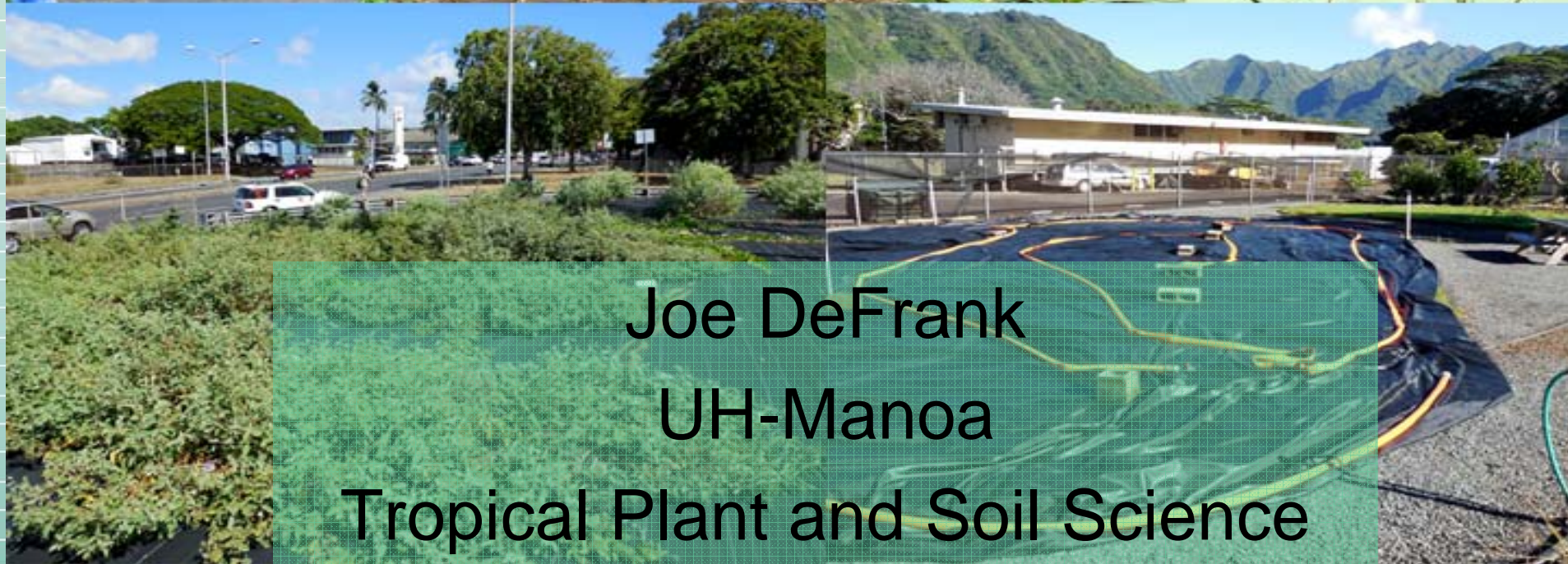


Weed control in Tropical Cropping Systems



Joe DeFrank
UH-Manoa
Tropical Plant and Soil Science



College of Tropical Agriculture and Human Resources
University of Hawai'i at Mānoa

For more information on topics covered

<http://www.ctahr.hawaii.edu/deFrankJ/index.htm>

WEED CONTROL IN HAWAII WITH DR. JOE DEFRANK

Professor of Weed Science - University of Hawaii Department of Tropical Plant and Soil Science



[Weed Science 481-Fall 2011- Lecture notes and handouts](#)

[Weed ID Gallery - Economically Important weeds in vegetables, turf and potted ornamentals in Hawaii](#)

[Streaming Media Content](#)



[Plants for People: Beverage Crops, Fall 2011 with Dr. Skip Bittenbender](#)

[ASHS 2011 WORKSHOP: Propagation Techniques of Select Tropical Ornamentals, Specialty Crops, and Native Plants in Hawaii](#)

[TPSS 491/711 Digital Tools for Scientific Content Fall 2012](#)



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[Web based resources for weed I.D. and control, problems weeds in warm season turf & Purple nutsedge control for gardens and ornamental nursery beds. \(posted 10/16/2012\)](#)

[Weed control recommendations-home turf, landscapes and gardens \(posted 06/01/2012\)](#)

[Weed control in Aiea ball field, Waipio Soccer Field issues and new rules for Aquatic weed control - CPS 12th Annual Seminar and Tradeshow \(posted 05/22/2012\)](#)

[Weed control update for warm season turf in Hawaii - Pacifica Ag. Tradeshow \(posted: 01/19/2012\)](#)

[Weed control Considerations for Potted Tropical Ornamentals and Turf \(posted: 02/09/2011\)](#)

[Aiea Baseball field weed cleanup - 2010 \(posted: 01/31/2011\)](#)

[Pili Grass as a Living Mulch in Tropical Vegetable Crop Production in Hawaii 2009.](#)

[Weed Control in Native Hawaiian Plants](#)

[Native Plants on Hawaii's Roadways](#)

[Restoring Native Habitats in Hawaii](#)

[Student presentations for Weed Science Lab, TPSS/PEPS 481](#)

[Herbicide and Growth Regulator Studies in Potted Ornamentals 2005 to 2007](#)

[Non-Weed Control Presentations \(posted 06/21/2011\)](#)

[HOME](#)



For more information on topics covered

Viewing tips for live seminar presentations – Open 2 browser windows
1- for video and 1 – for high resolution slides as pdf

Web resources_2012

www.ctahr.hawaii.edu/deFrankJ/NON_HOMEPAGE_PAGES/Web_resources_Weed_ID_control_10122012.htm

Web Based Resources For Weed I.D. And Control, Problems Weeds In Hawaiian Turf And Purple Nutsedge Control In Gardens And Ornamental Nursery Beds - 2012

On October 12, 2012, Dr. DeFrank made a presentation to participants of the "DOD Pesticide Applicator Recertification & PMPAR Training NAVFAC Pacific and HIJIRSG" at Ford Island on Oahu. The participants are part of federal employee's pesticide certification program required of all pesticide handlers. This presentation covers Dr. DeFrank's selected web based resources for Hawaii weed I.D. and control recommendations. Problem sedge and broadleaf weeds are described and control recommendations for warm season turf are discussed. The presentation concludes with an in-depth description of the biology of Purple Nutsedge and IPM practices used to control this important weed with cultivation, systemic herbicides and woven black plastic weed mat.

For more information on this presentation contact:
Dr. Joe DeFrank
email.defrenk@hawaii.edu
Phone: 808-956-5698.

Suggested method to view streaming media and slideshow:

1. Open two browser windows, one will be used to view the "talking head" and the other will be used to view the slide show images as an Adobe pdf.
2. Click on the link to "view lecture", let the program download and start then hit pause.
3. In the second window open the pdf version of the slide show and once the first slide appears return to lecture and resume play.
3. With two windows open, one for the video and one for the slide show you can follow the lecture for the queues to change the slide image.

| Title of Presentation | Media format | Seminar Handout Links to referenced web resources | Slide show images as pdf |
|----------------------------------------------------------------------------------------------------------------------------------|------------------------|---------------------------------------------------|----------------------------------------------|
| Web based resources for weed ID and control, problems weeds of warm season turf and Purple nutsedge control. (posted 10/16/2012) | MPEG-4 | pdf | Click to download slide show |

