Nutrition, Diabetes and the Tohono O'odham Food System

by

Tohono O'odham Community Action and
Tohono O'odham Community College

Prepared by
Daniel Lopez, Language & Culture Instructor, Tohono O'odham Community College
Tristan Reader, Co-Director, Tohono O'odham Community Action
FOR ADDITIONAL COPIES OF THIS REPORT, CONTACT:

TRISTAN READER, CO-DIRECTOR
TOHONO O'ODHAM COMMUNITY ACTION
POST OFFICE BOX 1790
SELLS, AZ 85634
520-383-4966

OR

DANIEL LOPEZ
TOHONO O'ODHAM COMMUNITY COLLEGE
POST OFFICE BOX 3129
SELLS, AZ 85634
520-383-4901

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I. INTRODUCTION

Wheat flours makes me sick! I think it has no strength. But when I am weak, when I am tired, my grandchildren make me gruel out of the wild seeds. That is food.

Maria Chona, 1933, Papago Woman

The wisdom and practical knowledge of traditional peoples has often been discounted as anecdotal at best. However, when 90-year-old Tohono O'odham elder Maria Chona spoke these words 65 years ago, she provided an accurate assessment of the effects of non-traditional foods on the health of the Tohono O'odham.

During Maria Chona's lifetime – and into the 1960's – no member of the Tohono O'odham tribe had ever been afflicted with Type II (adult-onset) Diabetes. Today more than half the population – including children as young as seven-years-old – suffer from the disease. This is the highest rate of any population in the world.

In the Fall of 2000, Tohono O'odham Community Action (TOCA) and Tohono O'odham Community College (TOCC) joined together to initiate a research program aimed at better understanding the causes and impacts of diabetes within the Tohono O'odham. This report represents the second in an ongoing research endeavor whose ultimate goal it to develop recommendations for how community-based organizations, tribal educational institutions, tribal programs and federal food assistance programs can contribute to reducing the incidence and impacts of Type II Diabetes within the Tohono O'odham community.

THE RESEARCH PARTNERS

TOHONO O'ODHAM COMMUNITY COLLEGE (TOCC)
Tohono O'odham Community College (TOCC) is a two-year tribal community college dedicated to serving the needs of the Tohono O'odham Nation. TOCC's mission is to enhance the unique Tohono O'odham Himdag by strengthening individuals, families and communities through wholistic, quality higher education services. These services provide a variety of academic, life and development skills.

TOCC's objectives include the following:
- To strengthen academic learning that will reinforce a strong competitive spirit to participate in an ever-changing society.
- To include elders as primary resources, instructors, advisors and counselors as a means of reinforcing the O'odham Himdag.
• To recruit highly qualifies faculty and staff who are dedicated to the art of teaching, advising and service.
• To ensure the integration of appropriate parts of the Tohono O'odham Himdag in the physical environment, curriculum and processes of the college.
• To ensure that curricular offerings are relevant to the needs of the community and individuals.
• To establish a technology core that will enable the community and individuals to meet the challenges of the future.

**TOHONO O'ODHAM COMMUNITY ACTION**

Tohono O'odham Community Action (TOCA) is an independent grassroots organization which strives to create effective, culturally based responses to the problems that confront our community. In pursuit of a sustainable community, TOCA's programs work directly to create: 1) sustainable economic development, 2) a community food system that keeps us healthy, 3) programs which rejuvenate our cultural traditions, and 4) ways of encouraging our young people to become strong members of the Tohono O'odham community. In order to achieve these goals, TOCA has developed four current program areas:

- The Tohono O'odham Basketweavers Organization
- The Tohono O'odham Community Food System
- The Tohono O'odham Community Arts and Culture Program
- The Youth/Elder Outreach Program

**TOCA's PRINCIPLES**

TOCA has adopted four principles that guide our decisions about program goals and strategies:

- **O'odham Himdag: Wisdom from our past creating solutions for our future** – The O'odham Himdag (Desert People's Way) guides us as we seek to develop culturally appropriate solutions to the challenges that confront our community. By drawing upon our heritage and cultural traditions we are able to create lasting solutions and a stronger community.
- **Community Assets: See our resources, not just our needs** – Our community already possesses many of the assets that are necessary to create a healthy and sustainable community. TOCA encourages people to take stock of our various community assets in order to develop indigenous solutions, rather than focus on the problems while importing “solutions” from the outside. The wisdom of our elders, the enthusiasm of our young people, the richness of our land, the centrality of our extended families, and our desire to create a healthier community all lead to the capacity to create solutions that will be culturally-based and sustainable.
- **Context is crucial: Strengthening the material roots of O'odham culture** – It is not enough to simply preserve cultural activities, such as ceremonies, songs and stories. The material basis out of which these cultural practices grew must also be maintained. A ground blessing dance looses much of its power when only ever performed for an audience in an auditorium rather than in the fields where the O'odham have planted for generations. TOCA works to redevelop the material foundation of the O'odham culture.
- **Encourage community self-sufficiency** – Social programs on the Tohono O'odham Nation have too often created dependent relationships which destroy the sustainable structures
that have previously supported the people. For example, although well-intentioned, the introduction of federal food programs helped devastate the traditional local food system, which has led directly to a high incidence of diabetes among the Tohono O'odham. These programs created destructive dependency where self-sufficiency had previously existed. In response, TOCA's Community Food System attempts to re-empower the community to become increasingly self-sufficient. TOCA continues to work toward such self-sufficiency in all of its programs.

**TOCA's Strategies**

Rather than keeping these principles abstract, they have become central to TOCA's program development process. Some examples of these commitments in action are:

- **Tohono O'odham Food System** — Until 1960, diabetes was unknown among the Tohono O'odham. Today, the O'odham have the highest rate of adult-onset diabetes in the world. The cause for this devastating change is the destruction of the traditional food systems and diet. Several scientific studies have confirmed that traditional O'odham foods — including tepary beans, mesquite beans, cholla (cactus) buds and chia seeds — help regulate blood sugar and significantly reduce the effects of diabetes. In short, the consumption of traditional O'odham foods has been documented to decrease both the rate and severity of diabetes.

As a way of addressing this problem, TOCA recognizes the assets already present in our community: wild desert crops, many unused fields, the annual monsoon rains, elders willing to share the traditions and skills related to traditional Tohono O'odham agriculture, unemployed individuals seeking creative ways to make a living, and an informal market structure which allows for distribution of such foods across the Tohono O'odham Nation. Drawing upon our heritage, we have worked to develop a community food system that provides the Tohono O'odham Nation with a healthy food supply. By combining the cultural knowledge of our elders, the assets already present in our community and innovative institutions (such as gathering cooperatives and community gardens), TOCA is working to address the root causes of the poverty and disease that are ravaging our community.

- **Tohono O'odham Basketweavers Organization** — The Tohono O'odham Nation lacks a solid economic base and the infrastructure necessary for conventional forms of economic development. As TOCA's members began to explore ways of developing an economic foundation, we once again turned to our cultural heritage — in this case basketweaving. For more than ten thousand years, the O'odham and their ancestors have woven some of the finest baskets in the world. Today, the retail prices for O'odham baskets can be as high as several thousand dollars. However, without direct access to markets, basketweavers are at the mercy of unfair traders, often receiving less than a quarter of the retail price.

In response, TOCA created a Basketweavers Organization that makes basketweaving a viable economic option and valued cultural practice for increased numbers of O'odham. By working to regulate traders, developing a cooperative to market baskets and teaching a
new generation of O'odham weavers, TOCA has drawn upon the O'odham Himdag to create sustainable economic development.

- Elder/Youth Outreach Initiative — The crisis of identity among Native American youth today is one of the most critical issues for the future development of indigenous communities. Given the tremendous damage to traditional social forms (ceremonies, material culture, sustainable economies, etc.) that has occurred, many Native youth are forced to seek a sense of identity in other places, such as the structured environment of gangs or the nihilism of drugs.

