Who is saving the seeds to save us?

by Gary Paul Nabhan

Urgent action is needed to preserve the basic stock from which modern crops are derived

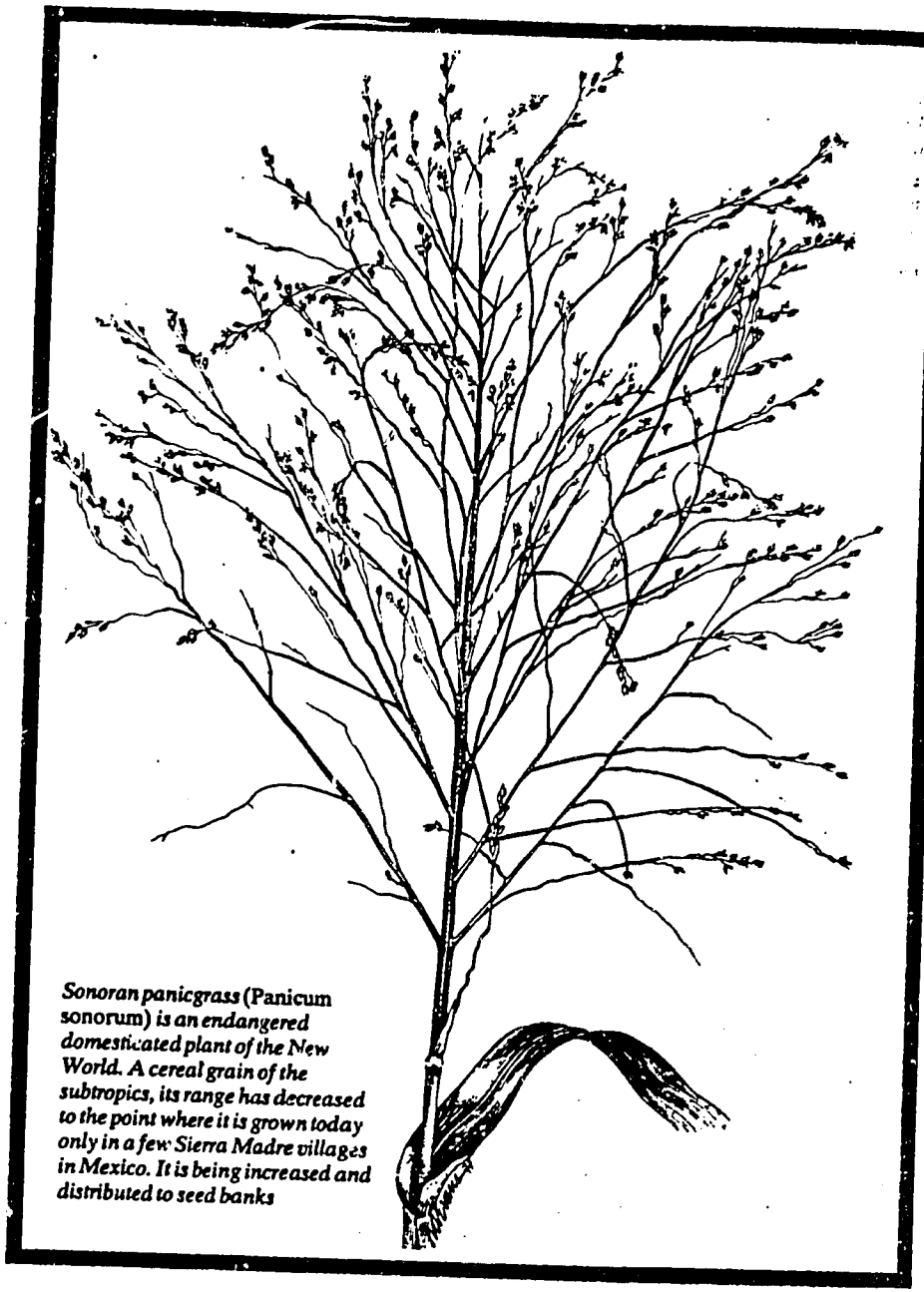
More than 500 generations of humans have engaged in the selective sowing, management and harvesting of food plants. Crops were domesticated and diffused out of at least eleven 'centres of origin and diversity' on five continents. Within these centres of crop evolution, the wild relatives of our domesticated food plants have, until recently, survived and occasionally 'out-crossed' to add to the genetic diversity of our crops.

