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Taming the wild pecan at Lyndon B. Johnson National Historical Park

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Preface

When President Johnson donated the LBJ Ranch to the people of the United States, one of the few requests he made was that the ranch "…remain a working ranch and not become a sterile relic of the past." To that end, Lyndon B. Johnson National Historical Park, Texas, is attempting to preserve a cultural landscape that includes the ranching and farming activities that LBJ engaged in when he lived here. The pecan orchard, along with other crops and the cattle herd, is managed for sustainable production. The goals are to produce a crop using the best management practices available and to adhere to NPS policies and regulations. Among the policies that we adhere to are those concerning integrated pest management (IPM). The Pecan IPM Plan will meet this responsibility, by reducing the use of pesticides to an absolute minimum, while still fulfilling the cultural and natural resource mandates of the park.

Introduction

National parks provide insights into many facets of the United States of America from the wild beauty of preserved wilderness to carefully managed agroecosystems that reflect our reliance on nature for sustenance and livelihood. The Lyndon B. Johnson National Historical Park contains much of this spectrum within its boundaries, and one plant species in particular provides a link from the frontier of the past to today's society. This plant is the pecan, *Carya illinoensis* (Wang) K. Koch, which is recognized by the Texas Legislature as the state tree of Texas. Cabeza de Vaca's 16th century journal provided the first written record of the pecan. While a captive of American Indians for six years, he noted returning every other year to camp on the river (probably the Guadalupe) to dine for several months almost entirely on pecans. Early traders bartered with wild nuts. Settlers thinned out other trees while leaving the still abundant 100+ foot-high wild pecans to provide nuts and some shade for the cattle that could now graze on the grass that the partially cleared land would support. The wild pecans were the sole source of these delectable nuts until vegetative propagation began late in the 19th century. The pecan is native along the rivers in Texas, and the native range extends eastward to the Mississippi River Valley. George Washington carried pecans as a snack and Thomas Jefferson had trees imported and planted at Monticello, anticipating the massive plantings in Georgia many decades later.

Until the early 1970s, more than 50% of Texas pecan production came from naturally occurring trees. Today, about 35% of the average annual crop of about 65 million pounds in Texas comes from the wild trees. A microcosm of pecan domestication–from wild trees growing in closed canopies adjacent to rivers and streams, to thinned river bottoms suitable for cattle and pecan operations, to a vegetatively propagated pecan orchard (figure 1)–is represented at the LBJ National Historical Park. At the park, an integrated pest management plan has been developed to allow the orchard to be agriculturally productive. The approach to IPM combines an understanding of how natural processes would proceed if left alone, with careful monitoring

Figure 1. Located in the Lyndon B. Johnson birthplace yard, this pecan orchard is managed for sustainable production using integrated pest management techniques. Other pecans on the national historical park are wild and are managed differently.

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and intervention when pest damage thresholds are reached and crop damage is imminent. This limited intervention protects the crop, while minimizing side effects.

IPM and the LBJ pecans

The national historical park represents a special environment for the development and implementation of pecan IPM. This is because the motives underlying conservation of this orchard differ from those of most other pecan operations where profit would represent the bottom line. At the outset, the standard pecan IPM program practiced by producers in the region was presented and discussed with park personnel to determine what could be adopted and what needed to be modified for use. As expected, the major modifications centered on pesticides, with minimizing impact on nontarget organisms emphasized to a greater extent than efficacy or maximizing profitability. The pesticides currently approved for use in the pecan orchard at LBJ National Historical Park are glyphosate for weed management, benomyl and propiconazole for pathogen management, and dormant oil, *Bacillus thuringensis* endotoxins, and carbaryl for insect management.

These pesticides are strategically used to conserve the annual production of pecan nuts in the orchard. The need for these pesticides is best understood by comparing and contrasting the wild pecan with the orchard pecan. The wild pecan grows in mixed-species riverine habitats with tree canopies often touching. Weed control is provided by dense shade, but the close spacing limits available sunlight above and nutrients available to the roots below. Wild pecan trees produce nuts synchronously at 2–7 year intervals (figure 2) and have never been shown to produce sizeable crops in consecutive years. Orchard pecans are vegetatively propagated at deliberately spaced intervals to allow ample sunlight between trees and root development well beyond the canopy of each tree to access water and nutrients. Left unchecked, weeds will readily colonize the orchard floor and outcompete the trees for water and nutrients. Thus, fertilizer is added (nitrogen, phosphorus, potassium, and zinc, as needed) to increase tree vigor and ensure sufficient food reserves are available to produce the current year's crop and establish a crop for the following year.

Natural enemies

Wild pecans survive pathogens through many mechanisms of which one of the most important is genetic diversity. Every wild pecan tree is genetically distinct from its neighbors. Pecan scab, a fungus and the worst disease of the orchard pecan, may become genetically entrained to attack specific genetic constructs. Additionally, vegetative propagation of orchard trees provides genetic uniformity that results in potential for disease epidemics. Disease development requires a susceptible host, a virulent pathogen, and a favorable environment. The relatively dry environment at the park limits the favorable environment for pecan scab to brief periods following rains when rapid leaf growth is occurring in the spring or nut growth is occurring shortly thereafter. Fungicide is needed under such conditions to prevent pecan scab epidemics.

