COVER CROP PLANNING TOOL

Step 1. Which cover crop should I plant? [What are your goals?]

Step 1: Decide what you are hoping to achieve from planting a cover crop using Table 1 as a start. *Reference the charts from Dr. Radovich and Dr. Wang from today's workshop

Table 1: Goals for cover crop:

- ☐ **Increase organic matter** - choose varieties with large above/below ground biomass
- ☐ **Carbon source** - terminate when woody
- ☐ **Nitrogen source** - (terminate & work into soil when green, also consider perennial ground covers and green mulch)
- ☐ **Outcompete weeds**
- ☐ **Biofumigation**
- ☐ **Reduce compaction**
- ☐ **Increase biological diversity & habitat**
- ☐ **Retain soil moisture & reduce soil temp**
- ☐ **Increase soil aggregates** - (most varieties have a relationship with mycorrhizal fungi which produce 'soil glues' such as Glomalin)
- ☐ **In-field windbreak**
- ☐ **Attract beneficials**
- ☐ **Short rotation**
- ☐ **Long rotation**
- ☐ I need a **drought-tolerant variety**
- ☐ I need a **salt-tolerant variety**
- ☐ I need a **variety that can tolerate shade/low-light**
- ☐ I need a **variety that won't climb my tree crop**

☐ **Other:** _____

☐ **Other:** _____

☐ **Other:** _____

Step 2. Where and when do I plant it? [What's your Timing & Rotation?]

Fallow fields

- **Step 2.1 Identify on your farm map which fallow fields you will be bringing into production.**

- **Step 2.2 How long can your fallow land be in cover crop and how soon do you want to bring the fallow fields into production?**
  - ☐ I need a 'place-holder' for fallow land that I don't have time to get to and want a cover crop that can stay in the ground for over a year.
  - ☐ I need to bring this fallow land into production in the next 6 months
  - ☐ I need to bring this fallow land into production in the next 3 months

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Production fields

- **Step 2.3 Identify on your farm map which production fields will be harvested soon and can be planted with cover crops?**

- **Step 2.4 How long can you have your field in cover crop and how soon do you need to rotate it with a cash crop?**
  - ☐ I can leave a field in cover crop for over a year
  - ☐ I can leave a field in cover crop for 6 months
  - ☐ I can leave a field in cover crop for 3 months
  - ☐ I can only leave a field in cover crop for 1.5 months

- **Step 2.5 Determine which cash and cover crops to rotate using Table 2 and Table 3**

Table 2: **What crops preceded the cover crop planting, and which ones will follow? What do I put in there next?"**

Cash Crop	Cover Crop
☐ Legume	☐ Legume
☐ Root	☐ Non-legume broadleaf
☐ Greens	☐ Grass
☐ Brassicas	☐ Brassicas
☐ Shrub/Tree	☐ Other:

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Table 3: Develop a Crop Rotation Plan (use with your farm map)				
	Planting	**Field 1**	**Field 2**	**Fallow Field**
Yr1	Fall	Spinach	Brassica- cover	Sudan grass- cover
	Winter		Cucurbits	
	Spring		Tomatoes or Peppers	
	Summer	Beans		
Yr2	Fall		Winter Squash	Terminate with silage tarp, molasses & biological inoculant
	Winter	Oats- cover	Spinach	
	Spring	Okra-Flowers-Basil		Compost
	Summer		Compost	Tomatoes or Peppers
Yr3	Fall	Brassicas -cash	Direct-Seeded Quick Crops / Small-Seeded Greens / Radishes	
	Winter	Legume- cover	Cucurbits	Spinach
	Spring	Direct-Seeded Quick Crops / Small-Seeded Greens / Radishes	Tomatoes or Peppers	
	Summer	Beans		Okra-Flowers-Basil

Step 2.6 (Seasonality) Determine what time of year would irrigation be required to install cover crops:

- ☐ I'm in a dry climate where I need to irrigate year-round
- ☐ I'm in a wet climate where I never need to irrigate
- ☐ I'm in a climate where I only need to irrigate in the hot summer months
- ☐ I can use other sources of water and won't need to pay for irrigation (e.g. flooding loi fields prior to seeding cover crop)
- ☐ Other:

_____

_____

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Step 2.7 Determine how the residue from the previous crop or the cover crop will affect prepping new growing areas and how much time is needed between terminating your cover crop and planting your cash crop?

- ☐ Decomposition will be slow since the cover crop will be woody and will need to be chipped and worked into the soil. After tilling, field won't be ready to seed for over a month or will need to be seeded with a no-till drill.
- ☑ ~~Decomposition will be slow since the cover crop has such a large biomass and will need to be mowed or terminated with a roller crimper or silage tarp and worked into the soil. After tilling, field won't be ready to seed for over a month or will need to be seeded with a no-till drill.~~
- ☐ Decomposition will be fast and can be terminated on it's own. Field can be tilled and seeded within a week.