Traditionally, farmers in many regions exposed old varieties with uncommon gene combinations to rigorous environments in which new traits were frequently selected. Slowly, crops diversified into numerous land races or folk varieties, each specifically adapted to the particular conditions in a given locality. These cultivated varieties gradually co-evolved with the pests and disease organisms of their regions and, sometimes, multiple gene resistance or tolerance to pathogens developed.

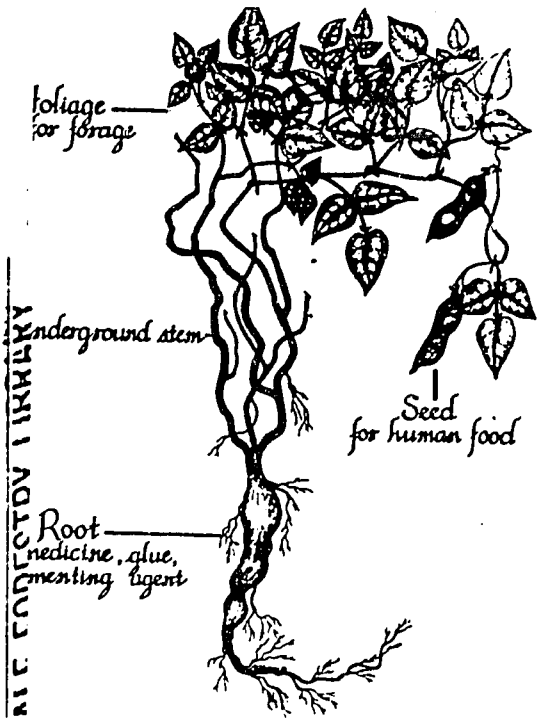
Adaptations to drought and heat, or to short growing seasons, became manifested in marginal agricultural areas. People also selected folk varieties on the basis of flavour and dependability of yield. Most cultures grew several crops together in one field. Even within one kind or species of crop, farmers occasionally grew several folk varieties intermixed. With each variety responding differentially to stresses, this diversity insured at least some yield of at least one variety, and buffered the culture against starvation.

Abandoned stock

Within the past two generations, this ancient pattern of local seed saving and slow selection has been disrupted on a global scale. With the application of modern genetics, scientists have been able to accelerate and more accurately direct the process of plant improvement. Genetic engineers can predictably combine certain economic traits gathered from numerous land races. Plant breeders have increased the yield of crops such as maize several fold within this century, through hybridization.



Sonoran panicgrass (Panicum sonorum) *is an endangered domesticated plant of the New World. A cereal grain of the subtropics, its range has decreased to the point where it is grown today only in a few Sierra Madre villages in Mexico. It is being increased and distributed to seed banks*



Cocolmeca (Phaseolus metcalfei) *is a wild bean that was used for hundreds of years for a variety of purposes. It was once cultivated as a forage crop in semi-arid lands, and can be used in plant improvement of lima (sieva) or other domesticated beans. Its range and abundance have drastically decreased over the past century; efforts are being made to increase it*

Hybrids are developed for predictable responses to definite spacing, water and nutrient levels. Commercial crops may have higher germination rates, may ripen more uniformly, and may be more easily harvestable. These accomplishments of modern plant improvements have helped feed the burgeoning world population, and their scientific significance cannot be underestimated.

