No. 12, 1985 Winter Solstice

# the Seedhead News

## Sonoran Desert Farming in the Past

Donde hay arboles hay agua
Donde hay agua hay vida

This Spanish "dicho" or saying describes the environmental setting in which Sonoran Desert agriculture takes place ... "where there are trees there is water, and where there is water there is life." Gallery-like mesquite forests in the Sonoran Desert have always been important to people living here, even before agriculture was present, because of the high productivity of this environment.

Around 2,000 years ago, Indians began growing crops in this region. The strategies that different groups throughout the Sonoran Desert developed to grow crops had remarkable similarities. Corn, certain bean and squash varieties, and various other crops were slowly introduced to the unpredictable and harsh desert growing conditions from the humid areas of origin in Mesoamerica. These crops became adapted to somewhat drier regions of northern Mexico before making the transformation into true desert crops. Because corn was not native, it took commitment and time from farmers to grow here. Even in the rich riparian gallery forests it was necessary to modify the climate by adding supplemental water to fields.

The scarcity of water is the greatest limiting factor in desert agriculture. Sonoran Desert rainfall is bi-seasonal, coming both in widespread gentle winter storms and in torrential localized summer monsoons. As they went into more arid areas, farmers were faced with increasing evapotranspiration (meaning the loss of water from plants and soil combined), and low rainfall coming at more unpredictable times. Even within the desert, conditions varied dramatically from place to place, season to season or year to year.

Throughout the Sonoran Desert, fields were placed to make the best use of available water in several different landscape situations. Broad rich floodplains were irrigated by perennial river water diverted through systems of canals. Similarly flat drainage basins not bisected by rivers were irrigated by funneling storm runoff into fields where moisture was stored in the soil. Low volcanic hillsides were terraced to be planted away from the hazards

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of frost in the valleys below. Alluvial fans perched above floodplains and at the base of mountains were also prehistoric agricultural settings.

From about 300 B.C. to 1450 A.D. central Arizona was settled by the great Hohokam. They created the largest prehistoric irrigated agricultural basin in the region, with settlements and canals near the Salt and Gila River confluence; the Salt River where downtown Phoenix is today; areas of the Tucson Basin; and the mid to upper reaches of the Gila River near Safford. All these areas are still being farmed today, mostly by non-Indians. Early Anglo settlers even placed irrigation canals along the same routes as ancient Hohokam canals. Hohokam settlements also extended away from river valleys, into the unwatered desert and mountains of south central Arizona.

Drawing by Tom Chalky

The most elaborate Hohokam canal system has been found in metropolitan Phoenix near the Salt River, covering a 150 square mile area. Gravity-fed canals of one to two degrees gradient were excavated using digging sticks and baskets, and sometimes extended twenty miles away from the Salt River channel. Estimates of the acreage irrigated at one time vary from 30,000 to 100,000 acres. Water was diverted from the main canals into secondary and lateral canals using brush and logs to construct intake dams, weirs and gates. Soil and brush were used to construct water barriers.

Among the many Hohokam crop remains, archaeologists have found evidence of lima beans, tepary beans, jack beans, flour corn, and an ancient popcorn from Mexico called Reventador. Cotton, gourds, common beans, pumpkins, amaranths and tobacco were also found in Hohokam ruins. Based on ethnographic analogs, these crops were probably grown during the summer rainy season and farmers probably harvested wild foods and hunted throughout the rest of the year. There is some archaeological evidence that they also planted in the early spring when snowmelt runoff was highest in the Salt and Gila Rivers. Terraced volcanic hills and low slopes lined with rock borders may have been cropped with the perennial century plant, which was roasted to make a sweet beverage, or cleaned for its fiber.

Between 1350 and 1450, the Hohokam culture as it had been known until that time suddenly changed, drastically, but the reason for the rapid demise of this culture complex is unclear. There are many speculations. Perhaps the climate changed rapidly, or trade with other regions began to break down abruptly. A recent interpretation of tree ring dating suggests that a catastrophic flood in 1350 caused the Salt River channels to be cut below the level that could be used for irrigation. Many dates of Hohokam culture end soon after 1450, although some elements of the culture were retained among the people who continued to populate the region.