Step 3. What equipment & supplies will I need? How much will it costs? *[We'll learn how to estimate costs & develop a budget at our virtual cohort session on 11/7]*

Step 3.1: Determine what type of equipment and supplies you'll need. What's available to you for planting and termination tools and equipment will have a bearing on which cover crops you can use. Equipment recommendations will depend on the cropping system you've elected.

Table 4: Identify what equipment & supplies you'll need (select those that apply to you below):	
Establishment/Planting	**Termination/Incorporation into Soil**
☐ Broadcast seeder	☐ Weed wacker
☐ No-Till Drill	☐ Mower (flail mower or other)
☐ Irrigation	☐ Chipper
☐ Bird & other pest guards	☐ Roller-crimper
☐ Other:	☐ Plow for strip-tillage system
☐ Other:	☐ Silage tarp

Step 3.2 Calculate your seeding rates using the checklist and Table 5 below.
To ensure good coverage, start by using a higher seeding rate and reducing it slightly after every planting. Low germination due to seed quality or seedbed preparation, uneven irrigation and predation by birds are challenges that require a hiring seeding rate to ensure success. Small farms can start with seeding rates that are 120 lb/acre or higher for cocktails. Farms using seed drills can use lower rates, 50 lb/acre.

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Seeding rate based on cocktail mix:

- ☐ 120 lbs/acre
- ☐ 100 lbs/acre
- ☐ 75 lbs/acre
- ☐ 50 lbs/acre

Number of acres to be planted with this cover crop mix:

- ☐ 1/4 acre
- ☐ 1/2 acre
- ☐ 1 acre
- ☐ Other:_____

Table 5: Cost of seed from Koʻolau Seed & Supply (as of 10/24/22)

Type	Cost under 50lb orders	Cost for over 50lb orders
Cow Pea	$4.50/lb for under	$3/lb. for orders over 50lbs+
Oat (white)	$3.50/lb under 50lb	$2.25/lb for over 50lbs+
Sorghum- Sudan (Hybrid)	$4.50 for under 50lb	$3.50/lb for over 50lbs+
Daikon Radish	$5/lb for under 50lb	$5/lb for under 50lb
Mustard	$5.50/lb for under 50lb	$4.75/lb for over 50lbs+
Sunn Hemp	$4.75/lb for under 50lb	$3.50/lb
Sun Flower	$4.25/lb for under 50lb	$2.40/lb for over 50lbs+
Lab Lab	$4.75/lb. for under 50lb	$3.75/lb. for over 50lbs+
Buckwheat	$4.50/lb for under 50lb	$3.15/lb for over

- *Shipping is estimated by Koʻolau Seed as $37 per 50lb. Minimum for Young Brothers is $100 minimum if over 3 50lb bags. Post office is cheaper for under 3 bags.*

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Step 5. Plant & Keep Records

Once you have taken all of the above into consideration, chosen your cover crop species, and entered your choices into your multiyear rotation plan from Step 2, you're ready to put the plan in place.

- Schedule your planting date & coordinate labor and equipment. (*Consider watching for consistent rain events to reduce the need for establishing with irrigation).*
- Setup a system to record seeding rates, seed sources, weather, field conditions, and general observations.
- Trial, record and adapt your cover crop planting & rotations
- Use the Hawaii Cover Crop Calculator [1]for determining biomass and nitrogen contributions from cover crops. Also refer to the Hawaii Cover Crop Handbook[2]. Reference Table 6 as an example.

[1] https://gms.ctahr.hawaii.edu/gs/handler/getmedia.ashx?moid=2318&dt=3&g=12
[2] https://oahurcd.org/covercrops/

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Table 6: 2018 On-Farm Trial Results for Cover Crop Cocktail Mixes[3] demonstrating C:N contributions and Plant Available Nitrogen (PAN)

	Site 1		Site 2		Site 3		Site 4		Site 5	
Seeding Rate (lb/ac)	92	125	92	125	92	128	92	126	92	115
Cover Crop	SH/BW/O[1]	CC[2]	SH/BW/O[1]	CC[3]	SH/BW/O[1]	CC[4]	SH/BW/O[1]	CC[5]	SH/BW/O[1]	CC[6]
Dry Matter (lb / ac)	3,045	4,636	2,462	2,140	4,621	4,146	2,869	3,874	–	–
C:N	16	13	12	12	21	13	17	13	–	–
PAN (lb/ac)	28	51	34	33	64	101	33	60	–	–
Seed Cost ($/ac)	$205	$328	$333	$458	$333	$558	$205	$451	$205	$326
Fertilizer Savings ($/ac)	$9	$17	$11	$11	$21	$33	$11	$20	–	–

