Upland Taro Production

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In the Beginning …

Taro originated in the Indo-Malaysian Peninsula over 50,000 years ago. Domestication in the Western Pacific occurred independently in many areas prior to Polynesian arrival. Grown in Hawaii for 2000 years, many cultivars are based on mutations. All Hawaiian cultivars can be narrowed to 4-5 original introductions, based on genetic mapping.

Growing Systems

- Wetland (lo'i) – a water pass-through system where corms are submerged. Slower maturing.
- Upland (mala) – a planting system that's usually rain-fed and utilizes soil and mulch as growing media. Usually faster maturing.

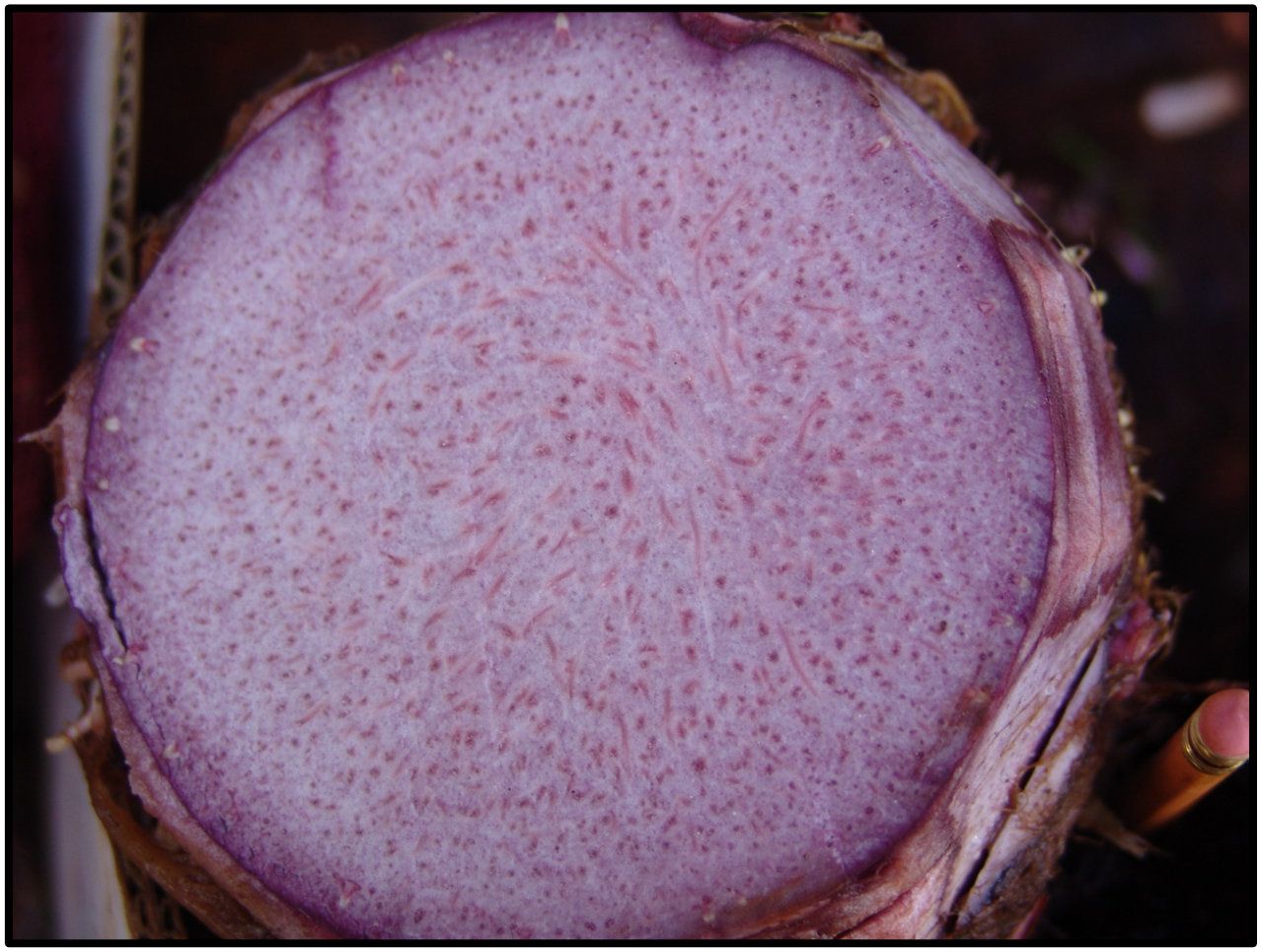
Mala System - Ho’olehua, Molokai

Mala System with Banana Windbreak

Hawaiian Taro Cultivars

