resources Unit, a special section within the FAO, was set up to act as a clearing house for information on genetic resources and to administer the FAO's programme.

The interest this aroused confirmed that the problem was as grave as had been feared. Moreover, the efforts already underway by individual institutes and the FAO itself were only able to tackle the most urgent problems. A relatively large amount of material has now been collected from the more accessible areas, but remoter regions of the world, which contain much of the remaining genetic diversity in many major crops, remain largely unexplored.

A plan for a worldwide network of genetic resource centres incorporating existing institutes and projects within an international collaborative programme was therefore drawn up at a meeting in 1972 sponsored by three bodies: the FAO, the Consultative Group on International Agricultural Research (CGIAR) and the Technical Advisory Committee to the CGIAR.

The programme is coordinated by a committee created 18 months ago, the International Board for Plant Genetic Resources (IBPGR). This falls under the aegis of CGIAR and has a secretariat in the Crop Ecology and Genetic Resources Unit of the FAO. Its budget in 1975 was some \$730,000, and a budget of \$1.3 million has been proposed for 1976. A year of fact-finding has resulted in several projects now being undertaken with IBPGR funds.

One of the most important projects from the point of view of coordination and information exchange is the genetic resources communication, information and documentation system (CIDS) project based at the University of Colorado at Boulder. This project is intended to realise the full potential of the collections made, which means they must not only be described botanically, but in such a way that the plant breeder can easily identify material which might be useful in a breeding programme. Botanists and plant breeders who wish to use the materials must know details of the original habitat, morphology and local conditions, which can only be recorded at the time of collection. Information on disease resistance and physiological properties can be added later after proper evaluation.

The CIDS project was originally set up, and is still partly supported, by the Crop Ecology and Genetic Resources Unit of the FAO, with the aim of devising a computer system suitable for recording and retrieving information on crop plant genetic resources. The IBPGR has given its support, allocating \$237,000 to the project in 1975. It hopes to provide another \$360,000 in 1976.

Through visits to existing collections and intensive collaboration with both collectors and plant breeders, the CIDS team has initiated a transfer of genetic resources records into a storable form through a system (TAXIR/EXIR) which is adaptable to any of the principal types of computer with an adequate memory bank. It is hoped that eventually the inventories of all major collections will be filed on this or some other compatible system, which will allow the user to retrieve the collections from the area or with the particular characteristics he wants.

As for the future, some of the field projects which the IBPGR is to finance out of its own fund for 1976 include the Near-East Regional Programme, a programme for the Mediterranean area centred on the Germplasm Laboratory at Bari in Italy, and the development of a regional programme for south and south-east Asia. The Board is also financing collections of rice by the International Rice Research Institute (IRRI) in Bangladesh, Indonesia and other south-east Asian countries.

Many important tropical forage legumes originate in Latin America—the pastures which support the Australian livestock industry are made up almost entirely of introduced species, many from Latin America—and the Board has also provided funds to begin a three-year programme of collection, conservation and evaluation of tropical forage legumes and grasses there. This work is to be carried out by the Centro Internacional de Agricultura Tropical (CIAT) in Colombia.

Attempts to improve the natural pastures in Latin America have used native legumes such as *Stylosanthes*, *Centrosema*, *Desmodium* and *Macropitium* which make important contributions to the nitrogen fixing ability of the pasture and its nutritional value. But the improvement has been at best sporadic, and the CIAT programme

aims to make a systematic and representative collection of these tropical forage legumes and their accompanying symbiotic bacteria, the *Rhizobia*, as well as some tropical grasses.

Ethiopia is an immensely important region of genetic diversity under stress and is an especially important area of variation in wheat and barley. Although several collecting expeditions have been mounted over the years, by the Germplasm Laboratory at Bari for instance, the region warrants its own regional genetic resources centre, like that serving the Near-East at Izmir in Turkey. The Federal Republic of Germany offered to finance such a centre several years ago, and the first funds are to be spent in 1976.

Natural disasters as well as human activity can threaten genetic resources. An expedition organised by the French Organisation for Scientific Research Overseas (ORSTROM), financed by the United Nations Environment Programme, is now in the Sahel collecting as much as possible of the remaining native varieties of sorghum and millet. The indigenous varieties are particularly resistant to drought, a characteristic not found elsewhere. After a disaster, restocking tends to be carried out with easily available varieties brought in from outside which lack the drought resistant characteristics peculiar to the indigenous varieties. If the native genetic material can be collected and stored, however, it can be used in future breeding programmes and even be reintroduced if such a disaster strikes again.

With so much to be done, the limited funds of the IBPGR are to be used mainly as 'seed' money to start off some urgently needed programmes. Its other task is to identify neglected areas and encourage potential donors to put their money into the most worthwhile projects—a task which will ultimately prove to be equally important.

Information retrieved from genetic resources data bank

HOW MANY HAVE GENUS, TRITICUM L. AND SECONDARY HABITAT, CULTIVATED LAND AND NOT SOIL CLASS, UNKNOWN AND NOT SOIL PH, UNKNOWN*

NO. OF ITEMS IN QUERY RESPONSE = 10
NO. OF ITEMS IN THE DATA BANK = 2208
PERCENTAGE OF RESPONSE/TOTAL DATA BANK = .45

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151	TRITICUM L.		TURRIDUM L. EMEND. BOWDEN
	GAZIANTEP		HILLY
	LOAMY SILT	MEDIUM	CULTIVATED LAND
161	TRITICUM L.		SP. LTOIDES TAUSCH GREN. EX RICHTER
	GAZIANTEP		HILLY
	LOAMY SILT	MEDIUM	CULTIVATED LAND
171	TRITICUM L.		MONOCOCCUM L.
	GAZIANTEP		HILLY
	LOAMY SILT	MEDIUM	CULTIVATED LAND
181	TRITICUM L.		CYLINDRICUM CES. PASS. ET GIB.
	GAZIANTEP		HILLY
	LOAMY SILT	MEDIUM	CULTIVATED LAND
2941	TRITICUM L.		TURRIDUM L. EMEND. BOWDEN
	YOZGAT		HILLY
	SANDY LOAM	MEDIUM	CULTIVATED LAND