



TRIP REPORT



Forest Health Protection Region 5 Injection of Koa Trees on Oahu

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Acacia koa is an important native component of montane Hawaiian rain forests and is found on all six of the major islands. Koa are fast-growing, nitrogen fixing trees that grow in pure stands or mixed with ohia (*Metrosideros polymorpha*). Despite its ecological and commercial importance, koa is declining due to many factors. Wilt/decline of *A. koa* was first recorded several years ago in Hawaii and *Fusarium oxysporum* f.sp. *koae* (origin unknown) was implicated as the cause. Since then, the Hawaii Agriculture Research Center (HARC) and Forest Health Protection (FHP) have cooperated in evaluating *A. koa* resistance to *F. oxysporum*. Common garden plots were established from 1994-1999 at the HARC location on Oahu (Figure 1) as part of an effort to determine if disease resistance occurs. Although wilt/decline has significantly impacted the koa plantings at HARC, some trees appear relatively unaffected and are growing well. Therefore, it is presumed that genetic disease resistance likely occurs and may be at high levels within some families.

HARC and FHP have invested money and time into evaluating, selecting and breeding for wilt tolerance in koa. Seeds from these selections, including survivors in the common garden plots, are highly desired for additional genetics work, reforestation and commercial forestry. HARC is identifying disease tolerant families from many populations of koa in Hawaii to meet site-specific reforestation needs throughout the islands with locally adapted, disease tolerant, seed.

Figure 1. Thirteen year old *Acacia koa* growing in common garden plot at the Hawaii Agriculture Research Center, Oahu.

Protection measures against seed feeding insects on the wilt tolerant trees are urgently needed. Seventy-five percent of the seeds produced in the koa common garden plots are not viable due to insect damage (Figure 2). The shortage of seed from wilt tolerant koa is preventing reforestation efforts with this valuable native. Seed damage is primarily caused by the Haole seed weevil (*Araecerus levipennis*; Figure 3) and the koa seed worm (*Cryptophlebia illepada*).

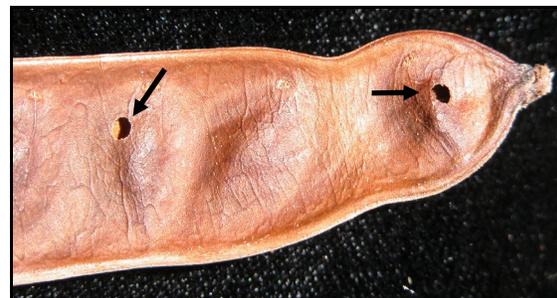


Figure 2. Koa seed pod with Haole seed weevil exit holes.

The koa trees in the common garden plots at HARC do not lend themselves to insecticide treatment by ground-based equipment. In addition, the small size of the common garden plots and the trade winds on Oahu make aerial application unfeasible. Based on work in coniferous systems, systemic insecticides (bole-injected) appear promising for protecting seeds from insect damage. If the insecticide injections are efficacious against the target insects, this treatment will likely be the most cost effective and environmentally sound option for increasing the availability of wilt tolerant koa seeds for reforestation.



Figure 3. Adult Haole seed weevil.
(Photo credit: K. Reed and A. Mangini)



Figure 4. Brian Strom (left), Rob Hauff (center), and Nick Dudley (right) preparing a koa tree for injection.

Thirteen year old koa trees that survived natural exposure to wilt in a provenance test at HARC were selected for injection treatments (emamectin benzoate, acephate, untreated; Figure 4). Twenty-four trees were included in the evaluation, with injections occurring in late April 2007. Dosages were derived from current labels (for other insect pests) and with input from the ArborJet Research and Development staff. Treatments will be evaluated by a combination of biological and chemical assays. Bioassays will be accomplished using visual evaluations of seed pods and seeds. Tissues will be collected from experimental trees for analysis of insecticide residues. Leaves, seeds, and seed pods will be analyzed to determine if the insecticides moved to these tissues and to estimate efficacious concentrations. Optimal dosages and re-treatment schedules will be determined in a later project if effectiveness warrants the additional work and expense.

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