Introduction

Perennial peanut can be grown with fruit trees to create a “living mulch” that is thought to improve soil quality, reduce grower reliance on synthetic inputs and improve the overall sustainability of tropical fruit orchards. There are two species of perennial peanut used for living mulch: *Arachis pintoi* and *A. glabrata*. *A. Pintoi* is used most commonly in Hawai‘i. Some growers and homeowners have been using perennial peanut for years as living mulch, and their positive experiences have resulted in many others being interested in doing the same thing. However, we know little about the contribution of perennial peanut to soil physical, chemical and biological quality. Also, we have little knowledge of how perennial peanut influences the growth and development of newly planted fruit trees during the critical period of initial establishment in the first year. This project was conducted by the University of Hawaii, Manoa in collaboration with Poamoho Produce and Frankie’s Nursery with funding from Hawaii Farm Bureau Federation and HDOA to address these gaps in our understanding.

Planting

In Hawai‘i, perennial peanut is propagated primarily by cuttings. Recommended spacing for cuttings is 1’ x 1’, although spacing is frequently increased to 1’ x 3’ because of the labor involved with preparing and planting cuttings. To ensure rapid establishment, cuttings should be approximately 6” long from older stolons with several nodes and at least one prominent bud or sprout. Most of the leaves should be removed from the cuttings and at least ¾ of the cutting should be buried in the ground. Stolons may also be pre-rooted in pots to improve establishment in the field, although this increases expenses.

Seed may be preferable to cuttings because it requires less preparation time and generally establishes more quickly. On O‘ahu, perennial peanut seed costs ~$13.00/lb. Recommended seeding rates are 20-40 pounds per acre. Seed may be broadcast and incorporated, or directly drilled into the soil.

At the UH experiment stations, stolons were planted in rows 3’ apart, with 9” between stolons within rows (approximately 14,500 stolons per acre). Seed was drilled in rows either 1’ or 3’ apart (high and low density, respectively) with 9” within row spacing. Seeding rates were 54 lbs/acre (high density) and 18 pounds per acre (low density).

Fertilization & Inoculation

Perennial peanut is a legume that fixes nitrogen through a symbiotic relationship with cowpea-type rhizobia. In greenhouse experiments, cuttings and seedlings nodulated well in Waimanalo and Poamoho soil without inoculation. In these trials inoculation did not substantially enhance plant growth, suggesting that the symbiotic bacteria are present in these soils.
At the UH experiment stations, perennial peanut was not fertilized or inoculated with rhizobia. The three fruit tree species (Mountain Apple, Guava and Chico) were fertilized with 2lbs of bone/blood meal incorporated in the hole at planting and top dressed with 2 ½ lbs compost approximately 3 months after transplanting.

**Irrigation**

Perennial peanut might establish adequately from seed without irrigation during the rainy season. However, irrigation will help ensure rapid establishment of perennial peanut, and is especially critical if cuttings are being used. After establishment, perennial peanut does not require irrigation and will persist through periods of little rain, although it will lose most of its leaves. New leaves will develop rapidly when rains return.

Perennial peanut was irrigated with micro-sprinklers three days a week for three hours at the UH Experiment Stations, for a total of 236,500 gallons per acre per month. This comes out to $100/acre per month at the current agricultural water rate of $0.425 per 1,000 gal.

**Growth and establishment**

Growth and development of perennial peanut is more rapid from seed than cuttings. Irrigated with no supplemental fertilizer, perennial peanut seeded at 54 lbs/acre resulted in close to 80-100% cover within 8 months at the UH experiment stations (Figure 1). Establishment was more rapid at Waimanalo than Poamoho.

**Figure 1.** Peanut ground cover over time.

**Weed control**

Weeds must be controlled in establishing perennial peanut plots. The UH experiment station plots were sprayed with Glyphosate (Round-up™) before planting then weeded by hand every 6-8 weeks. Total time for weeding was approximately 26 hours/month.
Soil quality and Tree growth

Living mulches can protect soil from erosion and improve soil quality by increasing moisture retention and increasing soil organic matter. In 3-year-old plots of perennial peanut at Poamoho Produce farm, greater soil moisture (Fig. 3) and higher levels of nitrate in the soil solution (Fig. 4) were observed compared to younger plots with lower canopy densities. Areas with rapidly establishing peanut generally had lower nitrate levels than bare-ground areas, suggesting that establishing peanut may not fix enough Nitrogen to meet plant needs early on. There was no clear relationship between perennial peanut density and total organic carbon in the soil.

