

Operational Disease Screening Program for Resistance to Wilt in *Acacia koa* in Hawaii¹

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Introduction

In Hawaii, koa (*Acacia koa* A. Gray) is a valuable tree species economically, ecologically, and culturally. With significant land use change and declines in sugarcane, pineapple, and cattle production, there is an opportunity and keen interest in utilizing native koa in reforestation and restoration efforts. However, moderate to high mortality rates in many of the low to moderate elevation plantings have impeded past efforts (fig. 1). The primary cause for this mortality, particularly in young plantings, is thought to be koa wilt, caused by *Fusarium oxysporum* f. sp. *koae* (FOXY) (Gardner 1980). *Fusarium oxysporum* is a relatively common agricultural and nursery fungus, but the origin of strains of FOXY virulent to koa in Hawaii is unknown.



Figure 1—Koa stand killed by *Fusarium oxysporum* f. sp. *koae* (FOXY).

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Solution

Identifying and developing koa populations that are genetically resistant to virulent strains of FOXY may be the key to successful koa restoration and reforestation (Snieszko 2006). Great differences in mortality among seed sources in young koa field trials planted in the 1990s were the impetus for developing a seedling screening test and investigating genetic resistance to FOXY (Snieszko 2003).

Status of Resistance Breeding Program

A statewide survey was conducted to determine distribution of koa wilt/dieback disease across the four main Hawaiian Islands: Kauai, Maui, Oahu, and Hawaii (fig. 2). A total of 386 samples were taken at 46 different sites covering approximately 5,597 ha of natural and planted koa forest. Koa trees and seedlings infected by *F. oxysporum* were found on all of the major islands in forest tree seedling nurseries and in natural and plantation forests. From these samples, more than 500 isolates of *F. oxysporum* were obtained. Of these, 160 isolates have been tested for virulence on koa seedlings in controlled greenhouse inoculation tests. From isolate screening tests, 10 highly virulent isolates have been identified for use in screening selected koa families for disease resistance (Dudley et al. 2007).

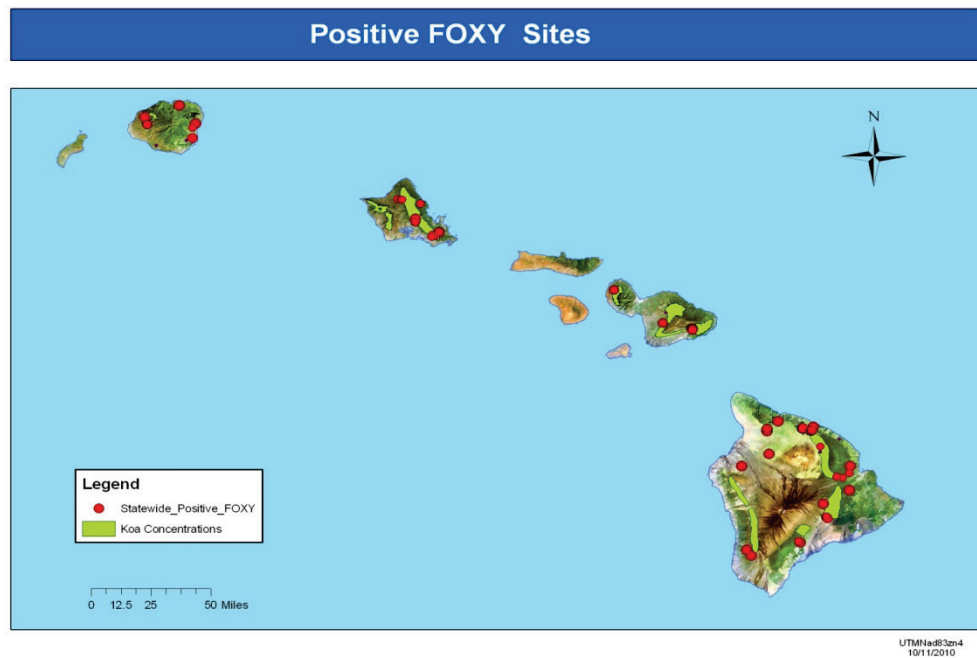


Figure 2—Koa concentrations and sites with *Fusarium oxysporum* f. sp. koe (FOXY) in Hawaii.

Between 2006 and 2011, more than 270 koa families were evaluated for their potential FOXY resistance in greenhouse tests (fig. 3). Most of the seed lots came from wild populations. However, several seed lots were from survivors of family level progeny trials at the Hawaii Agriculture Research Center's (HARC) Maunawili Field Station (fig. 4). All seed lots were open-pollinated. A composite of five virulent isolates of FOXY were used for inoculation (Dudley et al. 2007). Seedling wilting and mortality in the greenhouse was monitored over a 90-day period for each test. Seedling mortality among seed lots varied widely (4 to 100 percent) and averaged 60 percent (Dudley et al. 2009). These initial results indicate that natural resistance to FOXY is low within native koa populations.



Figure 3—Koa disease screening trial at the Hawaii Agriculture Research Center (HARC).



Figure 4—Koa seed orchard at the Hawaii Agriculture Research Center (HARC).

Continued screening of additional koa families for pathogen resistance, retesting putative resistant families, and developing koa seed orchards with disease-resistant stock are either ongoing or planned.

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