Early Spanish explorers and missionaries who reached the southern Arizona agricultural areas found significantly reduced populations from the previous Hohokam civilization. The locations that were being farmed were the prime agricultural spots. Terraced

volcanic and upland sites had been abandoned altogether. The Gila Pima and riverine Papago were practicing diversion irrigation in numerous small settlements along the Santa Cruz, Sonoita and Gila Rivers. They received seasonal farm labor from other, more mobile Papago who lived in the adjacent drier watersheds to the south and west. Similar crops as those found in Hohokam remains were still planted by the Pima and Papago, though amaranths and jack beans soon disappeared.

In the outlying desert, there were many groups of Papago Indians who lived between seasonal camps, away from any perennial stream. Winter season hunting and gathering camps tended to be in mountain ranges hear springs or shallow wells. In summer they moved to the flat plains where storm runoff from as far away as 15 miles soaked into the level soil.

Floodwater farming required careful engineering and a cooperative organization. For each ten irrigated acres, as much as 50,000 acres of upland catchment may have been necessary. Floods carried tons of detritus from the uplands and deposited it into the soil to renew nutrients and increase acidity needed for healthy crops. A community ditch boss organized collective spring ditch cleaning, building of brush weirs to spread water on the fields, channelling of storm runoff - even in the night- and returning channeled water into arroyos to avoid scouring field soil by too much water.

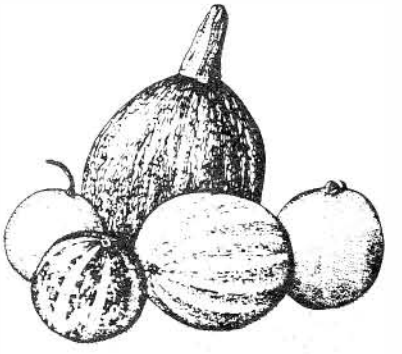
Maricopa, Cocopa, Mohave and Yuma Indians who come from a different language group than Pima and Papago, farmed along the Colorado River and its delta. As a source of grain, these Yuman groups planted a millet-like grass in the receding floodwaters of the delta. They used fewer water manipulating techniques for this form of agriculture. When the flooding of the Colorado River was controlled by dams, this form of agriculture and the grain, Sonoran panic grass, completely disappeared.

In this century, the traditions of subsistence agriculture have all but vanished north of the border. Much of the arable farmland is leased to non-Indian farmers. Yet few Indian farmers remain today, planting the seeds of crops passed down through generations from their ancestors. These seeds are drought tolerant and have been adapted to both the climate and soils over centuries. Though in some cases extremely rare, these seeds are valuable for plant breeding and their direct use in food production within similar desert climates.

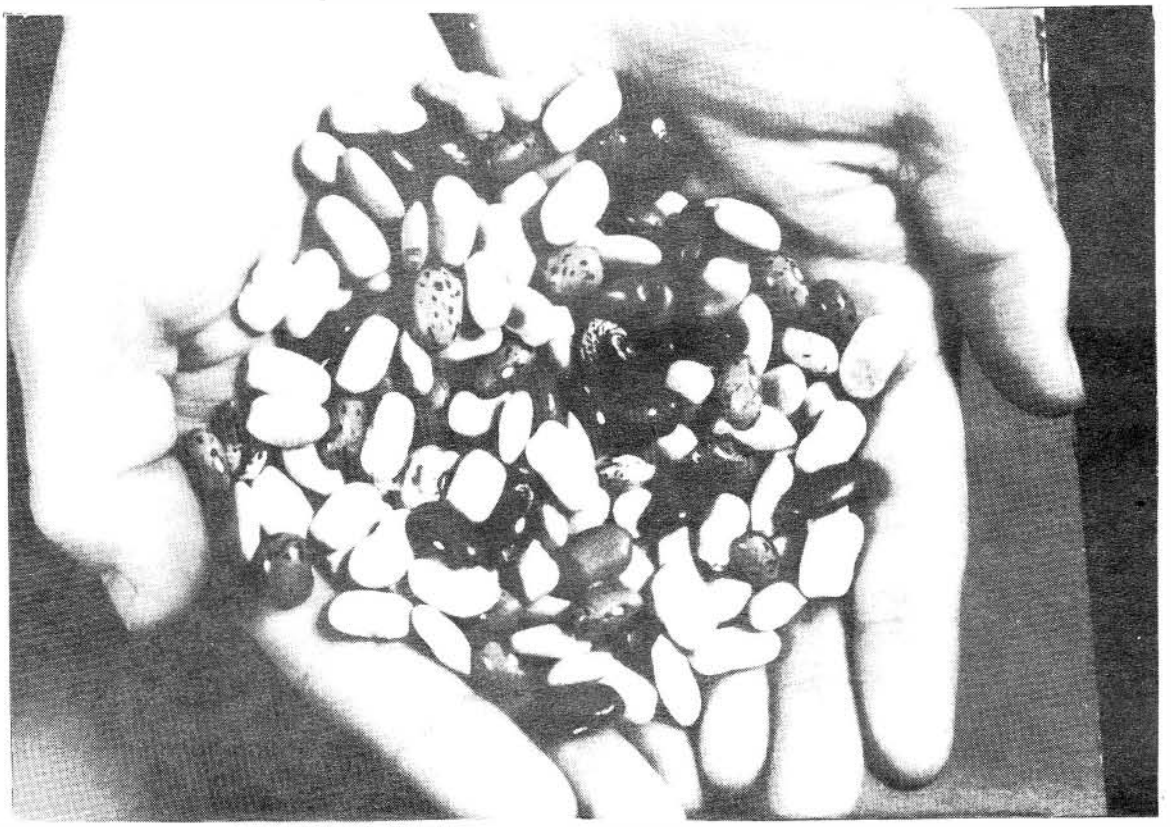
Spanish and Anglo farmers have also made valuable contributions to agriculture in the Southwest. They brought seeds from other climates that allowed whole new growing seasons, and they brought new technologies that eventually changed the landscape. Now it would be impossible to return to the pre-Columbian farming methods, given the size of populations here. Yet what remains of Sonoran desert agriculture should not be overlooked. If we learn from the past, a future of sustainable desert agriculture lies in our hands.