HOME

Ornamental Nursery Beds - 2012

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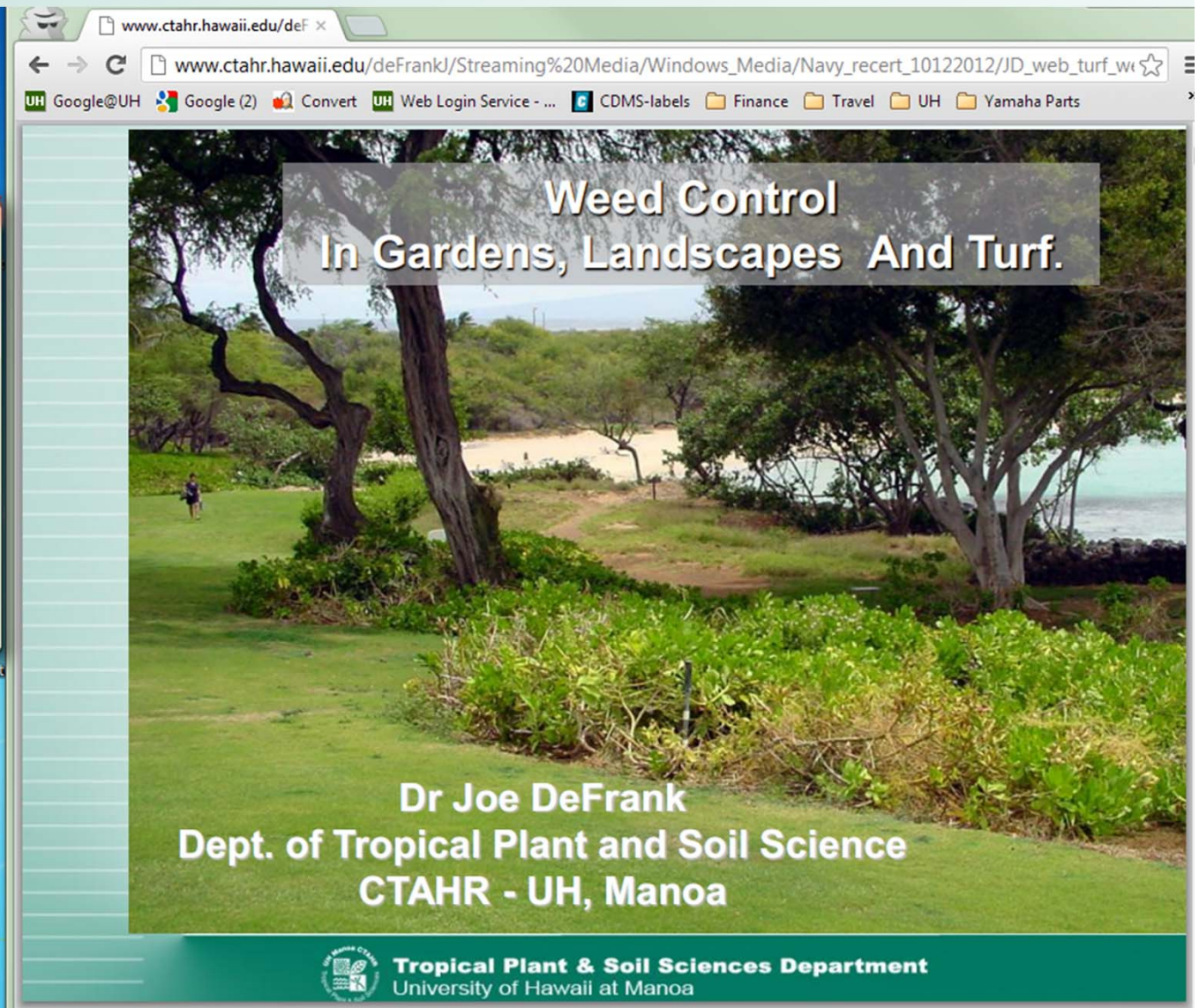
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2 items

For more information on topics covered

Viewing tips for live seminar presentations – Open 2 browser windows
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TOPICS COVERED

1. Weed control in vegetable crops: Conventional herbicides, & living mulches.
2. Azolla – living aquatic mulch for wetland taro.
3. Light exclusion with geotextile fabrics – weed control for organic farmers.
4. Mow & Blow turning chemical fertilizers in to mulch for orchard crops.
5. Weed control in potted ornamentals with fortified mulch.
6. Weed control in warm season turf with and without herbicides.
7. Native plants on roadways to exclude invasive species.



Herbicide screening on leafy vegetables
Chinese cabbage and lettuce
Data submitted to EPA to include Hawaii on product labels



untreated



Metolachlor .5 lb ai/a



Metolachlor 2.0 lb ai/a



Purple nutsedge

Nutsedge persistence



All forms of weed control require energy

- Energy = human labor,
- Energy = fossil fuel energy for tractor cultivation
- Energy = chemical energy in herbicides applied to soil and living weeds
- Energy = solar energy, least utilized form of energy for crop weed control

How can solar energy be used for weed control in crops?

LIVING MULCHES

Plants absorb solar energy, produce biomass and that biomass displaces weeds



Fresh chicken manure applied preplant as fertilizer.



Irrigation applied to stimulate weed growth



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Fertilizer + water provides maximum weed seed germination.
Weeds grow up to the point that foliar overlap begins.



Contact herbicide applied to kill weeds and
prepare for living mulch direct seeding

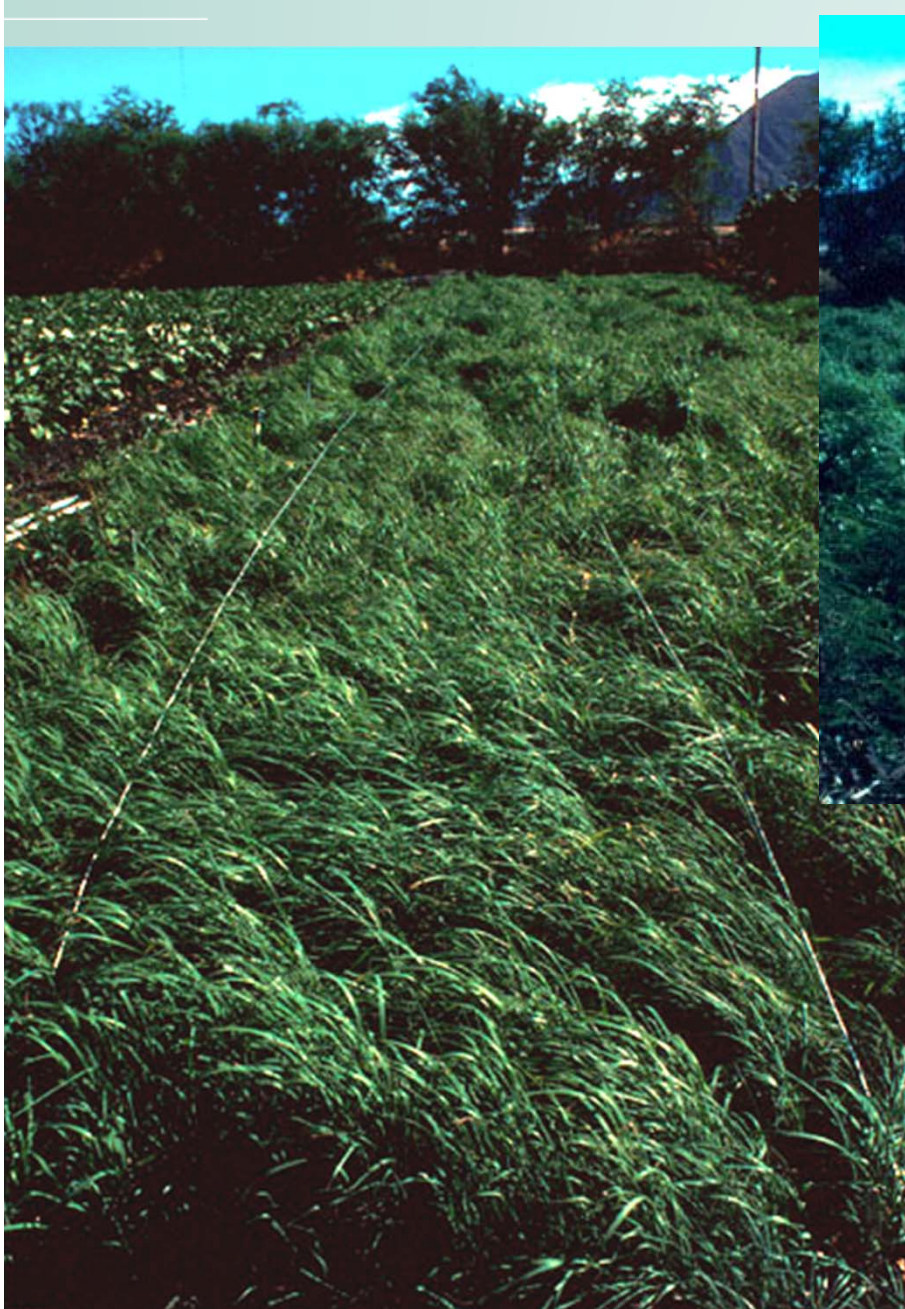


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Rhodes grass used for nematode suppression and bunch-type growth
Easily confined to the between row space



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Living mulch fills crop production space and
excludes weeds
Contact herbicide to generate planting rows