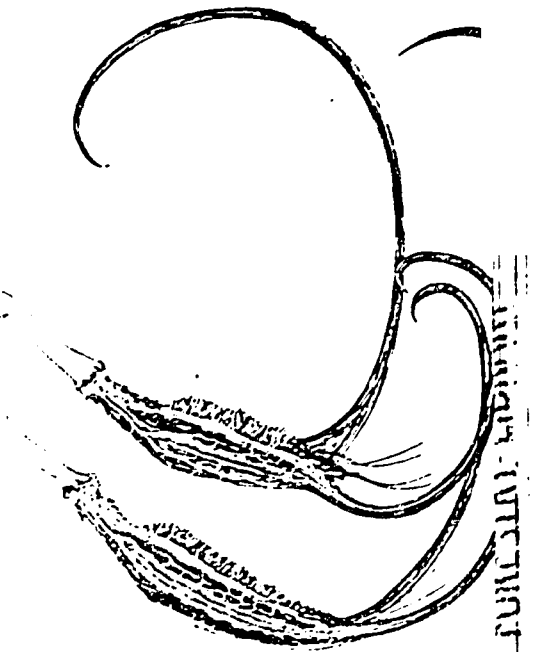
Unfortunately, the immediate success of commercial crop hybrids is threatening the very foundation upon which these plant improvements have been and will continue to be built. In the Turkish centre of wheat diversity, new Green Revolution hybrids from Mexico are being planted so extensively that both wild relatives and old land races of wheat are diminishing. Within the deserts of the USA, a Russian sunflower hybrid is genetically 'swamping out' Hopi Indian dye sunflowers, which have been grown in the same native American communities for centuries. In Europe, nearly three-quarters of the traditional crop varieties are expected to be extinct within a decade, due to recent plant variety patent regulations sanctioned by the Common Market. Already, since the first European colonization of the New World, roughly 70 per cent of the ancient cultivated plant varieties of the Americas have been abandoned. Once lost, these genetic resources are gone forever.

If the modern cultivars are so superior in yield, what have we actually lost that is of value? Haven't plant breeders simply discarded poorer quality genetic material and concentrated all the important traits in a few hybrids?

With decreasing genetic diversity, we not only lose many genes of neutral

or negative value; there is also a loss of certain beneficial characters, many of them 'hidden'. To develop disease resistance in a commercial crop cultivar, plant breeders typically screen traditional land races until they find a gene for resistance which they can transfer. Multiple gene resistance to several strains of the disease, more characteristic of folk varieties, is seldom sought, and rarely transferred. As a result, modern hybrids remain more vulnerable to pests. In the Pacific North Rim, the survival of a given modern wheat variety is about five years before another disease strain will force the development of a new, temporarily resistant variety.

Wild and primitive relatives of major crops have been intermittently utilized to provide resistance to commercial cultivars, but these sources remain largely untapped. A few screening and breeding programmes have cost less than US$100,000 each to find and transfer pest or disease resistance. In contrast, the development of a safe, species-specific pesticide may cost $5 million today. Sadly, the United Nations' efforts to encourage worldwide seed preservation and evaluation, co-ordinated by the IBPGR, are budgeted only at $1.3 million annually.



*Domesticated devil's claw (*Proboscidea parviflora*) is a food and fibre plant of the native cultures of the western United States. It has recently been collected for the first time for addition to seed banks and botanical gardens*

What of taste?

Most plant breeding today continues to be directed toward yield increases, and is done by large corporations which encourage the production of a single cultivar over an extensive area. Within this decade, more and more seed companies have consolidated or have been bought out by multinational corporations, resulting in fewer varieties released

worldwide. Only recently have there been major non-profit efforts to breed crop varieties adapted to the mixed plantings of small-scale farmers, who need legumes which readily twine around the stalks of cereals.

Breeding efforts have seldom resulted in crops which compare favourably with the taste or nutritive value of folk varieties. When hybrid maize was introduced to Latin American farmers in the 1940s, the majority in certain communities immediately adopted it. Yet despite the threefold yield increases they accrued, most of the farmers have abandoned the hybrid and reverted to their traditional maize variety. Why? The Latin Americans did not like the texture, colour or flavour of the introduced hybrid. It was utterly useless for making tortillas, the staple food of the region.

