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Authors: Goldenetz, J. A., and Halvorson, W. L.

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MORE THAN A MERE NEWTON: NUTRIENT ANALYSIS OF HEIRLOOM 'MISSION' FIG TREE FRUITS

J. A. GOLDENETZ, School of Natural Resources, University of Arizona, Tucson, AZ 85721; and
W. L. HALVORSON, USGS Southwest Biological Science Center's Sonoran Desert Research Station, Tucson, AZ 85721

ABSTRACT

Ficus carica L. (the common fig tree) is one of many non-native species adapted to home-garden systems within northern Mexico and southern Arizona. Along with other Mediterranean fruits such as grapes and olives, fig trees were introduced to the area through the Catholic mission system during the mid-1500s to the mid-1800s. Clonal descendents from the original 'Mission' fig trees persist in present-day home gardens. The objective of this study is to provide information critical for the conservation of heirloom 'Mission' fig trees in southern Arizona home gardens. One step in this process is the evaluation of the nutrients of heirloom fig fruits. The results from a preliminary nutrient study are presented in this paper. The results show that for fresh and dried heirloom fig fruit, sugar levels and vitamin A levels are statistically lower when compared to the U.S. Department of Agriculture's (USDA) National Nutrient Database for Standard Reference. For fresh and dried heirloom fig fruit, potassium levels are statistically higher when compared to the USDA Database. For calcium, heirloom fresh fig fruits showed statistically higher levels and heirloom dried fig fruits showed no difference when compared to the USDA Database. More studies are required to determine the causes for this variation in fig fruit nutrient levels.

INTRODUCTION

Ficus carica L. (the common fig tree) is a fruit tree that was domesticated during ancient times in western Asia (Condit 1969). The tree was introduced into North America upon European contact beginning in the early 1500s. Spanish Catholic priests played a key role in the establishment of Old World food crops, particularly Mediterranean fruits such as grapes, olives, and figs, because the missions required wine, oil, and food resources (Dunmire 2004). When the Mission Era ended and the mission gardens and orchards fell into neglect, local residents of Mexico and Arizona kept these food, herbal, and medicinal plants alive in their home gardens. Some of the original Mission Era cultivars exist in home gardens today.

HOME-GARDEN SYSTEMS

Home gardens are classified as a diverse agroforestry system greatly influenced by human societies and by microenvironments. Home gardens reflect the diversity of human cultures and ecosystems which shape them. For example, research has shown them to contain plant species with rich cultural heritage and genetic diversity (see Watson and Eyzaguirre 2002). In southern Arizona, home gardens often contain plant species influenced by American Indian and Hispanic cultures and adapted to semi-arid and arid ecosystems. Furthermore, garden plants which are propagated vegetatively (i.e., figs, olives, and grapes) retain the genetic make-up of the "parent" plant. Therefore, fig trees currently growing in home-garden systems, with oral histories tracing their origins to the Mission Era, are most likely genetic clones of the fig trees first introduced by European Catholic priests and planted in mission orchards.

CONSERVATION OF HEIRLOOM PLANTS

Heirloom plants by definition possess a history of being passed down through generations within a family or other social unit because they contain unique and/or desirable characteristics. Therefore, the seeds, cuttings, or bulbs of heirloom garden plants are a source of historical, cultural, and genetic wealth (Nazarea 2005). In particular, heirloom food crop species have gained the attention of plant breeders because they often contain genes not found in commercial varieties having a narrow genetic base. For example, plant breeders can use heirloom varieties to breed resistance (e.g., pest or drought tolerance) or other favorable characteristics into modern crops.

The 'Mission' fig trees used for this study are considered heirlooms because they have been safeguarded by individuals within their home gardens for generations. Their current owners also know the oral histories and other stories about their trees which date them to the Mission Era. As part of a larger study involving the collection of ethnobotanical and genetic information on these trees, fresh fruits were collected from four heirloom 'Mission' fig trees in order to evaluate their nutrient composition.

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METHODOLOGY

Ripe heirloom 'Mission' *F. carica* L. fruits (syconia) were collected from 12 July through 31 August 2006. A total of 20 fruits were collected from four trees. The four trees were located in home gardens in Tucson, Tubac, and Nogales, Arizona. Variability of nutrients (e.g., movement of carbohydrates) was minimized since all fruit collection took place during the summer months of the same year and all the harvested fruits were fully ripe. Ten fruits were used to evaluate the nutrient content of fresh figs, and ten fruits were used to evaluate the nutrient content of dried figs. Warren Analytical Laboratories, Inc., (Warren Lab) determined the levels of potassium, calcium, sugar, and vitamin A for both fresh and dried heirloom figs.