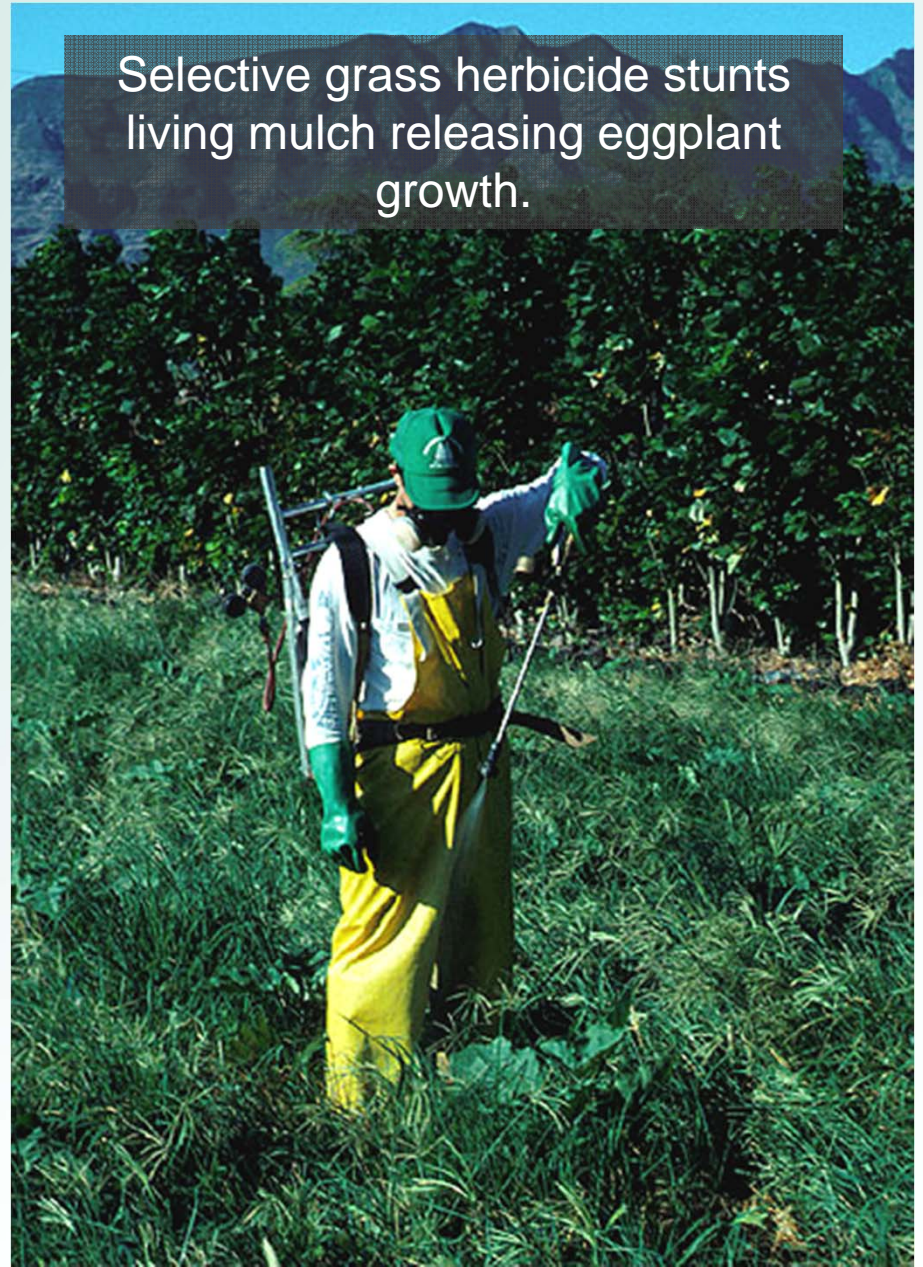
Transplants establish in micro-climate protected from wind and soil splash from heavy rains.



Living mulch thrives, masking the eggplant crop.



Selective grass herbicide stunts living mulch releasing eggplant growth.



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On-site mulch production eliminates heavy bulk transfer of externally supplied mulch



Eggplant growth gradually increases coverage of crop field with multiple suppression applications to living mulch





Mature stand of eggplant resembles a miniature orchard



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Living mulch produces biomass during the crop production cycle



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Mulch covered surface improves irrigation efficiency and provides a greater volume of moist soil for root growth.

Bare ground + drip irrigation in the crop row gives saturated soil below crop and bone dry soil in space between rows



Spent eggplant crop was mowed down, entire field fertilized
and new rows made in the between row space



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Cucumber variety trial followed 16 months of eggplant with no soil disturbance

Hurricane Iniki turned it all to mush week following farmers field day



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Zucchini in living mulch showed
reduce white fly and virus symptoms
due to aphids.



CLASSIC
SEEDED 01 APR. 1992



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With beans, not all grass types
result in similar rose beetle damage

Sudex



Rhodes Grass



Bare ground



Can a living mulch system work for paddy crops like wetland taro?



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WHAT IS AZOLLA

- A WATER FERN LIVING WITH A N-FIXING BLUE-GREEN ALGAE.
- AG. USE - GREEN MANURE AND FEED SUPPLEMENT
- INTRO. TO HAWAII 1940



STEPS FOR USING AZOLLA

FIND CLEAN SOURCE - NO SNAILS

GROW-OUT IN SMALL POOL - TO CLEAN-UP

MAKE NURSERY POND, BANKS-WEED FREE

ADD P USE PHOSPHORIC ACID = 40oz / 1000²

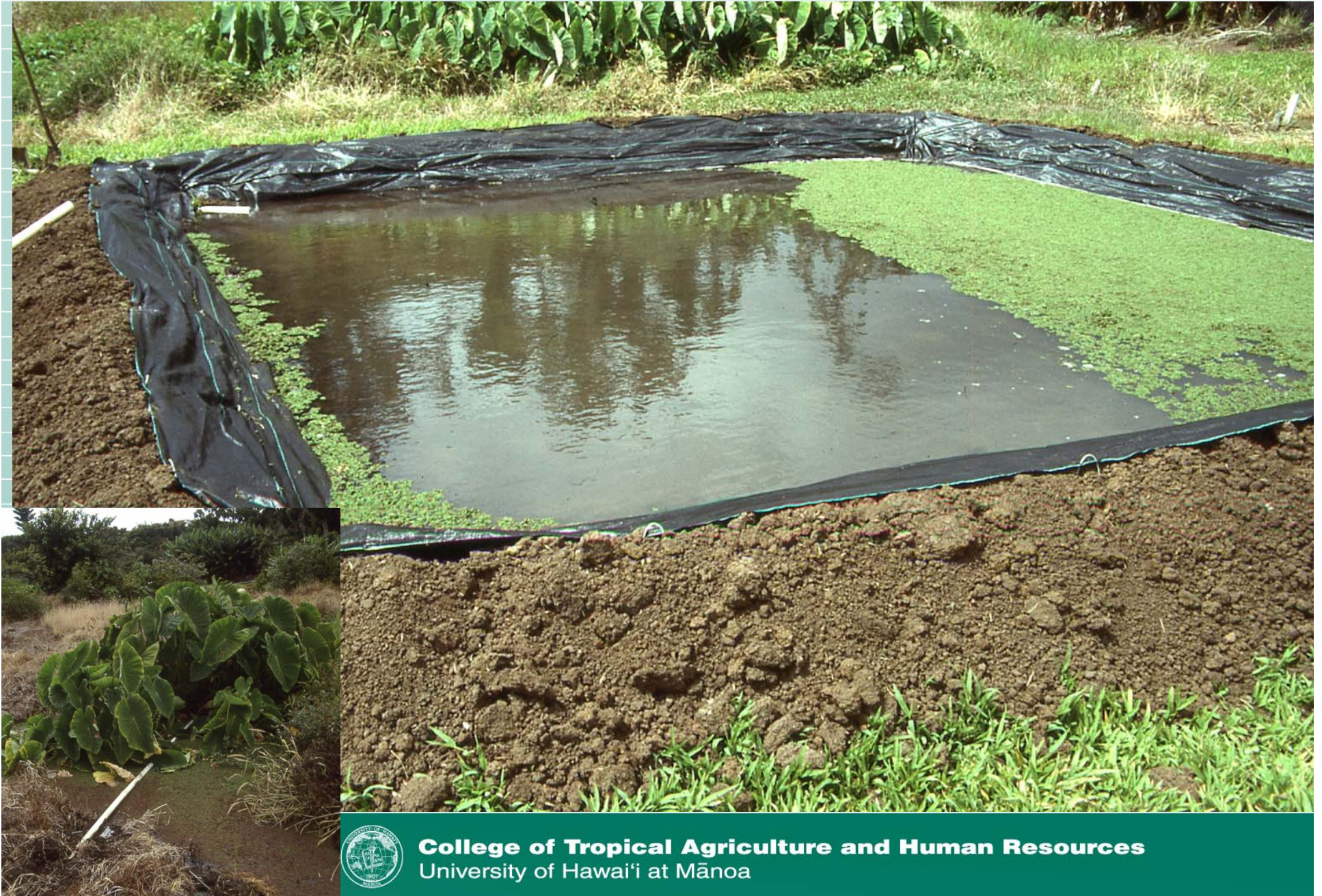
USE 0-46-0 TREBLE S = 1 lb / 1000²

APPLY EVERY 5 DAYS

TO HOLD - LOWER WATER LEVEL TO ALLOW ROOT CONTACT



Stock increase phase in nursery pond needed to acclimate azolla to full sun conditions and avoid weed transfer to production sites.