It's estimated that about 90-100 Hawaiian cultivars are left of the 200+ cultivars selected by them. Many cultivars have been lost due to changing eating habits. After end of Kapu System, demand moved to ali'i taro; purple or Lehua types. There are much more white and off-white cultivars than purple ones. Purple color is recessive. (only 7% purple in white cross)

Market Wants Purple Corms



Propagation

Taro is propagated vegetatively. There is a need to preserve ALL of the varieties for future generations, and the only way is through continuous planting or sharing with others have access to huli or planting material

Keiki = Banana Seed

Technical term for banana planting material is a keiki. Similar to huli.

Huli = Taro Seed

Identification Based On:

- General characters – height, maturity, unique characteristics
- Leaf blade, shape, & orientation
- Piko color
- Petiole and leaf edge (lihi) color
- Apex (kohina) color
- Corm fiber and skin color
- Inflorescence

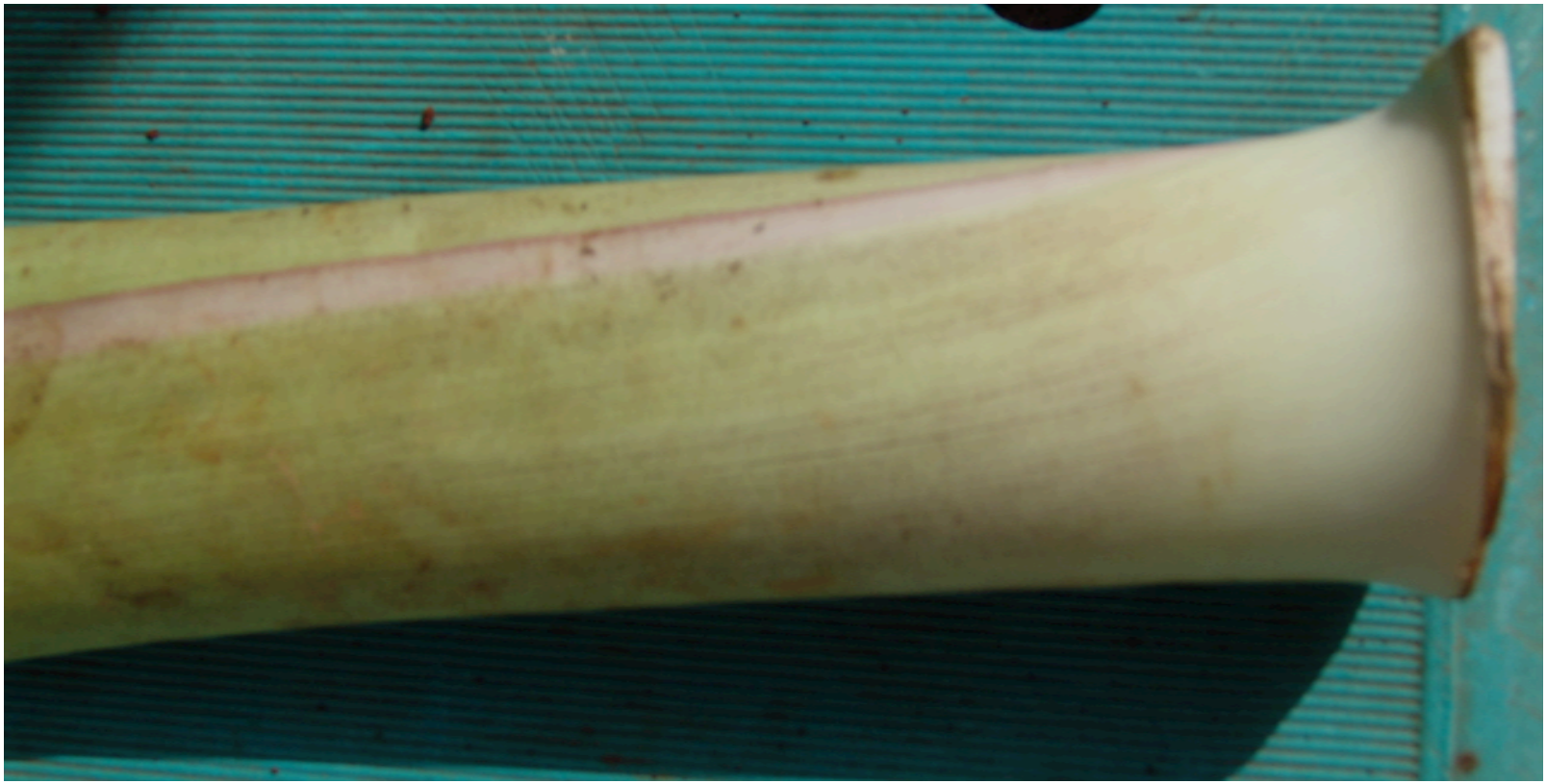
Leaf Shape – one of the characteristics used to identify a cultivar