(This is an excerpt of "A History of Sonoran Desert Agriculture", which was written for a booklet to be used at The Desert Botanical Garden native plant use trail. Writing was funded by the Arizona Humanities Council.)

Karen Reichhardt



# Field Collecting The Plant Diversity of a Tepehuan Indian Village

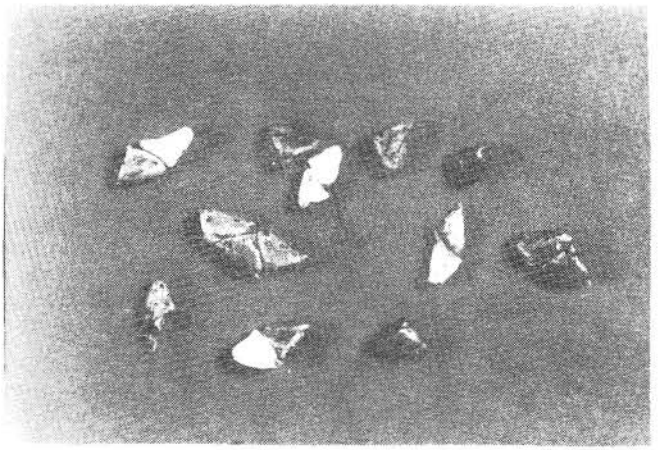


Common beans (Phaseolus vulgaris) landrace intercropped with corn and teosinte, which may have evolved for that purpose. Photo by Paul Mirocha.

There is an increasing tendency among the USDA and international agencies collecting plant genetic resources to go after only one crop when they explore a particular geographic area. Contrasting with this trend is the view that all the crops and weeds of a farming tradition as complementary resources. Our autumn efforts in the Tepehuan village of Nobogame, Chihuahua illustrate the value of this approach.

Explorer Carl Lumholtz first described how corn and a wild annual grass, teosinte, interbred in Nobogame in the 1890's. Teosinte was then known as as a close relative to corn, but it is now recognized as being in the same species of Zea, and the probable progenitor of corn. Nearly 300 miles from the closest teosinte population to the south, Nobogame has since been visited by several collectors of Zea germ plasm. To our knowledge, however, little or none of the other plant resources of this remarkable farming tradition have made it in to gene banks. This could have proved disastrous because illicit drug plant production developed in the area in the mid-1960s and could have forced native farmers to abandon their traditional crops.