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STEPS FOR USING AZOLLA

INOCULATION OF PRODUCTION AREA

FLOOD PADDY CROP FIELD

ADD AZOLLA - 2-TON/A OR 1/3 SURFACE (COVERAGE 12-14 DAYS)

STOP WATER FLOWING OUT - USE SCREENS TO HOLD AZOLLA BACK

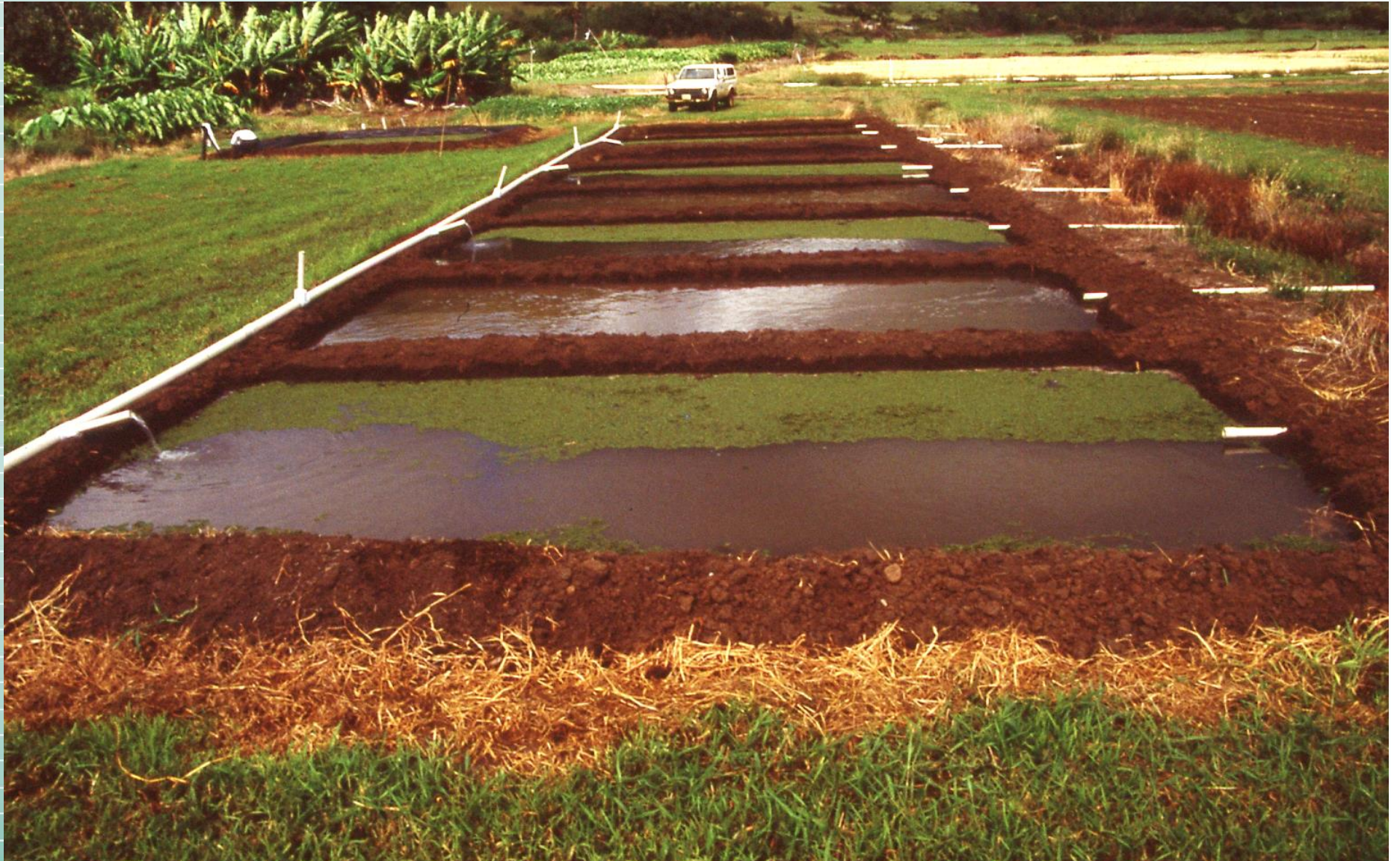
ADD P USE PHOSPHORIC ACID = 40oz / 1000²

USE 0-46-0 TREBLE S = 1 lb / 1000²

APPLY EVERY 5 DAYS

GROW UNTIL AREA COVERED





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PLACE SCREEN OVER EXIT DRAINING TO HOLD AZOLLA BACK



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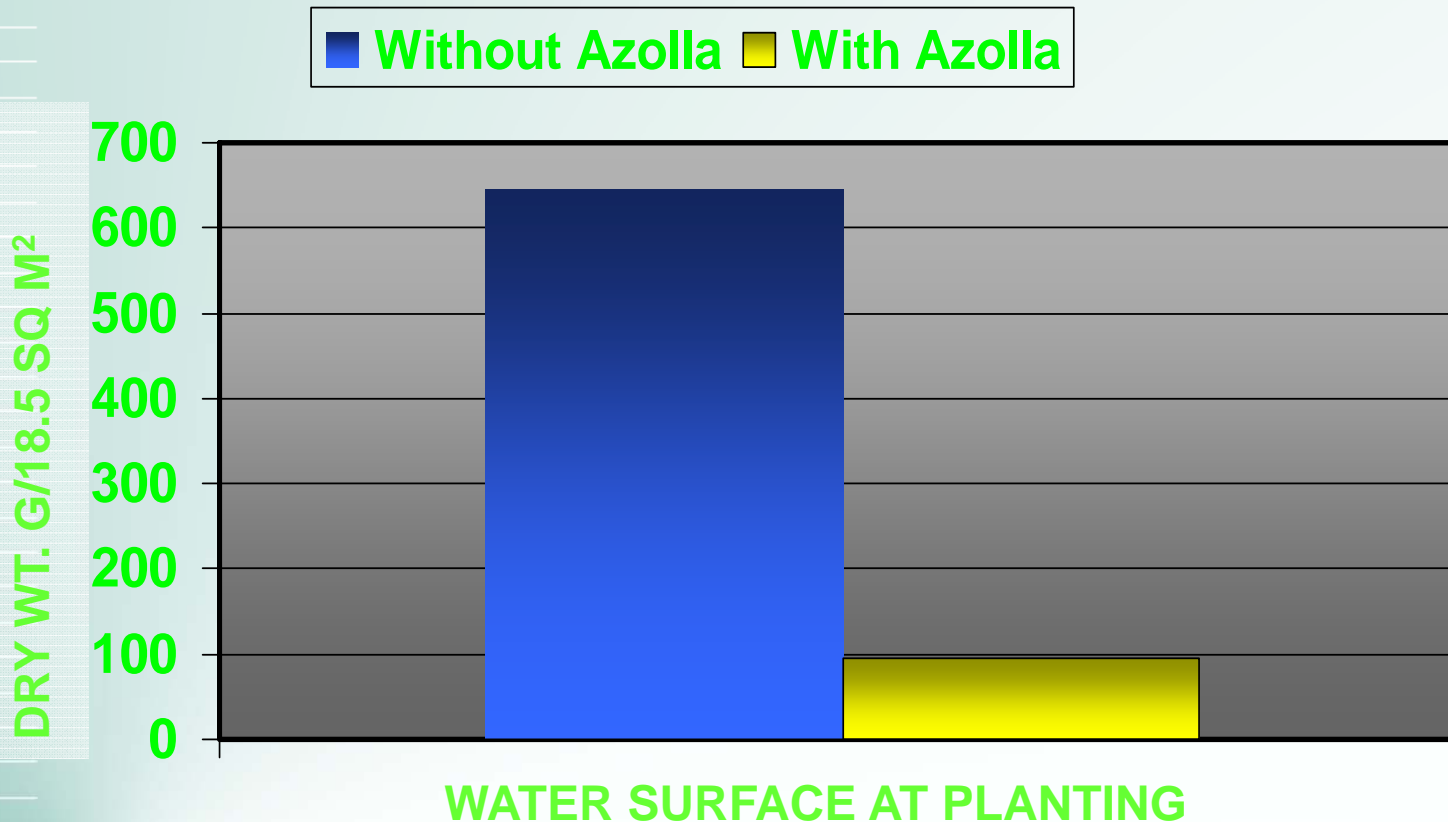




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Weed Dry Wt. Response to Azolla

RECORDED: 91 DAYS AFTER PLANTING



- Taro harvest timing set by maturity indicators in non-azolla plots
- Warmer water in non-azolla plots advanced maturity over taro w/azolla.
- Maturity differences biased yield increase towards non-azolla treatment