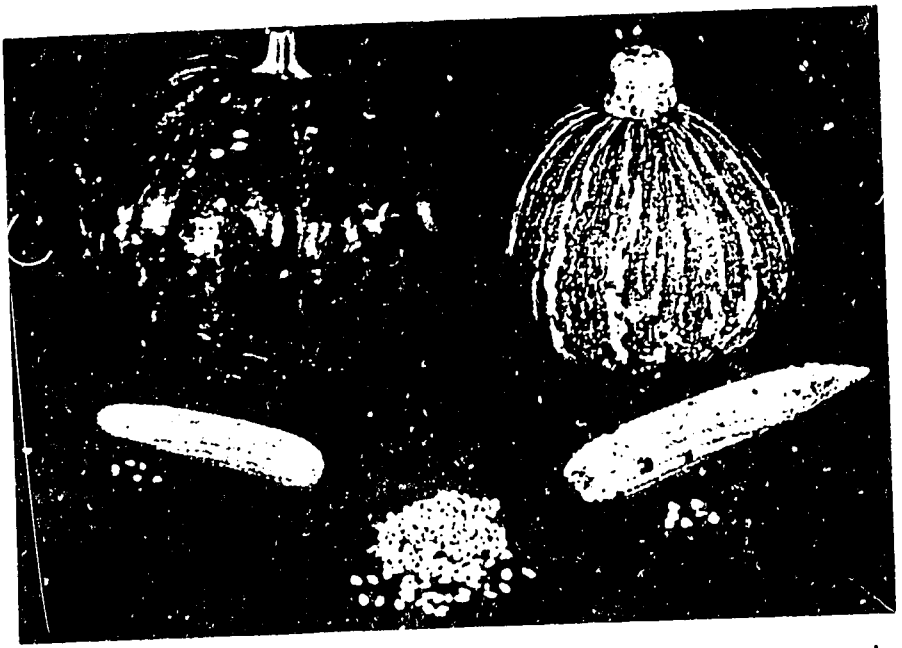
Traditional varieties have merit in their own right; they are part of a cultural heritage. Indigenous crops are often attributed social or religious significance. Certain rare land races are known to serve as identity symbols for cultures which are proud that they maintain traditions which other people have abandoned. There are numerous examples of indigenous foods being attributed curative powers in addition to their normal nutritive value.

Of the scientists who acknowledge that the traditional crop varieties are essential resources, most assume that they are already being conserved by national and international agencies. Doesn't the US National Seed Storage Laboratory alone contain germplasm of over 1200 plant species? Still, over 20,000 species have been cultivated for various purposes in North America during this century. There are no less than 10,000 food plant species on this planet, and many more that have been used as medicine or fibre. Of the traditionally cultivated species of Mexico, seeds of less than 30 per cent are now being conserved for posterity; the percentage is probably much lower for other regions.

Preserving options

All seed collection and maintenance programmes are critically underfunded. There are backlogs of seeds waiting to be documented and entered into seed banks that are deteriorating to the point of inviability. Once documented, seed lots are placed under conditions favouring their longevity, but they still must be periodically grown to renew viability. Again, few seed conservation programmes have the manpower to renew their accessions as frequently as needed, nor are the seeds renewed in the habitat from which they were derived. As a result of these handicaps, considerable genetic variation and adaptedness are lost even *after* the germplasm is introduced into a conservation programme. To collect and conserve the genetic variation of threatened and endangered varieties adequately, an integrated programme of exploration, immediate increase, thorough documentation and failsafe seed preservation are required. A ten fold increase in the funding of plant exploration and seed bank maintenance is desperately needed within the next decade.

However, seed banks are no more than a prophylactic approach to a serious problem. People practising indigenous agriculture must be given incentives for continuing to grow the traditional crops of their homelands. Small-scale plots of



*Five New World folk varieties which are poorly represented in seed bank collections: squashes (*Cucurbita moschata *and* Cucurbita mixta*) from the Sonoran desert; two ancient maize (*Zea mays*) varieties, reventador and onaveno; and white Papago Indian tepary beans (*Phaseolus acutifolius*). These are all drought-adapted crops that need little irrigation*

primitive varieties, found in association with the crop's wild relatives, remain the true sources of gene pool renewal. Some geneticists have proposed placing native agriculturalists in 'genetic resource reserves', where introduced varieties would be prohibited and ancient ones would be protected. Yet can these external restrictions be implemented without adversely manipulating the communities of native farmers? It is far better when a cultural community develops its own incentives and rewards for continuing a tradition.

Maintaining the genetic diversity of crops enables cultures around the world to choose from many options. Not every region can or should take the Green Revolution path. Many communities may want to continue with or renovate their traditional crop varieties, but this will be impossible in the future if conservation is not ensured now. As Dr Quentin Jones recently remarked to a meeting of geneticists: 'Talk about feeding a hungry world, better nutrition for more people, new drugs to fight major diseases, etc., etc., and you don't have to scratch very deeply until you find a core strand labelled *plant germplasm*.' These viable seeds are needed to keep the many distinctive cultures around the world *viable* for generations to come. □