Taro Families

- Mana (branching corms) – upland, drought tolerant, rubbery consistency, table or kulolo
- Piko (unique leaf shape) – late maturing, can be stored, once very popular
- Lauloa (large leaf) – upland, drought-tolerant, large corms, non-acrid, table or kulolo
- Lehua (reddish poi) – early maturing, dual-purpose, main poi variety, cannot be stored

Mana ulu - Mana leaf can be identified as long & skinny with upright habit and V connected to the piko. Corms also will branch (mana).

Mana ke’o ke’o – leaf edge (lihi) pinkish with white base. Light stripes.



Mana ke’oke’o - Buds (makamaka) in pairs on corm with pinkish stripes.

Leaf Margin (Lihi) - Ele ele naioea broad greenish margins, purple kohina (ring) at base. Lilac-pink near kohina for 3-4 cm upward.

Lauloa – Drought-Tolerant

Lauloa eleele ula

Eleele makoko

Preserving Huli

The key to preserving planting material is to prepare a new planting area before you harvest. This is critical. Another way is to grow huli for planting material.

Growing Huli (Center)

Uniform Huli

Sort huli by size. When using drip irrigation for home use, plant smallest huli closest to water source then plant next largest and so on. Harvest largest from end of line, then tie up line to irrigate the remainder.

Planting Material

Only two ways to have planting material available year-round:

1. *Grow Your Own – Always set aside a few rows for planting material.*
2. *Develop a network of growers who share planting material.*

Planting

Wetland Poi Varieties

- **Maui Lehua** – purple poi, early maturing, poor storage in field due to rot. (Hanalei)
- **Moi** – excellent taste, can be stored in field, whitish poi, medium maturity. (Maui, Oahu)
- **Piko uaua** – grey poi, can be stored in field, dense corms, late maturity. (Waipio)
- **Api'i** – dense, grey poi (Waipio)