TOCA's Elder/Youth Outreach Initiative works with our community's young people to help them develop a strong sense of identity rooted in the O'odham Himdag. By taking significant leadership roles in TOCA and by working closely with community elders, youth participate in the rejuvenation of Tohono O'odham culture and the development of a sustainable economy on the Tohono O'odham Nation. Through this process, TOCA is helping youth face into their crisis of identity, learn "who they are," and develop the skills they will need in order to lead the Tohono O'odham community into the future. TOCA's Elder/Youth Initiative is planting the seeds of a bright future for the Tohono O'odham community.
II. DIABETES, CULTURE AND THE TOHONOO O'ODHAM FOOD SYSTEM

A. THE TOHONOO O'ODHAM COMMUNITY

The Tohono O'odham (formerly known as Papago) Nation sits in the heart of the Sonoran Desert, sixty miles west of Tucson, Arizona. Approximately 18,000 of the tribe's 28,000 members live on this main section of the Tohono O'odham Reservation. The Nation encompasses nearly 4,600 square miles (larger than the state of Connecticut). Despite the richness of the Tohono O'odham culture and the community's many assets, there are many extraordinary challenges to be faced:

- **Economics** — Per capita income on the Tohono O'odham Nation is $6998 (compared with $21,994 nationally), the lowest of all U.S. reservations. Median family income is $21,223 (compared with $50,046 nationally). 41.7% of all households and 50.6% of households with children are below the poverty level (compared to the U.S. averages of 9.2% and 13.6% respectively). Only 31.3% of the adult population is currently employed. Of those employed 46.9% are government workers (compared to 14.6% nationally), indicating the need for the development of private sector employment opportunities.

- **Health** — More than 50% of all Tohono O'odham adults have Type II (adult-onset) diabetes, the highest rate in the world. Children as young as six-years-old suffer from the disease. Life expectancy is more than six years shorter than the U.S. average. The primary cause of diabetes within the community is the change from a diet consisting primarily of traditional food and the destruction of a sustainable Tohono O'odham food system.

- **Violence** — In the past five years, the number of Tohono O'odham juveniles charged with serious crimes has tripled, almost entirely related to the introduction of gang activity to the community. The homicide rate is nearly three times the national average and twice that of all U.S. Native communities.

- **Education** — Fewer than half of the Tohono O'odham community's adults have completed high school, the lowest rate of all U.S. Native American tribes. A dropout rate in excess of 50% continues to be the norm. 48.3% of the population is under 25-years-old (compared with 35.3% nationally).

- **Culture** — Tohono O'odham language and many cultural traditions and ceremonies are currently threatened with extinction.

The Tohono O'odham Nation encompasses nearly 5 million acres of land. Currently, just over 10,000 acres are dedicated to agriculture (non-traditional cash crops). The majority of the remainder of the lands are open range for cattle and “forestland” (i.e., desert) that supports subsistence activities (e.g., firewood harvesting, harvesting of wild foods and medicinal plants). The Tohono O'odham Nation does not have a comprehensive land-use plan. However, in 1999 a comprehensive land survey was conducted; this survey identified all of the “prime farmland” within the main section of the Tohono O'odham Nation. The land upon which TOCA farms are located are designated as “prime farmland.”

B. THE THREE ELEMENTS OF THE TRADITIONAL TOHONOO O'ODHAM FOOD SYSTEM

For many centuries, the Tohono O'odham and their ancestors combined a series of well-
adapted strategies of producing food in the arid lands of the Sonoran Desert. This traditional food system combined three primary components to provide the O’odham with a rich and varied diet. The three parts of this traditional Tohono O’odham food system were:

- **Ak Chin Farming** – Using the flood waters that accompany the summer monsoons, thousands of acres were planted with crops that are nutritious and well adapted to the short, hot growing season. These foods, included tepary beans, corn, squash, melons, chiles, caño (“sugar cane” sorghum”) and much more. Many of these foods were eaten fresh and preserved for use throughout the rest of the year.
- **Harvesting Wild Foods** – Throughout the year, the desert provides a wide variety of wild foods that were collected and eaten. These wild foods included cholla buds, the fruit of different cacti, mesquite bean pods and acorns. Many of these foods were preserved for use throughout the year.
- **Hunting** – The animals of the desert also provided an important source of nutrition. The hunting of rabbits, deer, havalina and other desert dwellers was a significant supplement to the foods grown in O’odham fields and collected in the desert.

**C. THE DESTRUCTION OF THE TRADITIONAL TOHONO O’ODHAM FOOD SYSTEM**

*The reason Elder Brother planned this was that some day in the future... the rains would not come down all over the earth very often, only once in a while, and the crops that the people raised wouldn’t be irrigated anymore by rain water.*

— Tohono O’odham origin story

Until the second half of the 20th century, the Tohono O’odham were almost entirely food self-sufficient utilizing agricultural practices that date back over one thousand years. As late as the 1920’s, the community utilized traditional methods to cultivate over 20,000 acres in the floodplain of the Sonoran lowlands. By 1949, that number had declined to 2,500 acres. Today that number is certainly less than 25. At the same time the once common practice of collecting and storing wild foods declined in an equally dramatic way.

The causes for this decline are complex and multifaceted. They include the following factors:

- Many Tohono O’odham were encouraged by Federal work projects to take jobs as field labor for large, irrigated cotton farms that surround the Tohono O’odham homelands. Entire families left their communities for six to eight months each year, making it impossible for them to plant, tend and maintain their fields, to engage in the ceremonial life related to agriculture, and to collect wild foods on a seasonal basis.
- The introduction of and easy access to processed foods through Federal food programs and commercial outlets led many people to alter their diets and decrease the amount of traditional foods consumed.
- These same social programs — although well intentioned — often created dependency relationships where self-sufficiency had previously existed. Over the course of a few short decades, the Tohono O’odham community went from being almost entirely food self-sufficient to being almost entirely food dependent.
• As warned in the Tohono O’odham origin story, environmental factors (such as a lowering of the water table due to nearby development) combined with misguided governmental flood control efforts to make water sources for traditional agriculture even more scarce than normal in the arid Sonoran Desert. In many of the traditional farming villages, flood waters no longer reach the fields that once fed entire communities.
• Large numbers of Tohono O’odham children were forcibly placed in boarding schools where they were prohibited from speaking their language and practicing their culture. At school, they were not exposed to the traditional ways in which knowledge was passed on within the culture. This meant that they did not learn the skills necessary to farm in the desert or how to collect, process and cook wild foods.
• During the Second World War, most young O’odham men – those responsible for most of the farming and many parts of ceremonial life – were in the military for years at a time, leaving many fields empty of crops and ceremonies unperformed.

D. HEALTH EFFECTS OF THE LOSS OF THE TRADITIONAL TOHONO O’ODHAM FOOD SYSTEM

I just lay there awake and I think about it. The numbers of diabetics are going up and the ages are going down. People just have to wake up to what we are facing.
– Mary Antone, Tohono O’odham Community Health Representative

The most immediate and devastating effect of the loss of the traditional Tohono O’odham food system has been upon the physical health of the people. For centuries, traditional desert foods – and the effort it took to produce them – kept the Tohono O’odham healthy. The introduction of processed foods, however, changed all of that, leading to unprecedented rates of adult-onset diabetes.

As recently as the early 1960’s, diabetes was virtually unknown among the Tohono O’odham. Today, more than 50% of the population develops the disease, the highest rate in the world. Adult-onset diabetes has even begun to appear in children as young as seven-years-old.

As a degenerative disease, diabetes causes many subsequent health problems, including kidney failure, loss of eyesight, circulatory problems and severe organ damage. In the year 2000, Arizona and Sonoran (the northern Mexico state that borders the Tohono O’odham Nation) health programs will spend $2 billion annually to treat Mexican and Indian diabetics. Similar, although marginally less dramatic, rates of adult-onset diabetes effect many other Native communities as well.

E. CAUSE OF THE DIABETES PROBLEM

Wheat flour makes me sick! I think it has no strength. But when I am weak, when I am tired, my grandchildren make me gruel out of the wild seeds. That is food.
– Maria Chona, 1933, Papago Woman
The wisdom and practical knowledge of traditional peoples has often been discounted as anecdotal at best. However, when 90-year-old Maria Chona spoke these words 65 years ago, she provided an accurate assessment of the effects of nontraditional foods on the health of the Tohono O'odham.

Over the past several years, several scientific studies have confirmed what Chona already knew: traditional Tohono O'odham foods — such as tepary beans, mesquite beans, acorns and cholla (cactus) buds — help regulate blood sugar and significantly reduce both the incidence and effects of diabetes. Over the course of many centuries, the Tohono O'odham metabolism had become especially well adapted to the foods of the Sonoran Desert. As the majority of Tohono O'odham moved away from traditional foods and adopted a more “Western” diet, diabetes began to appear at an extremely high rate. Unlike the traditional foods that helped control blood sugar levels and increase insulin production and sensitivity, this new diet overwhelmed the O'odham metabolism, leading to high rates of obesity as well as diabetes. In a very real sense, the destruction of the traditional food system is literally killing thousands of Tohono O'odham.

