

Koa pasture scarification, silvopasture, and plantation

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Kukaiiau Ranch

James Leary, Assistant Specialist, Invasive Plants, Department of Natural Resources and Environmental Management, UH Mānoa CTAHR (Kula, Maui), 808-352-8774, leary@hawaii.edu, <http://www.ctahr.hawaii.edu/LearyJ/>

J. B. Friday, Extension Forester, Cooperative Extension Service, NREM, UH Mānoa CTAHR (Hilo), 808-969-8254, jbfriday@hawaii.edu, <http://www.ctahr.hawaii.edu/forestry/>

Travis Idol, Associate Professor of Forestry, Department of Natural Resources and Environmental Management, UH Mānoa CTAHR (Mānoa), 808-956-7508, idol@hawaii.edu, <http://www.ctahr.hawaii.edu/Idolt/>

Paul Scowcroft, USDA Forest Service Institute of Pacific Islands Forestry (Hilo), 808-933-8121 ext 127, pscowcroft@fs.fed.us, <http://www.fs.fed.us/psw/programs/ipif/>

Robert Sporleder, Kukaiiau Ranch, cell 808-217-5640, bob@cordonllc.com

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Soil scarification and weed control for koa stand regeneration at Kukaiiau Ranch

Soil scarification using a bulldozer with brush blade has long been used to regenerate koa stands where there is a buried seed bank. The resulting dense stands require pre-commercial thinning to maintain good growth rates on potential crop trees. We wanted to demonstrate other methods of soil scarification for koa regeneration that would cause less soil disturbance and create less dense stands that would not require thinning so soon. See the video at <http://www.ctahr.hawaii.edu/forestry/video/koa-silvopasture.html>

Methods

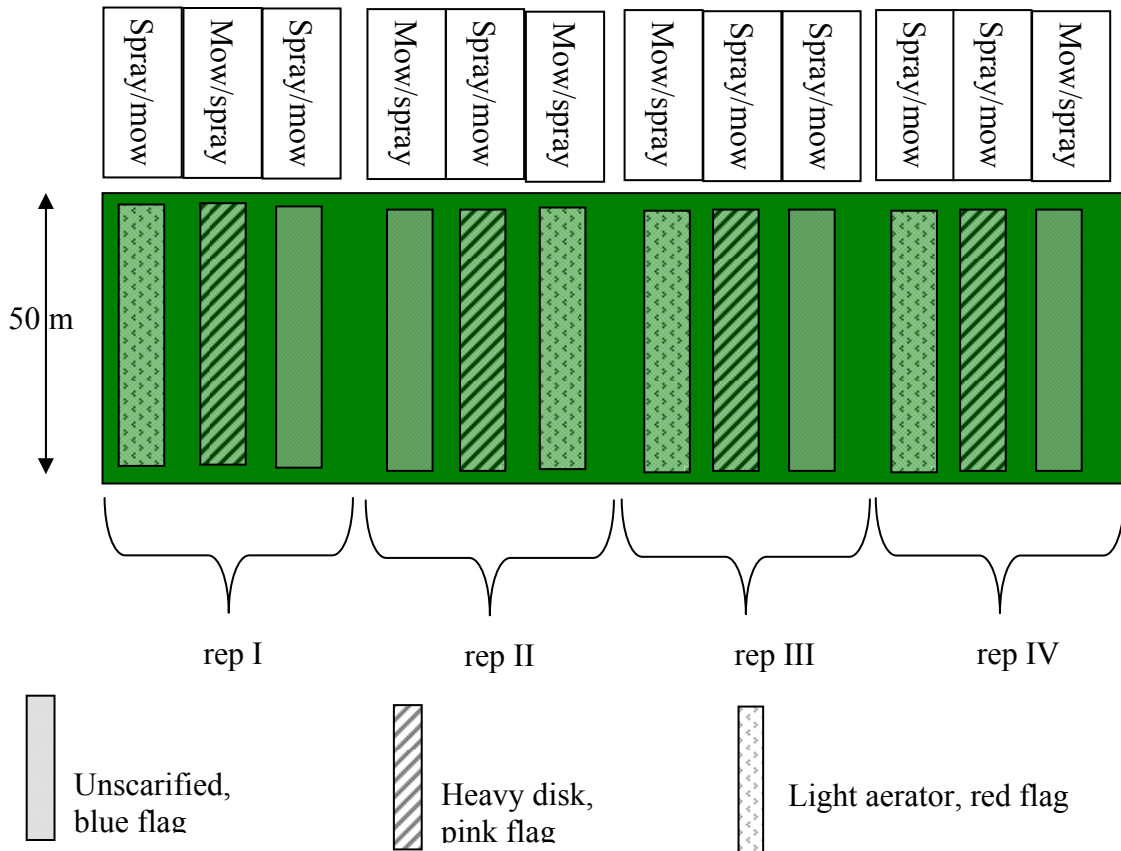
The experimental layout is a randomized split plot design with 4 replications. There are three main treatments (50m x 6m): no scarification, heavy disk and light aerator; Split treatment: w/, w/o herbicide randomized by shifting the scarification treatment above or below the spray corridor. Due to the heavy forage stand present, a mechanical mowing was imposed on the no-herbicide treatment. Thus, the subplots are described as chemical mowing vs. mechanical mowing. The chemical mowing operations consisted of two separate herbicide applications with imazapyr applied at 1qt/A (09/08) and imazapyr + glyphosate applied at 1 qt/A (03/09). The mechanical mowing was performed the day of scarification (06/09). Light disturbance was performed with a weighted 2m wide aerator with 4-star blades leaving indentations in the soil approximately 10cm deep. This application was performed with 2 passes. Heavy disturbance was performed with a heavy 3-disk offset designed for cutting and turning intact sod pieces up to 15 cm deep. This application was performed with a single pass.