TARO HARVEST 324 DAYS AFTER PLANTING



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324 DAY TARO
W / AZOLLA

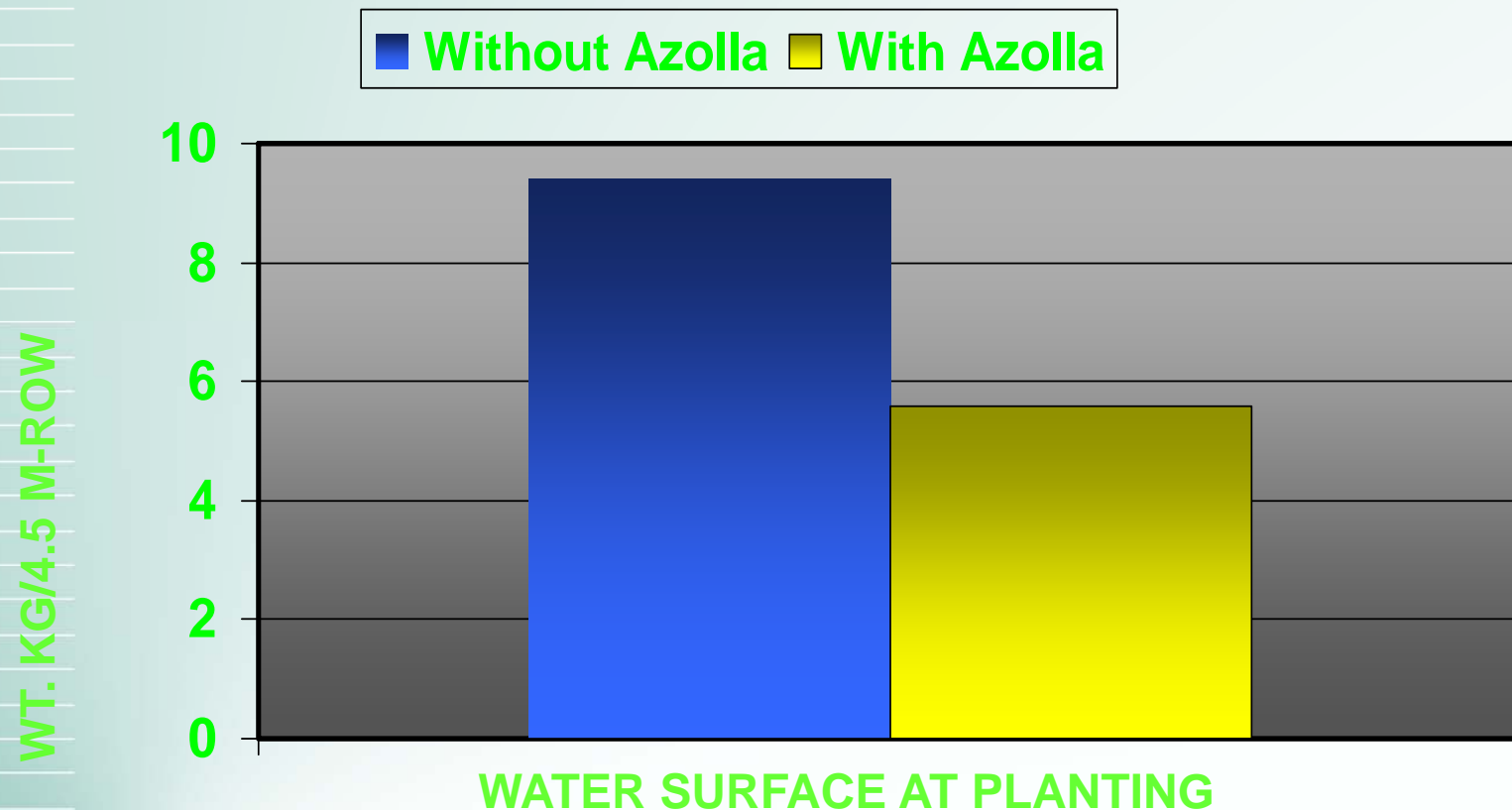
324 DAY TARO
NO AZOLLA



COMPARE ROOTS AND CORM MATURITY



TARO MARKETABLE CORM YIELD 324 DAYS AFTER PLANTING



CONCLUSION

- AZOLLA NURSERY PONDS FOR CLEAN SUPPLY
- AZOLLA NEEDS FULL LIGHT CONDITIONING + CLEANED OF PESTS FOR NEW PLANTINGS
- AZOLLA CAN REDUCE WEEDS WITH RAPID GROWTH AND COVERAGE OF SURFACE
- AZOLLA COOLS WATER MAKING TARO GROWTH SLOWER, NEEDS 1-2 MONTHS EXTRA TIME FOR FULL CROP MATURITY



TURN THE PAGE FARMING NON-HERBICIDE NOTILL FARMING METHOD

1. No-till farming without herbicides
2. Potential for organic farming systems
3. Adaption for large scale farming ?





Weed control in vegetable crops has always been challenging.

Herbicide choices are limited.

Post harvest weed destruction requires soil cultivation during busy times/continuous production.



Coverage with geotextile fabric kills weeds and buys time for next crop cycle.



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Good weed kill w/ 1-week of cover



14 days of weed growth

14 days weed growth + 1-wk cover

3-wks weed growth



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With small annual weeds or short term cover crops
1-2 weeks of cover provides weed free site preparation.
Crops planted using hydro seeding or conventional transplanting
w/minimal soil disturbance for good weed control during early crop growth



PCUG - 2014

Upscaling Turn the Page Farming to larger garden sized plots



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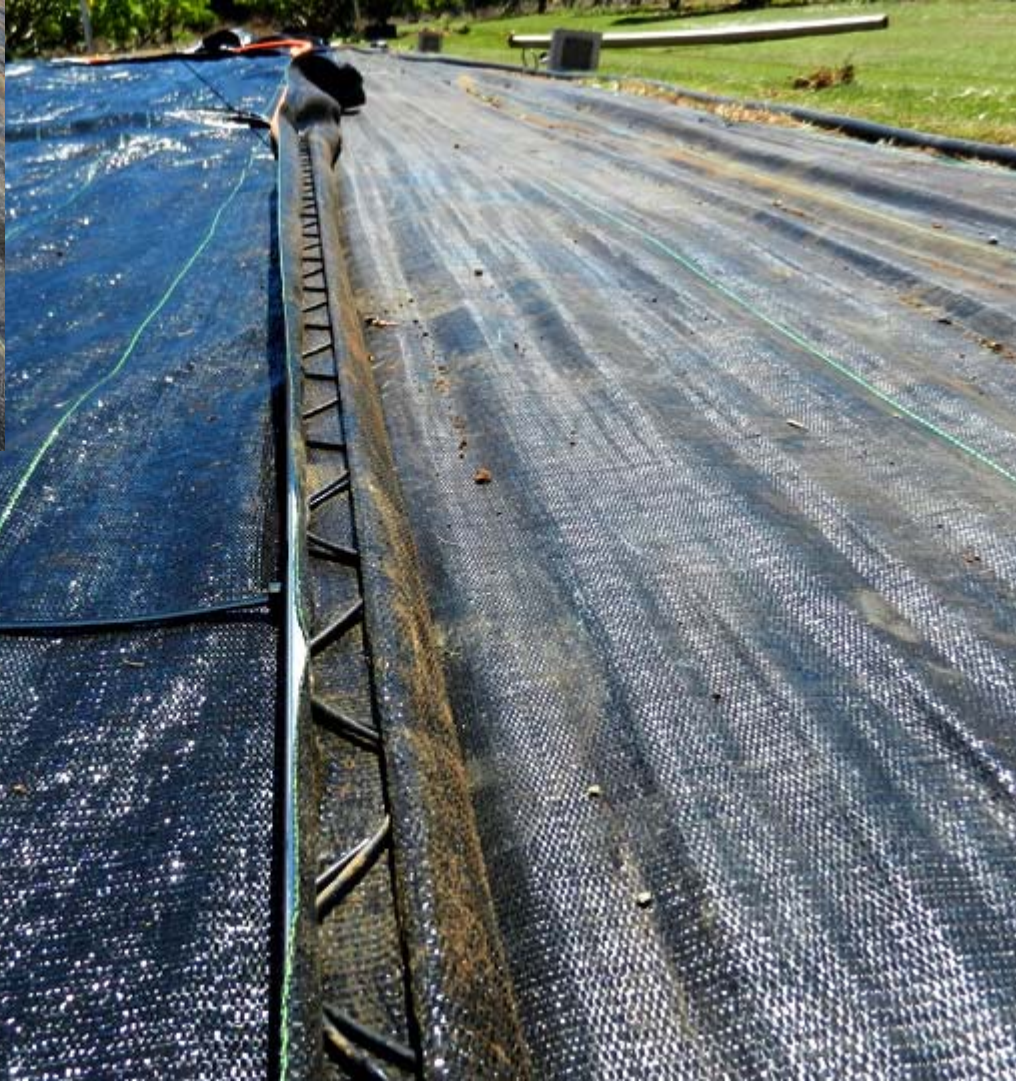
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Weed mat remains in place until ready to plant



Upscaling Turn the Page Farming to commercial sized farms.

Consider the concept of a crop module instead of a crop field

Basic size of crop module is 2 planting beds

Row length = weed mat roll, 300 ft.

Width of beds = 6 ft. Width of weed mat = 8-10 ft.



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Weed mat left edge secured in trench, right side secured with water hose



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Hydroseed seed cover crop or lets weeds grow on the left side.



Cover weeds or cover crop and reveal weed free side ready to plant.



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Cash crop planted with transplants or using hydro seeding,
avoid soil disturbance, sub-soil has weed seeds!



Post harvest weeds and crop residues are covered to prepare for next crop cycle.



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Clean bed ready for a new cash or cover crop, weeds covered and terminated.



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Cover crops can be mowed, covered to kill understory weeds and then cash crop planted into nutrient rich organic mulch.