F. LIMITED EFFECTIVENESS OF CONVENTIONAL MEDICINE

Since diabetes is a degenerative disease with no cure, conventional Western medicine is extremely limited in its ability to effectively respond to this health crisis for Native communities. Although there are medicines that can help control blood sugar levels and mitigate some of the worst effects of diabetes, the effectiveness of these treatments is often overwhelmed by the progress of the disease.

One indicator of the limited effectiveness of conventional medicine is the number of Tohono O'odham who have experienced severe kidney damage as a direct result of diabetes. Despite the best efforts of doctors, almost one in ten Tohono O'odham diabetics are forced to undergo regular dialysis. Circulatory problems, amputations and loss of eyesight are also common among Tohono O'odham diabetics. All of this has combined to create a situation in which Tohono O'odham life expectancy in more than ten years shorter than the national average. At least as important, the richness and quality of life of O'odham diabetics is also greatly reduced.

G. EFFECTIVENESS OF THE TRADITIONAL DIET

The solution to the diabetes problem among the Tohono O'odham community is both extremely easy to identify and maddeningly difficult to achieve. 65 years ago, in advocating for
the power of traditional foods, Maria Chona correctly identified the need for the Tohono O'odham to consume traditional foods in order to be strong and healthy. A simple return to a more traditional diet would surely be a major step in solving a health problem that is devastating the Tohono O'odham community.

Two primary attributes of traditional Tohono O'odham foods are thought to contribute to reductions in both the incidence and severity of diabetes. First, the soluble fiber, tannins and inulin in one group of traditional foods (which includes mesquite bean pods, acorns and tepary beans) helps reduce blood sugar levels, slow sugar absorption rates, and improve insulin production and sensitivity. Indeed, these foods are known to be among the 10 percent most effective foods at controlling blood-sugar levels. Second, a complimentary group of traditional foods (including prickly pear fruits and pads, cholla cactus buds, chia seeds and mesquite bean pods) contain mucilaginous polysaccharides gums that slow the digestion and absorption of sugary foods. Combined, these two categories of desert foods prevent and reduce the effects of diabetes.

As easy as this solution might appear on the surface, however, two major stumbling blocks remain. First, after decades during which most members of the Tohono O'odham community have abandoned the traditional diet, a great deal of culturally-appropriate education, asset development and capacity building is required in order to help people to reverse this trend. Second, and perhaps more fundamental, given the extreme damage to the traditional food system – the forms of producing, distributing and preparing traditional foods – it is not obvious how a person who wants to return to such a diet would be able to do so. The Tohono O'odham Community Food System provides a mechanism for these two obstacles to be overcome.

H. CULTURAL EFFECT OF THE LOSS OF THE TRADITIONAL TOHONO O'ODHAM FOOD SYSTEM

Traditional people often use culinary customs as primary indicators of a particular culture.

— Gary Paul Nabhan, Cultures of Habitat

Farming is not seen just as an economic necessity, but as a religious duty.

— Emory Sekaquaptewa, Hopi

Destruction of the Tohono O'odham food system has led to a dramatic loss of Tohono O'odham language and cultural traditions, as equally devastating as the loss of the people's physical health. Virtually all elements of traditional culture – ceremonies, stories, songs, language – are directly rooted in the system of food production. O'odham culture is truly an
agriculture. As a result, destruction of the traditional food system has contributed to the significant loss of many elements of the O'odham Himdag – Desert People's Way.

One of the most sacred of these cultural practices is the saguaro wine ceremony. Designed to “sing down the rain” that makes agriculture possible in the dry desert, the saguaro harvest and the wine ceremony served as a cornerstone of O'odham ceremonial life, marking the beginning of the new year. Today, however, only a tiny portion of the O'odham community participates in this sacred rite. The reason for this decline is relatively simple: today, few O'odham produce their own food. Grocery stores and federal commodity programs – rather than the desert – are the source of food. The endangerment of this essential element of O'odham culture is the direct result of changes in the material foundation: People did not stop planting the fields because the ceremony was dying out; the ceremony began to die out when people stopped planting their fields. The saguaro wine ceremony is but one of many examples of O'odham culture's reliance upon and connection to the traditional food system.

I. THE TOHONO O'ODHAM COMMUNITY FOOD SYSTEM

Beginning in the summer of 1996, Tohono O'odham Community Action (TOCA) initiated a community-based project aimed at redeveloping a sustainable food system within the Tohono O'odham community. TOCA sought to create a comprehensive response to the near total destruction of the traditional Tohono O'odham food system and the resulting nutrition-related disease that is devastating our community. The goal was to engage in a variety of interrelated activities such as the redevelopment of traditional flood-based farming, implementation of a desert foods collecting project, creation of family and village gardens throughout the community, creation of partnerships with schools, hospitals and other institutions, establishment of community gardens, and other activities.

Over the past four years, TOCA has accomplished a tremendous amount and developed a strong record of success. Some of these accomplishments include:

- Redeveloped traditional floodplain agriculture on a small-scale in the village of Cowlic. With four acres of traditional crops planted in the summer of 2002, this represents the first traditional agriculture project within the Tohono O'odham community in many years. This project serves as a community “laboratory” for re-learning and teaching the practical skills and processes needed for larger scale redevelopment of traditional floodplain agriculture.
- Established two community gardens (including one on the grounds of the Indian Health Service hospital in Sells) to serve as learning centers where elders, younger adults and youth can redevelop the multigenerational transfer of skills and information about the ways in which farming, gardening, collecting wild foods and hunting can be combined to create a strong and healthy Tohono O'odham food system.
• Provided technical and material support (including free traditional seeds, free fencing and use of tools) for the creation of over 60 family gardens in villages throughout the Tohono O’odham community.
• Organized dozens of trips to collect wild desert foods (e.g., desert acorns, saguaro fruit, cholla cactus buds and mesquite beans). In addition to providing families with healthy foods, these trips provided an opportunity for young people to learn the cultural importance and health benefits of these foods, as well as the practical skills necessary for collecting, preserving and preparing these foods.
• Co-sponsored and organized the Desert Walk for Health and Heritage a 250-mile walk in which hundreds of community participants ate traditional foods, utilized traditional medicines and shared their perspective on the role of cultural traditions in solving the diabetes problem that is devastating Native communities.
• Provided technical and material support for the creation of gardens at the Tohono O’odham Elderly Program, the Sells Head Start Program, the Santa Rosa Ranch School and other community programs. Provided community-based training and consultation for Indian Health Service, Tohono O’odham Nation Elderly Program, Tohono O’odham Nation Agriculture Program, Indian Oasis Primary School, Ha:san Preparatory and Leadership School, Tohono O’odham High School, etc.
• Developed educational resources for use within the Tohono O’odham community about the linkages between the food system, cultural traditions and diabetes prevention, including the production of a 25-minute educational video written, directed and produced entirely by community members (a copy is enclosed).
• Redeveloped cultural traditions related to the traditional food system, including organizing the first Nawat I’i — rain ceremony — in 30 years in the farming village of Wainam Ke:k.

J. RECENT DEVELOPMENTS IN TOHONO O’ODHAM FOOD PRODUCTION:
Since this USDA funded research began in the Fall of 2000, there have been significant steps taken toward the redevelopment of a sustainable food system that meets the cultural and nutritional needs of the Tohono O’odham community.

In February 2003, Tohono O’odham Community Action (TOCA) took a major step forward in expanding its food production activities. TOCA came to an agreement with the Tohono O’odham Farming Authority (TOFA) allowing TOCA to lease approximately 50 acres of agricultural land. This represents a major opportunity for TOCA and a significant change in policy by TOFA. For TOCA, the agreement provides access to key resources (e.g., high quality agricultural land, water resources and technical support) that are essential to a successful expansion of traditional Tohono O’odham food production. For TOFA, the agreement represents a major shift in approach; currently TOFA farms 10,000 acres cropland, producing mostly cotton and hay in an unsustainable manner. In addition to providing TOCA with essential resources, this project will demonstrate how traditional and modern agricultural production can be combined in a sustainable manner that benefits the Tohono O’odham community.