For the dried fig analysis, freshly harvested fruits were dipped into boiling water for 30 seconds to kill bacteria. After sterilization, they were placed inside an oven to dry by the heat of the pilot light for 4 days. After drying was complete, the fruits were mailed to Warren Lab for analysis. Therefore, both fresh and dried figs were received by Warren Lab. within 5 days of harvest.

Documentation on the nutrient levels of fig fruits is scarce, partly because research is largely focused on characteristics linked to the marketability of fruits (e.g., shipping durability, size uniformity, taste). However, the U.S. Department of Agriculture (USDA) maintains an online database intended for use by dieticians. This National Nutrient Database for Standard Reference (USDA 2005) lists the nutrient composition of commercially grown fresh and dried figs. The values for sugar, calcium, potassium, and vitamin A listed in the database were used as a comparison to the heirloom fig nutrients determined by Warren Lab. Warren Lab used the same analytic methods employed by the USDA. High performance liquid chromatography (HPLC) was used for analysis of sugar and vitamin A. Inductively coupled plasma mass-spectrophotometry was used for analysis of calcium and potassium.

RESULTS

The Student's t-test was used to compare the fig fruit nutrient levels determined by the USDA (commercially grown figs) and Warren Lab (heirloom, home garden-grown figs). Eight t-tests were conducted, one for each of the four nutrients and for both fresh and dried fruits. Sample size for the Warren Lab analysis was n=10, and the sample size for the USDA analysis was n =8 except for fresh fig sugar and calcium which was n=16. The p value was 0.05. Table 1 shows the t-test results.

DISCUSSION

When looking at the genus *Ficus* on a global scale, fig trees are considered by many scientists as integral ecosystem components (e.g., Tous and

Table 1. *Test results.*

	Mean values (per 100 g)*		Standard error		Standard difference
Nutrient	Warren Lab	USDA	Warren Lab	USDA	Warren Lab vs. USDA
Fresh Figs					
Sugar	14.61 g	16.26 g	0.44	0.337	yes
Calcium	63.2 mg	35.0 mg	8.92	1.91§	yes
Potassium	296.0 mg	232.0 mg	19.00	10.96	yes
Vitamin A	0.0 IU†	142.0 IU	0.0	0.0	yes
Dried Figs					
Sugar	34.15 g	41.92 g	3.19	0.375	yes
Calcium	181.8 mg	162.0 mg	16.99	1.91	no
Potassium	909.0 mg	680.0 mg	86.10	12.39	yes
Vitamin A	0.0 IU	10.0 IU	0.0	0.0	yes

Ferguson 1996, Shanahan et al. 2001, IPGRI and CIHEAM 2003). Their ecosystem services range from providing food for wildlife to the stabilization of soil. For humans, both fresh and dried figs are considered a nutrient-rich food providing a multitude of health benefits. Moreover, several influential international development organizations have recently included in their research agendas the need to link agricultural biodiversity with the improvement of human health (IPGRI 2006). Thus, conservation of heirloom food crops such as figs and research on their role in human health is important.

The results from this preliminary nutrient study on 'Mission' *F. carica* are valuable on a number of levels. At the most basic level, the owners of the four heirloom fig trees gain knowledge about the nutrient composition of fruits from their trees. Also, the fact that the USDA Database contains information that may differ from other nutrient analyses is valuable information. For natural resource managers, information contrasting the nutritional benefits of food crops grown in different landscapes (e.g., commercial orchards and homegarden systems) is notable.

As stated above, the nutrient analysis of heirloom fig fruits is preliminary, and the need for further research is recognized. For example, controlled experiments are required to determine the factors (e.g., environment, genes, maintenance of trees) influencing fruit nutrient variability. Also, further documentation of the history, cultural value, and ecosystem services of home garden-grown, heirloom fig trees is required. All of this information, including the data listed in this paper, reinforces the importance of conserving heirloom fig trees both in situ (within home gardens) and *ex situ* (at germplasm banks).

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