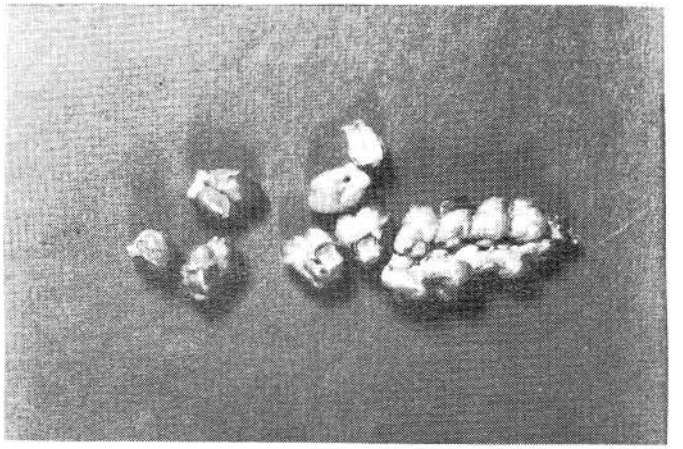
Fortunately, Nobogame was affected by drug traffickers less than were nearby localities. Yet in the last two decades, USDA and CIMMYT gene banks had depleted their stocks of the Nobogame teosinte collected by Wilkes, Gentry and other earlier plant explorers. Encouraged by Garrison Wilkes, we returned to visit his friends there, resolving to collect other seeds from them as well.



Teosinte found at Nabogame, Chih. Photo by Paul Mirocha.

Barney Burns and Mahina Drees visited the village via pack animals in late October, encountering teosinte and corn tomatillos, and a diversity of cultivated beans in the fields. They collected enough teosinte to replenish the gene banks. One month later, with SEARCH advisor Laura Merrick and Mexico's cucurbit and chile specialist Salvador Montes, I rode into the village. There we gleaned from the surplus harvests of several families, including chilacayote and acorn squashes, several other wild and cultivated beans, and two distinct chiles. Several of these are intercropped, with one plant twining around the other. We also collected individual plant samples from one field's population of corn, teosinte and hybrids that Dr. John Doebley of Texas A&M is now analyzing to see the extent that one genetically enriches the other. Such information will help us appreciate how genetic diversity functions in its native habitat. The seeds will also serve to replenish gene banks, where they can be cross-referenced to one another by computer, so that scientists in the future can study the relationships between these intercropped plants.

Gary Nabhan



Hybrid of corn and teosinte from Nabogame, Chih. Photo by Paul Mirocha.

# Book Donations in Memory of Gabriel Williams

In November, Pima Indian Gabriel Williams died in Sells, Arizona. Gabriel was known to many of us involved in native seeds through his work as nutrition counselor, gardening educator and saguaro harvest coordinator of Papago youth during his years with the Papago Tribal Nutrition Program. He was a warm friend with a contagious sense of humor. While in the hospital, he told us that if his condition improved, he wished to help with gardening and nutrition education again.

So in his memory, we have contacted the Venito Garcia Library and Media Center in Sells where his family lives, and they will accept agriculture, health and desert plants books in his name for use by the community as a whole. A book plate dedicated to him will be placed in each donated book. If you wish to contribute, send books or monetary donations to be used for books to: Williams Book Memorial, c/o Native Seeds/ SEARCH, 3950 W. New York Drive, Tucson, Az., 85745.

# Book Reviews

GREEN INHERITANCE: THE WORLD WILDLIFE FUND BOOK OF PLANTS

By Anthony Huxley. 1985. Published by Anchor Press/Doubleday, Garden City, New York. 193 pp. $19.95.

English botanist and gardener Anthony Huxley has produced a book that's a hybrid -- a cross between a scholarly textbook and a coffee-table showpiece. Richly illustrated and encompassing the wide landscape of plant science, Green Inheritance presents a convincing argument for the conservation of plants. It's publication launches an international campaign by the World Wildlife Fund to save threatened wild plants and plant communities.

The book aims "to demonstrate the worth and wonder of plants, their great potential, to explain why they cannot take any more punishment, and to point out how those that remain can be saved." Worldwide, there are about 25,000 species in imminent danger of extinction, as we destroy their principal habitat at the rate of 20 hectares per minute.

In explaining the various uses we make of plants, Huxley finds room for the incidental but fascinating plant lore that I love learning about. For instance, he notes that Tibetans always add rancid yak butter to their tea. That's something I look forward to working into the next conversation with someone drinking tea. Interesting facts and tidbits -- usually tied more directly to plant conservation issues -- are here in abundance, and they make up for the occasional extra effort I had to make in understanding Huxley's British prose.

All in all, the combination works great -- lavish presentation, interesting compilation of information, and a topic both timely and vital. Green Inheritance makes a strong and eloquent plea for conserving our plant heritage.