Despite uncertainty about future funding for the purchase of harvesting equipment, in June 2003
TOCA planted 22 acres of crop-land with traditional Tohono O'odham crops, more than four times the total number of acres planted in the entire Tohono O'odham community in 2002 and 25 time (2500%) the total amount planted in 2000. In the fall of 2003, TOCA harvested over 30,000 of traditional Tohono O'odham crops from this initial stage of production farming. This harvest includes over 10,000 pounds of white tepary beans, brown tepary beans and Tohono O'odham 60-day corn (traditional dietary staples) without the assistance of any farm machinery; the entire harvest was conducted by hand. These foods have been distributed to schools, tribal elderly programs, tribal correctional institutions, the Indian Health Service Hospital, and directly to individuals.

Although there is still a long way to go, these developments represent hope for a larger-scale development of...
III. RESEARCH PROGRAM

PRIMARY RESEARCH QUESTIONS

In undertaking this third and final stage of USDA-funded research, three primary research questions were developed:

- Given the extremely high rates of Type II Diabetes within the Tohono O’odham community, what is a sufficient theory of community change to drive the future development of tribal, Federal, non-profit and private food assistance/food system programs? What are the implications of this theory?

- What information in the survey results of the second year of research (see "Community Attitudes Toward Tohono O’odham Foods") can provide guidance into how this theory of community change can be implemented on a practical level?

- What practical and cultural knowledge is needed in order for educational programs to effectively encourage the development of healthy eating habits, including the increased consumption of healthy, traditional Tohono O’odham foods?

RESEARCH ACTIVITIES

In order to provide answers to the three research questions, research was commenced in three different, yet related areas.

A. NUTRITION, DIABETES AND A THEORY OF CHANGE

With half of the population suffering from the disease, including children as young as six-years-old, diabetes is a devastating reality for every Tohono O’odham family. In order to understand the roots of the problem, researchers have worked to develop a comprehensive analysis of the ways in which the loss of the traditional food system led to the diabetes epidemic (see the two previous USDA research reports). Based upon this analysis – and in order to create effective solutions to the problem – researchers developed a three-part theory of change:

1. THE MYTH OF INDIVIDUAL CHOICE & THE NEEDS FOR SYSTEMS CHANGE

Too often the solution to diabetes and other health conditions is placed only on the shoulders of individuals; if only the individual would make better choices (in what they eat, in how much they exercise, etc.) they would be healthy. Although the ultimate choices of behavior rest on the shoulders of the individual, the viability of these choices requires systems that allow for and support them. For example, if a Tohono O’odham single mother wanted her family to eat larger quantities of healthy, traditional foods, it would be virtually impossible for her to do so under the current conditions. She cannot purchase them at any store; the traditional village structure that made traditional agriculture possible no longer exists; her children eat school lunches (and often breakfasts) that do not take into account the special nutritional needs of the Tohono O’odham; at community gatherings, traditional foods are rarely served. Thus, in order
for individuals to make healthy choices there needs to be systemic support for these choices. Therefore....

2. Food System Redevelopment Is Essential
The solution to the diabetes epidemic within the Tohono O'odham community requires the redevelopment of a sustainable food system that meets the nutritional and cultural needs of the community. Without redevelopment of systems of producing, processing, distributing, sharing and eating the foods that are nutritionally and culturally appropriate for the Tohono O'odham, no significant diabetes prevention can take place. And....

3. Incentives for Change
In order for communities, families and individuals to fully embrace systemic change (i.e., local food system redevelopment), there need to be three types of incentive: health incentives, economic incentives and cultural incentives.

The first, and perhaps the most obvious, incentive for eating traditional foods lies in the health benefits; these foods help regulate blood sugar levels, preventing and regulating diabetes. However, as can be seen with the increase in diabetes, obesity and other nutrition-related diseases across the U.S., these health incentives alone are rarely sufficient to alter people's food choices.

A second form of incentive is economic. For example, in a community with extremely high rates of poverty, the ability of a family to make $3000 during the two-week saguaro fruit harvest season provides a strong incentive to engage in the production, processing, consumption and sale of this traditional food. Or given high rates of lactose intolerance among Native Americans, if a mother of young children can purchase cholla buds (which have the same levels of calcium as milk) with WIC coupons, she has an economic incentive to improve the nutrition of her family and support food system redevelopment.

Third, there are strong cultural incentives for embracing community food system redevelopment. The current movement to revitalize the O'odham Himdag – the Desert People's Lifeways – can encourage increased production, processing, distribution and consumption of traditional foods. In legend, the milky way was created when Ban (Coyote) scattered tepary beans across the sky. In ceremony, song cycles call the summer monsoon rains to water the crops in the fields. The revitalization of cultural practices reinforces the message that Tohono O'odham identity, foods and health are inextricably linked.

4. From Theory to Practice
Thus, the reduction of diabetes within the Tohono O'odham community requires that the healthy choices of individuals are made viable through the creation of a sustainable food system and motivated by health, economic and cultural incentives.

5. From Implications for Federal Food Assistance Programs
Given the compelling public and governmental interest in reducing the incidence and severity of Type II Diabetes within the Tohono O'odham – and other Native American – communities, this theory of diabetes and community change leads to two general principles for the future.
development of Federal food assistance programs:

- **Support for Food System Change** – Federal food assistance programs need to expand their focus beyond merely providing direct food assistance to individuals and families; they must also implement policies and practices that support the creation of food systems that support the development of healthy choices by individuals.

- **Create Multiple Incentives for Healthy Food Habits** – Federal food assistance programs must expand the scope of their mission beyond direct food aid. These programs must also contribute to the creation of health, economic and cultural incentives for people to make healthy choices.

It is important to note that these principles align closely with the principles adopted by the Office of Community Food Security, a crosscutting initiative of the USDA.

The implementation of these general principles has dramatic implications for the way in which Federal food assistance programs serve Native American communities. It calls for reexamination of the ways in which programs such as WIC, food stamps and commodity distribution programs function within tribal communities. Examples of how these principles might guide revised planning and implementation for these programs include:

- The WIC program must respond to the unique and diverse nutritional needs of tribal communities. In the example above, the expansion of the WIC program within the Tohono O’odham Nation to include cholla buds in addition to milk would respond to high levels of lactose intolerance within the Tohono O’odham population. In addition, it would create an economic incentives, both for pregnant women and mothers of young children to consume healthy, traditional foods, and for community members to produce these food in greater quantities.

- FDIRP programs should be permitted (and funds should be appropriated) to purchase 10% of the foods they distribute locally. These foods should be traditional foods that have a proven nutritional benefit. The list of approved foods would be developed in cooperation with each participating tribal community to insure both nutritional and cultural criteria are used. Among the benefits of this approach would be:
  - The program would provide economic and cultural incentives for vulnerable parts of the population (pregnant women and young children) to develop healthy eating habits, focusing of the foods that have kept their people and cultures healthy for generations. This would, in turn, reduce the incidence and severity of nutrition-related disease (particularly diabetes) in Native American communities.
  - The program would stimulate increased production of traditional, nutritionally beneficial foods within Native communities by providing producers with an economic incentive to once again produce traditional, healthy foods. By providing a market incentive to producers in the form of IHS purchases, the economic viability of traditional food production would be increased, contributing to job creation, economic development, the redevelopment of sustainable food systems and increased self-sufficiency.

- Congress should allocate funds to waive the matching requirement for the successful WIC Farmers Markets Nutrition Program on Native American reservations. The current
required 50% cash match from tribal communities dramatically limits the program's ability to provide pregnant women, infants, children and seniors with culturally appropriate, nutritious traditional foods as a supplement to regular WIC and social security benefits. For a relatively small investment, recipients would be provided with supplementary coupons which could be exchanged for locally produced, traditional Native foods that have been demonstrated to prevent nutrition-related disease. Benefits of this approach would include:

- The program would provide economic incentives for one of the most vulnerable parts of the population (elders, pregnant women and young children) to develop healthy eating habits, focusing on the foods that have kept their people and cultures healthy for generations. This would, in turn, reduce the incidence and severity of nutrition-related disease (particularly diabetes) in Native American communities.

- The program would provide economic incentives that would stimulate increased production of traditional, nutritionally beneficial foods within Native communities by providing producers with an economic incentive to once again produce traditional, healthy foods. By providing a market incentive to producers in the form of WIC supplemental coupons, the economic viability of traditional food production would be increased, contributing to job creation, economic development, the redevelopment of sustainable food systems and increased self-sufficiency.