R. Hamasaki-2015

Cover crop: This is a commercial mix containing 15% oats, 30% bell beans, 20% purple/hairy vetch mix, and 35% Magnus peas.



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Mow & Blow

Orchard weed control with on-site mulch production



Challenges for orchard weed control and nutrient management on excessively drained lava based soils .

Locations: Puna, Keaau & Mt. View on the Big Island.

- High rainfall areas + highly porous soil = hard to retain chemical fertilizers in root zone.
- Poor binding potential of soils makes preemergence herbicide in crop row risky.
- Weedy between row spaces requires regular mowing to maintain field access for orchard operations.
- How to control weeds efficiently and reduce risk of crop injury?



Mow & Blow

Weedy space between the rows is fertilized



Mow & Blow

Weedy space between the rows is fertilized
Nutrient rich cuttings are transferred to crop row.





Mow & Blow
Compared to tree growth
With w/chemical fertilizer applied
directly to trees.





M&B-roots

Results

- Surface roots increased with mulch
- Tree growth similar with direct feed and M&B
- Seedling weeds less with mulch
- Weedy grass clippings rooted below trees
- Best to mix M&B with row fert.



Direct Fert-roots



Weeds in potted plants



Challenges to weed control in potted ornamentals

- Growers want to spray a variety of stock when weeds appear.
- Spraying preemergence is near impossible to get the labeled amount in the pots.
- Potting mix high in cinder = good drainage, poor retention of chemical agents at the surface and away from roots
- Need an easy way to SEE the right amount of herbicide to add to each pot.
- Keep chemicals from leaching out
- Prevent unwanted root damage and loss



Sources of weeds

- Cinders/media as a source of weed
- Contamination during mining, transportation and storage.
- Seeds blow in from forest edges





Sources of Weeds Cinders as a Weed Source



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Sources of Weeds - Wind Carried Seed From Forest Borders To Production Site



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Preemergence herbicide research in potted nursery stock

2005 Research

Compare Herbicide granules on 5 potted landscape ornamentals



Treatments

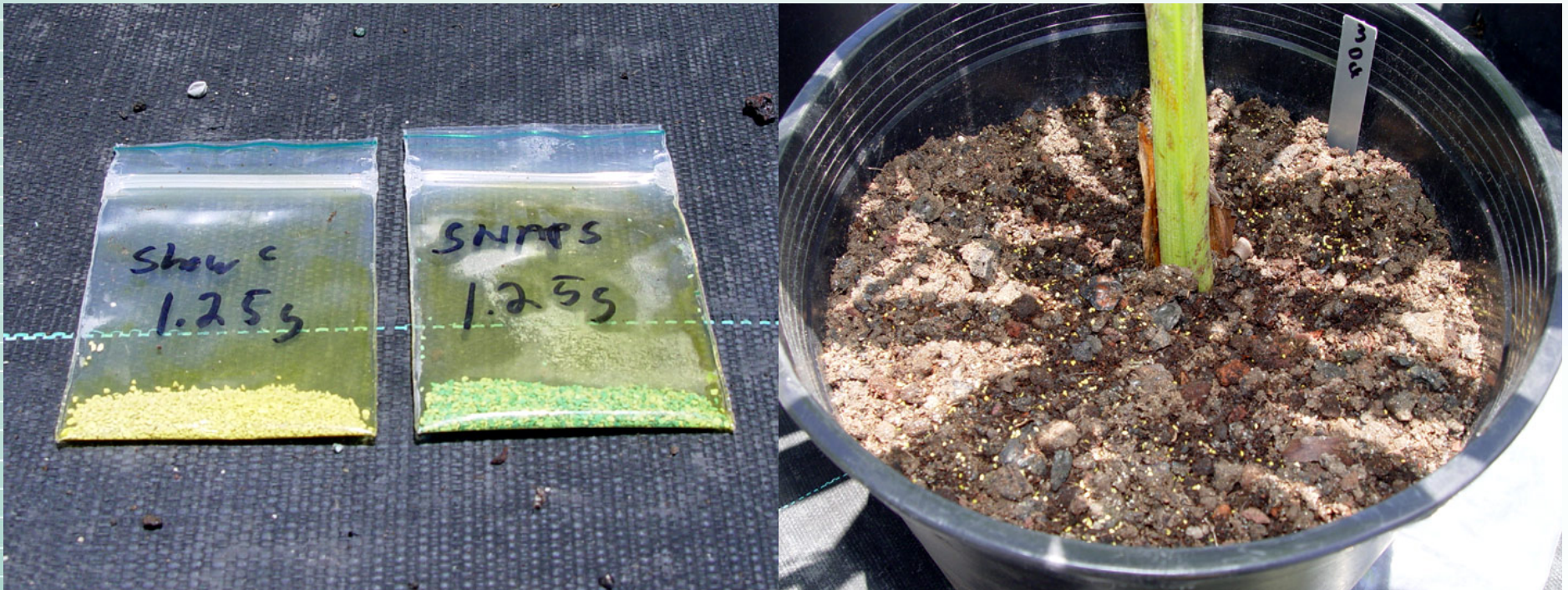
1. Unt.
2. Dimension Ultra
3. Dim U + Gallery
4. Snapshot
5. Showcase

Test plants

1. Sago palm
2. Triangle palm
3. Norfolk Island Pine
4. Foxtail palm
5. Manila palm



Preemergence herbicide research potted nursery stock



Preemergence herbicide research potted nursery stock



1=Untr, 2=Dim, 3Dim+Gal, 4=Snapshot, 5=Showcase



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Figure 3.

Lady Ann

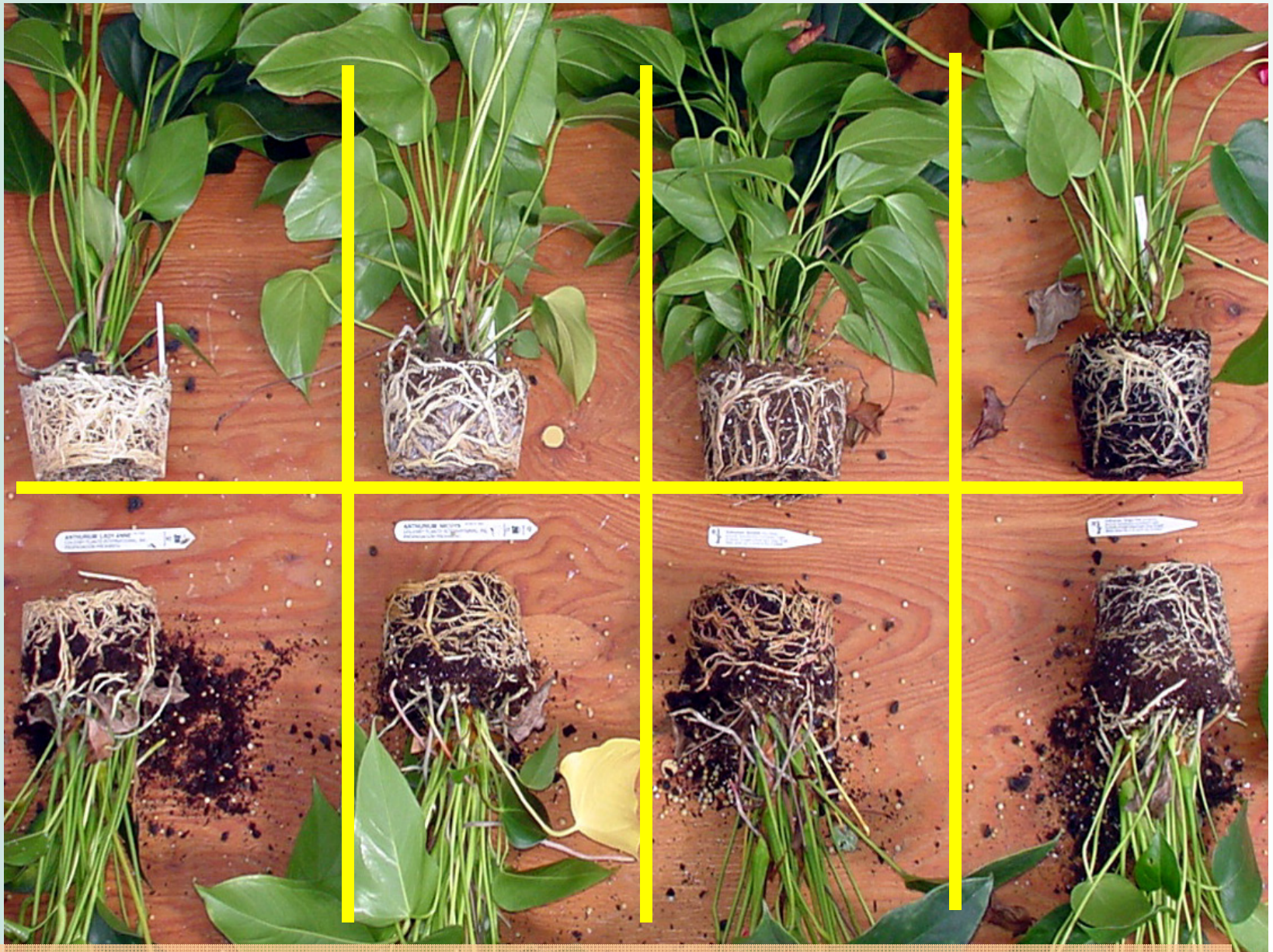
Nicoya

Sundial

Tropic Fire

Untreated

Gallery 1X



Anthurium response to 5 herbicide **sprays**, photo 71-D after last application.