Kevin Dahl

ALTERED HARVEST: AGRICULTURE, GENETICS AND THE FATE OF THE WORLD'S FOOD SUPPLY

By Jack Doyle. 1985. Published by Viking Penguin, 40 W. 23rd St., New York, N.Y., 10010. 502 pages. $25, hardcover.

The mass media has told us that "sunbeans" and other genetically engineered organisms will soon make food crops selected by nature and cultures "obsolete". A set of new scientific techniques, loosely labelled biotechnology, frightens some of us and inspires others. With a skeptical but open ear, Jack Doyle listened to dozens of gene manipulators describe what they are doing, and whom their products may benefit. He asked government, university and private plant breeders and pathologists to describe how heavy investment in biotechnology is changing the appreciation for plant diversity, and how it may ultimately change the growing of food. Finally, he traces the history of the seeds and chemical industries, and shows indisputable trends in consolidation.

Doyle asks probing questions, but is careful not to condemn anyone as "bad guys". Indeed, gene transfer of pest and disease resistance may benefit agriculture and human health by reducing the amount of pesticides needed, but only if genetic engineers are encouraged to work for the public good. (Some companies now are engineering crops that are resistant to pesticides, so that more can be used!) Unless the public becomes concerned enough to guide and control this new industry, rather than considering it too technical to understand, we all stand to suffer.

Suffer from what? Doyle provides evidence of the catastrophes that have happened when genetically manipulated, uniform plants become vulnerable to epidemics, plagues, and climatic vagaries. While critical of clearcut coverups of such problems, he hopes to encourage the seed industry to learn from past mistakes. He is respectful of the value of vanishing crop land races for nutrition and as a source of breeding materials that can never ultimately be "obsolete." Doyle's book opens many issues that the USDA, FDA and private industry must now answer, and for that he has done a great service for all of us who eat food.

Gary Nabhan

# Staff Changes

With the opening of our office we are proud to announce some changes in the SEARCH staff. Kevin Dahl has come on board as our information exchange specialist. His capabilities as a writer and computer pro have already proven successful. He wrote a grant proposal this fall to the Wallace Genetic Foundation which awarded us 1,000 dollars. Kevin will continue writing and troubleshooting for us!

Gary Nabhan was given a new position as assistant director of the Desert Botanical Gardens, 1201 N. Galvin Pkwy, Phoenix, Az., 85008. He will continue as SEARCH Board of Directors President and maintain an involvement with activities.

Esther Moore will begin coordinating volunteers involved in the growers network in addition to being TBG garden manager. Linda Parker will also assist at the office in curating the smaller quantities of rare seeds. We are seeking support to make her efforts a paid position.

# SEARCH Opens Office at Tucson Botanical Gardens

SEARCH now has an office on the property of Tucson Botanical Gardens, 2150 N. Alvernon Way. An open house for all to attend will be held on Saturday, January 25, 1-5 pm. Office hours will be Monday, Tuesday and Thursday from 10-5, other hours by appointment. The phone number is 327-9123. Please check in with the docents at the TBG gift shop at the entrance to the Gardens for directions to the office. The space was donated by TBG, thanks to director Rodney Engard! Funds for renovation of the Friends House where the new office is located were provided to TBG by the Dart and Kraft Foundation.

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# Highlights of Seed Conference October, 1985

The SEED CONFERENCE was co-sponsored by the National Gardening Association and Missouri Botanical Gardens, where it was held October 4-6, 1985. It was attended by people representing all facets of the seed saving community and seed industry speaking on issues in an atmosphere of listening and non-confrontation. Eight of the speeches given are printed in the 1985 Harvest Edition, edited by Kent Whealy, director of the Seed Savers Exchange, P.O. Box 70, Decorah, Iowa, 52101. (This is required membership for anyone interested in heirloom seed saving.)

In the face of genetic wipeout, which is liable to occur in both developing and high-tech societies, the roles of seedsmen are changing. A reminder of the importance of seeds was stated by Garrison Wilkes, professor of biology at University of Massachusetts. "Given the needs of the future, genetic resources can be considered one of society's most valuable raw materials. Genetic loss is genetic loss, no matter how it happens. But genetic erosion is the loss of landraces and heritage crops -- biotypes -- that have been in families for a long time. Genetic vulnerability is caused by a very narrow genetic base over thousands and thousands of acres. Genetic wipeout is the complete loss of a genetic line." (From 1985 Harvest Edition).

Karen Reichhardt

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