These are but a few examples of how the development of a coherent theory of change within Native communities can inform Federal food assistance program development. Although these and other related changes would require a fundamental rethinking of the nature and goals of Federal food programs in tribal communities (as well as possible legislative action), such changes are necessary in order to solve the health problems created in no small part by 50 years of policies that contributed to the decline of sustainable, Native food systems.
B. FURTHER SURVEY AND MARKET ANALYSIS

In order to better understand the practical implications of the survey data collected in year two research, additional survey analysis was conducted to help determine what level of demand for traditional, healthy foods exists. This analysis of survey data was augmented with other market analysis to determine the current levels of unmet demand for traditional Tohono O'odham foods. This analysis can help determine future directions for Federal, tribal, non-profit and private food system development activities and programming. It also directly relates back to the theory of change described above in that it begins to quantify and document the level of economic incentive that exists for the redevelopment of a sustainable food system that supports healthy eating habits by individuals.

In the course of this analysis, two general categories of demand for traditional foods were identified: internal Tohono O'odham markets and external commercial markets. First, as documented in the previous survey results, there is currently a high level of unmet demand for traditional foods within the Tohono O'odham community. There are several market segments available within the Tohono O'odham community:

I. DIRECT MARKETING TO INDIVIDUALS AND FAMILIES

Individuals and families represent the largest and most easily accessed market segment within the Tohono O'odham community. To help assess the current levels of demand, TOCA surveyed 128 households about their attitudes toward traditional Tohono O'odham foods in 2002. Based upon these survey results, we estimate the following levels of current demand for traditional foods:

- Tepary Beans – 36,756 pounds annually
- Tohono O'odham Squash – 68,731 pounds annually
- Tohono O'odham Corn – 44,239 pounds annually
- Tohono O'odham Yellow-Meated Watermelon – 184,760 pounds annually
- Ke'li Ba':so Melon – 61,437 pounds annually
- Tohono O'odham Peas – 25,988 pounds annually
- Tohono O'odham Black-Eyed Peas – 28,080 pounds annually

It is important to note that these levels of demand are based upon current community desires. This level of demand currently exceeds the projected levels of production during years one and two. With the continued expansion of nutrition/cultural education programming and marketing efforts, levels of demand for these traditional foods products are expected to increase substantially, thereby supporting increased levels of production.

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2 These levels of demand are based upon the following calculations using survey data:
- The total population (20,000) was multiplied by the percentage of respondents in each category of demand (i.e., those who would eat the food “daily,” “often,” “sometimes,” “rarely,” and “never.”
- Respondents who said they would eat a particular food “daily” were projected to eat 5 servings per week, those who said “often” were projected to eat 3 servings per week, those who said “sometimes” were projected to eat 1 serving per week, and those who said “rarely” were projected at 1 serving per month.
- These levels of demand were multiplied by the serving sizes for each food to determine the level of demand.
- This total demand was then reduced by 20% to compensate for the fact that survey responses are often more positive than actual behavior. This lower level would appear to be a realistic expectation for current levels of demand.
2. INSTITUTIONAL DEMAND
Developing institutional markets within the Tohono O'odham Nation will constitute an important future market. To date, the following institutions have expressed interest in purchasing and utilizing traditional Tohono O'odham foods:
- **Tohono O'odham Senior Services** – This program prepares and serves meals to tribal elders four days per week at four locations spread across the Reservation. Elders have expressed a strong desire to increase the amounts of these foods served by the program.
- **Indian Health Service Hospital** – I.H.S. has agreed to purchase traditional foods as a part of meals served in their in-patient wing.
- **Public and Charter Schools** – TOCA will work to develop a farm to school program which will bring traditional foods into the school breakfast and lunch programs. In addition to creating an immediate increase in demand, it helps build future demand by helping build healthy, life-long food habits when community members are young.

3. FOOD ASSISTANCE PROGRAM DEMAND
Federal food assistance programs (i.e., Food Stamps, WIC coupons and the Commodity Distribution Program) play a central role in meeting the food need of the Tohono O'odham community. According to survey data, 76% of food stamp recipients and 88% of WIC recipients would use these resources to purchase traditional foods. This constitutes a high level of demand for these foods.

4. WHOLESALE MARKETING
There is one full-service grocery store and several small village stores on the Tohono O'odham Reservation. The grocery store and three of the small stores have expressed interest in carrying many of the traditional Tohono O'odham foods.

In addition to these four areas of internal Tohono O'odham community demand for traditional Tohono O'odham foods, an analysis of external markets and levels of demand was undertaken to determine to levels of economic incentives for food system redevelopment that might exist. There are several current and potential markets external to the community that can be tapped as internal demand is met. Traditional Tohono O'odham foods can fill a largely untapped market niche: healthy, traditional Native American foods. They would appeal to three segments of consumers: 1) consumers who are increasingly concerned about diabetes (as the diabetes rate in the U.S. is projected to double over the next 20 years); 2) consumers interested in native and natural foods; and 3) people interested in gourmet food products. Although the size of these markets have not been fully analyzed through market research, current levels of demand indicate a large and growing market for traditional Tohono O'odham foods. External markets include:

I. WHOLESALE MARKETING
Several local retail outlets have expressed interest in carrying Native Trade Routes products. These include:
- **Native Seeds/SEARCH** – Native Seeds/SEARCH sells more than 12,000 thousand pounds of traditional Tohono O'odham foods annually for sale through its retail outlet on 4th Avenue in Tucson and catalogue distribution. NSS management have expressed a desire to purchase these foods from Tohono O'odham growers rather than from their current contract grower.
• Gift shops at cultural sites (i.e., Arizona-Sonora Desert Museum, the Heard Museum, the Arizona State Museum, Tohono Chul Park, Casa Grande National Monument) could provide outlets to reach tourists and others interested in the culture and nature of the Sonoran Desert.

• Upscale Grocery Stores – Upscale grocery stores (such as Whole Foods and Wild Oats) represent another market for these foods.

2. RESTAURANT MARKETING
The Executive Chef at Canyon Ranch (the top spa resort in the U.S.), James Beard Award-winner Janos Wilder, and the Executive Chef of Kai at Wild Horse Pass Resort are a few of the chefs who have expressed a desire to purchase significant quantities of traditional Tohono O'odham foods for service in their restaurants.
C. Practical and Cultural Knowledge Research

In order to begin answering the third research question, an intensive research program was begun to gather information about the practical and cultural knowledge needed in order for educational programs to effectively encourage the development of healthy eating habits, including the increased consumption of healthy, traditional Tohono O'odham foods. The types of information sought as a part of the research program included:

- Practical information about the production, processing and preparation of the traditional Tohono O'odham foods that help regulate blood sugar levels. This included both wild foods (information about how they are harvested, processed, preserved and prepared) and cultivated foods (how and when they are grown, harvested, preserved and prepared).
- Nutritional data about traditional Tohono O'odham foods was researched. Although few of these foods have been subject to full nutritional analysis, all available information was researched. This information can be utilized to help create the health incentives described as a part of the theory of changed developed by researchers (see above).
- Cultural information – songs, legends, ceremonial practices – about these foods was documented and collected. This information is critical to providing the cultural incentives described as a part of the theory of changed developed by researchers (see above).

This information was collected utilizing a variety of methods, including:
- Ethnographic Research – Researchers worked with more than 20 Tohono O'odham elders to collect practical and cultural information about traditional Tohono O'odham foods. More than 200 hours of interviews and hand-on research activities were conducted. 50 hours of audio recordings were made during these research activities, and over 1500 high-resolution digital photographs documenting the various research topics and activities were taken. The types of information collected through this process included (but were not limited to) how traditional foods are produced (cultivated or collected in the wild), processed and prepared; additional cultural information (e.g., legends and songs) were also collected and recorded.
- Literature Research – Researchers engaged in a literature review of books and journal articles to gather together all available nutritional data relating to more than 20 traditional Tohono O'odham foods. Although limited resources exists, specific data was available for a variety of foods; for others, compounds that help regulate blood sugar levels and are common in both wild and cultivated desert foods were identified.

Based upon the results of these activities, researchers have begun to develop a set of educational resources about traditional foods for use and distribution within the Tohono O'odham community. An educational brochure about each of the traditional foods is currently under development. Each brochure will provide community members with the following information about a specific food:

- A step-by-step description of how the food is produced (either cultivated or harvested in the wild)
- A description step-by-step of the method of processing and/or preserving the food (where appropriate)
• A description step-by-step of how the food is traditionally prepared (including recipes)
• A description step-by-step of alternative/modern ways of preparing the food (including recipes)
• Cultural information about the food
• Nutritional information about the food

With the development and distribution of these educational materials, both health incentives and cultural incentives to eat traditional foods are strengthened. In addition, the educational resources provide the practical information necessary for individuals to actually produce, preserve, prepare and/or consume these healthy, traditional foods. A working draft of one brochure is attached at the end of this report; although the layout and production of this sample is far from complete, it provides a good preview of the completed educational resources being developed. Additional brochures will continue to be developed based upon this research.
IV. DIRECTIONS FOR FUTURE RESEARCH

The need for research about traditional foods, nutrition, diabetes and other related topics is more than an academic exercise for the Tohono O'odham community; it is an essential element in the development of programming that can contribute to the creation of a healthy, sustainable and culturally vital community. Thus, although USDA research funding has come to an end, new directions for continued research have emerged from the results described in this report. Among possible directions for future research are the following.