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Untreated



**Gallery +
Surflan
1X**



RAPHIS PALM response to 5 herbicide **sprays 69 DAS**



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FORTIFIED MULCH

COIR INFUSED WITH PRE-HERBICIDES



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Concept for accurate in-pot herbicide placement and retention

1. Growers prepare fortified coir chips in cement mixer.
2. Coir chips - easy to see 1-piece layer in pots.
3. Chemical release timing based on % of Latex surfactants.
4. Blend .5, 1 & 4% Latex batches to extend control and keep herbicides at the surface of pots.
5. No label prohibitions w/F.M. then OK to use.



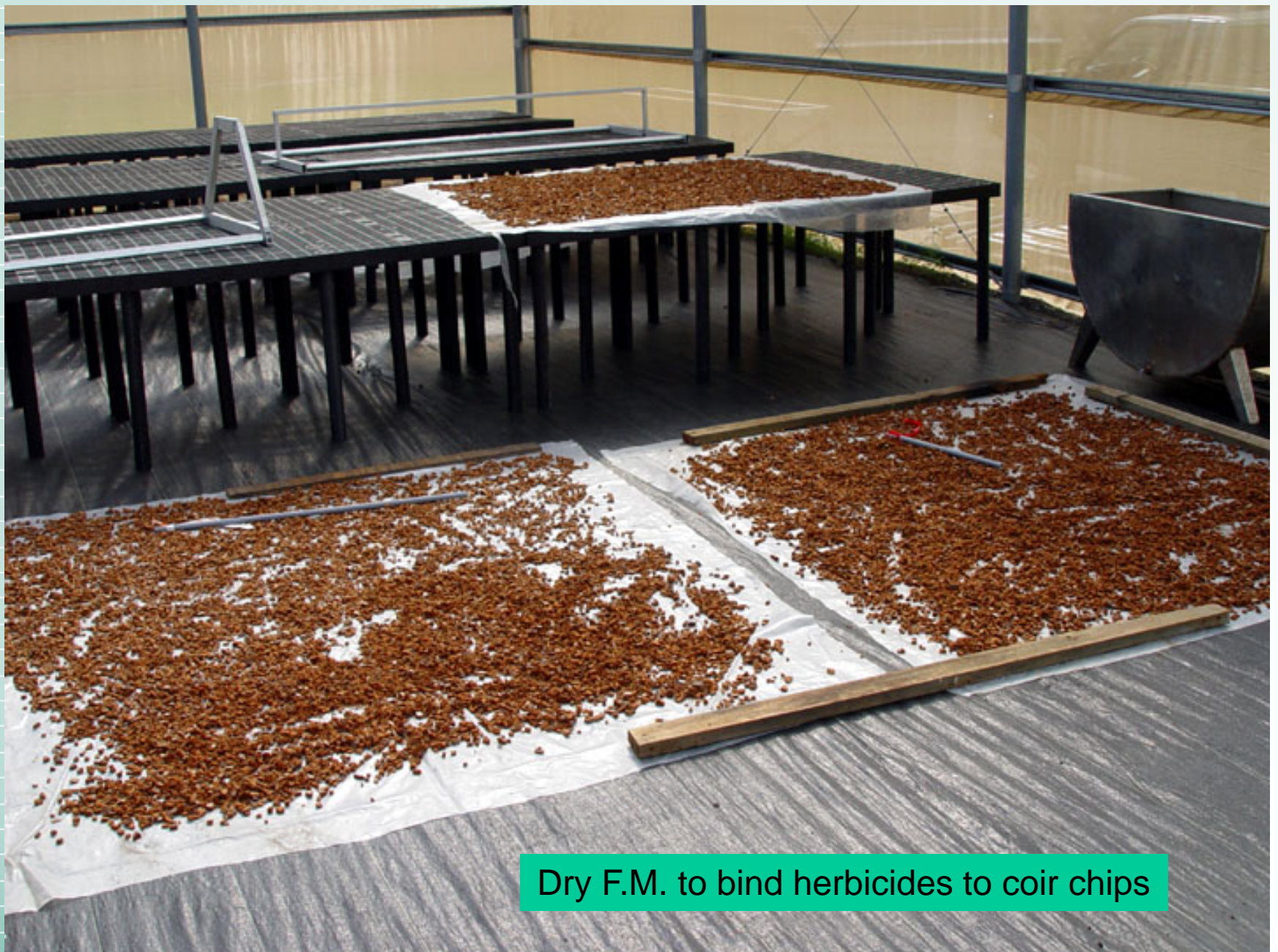
Concept for accurate in-pot herbicide placement and retention

1. Amount in pot = 1-piece layer on surface
2. 3 - gallon pot = $.6 \text{ ft}^2 = 55 \text{ grams}$
3. 5 – gallon pot = $.9 \text{ ft}^2 = 92 \text{ grams}$
4. To treat 25 3-gallon pots = 1375g coir
5. Herbicide carrier volume = wet but not drip.
6. Herbicide in wetting volume = amount need to treat the area of pot x 25 ($A = \pi r^2 \times 25$).





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Dry F.M. to bind herbicides to coir chips



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WEED CONTROL WITH FORTIFIED MULCH

Custom blends for Hawaii's-growers

For Potted Landscape Plants

| Herbicides for custom blend | Wetting volume w/ 2046 ml or 69 oz | Coir for 25 3 gallon-pots | Into pot |
|-----------------------------------------------------|------------------------------------------|---------------------------------|------------------------------|
| Surflan + Gallery | 1.3 ml | 1375 g or 3.0 lb | 1 piece layer- surface |
| | .2 grams | | |
| Ronstar 50WP | 1.3 grams | | |
| 55g/3-gallon pot batch for 25 pots = 3 lb (1375 g). | | | |





3 gallon pot = 55 g
5 gallon pot = 92 g



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158 Day after application

W/O - LATEX

WITH - LATEX



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158 Day after application

W/O - LATEX

WITH - LATEX



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Fortified mulch approach needs tipping support – keep mulch in pots



Using geoweb & stakes to hold up plants in nursery

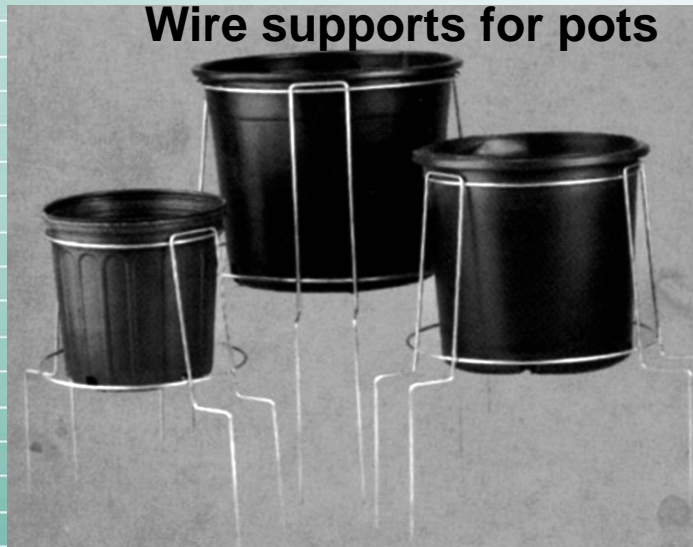


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Fortified mulch approach needs tipping support – keep mulch in pots



Wire supports for pots



Cherokee Manufacturing, Inc.

Weed Control in Common Bermuda Sport Turf



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Untreated Common Bermuda grass sport turf
Waipio Soccer Complex on Oahu
12/03/13



22 DAS02 Tenacity(4 oz/a)+Sencor (8 oz/a) – 01/06/14



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13 days later – 01/26/14



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Control of Goose grass & Love grass
2 hard to control weedy grasses
5oz Tenacity + 8oz Sencor/a
Apply 2X's

102 DAS02 - 08/09 to 12/03/13



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Spot treatment with Roundup on
fine turf



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**Non-selective
Herbicides applied with
Wiper in non-crop areas**



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Selectivity based on height
Wiper for tall weeds in turf
Wiper modification with
K. Bernie with
H. C&C Parks and Rec.



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Improved weed wick for stubborn
grasses

With UH development product is
commercially available at:

<http://weedwipe.corecommerce.com/>



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Spray marker used to
show contact





Hand pulled wiper with
modified drip irrigation
reel dispenser

CO_2 gas to move
systemic herbicide,
PSI – 2-3.



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Good isolation of contacted weeds and sport turf – Aiea H.S. baseball field

11/29/13-wiper application.