Wild pecans survive insect depredations through many mechanisms, too. Foliage and root feeders are generally limited by natural enemies, the environment, and the intrinsic ability of the pecan to resist or recover from attack. Indeed, damage from insects is rare. However, careful monitoring is needed to detect and respond to these rare occurrences, if sustained nut production is to be achieved. Insects that feed on nuts are another matter. Recent research shows that the wild pecan survives the ravages of nut feeders in nature by producing a big crop followed by low production for one or more years. This "boom and bust" cycling of production starves nut feeders to low levels during bust years and produces so many nuts in boom years that nut feeders are satiated long before the big crop is consumed. The nuts left over survive to germinate the following year.

An integrated pest management plan has been developed at the park to allow the orchard to be agriculturally productive

Figure 2. This pecan cluster represents a boom year for wild pecan trees, which occurs at 2–7 year intervals. In contrast, orchard pecans at the park are managed for continual production, and are fertilized and managed in other ways to ensure annual productivity.

Once in awhile a nut will survive to become a tree and form the beginning of the next pecan generation.

The pecan is not perfect in regulating this boom and bust production. Trees on especially good sites, where branches may have better access to sunlight, for example, have extra food reserves. These individuals produce enough flowers to yield up to 10% of a crop in a bust year, even though the remaining trees remain barren. If these pecan flowers continued to grow to maturity, late-season nut feeders like jays, squirrels, and especially the pecan weevil, *Curculio caryae* (Horn) (Coleoptera: Curculionidae), would use them to grow and reproduce, and their progeny would occur in much greater numbers to consume the boom year crop. However, the pecan nut casebearer, *Acrobasis nuxvorella* Nuenzig (Lepidoptera: Pyralidae), attacks nuts just after pollination and removes almost all the nutlets in years of low production. This leaves few nuts to mature in bust years. In years of high production, a similar amount of nutlets (2–10%) is removed by the casebearer, although this has little effect on the boom crop.

This competition between late-season nut feeders and the casebearer works great in nature, preserving the boom-bust cycle in the wild trees, but the pecan grower strives to produce nuts every year by keeping trees well spaced, watered, and fertilized. This practice increases pecan nut production in the orchard. Unfortunately, the pecan nut casebearer comes from nearby wild trees to this pocket of productivity and causes severe

Figure 3. An insect trap dangles from the branch of an orchard pecan and is indicative of the park's ongoing monitoring program for the casebearer moth. A forager of pecans when they are developing in the flower, the casebearer can severely damage the orchard pecan crop in years when wild trees have little or no production.

Figure 4. Insect traps of a different design are used by resource managers to track changes in the population of the pecan weevil. Although this insect species can potentially damage an orchard pecan crop of mature nuts, its numbers have not yet been of concern to resource managers.

damage in the orchard in years when the wild trees have little or no production. The park IPM plan prescribes monitoring for casebearer activity in the orchard using a pheromone (figure 3). If damaging numbers of the casebearer occur, as determined by using a sequential sampling plan, a well-timed treatment with *Bacillus thuringiensis* endotoxin is recommended to conserve agricultural production. This also means abundant nuts will occur in the orchard in the fall when surrounding wild trees are barren. These nuts will often require protection from late-season nut feeders like the pecan weevil. Monitoring protocols have also been developed for the weevil (figure 4) to ensure that action to reduce their numbers is only taken when needed. If treatment is required, the least intrusive, but still effective, management possible is used. However, pecan weevil densities have not built up sufficiently to warrant treatment, despite the species' presence in the orchard.

A groundwater monitoring protocol has also been established in the park to detect runoff or leaching of pesticides used in the pecan IPM program. No runoff has been detected, and the minimal levels of chemical intervention are not expected to cause such problems. Insecticide use, for example, is never expected to require more than 21 days of pesticide protection on the foliage in a growing season of 220+ days. Additionally, the chemicals used are neither biologically magnified nor readily leached through soil. Plus, they are biodegradable. Routine water monitoring is an additional precaution designed to provide the highest quality of stewardship possible.

Conclusion

According to Brison (1974), the pecan is the most important horticultural crop native to the United States. Lyndon B. Johnson National Historical Park provides a setting for the public to enjoy the pecan in all its glory from the wild trees along the Pedernales River, to the semi-domesticated cattle and pecan environs reminiscent of the early 20th century, to the responsibly managed pecan orchard of today and the future. Most of the agriculturally important crops grown in the United States today originated elsewhere. The pecan is ours, and the opportunity to see the entire range of the pecan domestication process is a special legacy indeed.

The pecan at LBJ National Historical Park is a microcosm of the issues and responsibilities facing the National Park Service today. In and near the park, the wild pecan reflects nature preserved in a pristine form, inspiring us as only nature can. The thinned, native pecans show agricultural inroads into nature in order to produce more human-valued, physical resources like nuts and cattle to support more people than the same land could in Cabeza de Vaca's time. The managed pecan orchard shows responsible pecan production that optimizes availability of the human-valued nut resources using the Pecan IPM Plan. Our society needs food for thought as well as food for survival. The pecans at LBJ National Historical Park can help inform and engage the public in addressing these issues.

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