Moi Varieties

Maui Lehua = Lehua maoli hybrid

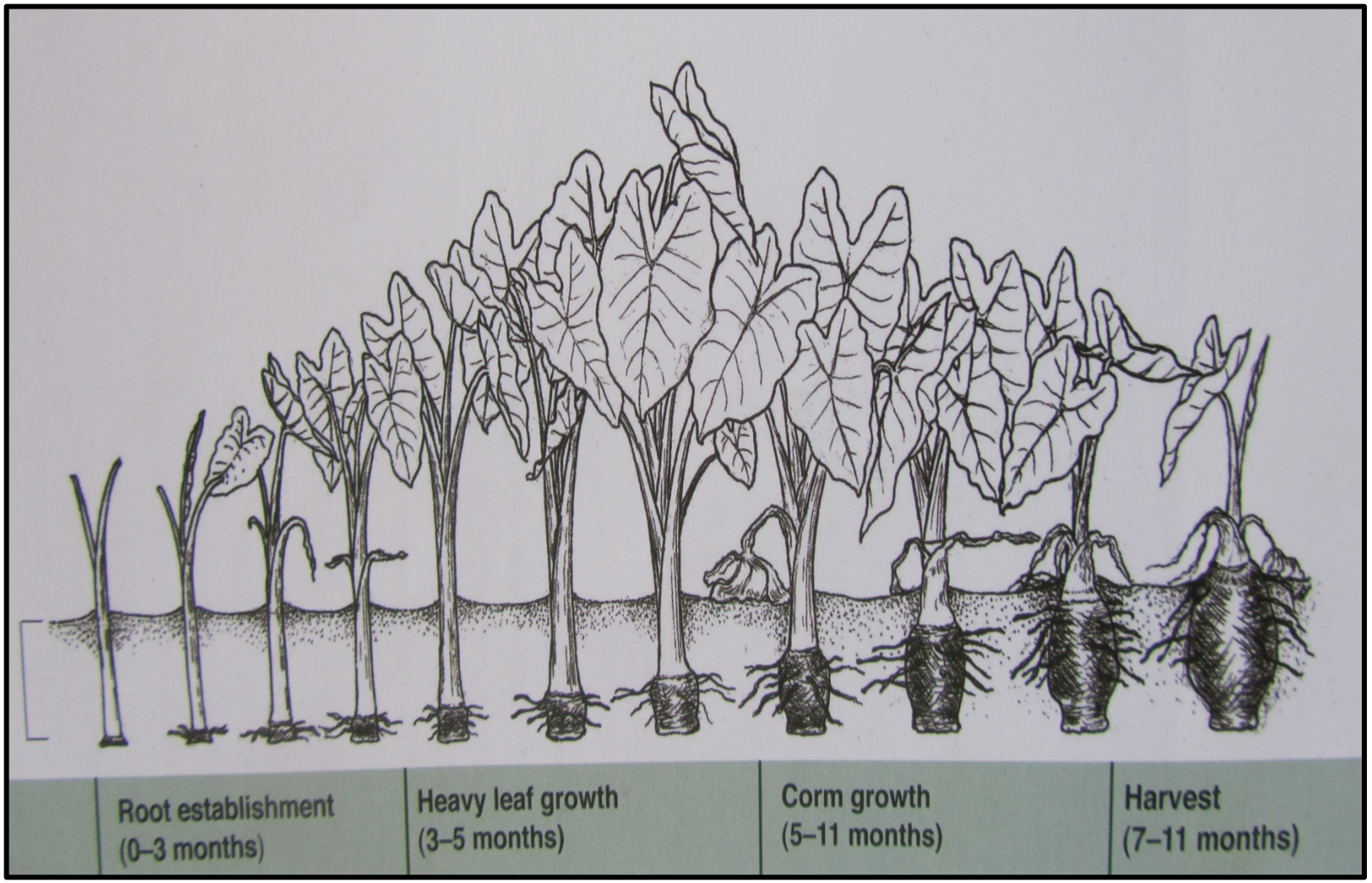
What Cultivars to Grow

Depends on:

- Growing conditions
- Use – poi, table, kululo, or leaf
- Luau – Bun long preferred, but any works
- Home use – any variety can fit
- Early and late varieties – can have taro over a longer period of time.
- Availability of planting material

Luau = leaf

Taro Cycle - Upland



Growth Cycle

Example – Mana ulu: 8 month cycle

- Month 1: Plant huli – weed control
- Month 2-5: Active vegetative growth - plant can grow to 6+ feet
- Month 6-8: Active corm growth - height decreases; swelling of corm.
- Harvest: Month 8 – height 2-3’

Mana ulu at Harvest

Pa’akala = Ngeruuch (Palau) X Maui Lehua @ 12 mos.