Observations on June 25, 2009

- Cattle removed from the paddock in August 2009
- 42" rain accumulated from January 2009 to June 2009 and more since
- Resulting in heavy forage production with excellent diversity of kikuyu plus cool season grasses (*Dactylis glomerata*, *Holcus lanatus*) and legumes (*Lotus corniculatus*, *Trifolium incarnatum*) with sward stands up to 1m ht.
- The herbicide application sufficiently suppressed forage growth keeping the stand ht. < 10cm. The aerator created more disturbance in the chemical mow subplots
- We don't expect that the chemical or mechanical mowing will have a significant influence within the heavy disk scarification.

Experimental layout of main plots and superimposed subplots.

Either the mauka or makai side of each scarified row was sprayed as indicated:



“Cornfield” koa plantation by orchard at Kukaiiau Ranch

- Planted 1976 by Gerry Walters (USDA Forest Service IPIF) to demonstrate feasibility of koa reforestation on ranch lands, unknown seed source, probably local
- 4 foot x 4 foot spacing, 10 rows wide by about 426 feet long, probably 1066 trees planted
- Twelve potential crop trees selected in entire stand
- One crop tree and four cull trees harvested August 13, 2009 for wood quality/defect determination
- *Update August 17th: The crop tree (20.2 inch dbh) yielded 200 board feet of lumber. The wood was light in color with little figure. The two “cull” trees (12.1 in dbh and 15.5 in dbh) adjacent to the crop tree yielded 42 board feet each.*

Single tree selection thin, fertilization, and weed control at Umikoa Ranch

- Nine-year-old koa stand regenerated from soil scarification
- In 2007: 2,768 trees/acre, basal area 140 ft²/acre or 32 m²/ha
- We selected 64 crop trees based on growth and stem form
- See video at <http://www.ctahr.hawaii.edu/forestry/video/Friday-koa-improve.html>

	DBH (in)	Height (ft)	Length of clear bole (ft)
Crop trees	4.9	27	14.5
Average tree in stand	4.1	24	10.5

- March 2007 we thinned all trees within 16 ft. radius of crop tree leaving 160 crop trees/acre
Basal area of 140 ft²/acre will allow 160 trees/acre to grow to average 13 in. diameter
Then time for a second thinning. Commercial?
- June 2007 we fertilized selected trees with 9.3 lbs treble super phosphate (0-46-0) per crop tree (equivalent to about 600 lbs TSP/acre)
- June 2008 we applied a second dose of fertilizer at same rate
- November 2008 we sprayed grass under crop trees with imazapyr (Arsenal Powerline®), 1 qt/acre rate

Results after 2 years

	annual DBH increment (in)
Thinned	0.66
Unthinned	0.40

No effect yet of fertilization on growth. Uptake of P by koa leaves uneven. Visually imazapyr killed kikuyu grass understory and all other weeds; need to measure effects on tree growth.