

Advancing the Adoption of the Cover Crop Technology Using Sunn Hemp, Oats and Buckwheat in Commercial Rotational Crops in Hawai'i

John McHugh (Work evolving from a Western SARE Research & Education Grant)

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Weed growth between buckwheat and sunn hemp plants at the Pioneer demonstration site.

Project background:

In Hawai'i, the practice of bare ground fallow is often used to manage weeds and soil pests between crop cycles. However, bare ground fallow poses risks of soil erosion and non-point source pollution and results in a loss of valuable top soil and diminished soil quality for agriculture.

- Barriers to implementation:
 - 1) Cover crop seed can be expensive and unavailable.
 - 2) Farmers afraid to make costly mistakes.
 - 3) Demonstrations and information not specific to farmers' situations.
 - 4) Cost benefit of cover cropping not well quantified.
- The initiative to advance the adoption of cover crops as a Best Management Practice began with a Western SARE Research & Education grant in 1998 (SW97-001, Management of Soil-Borne Plant Parasitic Nematodes for Sustainable Production of Field-Grown Tomatoes and Cucumbers by Cover Cropping). Subsequent efforts, to date, have been funded by: the Hawai'i Department of Health (under the 319(h) program), the American Farmland Trust and the USDA Natural Resources Conservation Service State Conservation Innovation Grant program.
- The current effort is funded for three years (October 1, 2007 through September 30, 2010) by the USDA NRCS National Conservation Innovation Grant program.

Project Objectives:

- Demonstrate benefits of cover crops on soil fertility levels, beneficial insects, pest reduction, weed suppression and soil compaction to farmers on five islands while, at the same time, documenting any adverse impacts to key cash crops.
- Quantify the direct cost benefit for selected cash crops by estimating yield gains (if any) and examining cash crop tissue nutrient levels as a measure of crop vigor and response to improved soil quality. Savings on fertilizer costs will also be calculated.
- Motivate cooperators to implement cover crops on 10% of their farmed acreage.
- Guide farmers through the process of using cover crops by providing on-site consultation outreach.

Project Methods:

- Fourteen field sites on five islands (Kaua'i, O'ahu, Moloka'i, Maui and Hawai'i) being planted with sunn hemp, oats, buckwheat and combinations of sunn hemp with oats and buckwheat. These will be followed with or planted into papaya, sweet potato, coffee, Hawaiian koa, tomatoes, pineapple and organically grown produce.
- O'ahu Resource Conservation and Development Council (O'ahu RC&D) staff and Crop Care Hawai'i, LLC is conducting field plantings, collecting soil and tissue samples for soil fertility analysis and assessing weed suppression and percent ground covered by the use of the selected cover crops.
- O'ahu RC&D is staging 14 separate field days at demonstration sites.
- Susan Schenck, Ph.D. (Hawai'i Agriculture Research Center) is measuring soil nematode density on all 14 sites before and after cover crop plantings at prescribed intervals.
- Mark Wright, Ph.D. (UH – CTAHR) is monitoring insect populations on six sites for five cropping situations (seed corn, sweet potato, papaya, organically grown produce and coffee).
- Jonathan Deemik, Ph.D. (UH – CTAHR) is monitoring five sites representing major soil types for soil fertility, bulk density and soil microorganism activity.
- Stuart T. Nakamoto, MBA, Ph.D. (UH – CTAHR) is conducting a cost-benefit analysis for each of the seven demonstrated cash crops on selected sites.
- Partnering with Waialua High School to provide community capacity building by having junior and senior high school students work with us in all phases of the project. First year's students were: Mike Ahyai, Kaikala Carvalho, Josiah Castellanos, Kristian Castellanos, Lōkahi Herrod, Geena Pinacate, Abcede Tantog and Bryce Whittaker. Students were hired and paid by Pioneer Hi-Bred International Inc. as interns.



From left, buckwheat, sunn hemp and sunn hemp with oat cover crops on Moloka'i

Anticipated Environmental/Natural Resource Impacts:

- Reduced soil erosion
- Reduced pesticide application due to enhanced weed suppression, reduced nematode populations and increase of natural enemies of the cash crop pests
- Reduction of fertilizer requirements due to nutrient cycling and biological fixation of nitrogen
- Reduced nutrient leaching and runoff
- Improvement of soil quality (fertility and nutrient levels, soil microorganism activity, organic matter content)

Project Progress to Date:

- 12 sites planted: HARC Kunia and Maunawili (sweet potato and Hawaiian Koa); Pioneer Hi-Bred International Inc. in Waialua (seed corn); Mōhala Farm in Waialua (organically grown produce); Dole Food Co. in Helemano (coffee); Lynne and Russell DeCoite in Ho'olehua, Moloka'i (sweet potato); Orlando Manuel Farm on the island of Hawai'i in Pu'uiki in the Puna District (papaya); Alberto Belmes Farm on the island of Hawai'i in Kea'au in the Puna District (papaya); Taiwan Gu Farm on the island of Hawai'i in the Hāmākua District (sweet potatoes); Greenwell Farms on the island of Hawai'i in the North Kona District (coffee); Kaua'i Coffee on the island of Kaua'i in 'Ele'ele (coffee); and Kapalua Farms on Maui in Kapalua (organically grown produce and pineapple).
- Pre-plant soil analysis for baseline soil fertility and plant parasitic nematode populations performed at all sites.
- Baseline soil microbiological activity at four of five sites performed: HARC Kunia, Pioneer Hi-Bred International Inc., Kapalua Farms and Taiwan Gu Farm. Fifth site to be selected later this year.
- Two cover crop disk-down soil samples collected at HARC Kunia and Pioneer Hi-Bred International Inc.
- Seed distributed to additional growers interested in cover crop practice: Mary Lorenz (weed suppression in dracaena stock plants in Kea'au, Big Island), Jimmy Bernardo (nematode management in noni in Pāhoia, Big Island), Wei Chong Ho (green manure application in Kahuiki, Oahu). Farmer counseling provided.
- Insect natural enemy data collected from Pioneer Hi-Bred International, Inc. site in Waialua. Currently sampling beneficial/pest insect populations at Kapalua Farms, Taiwan Gu Farm.
- Commercial crop of sweet potatoes planted over cover crop treated plots at HARC Kunia. Seed corn crop planted over cover crop and compost treated plots at Pioneer Hi-Bred International Inc.
- Presentation on project at the 2008 Annual Meeting of the Hawai'i Association of Conservation Districts in Keauhou, Kona, June 18, 2008.
- First project field day conducted at Mōhala Farms, February 16, 2008.
- Second project Field Day conducted at the HARC Kunia site, June 24, 2008.
- Poster to be displayed at the Hawai'i Ag Conference 2008, September 4, 2008.
- Working with UH-CTAHR Sustainable Agriculture program to provide Virtual Field Day video.
- Formed strategic collaborative relationship with Dr. James Leary at UH-CTAHR to further expand the adoption of the cover crop practice in Hawai'i.



Nitrogen nodule formation on sunn hemp at the Hāmākua demonstration site.



Buckwheat in full flower at the Pepe'ekeo site.

Weed Suppression and Ground Cover

Mōhala Farm (Waialua – Organic Vegetables)

Treatment	Weed Suppression*	%Ground Covered
Check (Bareground)	0	0
Sunn Hemp	9.7	91.7
Buckwheat	4.3	33.3
Oats	8.7	78.3
Sunn Hemp + Buckwheat	9.3	88.3
Sunn Hemp + Oats	9.3	91.7

Pioneer Hi-Bred International, Inc. (Waialua – Seed Corn)

Treatment	Weed Suppression*	%Ground Covered
Check (Bareground)	0	0
Sunn Hemp	9.7	93.3
Buckwheat	9.3	86.7
Oats	10	95
Sunn Hemp + Buckwheat	10	91.2
Sunn Hemp + Oats	10	98.3

Orlando Manuel Farm (Big Island, Puna, Pu'uiki – Papaya)

Treatment	Weed Suppression*	%Ground Covered
Check (Weedy)	0	100
Sunn Hemp	8	86.7
Buckwheat	8	86.7
Oats	8	90
Sunn Hemp + Buckwheat	8.5	90
Sunn Hemp + Oats	8.5	93.3

Russell and Lynne DeCoite (Moloka'i, Ho'olehua – Sweet Potato)

Treatment	Weed Suppression*	%Ground Covered
Check (Weedy)	0	100
Sunn Hemp	8	86.7
Buckwheat	8	86.7
Oats	8	90
Sunn Hemp + Buckwheat	8.5	90
Sunn Hemp + Oats	8.5	93.3

Kapalua Farms (Maui, Kapalua – Organic Vegetables, Organic Pineapple)

Treatment	Weed Suppression*	%Ground Covered
Check (Bareground)	0	0
Sunn Hemp	8	88
Buckwheat	7	62
Oats	6	57
Sunn Hemp + Buckwheat	8	85
Sunn Hemp + Oats	8	78

Taiwan Gu (Big Island, Hāmākua Coast, Pepe'ekeo – Sweet Potato)

Treatment	Weed Suppression*	%Ground Covered
Check (Bareground)	0	0
Sunn Hemp	7	73
Buckwheat	9	87
Oats	10	93
Sunn Hemp + Buckwheat	10	97
Sunn Hemp + Oats	10	90



High school students sowing cover crop seed.