Determination of Harvest Time

- Plants will reach its maximum height in 6-7 months for those maturing in 12 months. For 8-9 month varieties, its about 4-5 months.
- Plants will start to drop in height and the base of corm (kohina) will start to constrict or close, forming a dome. Huli will be the diameter of a silver dollar where it attaches to the corm.
- Can be harvested earlier to allow for time to harvest large fields.

Months to Harvest - Upland

• Mana ulu, Lehua ele ele	7-8 months
• Pi'i ali'i, Ele ele makoko	8-12 months
• Maui lehua,	9+ months
• Lauloa varieties	9-12 months
• Moi, Mana varieties	10-12 months
• Piko varieties	12+ months

This is approximate. Factors include season of planting, windward/leeward, elevation, etc.

Height Determines Yield

What Can Go Wrong?

Leaf Blight, Irrigation Clogging, Weeds, Nematodes, No Seed, Mealy Bugs, Ants, Mites, Slugs, Corm Rot, Storms, Injury, Sickness, Loss of Labor, Water Shortage, New Disease, Wrong Variety, Injury, New Insect, Marketing Problems, Equipment Breakdown, Contamination

Rain + Cold = Leaf Blight

Phytophthora colocasiae

Pros and Cons of Taro Hybrids

- Key to developing genetic resistance, especially leaf blight (Phytophthora)
- Hybrid vigor resulting in higher yields
- Possible loss in poi quality
- May gain one resistance and lose another
- Genetics not well understood in taro. Not straightforward; unique

Moi X Palau : Piko ulaula : Pauakea

Hybrid 99-4

Selecting Cultivars

- Lehua– maoli, Maui, palai'i, ke'oke'o, 'ele'ele
- Mana – ulu, ke'oke'o, lauloa
- Lauloa – ke'oke'o, 'ele'ele ula,
- Piko – kea, ke'oke'o, ulaula, uaua,
- Eleele – naioea, makoko
- Other – Moi, Bun long,
- New UH Hybrids – 99-6, 99-7, 99-9, Pa'akala, MP6, 99-33, 2000-141

Mala Weed Control

Your Biggest Challenge!!!

Strategies

- Mulches – natural and inorganic
- Sterile Seed Bed
- Tillage to decrease weed load
- Timing of planting

Furrow & Hand-Weeding

Weed Control:
Plastic Mulch & Cultivating

Pest Control

- *The key to pest control is to grow a healthy plant.*
- *Understand pest biology and natural controls, as well as environmental conditions conducive and detrimental to certain pests.*
- *Identify at least a few control strategies for each.*

Aphids

Mealy Bugs

Aphids & Mealy Bugs

- For Aphids, watch Nitrogen status. High N will attract them.
- Fatty soaps, including Safers and Impede
- Mix with Diatomaceous Earth for added punch
- Control Ants – need attractant + killer. Two types of ants, sugar and protein lovers. Boron is a good killer. Attractant for protein lovers is peanut butter, sugar for sugar lovers

Snails & Slugs

Snails and Slugs

- Can be major problem on upland taro. Collect at first rain, like the one that just passed a few weeks ago. Pound nail into tip of old tool handle, and sharpen. Copper is toxic to both; pennies made before 1982 are useful. Iron Phosphide - organic

Root-Knot Nematodes

Pest Stress

- Root-Knot Nematode – control strategies include fallow, sunn hemp green manure, crop rotation, increase organic matter.
- Mites – good air circulation, wider spacing, resistant varieties, overhead irrigation
- Rose beetle – picking at night, neem/DE
- Mice/Rats – baiting, plant spacing, thick drip