1. COMMUNITY ATTITUDES TOWARD TRADITIONAL TOHONO O'ODHAM FOODS FOLLOW-UP SURVEY

In 2002, TOCA conducted a USDA-funded survey about community attitudes toward traditional Tohono O'odham foods. As continued educational and food system redevelopment programming takes place, a follow-up survey to evaluate progress toward meeting the broad goals of such programming, and the programming's impact within the Tohono O'odham community.

2. COMMUNITY-BASED HEALTH INTERVENTION STUDY

Although the nutritional make-up of a variety of traditional Tohono O'odham foods has been analyzed, there has never been a study to measure the impacts of incorporating the these foods into the diet. In future research, TOCA will engage in a community-based health intervention study to examine the effectiveness of incorporating traditional foods into the diet. This study will provide concrete data on the health effects of eating traditional foods, as well as an important level of clinical integrity to the project. Because the study will be designed and implemented at the community level (rather than in a formal clinical setting) it will overcome many of the cultural and historical barriers to success of previous studies of diabetes in Native communities. Additionally, unlike more than 40 years of studies conducted by the National Institutes of Health that have looked at the causes of the diabetes epidemic in O'odham communities, this study will assess the effectiveness of an actual prevention and treatment strategy.

As a part of this health intervention study, at least ten Tohono O'odham households will be selected to participate in a community-based “clinical” trial to examine the impacts of including traditional foods into their diets. This study will examine the inclusion of both moderate amounts of traditional foods and large amounts of traditional foods into the diet. The study will take place in two stages.

Stage one will examine the impacts of including moderate amounts of traditional foods into the diet. For the first three months of this study, participants will merely monitor key health factors without making any significant dietary or lifestyle changes. For the second three months, participants will agree to eat at least two servings of traditional Tohono O'odham foods per day. Throughout the six-month study period, participants will be asked to provide the following data:

- The weight of each household member (measured twice per week).
- The blood sugar level of each household member (measured twice per week)
- A journal detailing topics such as how each family members feels physically, levels of exercise, challenges faced in incorporating traditional foods into the diet and other
subjective evaluative measures.

Stage two will examine the impacts of including larger amounts of traditional foods into the diet and increased exercise levels. Once again, for the first three months of this study, participants will merely monitor key health factors without making any significant dietary or lifestyle changes. For the second three months, participants will agree to eat at least four servings of traditional Tohono O’odham foods per day. They will also agree to engage in some form of physical exercise at least three times per week. The same data as in stage one will be collected.

Throughout the study period, participants will be provided with a number of key resources. These resources will include:

- Sufficient amounts and varieties of traditional foods will be provided to households to allow them to meet the required consumption levels.
- TOCA’s Dietary Intervention Specialist will help participating households with the process of collecting data.
- Participating households will be provided with educational and training opportunities on such topics as how to cook traditional foods (both traditional preparations and contemporary preparations), how to monitor blood sugar levels, the importance of physical activity to healthy, etc.
- Participating households will be invited to participate in a weekly support circle in which challenges can be shared, lessons can be learned and peer support can be developed.

This health intervention study will be coordinated by TOCA’s Diabetes Intervention Specialist. The person hired for this position will be a community member with at least some training in health education, nutrition and/or nursing.
WORKING DRAFT OF
EDUCATIONAL BROCHURE

PREPARED BY
DANIEL LOPEZ, LANGUAGE & CULTURE INSTRUCTOR, TOHONO O'ODHAM COMMUNITY COLLEGE
TRISTAN READER, CO-DIRECTOR, TOHONO O'ODHAM COMMUNITY ACTION
MARY PAGANELLI, TOHONO O'ODHAM COMMUNITY ACTION
The Life of the Ha:sañ

Ha:sañ (saguaro cactus, Carnegiea gigantea) begins its life as a tiny black seed. The seed lodges in the earth and begins its long journey to maturity. Those seeds that do grow are often found near or beneath a chepa (mesquite tree) or kuk chehethgi (paloverde tree) which protects the tiny cactus as it grows, offering shade and protection.

Reflections....

We need some sort of quote or recollection here that talks about the importance of the saguaro and the relationship between the Tohono O'odham and the ha:sañ. The saguaro cactus providing pollen for the birds, bees and bats. In just 24 hours the flowers will close up and turn into green pods, ripening several weeks later into delicious, juicy bahida'y (fruit). When the pods are flushed with pink they are ripe and ready to be harvested. Many split open naturally, offering their magenta flesh and shiny black seeds to the birds, bees and other desert creatures that also feed on this sumptuous fruit and continue its cycle of growth, spreading seed far and wide.

Each ripe fruit is full of as many as 2,000 seeds, and in its lifetime a ha:sañ can produce as many as 40 million seeds but only a tiny number of these ever grow to become a new cactus. Although rare, ha:sañ can grow as many as 50 arms and grows primarily on south facing slopes.
Elders say the ha:sañ used to be a human being way, way back. The story goes that there was once a woman who excelled at the game of toka (a sport like field hockey that only women play). She was the best player in all the villages and she was rich because she won lots of competitions.

One day the woman had a baby but she was so dedicated to playing toka that she was not interested in the child and continued to play the game as she had before. One day a village some distance away asked her to play in a big tournament. Without hesitation, she agreed, even knowing that she could not take her baby.

When the day of the tournament arrived, the woman packed up her things and left the baby at home by herself, leaving her food and water. She told the baby to take a nap and then left for the distant village to play toka.

When the baby woke up she was crying and looking all over for her mother but she couldn’t find her anywhere so the baby got together some haa (earthen jars) of food and water and left the house to look for her mother.

Along the way she met Ban (Coyote) and asked him if he had seen her mother. Ban told her to head west, and she gave some food and water to him as thanks. She walked and walked and next she met Kakaichu (Quail) and asked him if he had seen her mother. He couldn’t help her but she thanked him and gave him some food and water too.

Next she ran into Baag (Eagle) and asked him if he had seen her mother. Eagle flew high into the air and looked for a village and there he found her mother. The girl gave the rest of the food and water to Baag in thanks.

When she finally got to the village her mother became very angry at the baby for following her. She yelled at her in a very mean voice and told her to go away. The baby wandered off crying and crying and suddenly she started to sink into the ground. As she sank, she raised her arms and called and called to her mother who rushed to her and tried to pull her out but she could not.

Everyone in the village came and tried to pull her out and cried many many tears when they couldn’t. Siwani (Medicine men) were called but no-one could pull her out. As the earth became soft with tears she sank completely into the ground her arms raised up hoping someone could save her. The poor baby went back to the earth because her mother didn’t care for her.

Where the baby sank into the ground soon a cactus started growing and it grew and grew. As it got bigger it grew many arms and produced beautiful white flowers and fruit which Baag eats first because this is the way the girl gives thanks to the birds for their help in finding her mother.
BAHIDAJ (saguaro fruit) ripens between late May and early July. First the waxy white flowers of the ha:sañ (saguaro) close up, the flower dries and becomes stiff and brown, and the fruit forms at its base. Watch the ha:sañ carefully and when you see the fruit begin to turn pink, it is time to start harvesting it.

Keep in mind that early rain will wash the ripe fruit off the cactus arms, and during extreme heat the fruit will ripen faster. Also the location of the saguaro will affect the ripening time, some areas ripen later than others due to the climate and exposure so your harvesting must be arranged as soon as the fruit appears and takes on a deep pink color — a sign that it is ripe.

In the early days, the harvest took place over several weeks. Each family set up bahidaj camps among the saguaro and processing and cooking stations to prepare the syrup, pulp and seeds. The saguaro harvest season (ha:sañ masad — moon of the saguaro harvest) also starts our traditional calendar.

Elders tell us that we should use the bright colored pulp of the first fruit we pick to make the sign of the cross over our heart, to bless the fruit and the harvest. We should say a blessing to thank the saguaro for its bounty and to ask for continued good harvests and rain. Many people also ask for other blessings such as health, to be hard worker, or other important things in their lives.
Reflections....