12/11/13
11 Days
after wiping



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“Lights Out” for sport turf renovations



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“Lights Out”

Weed control and turf renovation without herbicides

Appropriate Sites and Concept

1. Public parks, school fields & private residences
2. Eliminate herbicides for turf and weed removal during turf renovation
3. Use geotextile woven plastic weed fabric for weed/old turf kill.
4. Requires time, irrigation & fertilizer to accelerate renovation process



“Lights Out” for sport turf renovations



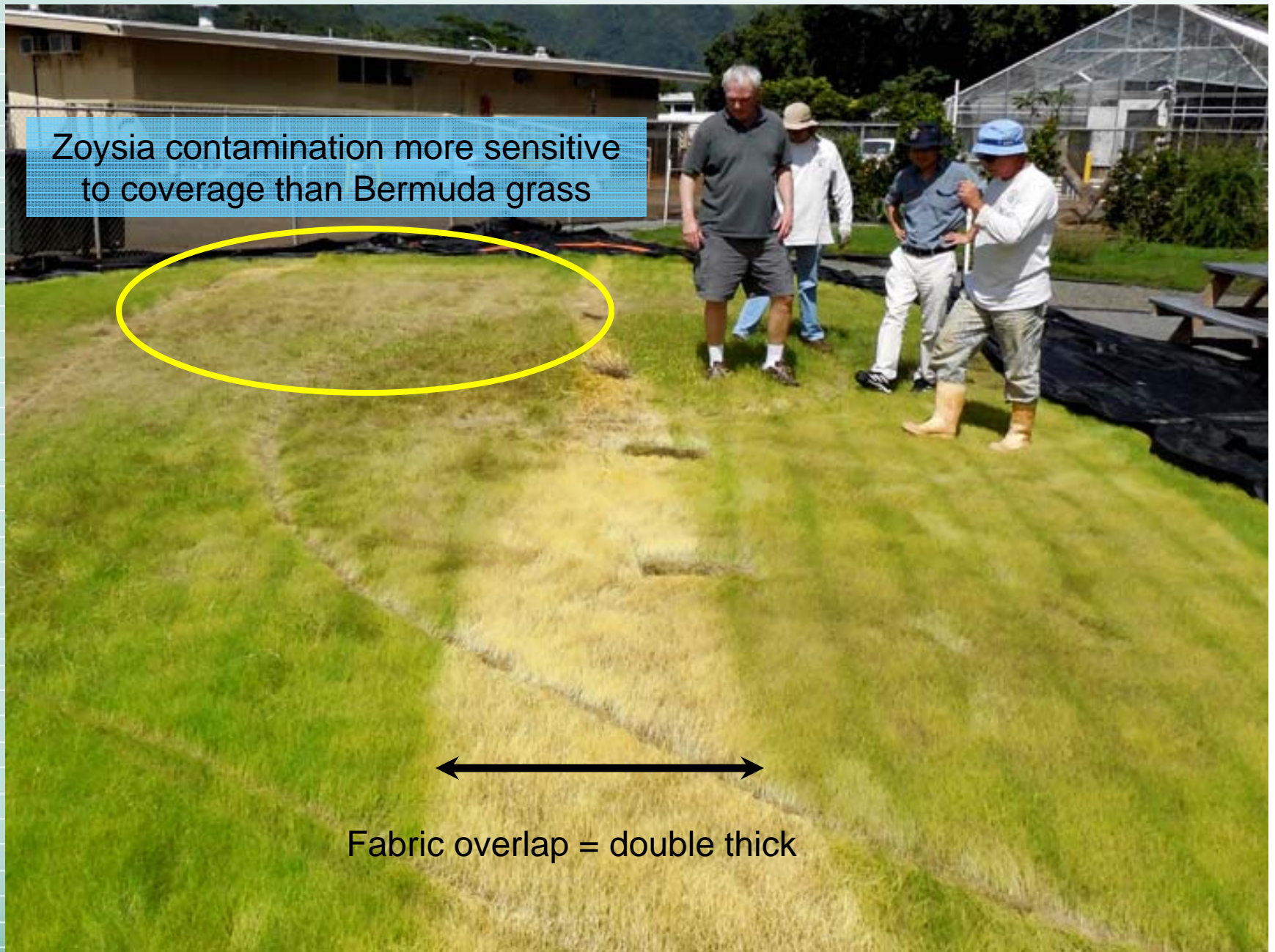
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Bermuda turf covered for 28 days



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Zoysia contamination more sensitive
to coverage than Bermuda grass



Fabric overlap = double thick



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Selective weed control is possible with light exclusion
Gr. Kyllinga and Zoysia contamination suppressed
P. nutsedge and Bermuda grass recover and fill the space



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Production of Native Hawaiian Plant Seeds & Installation of Native Dry-Land Plants On Hawaii's Roadside areas



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Statutory justification for the use of native vegetation as roadside vegetation.

The Clean Water Act - cannot discharge polluted runoff to “Waters of the United States”

- Section 402(a) of the CWA provides for a system of permitting known as the National Pollution Discharge Elimination System.
- Authorized states may issue permits that allow the discharge of any pollutant directly into navigable waters of the U.S
- The term pollutant includes: solid waste, sewage, garbage, rock, and industrial, municipal, and agricultural waste.
- HI DOH has been authorized by the EPA to administer the NPDES program for the state of Hawaii pursuant to Section 402(b) of the CWA



The NPDES permits issued to HDOT require the composition and enforcement of a Storm Water Management Plan

Oahu Storm Water Management Program Plan



State of Hawaii Department of Transportation
Highways Division



PROTECT
OUR
WATER
MĀLAMA I KA WAI
OFFICE OF WATER RESOURCES
March 2007



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Oahu Storm Water Management Program Plan



State of Hawaii Department of Transportation
Highways Division



SWMP has BMP's for
chemical application to roadways

CHAPTER 9 Pollution Prevention and Good Housekeeping 9-1

| | |
|------------------------------------------------------|------|
| 9.1 Debris Control BMP Program..... | 9-1 |
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| 9.1.1.1 Street Sweeping | 9-2 |
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Native vegetation as roadside ground covers
= compliance to SWMP

9.2.3 Non-Chemical Solutions

In order to develop sustainable and durable landscapes with an Hawaiian sense of place, HDOT Highways is developing a Statewide Sustainable Landscape Master Plan, which is scheduled to be completed by the end of 2009. The objective of the plan is to develop a list of plants that can be used in highway landscaped areas that have a lifespan of 15-plus years, are durable, and where their natural form is preferred. These plants would require little or no maintenance (e.g., little or no application of fertilizers and herbicides), no irrigation, are cost effective, and reflect Hawaii's sense of place. **Native species meeting these criteria** will be prioritized in the list, which will be categorized by annual rainfall and typical locations. Once completed, the plan will be distributed to HWY-OM and HDOT Highways design managers, and be made available to landscape architects working on HDOT Highways projects.

DOT-Funded Projects 2013-2016

Project Objectives

1. Develop establishment and maintenance protocol for plantings of Native HI plants on roadside areas.
2. Describe seed harvest index and seed cleaning protocols for 4 grass and 5 broadleaf species.
3. Install 8,000 ft² plantings of 5 broadleaf native HI plants for roadside seed producing at Halawa.
4. Install roadside demonstration planting to simulate native dry land ecosystem on roadside area



Install roadside demonstration plantings to simulate native dry land ecosystem on roadside areas. - Molokai Land Trust Exclusion Area



Recommendations for all DOT contracts
For large scale establishment on roadways

1. Protocol for dryland ecosystem installation starts with weed eradication period, then 4 phase approach
2. **Phase 1:** drop seed on drip line and cap
3. **Phase 2:** fertilize and mow develops plant structure for seed production
4. **Phase 3:** seed laden mulch to populate between row space
5. **Phase 4:** Into clean stand of Pili grass, plant native broadleaf plants into heavy mulch.



Irrigation to grow weeds and then apply herbicides for kill of perennials, 6-9 months



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Weed free site ready for foundation species = Pili grass



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Phase 1: drop seed on drip line and cap



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Phase 1: drop seed on drip line and cap

1/2 lbs./100 linear ft – at least 2 live seed per linear foot



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Phase 1: drop seed on drip line and cap



Phase 1: drop seed on drip line and cap – Pili grass seedling 2-wks



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Phase 1: drop seed on drip line and cap

Use hydro mulch applicator to apply pre-herbicide to between row space
Apply Ronstar 50 WP 2.5 lbs./a



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Phase 1: drop seed on drip line and cap



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Phase 1: drop seed on drip line and cap
Broadleaf weeds removed with selective herbicides



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Phase 2: fertilize and mow grass. Adds mulch and conditions plants for heavy seed production.



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Phase 3: seed laden mulch to populate between row space.



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Phase 4: broadleaf natives planted into Pili mulch = simulated dryland ecosystem.



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Phase 4: broadleaf natives planted into Pili mulch = simulated dryland ecosystem.



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For more information on topics covered

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