Windbreaks

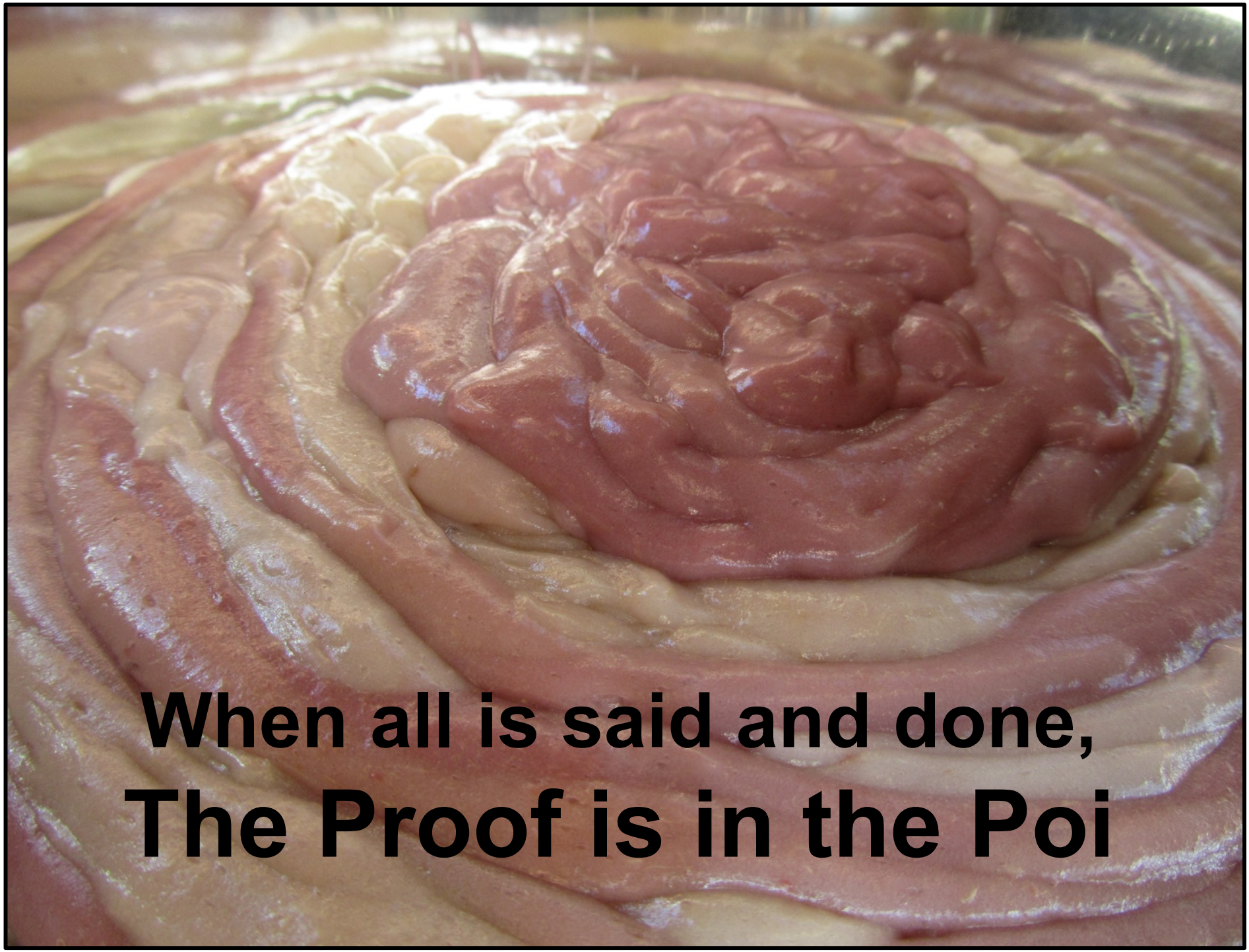
Windbreaks are critical to the protection of upland taro, especially in windy areas such as Kohala, Ho'olehua, Kahului, and many areas of the state. Temporary windbreaks such as sorghum-sudan hybrid grass are fast growing, planted by seed, and will protect taro for a year or more.

Sorghum-Sudan Grass Windbreak

Sorghum-Sudan Windbreak

Sow 2 months prior to planting huli. Use hand seed planter with radish seed plate. Can be cut and re-grown (ratoon). Can be used for animal feed or to build soil organic matter. Nematode-resistant

Post-Harvest


When all is said and done,
The Proof is in the Poi