Ha:sañ Ne’i
Saguaro Song
As sung by Christine Johnson of

Song is an everyday thing, we use it to wake up, to go to sleep, there are songs about planting, harvest, rain, rainbows, clouds. In my age group it was an everyday thing, you sing to get up, sing to go walking, sing to cook, it’s a way of living.

Wañ ge s-wepegeim o babahi
Wañ me:k o s-mamasim o kekiwa
La ñ-da:m g ce:wagi da’iwuñe
Heg o g jewed w’usida

This is a song to encourage the saguaro to be strong and to bear fruit, and to thank the saguaro for its harvest and for helping to bring the rain which will help our seeds to grow which will help us grow our crops and help grow the materials to make our baskets which we use to carry the ripe saguaro fruit.

In our family, we sing this song before any saguaro fruit is harvested, as we pick the ripe fruit and as we dance the dance to encourage the saguaro to grow. You don’t just run out and start picking - it’s like a prayer to thank the creator. You do that before you even harvest it.

English translation here.

English translation here.

Here is the translation into English
Picking Bahidadj

Picking Saguaro Fruit

The best time to pick bahidadj is in the early morning just as the sun comes up or in the early evening as the sun begins to set. Be sure to take plenty of water and wear a hat to protect yourself from the hot sun. And remember to always watch out where you step... Snakes are active during this same time of year.

- Use your kulpad to nudge the ripe bahidadj from the arms of the cactus.
- Because of the continuous ripening process, one cactus may contain both ripe and unripe fruit, be careful not to dislodge unripe fruit as it lands.

- Catch the bahidadj in a bucket or pick it up from the ground once it lands.

- If the fruit is not open, twist off the stem end and use the sharp, round edge of the stem to slice open the fruit. You can also use your fingernail or a sharp knife to open the fruit.
- The fruit has only a few hairlike thorns so it is easy and safe to handle with your fingers.
• Pull the pod apart and press out the pulp into the bucket.

• Check the surrounding trees and ground for gune (dried fruit) and add this to the bucket.
• Don’t worry about cleaning off small rocks or bugs as these will be strained out during the cooking process.

• As you harvest, place the empty fruit skins with their red sides facing the sky. This way they call for the clouds that bring the monsoon rains that are essential for the desert to thrive.

• If you are going to cook the bahidadaj into sitol the same day, begin to follow to directions for preparing sitol (page TK) as soon as you finish picking.
• If you do not plan to use the bahidadaj right away, re-fridgerate or freeze the fruit as soon as you finish picking.
PROCESSING BAHIDAJ
PREPARING SAGUARO FRUIT FOR EATING, STORAGE AND USE

There are many ways you can use bahidaj (saguaro fruit). The most common is to make sitol (syrup). You can also make a fresh juice and eat the fresh bahidaj with the seeds right out of the pod. The seeds can be dried and stored for other uses and you can use the dried pulp to make jam. The gune (dried fruit) you may have collected is also delicious to eat right off the trees or you can add it to the fresh fruit when you make the sitol.

Reflections....

I had a flashback to when I used to beat the tu'eech with a saguaro rib to separate the pulp from the seeds. You don't hit it too hard, you're not trying to pound the seeds. We sing while we work, it helps us to concentrate, to focus so it doesn't seem like work.

- Delphine Saraficio, Bahidaj Camp, July, 2002

Here are the ways you can process the bahidaj into sitol, jam and juice and prepare the seeds and pulp.

Note: Because the bahidaj goes bad very quickly, it should be processed within one day of when it is picked. If you do not have time to process it immediately, the ripe fruit can be stored up to one week in the refrigerator or you can freeze the pulp for up to one month.
SITOL
SAGUARO FRUIT SYRUP

1. Place the bahidaj (saguaro fruit) and any gune (dried fruit) you have collected in a bucket or large container and add water until the liquid just reaches the surface of the pulp mixture.
2. Let pulp and water sit for 1-2 hours.
3. Stir pulp mixture occasionally to break up any clumps using your fingers or a spoon.
4. Mixture will thicken slightly and turn a bright red color.

• Place the mixture in a large pot and bring to a boil until the fruit is completely broken up and very soft. This usually takes about one hour.

• Pour fruit and water mixture through a fine strainer or cloth (a flour sack or cheese cloth is best) into a large pot. If you are using cloth, twist it tightly to squeeze out as much juice as possible.
• Some people do not squeeze the cloth, letting the juice just drip through. This creates Sitol that is clearer and less cloudy than if you squeeze the cloth.
• Set the pulp aside and process it following the steps below.
• Use the strained, boiled liquid to make juice, Sitol, jam or wine following the steps below.

• Pour strained liquid into a pot
• Cook liquid uncovered over medium high heat at a high simmer until it is thickened and syrupy, and has reduced by about half, about 4-6 hours (depending on how much water was added).
At first, foam will develop on the top of the boiling liquid. This foam will disappear as the sitol gets close to being finished.

You can tell the sitol is ready if it coats the back of a spoon and is a deep brownish red color. It should be about the thickness of maple syrup.

Pour the hot syrup into prepared jars. Store bought canning jars with lids are ideal. Be sure to sterilize the jars according to manufacturer's instructions.

Store syrup in a dark, cool place for up to 1 year. You do not need to refrigerate sitol.
KAIJ
SAGUARO SEEDS

- After you strain all of the juice to make Sitol, lace remaining pulp and seeds on a tarp or large cloth, and dry completely in the sun. This should take from one to three days depending on the weather.
- Option: One modern technique is to dry the pulp in an oven on very low heat or in a food dehydrator.

When pulp is completely dry, pound it with a long piece of walpul (dried saguaro rib) or flat stick. This will separate as much pulp from the seeds as possible.
- Gather the pulp and seeds into a large bowl and swish them back and forth. The heavier seeds settle on the bottom of the bowl.

Separate the seeds from the dried pulp using just your fingers or by rubbing the pulp against the sides of the sieve.

- If you are using a sieve, be sure to place it in a large, high sided bucket or container so the seeds will fall into it
- Pulp is ready to use when it is free of seeds and resembles thin reddish threads (it looks like the spice saffron).
- Store the dried pulp and the seeds separately in tightly covered jars for up to 1 year.
- You can eat the dried pulp by itself as a snack, or add it to Sitol (syrup) to make jam following the steps below. The dried pulp is a natural thickener (pectin).
Alternate Method for Processing

1. Soak the pulp and seeds in fresh, room temperature, water for just a few minutes until the seeds rise to the surface and the pulp falls to the bottom.

2. Blow on the surface of the water to separate the seeds and leave a space on the surface of the water.
   - Using an ocotillo branch, twist it into the space in the water and use it pull out the pulp from the bottom.

3. Once the pulp is removed, use a fine seive to remove the seeds from the water.
   - Dry the seeds and pulp separately.

Roasting Kaij

Traditionally kaij were put in an ha’a (pottery jar), held over the fire and stirred with a sticks until they popped, then cooled and eaten. Today, the following technique is used.

- Preheat oven to 400 degrees. Place saguaro seeds in a sheet pan or baking pan. Place pan into the oven. Watch carefully and stir or shake the pan frequently until the seeds start to pop.
- Remove from heat, cool and store in tightly sealed containers.
1. Begin by bringing the fruit to a slow simmer.

2. Add the dried pulp back into prepared syrup and cook until thickened into a jam. (Approx 1 hour). For ___ cups of syrup, add about ___ cups of dried pulp.

3. Cool until the mixture reaches room temperature.

4. Pour the cooled jam into prepared jars (store bought canning jars with lids are ideal). Be sure to sterilize the jars according to manufacturer’s instructions.

5. Store jam in a dark, cool place for up to 1 year.
HA:SAÑ [RECIPES]
Recipes Using Saguaro Fruit

The taste of sitol (saguaro syrup) is like nothing else. A deep red, delicious, dense caramel flavor, naturally sweet, ripened by the heat of the sun, tinged with mesquite smoke, the smooth syrup satisfies like nothing else. And, it is perfectly natural and organic, with absolutely no sweeteners or artificial ingredients. Sitol can also be used in salad dressings, as a sweetener or in BBQ sauces in place of maple syrup or molasses.

The whole ripe bahildaj is also eaten raw. The vibrant magenta colored flesh inside the pod oozes with bright juice and is full of tiny crunchy black seeds. Full of natural fiber, it’s got a crisp texture, with a refreshing flavor not unlike watermelon but not as sweet. It can be frozen and eaten as ice cream, or used fresh in salsa’s.