At the UH experiment stations, there was no relationship between most soil properties and perennial peanut treatments in the first 8 months of growth. However, tissue tests of leaves from the fruit trees show a clear trend for lower tissue nitrogen in perennial peanut plots compared to trees grown with black weed mat. When establishing perennial peanut in new orchards, young trees should be well fertilized and peanut kept away from the base of trees during establishment.
Varieties
There are several varieties of both species of perennial peanut. The most common in Hawaii, “Golden Glory” (cuttings) and “CIAT-17434” (seed) were used in the UH Experiment station trials.

Recommendations
To maximize the benefits of perennial peanut as a living mulch in orchards, we recommend the following:

1. Use seed at 40-50 lbs/acre or cuttings spaced at 1’ x 1’ for most rapid establishment.
2. If using cuttings, prepare them well and irrigate thoroughly until establishment.
3. Light nitrogen fertilization (50 lbs N/acre) may improve peanut establishment.
4. To avoid competition:
   a. Make sure trees are well fertilized during peanut establishment (at least one year).
   b. Avoiding planting peanut directly adjacent to newly planted trees.
5. Use appropriate herbicides to control weeds during canopy closure. **If growing organically, it is especially important that peanut be planted densely** to complete cover as quickly as possible. After canopy has closed, close mowing may be used to control most weeds.
6. Benefits of perennial peanut living mulches are long term. Do not expect significant contributions to soil quality or fruit tree growth in the first year or two of peanut establishment.

Figure 5. Tissue nitrogen (% N) in the fifth most recently matured leaf of guava and chico (sapodilla) fruit trees. Bars with the same letters within each group are not statistically different from each other.
PERENNIAL PEANUT TREATMENT COMPARISON (EXPERIMENT STATION TRIALS)
Quick Reference Guide. All estimates on a per acre basis.

<table>
<thead>
<tr>
<th></th>
<th>Weed Mat (no peanut)</th>
<th>High Seed rate</th>
<th>Low Seed Rate</th>
<th>Cuttings (Stolons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planting Material</td>
<td>N/A</td>
<td>54 lbs/acre</td>
<td>18 lbs/acre</td>
<td>121 lbs/acre</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$702</td>
<td>$234</td>
<td>(14,500 cuttings) @ $6/lb $726/acre</td>
</tr>
<tr>
<td>Estimated Peanut Establishment Cost for first year</td>
<td>$2,592</td>
<td>$5,234</td>
<td>$4,766</td>
<td>$4,758</td>
</tr>
</tbody>
</table>
**Project principals:**
Ted Radovich (Principal Investigator)
Becky Mitschele (Graduate Student)
Jari Sugano (Principal Investigator)
Al Santoro (Farmer cooperator)
Frank Sekiya and Lynn Tsuruda (Farmer cooperators)

**Supporting personnel:**
Roger Corrales (Waimanalo farm manager) and Waimanalo crew
Susan Migita (Poamoho farm manager) and Poamoho crew and retirees
Ted Goo (Technical Support)
Gabriel Ortega (Technical support)
Brooke Moreno and Christina Theocharis (Student help)

**Supporting Agencies and Organizations:**

---

**Project Sources**
- Frankie’s Nursery (Golden glory plants, fruit trees) 808-259-8737.
- Hawaiian Earth Products (Compost) 808-682-5895.
- Island Commodities (Bone/Blood meal) 808-682-5844.
- Koolau Seed Supply (CIAT-17434 seed and inoculum) 808-239-1280.
- Plant-it Hawaii (Fruit trees) 808-966-6633.
- Poamoho Produce (Golden glory cuttings) 808-637-4555
- Wisdom Irrigation (Mat and irrigation) 808-839-0006.

**For more information, contact:**
Ted Radovich
3190 Maile way, rm. 102
Honolulu HI 96822
808-956-7909
Theodore@hawaii.edu