The dried pulp is used to make jam once added to the syrup. Once dried, the pulp melts in your mouth with a rough sweetness that is addictive.

The numerous kail (seeds) are used to make nut butter, porridge and for snacking. The tiny seeds, toasted, have a nutty flavor and crunch in your mouth. They can be substituted for poppy seeds in any recipe.

KAIJ [BUTTER]
Saguaro Seed Butter

This delicious, jet black nut butter can be eaten plain or used in place of any nut butter. It has a nutty, slightly sweet flavor and a consistency like a thick peanut butter but with less oil.

1. Grind toasted kail(saguaro seeds) by the handful in an old fashioned meat grinder set fine so that they are the consistency of nut butter, like paste. You can also use a spice grinder, blender or food processor.
2. The final product will be very thick and slightly oily - like a nut butter or paste.
3. Roll into balls and eat or store.

Note: Saguaro seed butter will keep for ____[?] days/weeks/months in tightly sealed jars. [does it have to be in the refrigerator?]
T his nutritious porridge can be eaten any time, not just for breakfast. It will be fairly thin with specks of black (the seeds) and a dark grey color, it has the flavor of toasted nuts.

1. Bring large pot of generously salted (two big handfuls) water (4 cups?) to a boil.
2. Add 1 tablespoon of coarsely ground dried ciolim (cholla buds).
3. Cover and let boil for about 30 minutes.
4. Make a slurry of whole wheat flour (2 large handfuls, approx 1 c) with water, approximately equal amounts. “It’s ok if it’s lumpy.”
5. Add flour mixture to water/cholla mixture, stir briskly.
6. Add ground toasted kail (saguaro seeds butter)
7. Stir constantly over high heat till the porridge starts to thicken. Cook until it is the consist-

Valencia Orange and Texas Pink Grapefruit with Saguaro Fruit Syrup
Contributed by Chef Albert Hall, The Grill at Hacienda del Sol

The gune (dried fruit) collected from the ground or nearby trees is nature’s candy. The crisp sundried fruit bursts with flavor and is eaten as a snack or added to the fresh pulp to make sitol.

- 2 Valencia oranges
- 2 ruby or pink grapefruit
- 1 tsp lime juice
- 1 tsp anjou (spirit of cactus) or tequila (optional)
- 1 tbsp powdered sugar
- 2 tbsp saguaro fruit syrup
- 4 fresh mint sprigs

In a glass bowl, whisk together the Anjou or tequila, powdered sugar, lime juice and saguaro fruit syrup. Peel and segment the oranges and grapefruit. Add the segments to the liquid, being careful not to break them. Squeeze excess juice from pulp into the bowl and mix gently. Refrigerate for 30 minutes to blend flavors. Arrange segments alternatively in a circular fashion on four six-inch plates. Spoon liquid over the fruit and garnish with fresh mint sprigs. Serve very cold.
Saguaro Salsa
(CONTRIBUTED BY WWW.DESSERTUSA.COM)

This refreshing, fruity salsa is a great complement to grilled meat or fish.
- 1/2 cup Saguaro fruit, diced
- 1/4 cup watermelon, diced
- 1/2 cup cantaloupe, diced
- 1/4 cup red onion, finely chopped
- 1/2 cup rice wine vinegar
- 4 Tbsp honey
- 1/2 tsp dried crushed red chili pepper

Combine all ingredients and toss until well mixed. Chill.

LEMON KAIJ MUFFINS
(ADAPTED FROM WWW.CHEFRICK.COM)

This one-bowl recipe is incredibly easy, quick and delicious!
- 2 eggs
- 1 cup milk
- 1 tbs lemon juice
- 2 tbs grated lemon peel
- 1/4 cup canola oil
- 2 cups flour
- 1/4 cup sugar

Combine above ingredients and toss until well mixed. Chill.

- 2 1/2 tsp baking powder
- 1/4 tsp nutmeg (optional)
- 2 tsp kaij (saguaro seeds)
- 1/2 cup chopped walnuts (optional)

In a 1 1/2 quart bowl, using a large spoon, stir together eggs, milk, lemon juice, grated lemon peel and oil until well blended. Add flour, sugar, baking powder, optional nutmeg and KAIJ (seeds); stirring well as each is added. Fold in optional chopped nuts. Spoon batter into greased muffin tins, until about 3/4 full. Bake at 400 degrees for about 20 minutes.
**BAHIDAJ [AND HEALTH]**

**SAGUARO FRUIT & HEALTH**

Scientists, nutritionists and doctors are only now learning what our elders have known for centuries — that desert foods, especially cactus fruits, are healthy foods.

**REFLECTIONS...**

All the year round we were watching where the wild things grew so we could pick them. Elder Brother planted those things for us told us where they were and how to cook them. You would not know if it had not been given. You would not know you could eat cactus stems and shake the seeds out of the weeds. To us he gave the wild seeds and the cactus, those are the good foods.

— Maria Chona in *Autobiography of a Papago Woman*

**REFERENCES ****

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Bahidaj is a very healthy food, especially for diabetics. Bahidaj is rich in soluble fiber, vitamin C, protein and fatty acids. When eaten fresh or frozen, the fruit has special qualities which help control blood sugar and keep it from going too high. Bahidaj may also reduce cholesterol which can contribute to many other health problems (like obesity, heart disease and high blood pressure).

The fresh fruit is also high in protein, fat and vitamin C. Each fruit contains about 34 calories\(^1\), while an average serving consisting of five fruits contributes 4 grams of protein, five grams of fat, and 167 calories\(^2\).

The unsweetened juice may even reduce blood sugar levels if drunk on a regular basis. Use the filtered juice in drinks or mixed with seltzer or club soda to make a refreshing and healthy drink.\(^3\)

The sitol (syrup) or the jam (without seeds or added sugar) are high in reducing sugars (62 %)\(^4\) which means that using it in place of white sugar, commercial sweeteners (like maple or corn syrup) or instead of commercial jams, will help keep your blood sugar levels from going too high.

The seeds themselves are high in protein and fat.\(^5\) About 2 tablespoons of dried seeds have 74 calories\(^6\) and the seeds help slow the release of sugar into your blood\(^7\) keeping your blood sugar levels even.

If you are diabetic, the type of natural sugars and fibers that are found in bahidaj have been shown to regulate, if not reduce, blood sugar levels. In fact, saguaro fruits contain special gums (called mucilaginous polysaccharides) that slow the digestion and absorption of sugary foods,\(^8\) prevent wide swings in blood sugar, slow down the digestive process and delay the return of hunger.\(^9\)
Storage and Preserving....

- Ripe, unpeeled fruit can be kept up to one week in the refrigerator.
- Fresh saguaro fruit pulp can be kept in the refrigerator for up to five days.
- Gune (sun-dried fruit) can be stored in airtight containers for up to several months or in the freezer for one year.
- Sitol (syrup) can be stored in sealed jars in a dark cool place for up to one year. You do not need to refrigerate it.
- Untoasted seeds can be stored in airtight containers for one year.
- Pulp, once dried, can be stored in airtight containers for one year.
- Sitol (syrup) can be frozen. Simply pour syrup into freezer proof containers or, for small quantities, pour into ice cube trays and freeze.
- Fresh pulp can be frozen for up to three months, place in freezer proof plastic bags.

Usage Hints....

- Use the fresh or frozen pulp in quick breads or cakes.
- Use the syrup in place of maple syrup on pancakes, waffles or tortillas.
- Use the syrup as a natural sweetener instead of sugar in hot or cold drinks.
- Use the jam in place of commercially sweetened brands on sandwiches and toast.
- Use the jam/syrup to sweeten baked goods calling for maple syrup or honey.
- Use seeds in place of poppy seeds in any recipe.
- Use ground seeds in place of peanut butter.
- Combine seeds and sitol to make a crunchy candy.
- Use the ground seed butter in place of peanut butter on sandwiches.
- Use the frozen pulp in place of ice cream or fruit sorbet.
- Use the juice as a refreshing drink or in salad dressings and BBQ sauces.

Microwave....

- Saguaro jam and syrup cannot be made in the microwave.

Crockpot....

- Saguaro jam and syrup cannot be made in a crockpot

Where to Purchase it....

- On occasion, sitol, kal, and dried pulp are available for tribal members from Tohono O'odham Community Action by calling 520-383-4966, at their office in Sells, Arizona or ordered from their website at www.tocaonline.org.