[3] 1 SH/BW/O: Sunn Hump, Buckwheat and Oats; objective: good general performance in a wide variety of conditions to generate biomass, fix nitrogen and suppress weeds.
2 Site 1 Custom Cocktail (CC): Sunn hemp, black oats, lablab, sorghum-sudan, pearl millet and graza radish; farm objective: reduce soil compaction, improve soil texture and suppress weeds.
3 Site 2 Custom Cocktail (CC): Buckwheat, lablab, alfalfa, sunn hemp; farm objective: weed suppression, increase soil organic matter, fast break-down of crop residue, and attract beneficial insects.
4 Site 3 Custom Cocktail (CC): Sunn hemp, black oats, lablab, sorghum-sudan, tillage radish, cow pea; farm objective: contribute nitrogen and organic matter to soil.
5 Site 4 Custom Cocktail (CC): Sunn hemp, lablab, sorghum-sudan pearl millet, graza radish; objective: weed suppression, organic matter, transition to perennial cover for orchard crop.
6 Site 5 Custom Cocktail (CC): Sorghum-sudan, buckwheat with a small amounts of basil and cilantro; objective: add organic matter and have a flexible termination date with the option to mow and let cover crop regrow to prolong cover.

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Case Study: Hui Makaʻāinana o Makana

Location for cover crop design:
Please reference the farm map for current location to be seeded in cover crop over the winter and to plan for a seasonal cash/cover- crop location around the months of Nov-March (roughly 6 months).

Loi 1) 30 ft x 33 ft = 990 sq ft.
Loi 2) 50 ft x 25 ft = 1000 sq ft.
Loi 3) 60 ft x 60 ft = 3600 sq ft.
Total area of the three loi = **5,590 sq ft. = .12 acres (roughly 15% of a acre)**

Farm management challenges & considerations in variety selection:
November through early March the farm is in a shadow of the mountains with no direct sunlight. They may only see 2 -3 hours of direct sun. High salinity is also an issue due to their location. This makes it challenging to till and prepare lo'i for planting taro cover crops or other crops in the winter. Therefore the farm would like to select a cover crop variety that can rest fields in the winter and build soil health. They need to develop a timeline to plant taro and other crops before the rainy/short season.

Table 7: Case Study Selection of Cover Crop Variety based on Management Challenge

Varieties to consider to manage nematode pressure	**Management Challenge**
Cow pea, sunflowers, cereal cover crop, some buckwheat.	These varieties can tolerate high salinity
Cowpea is a very good host of reniform nematodes, some varieties are resistant to some species of root knot but there are many species of root knot nematodes in Hawaii.	Conduct a soil test to identify the type of nematode pests.
Some **sunflower** varieties might be resistant to specific types of rootknot nematodes.	Sunflower also don't grow well in the winter, they are short day plant. Conduct a soil test to identify the type of nematode pests.
Buckwheat- varieties sold at Koʻolau is resistant to root-knot nematodes.	Find out which Buckwheat varieties are salt tolerant.
Black oat is a good host for southern root-knot nematodes.	Conduct a soil test to identify if Southern root-knot nematodes are present in the soil.

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Among the cereal cover crop, **sorghum** is very suppressive to root-knot.	Sorghum can only grow well between April to Oct. Consider growing sorghum during these months and using a soil amendment to address nematodes. (Other varieties of cereal cover crop grow well in winter, but they don't have allelopathic compound against plant nematodes).
Marigold	Tolerate salinity moderately, but they are also day light sensitive.

Table 8: Case Study Annual Cover Crop Cost Estimate for for 5,590 sq. ft. area (3 loi rotation)			
Irrigation	Flood & drain field prep loi to seed cover crop. After draining, trench the soil and seed.		
Labor	Conservative estimate: Per individual loi is that takes about 4 hours to Prep and Broadcast: (Estimated costs: 4 hours x $20= $80 to broadcast). Maintain: 1.5 hours to mow (45 minutes to mow around the 45 day period and 45 more minutes to cut down the entire cover crop to terminate). 1.5 hours to mow x $20= $30 x 6 times mowing = $180. Terminate: 1 hr to till in crop residues = $20 (plus cost to operate machinery/equipment). **Total labor: $280**		
Variety	Seed costs (based on seeding 120lbs/ac.)	Amount	Total costs
Oat (white)-Select for Nov-March	$3.50/lb under 50lb $2.25/lb for over 50lbs+	15 lbs (will cover all three loi which are 5,590 sqft/.128 an acre.	$3.50x15= $52.50 (plus shipping) $2.25 x 50lb = **$112.50 for 50lb (plus $37 shipping via USPS)= $149.50**
Sorghum-Sudan - select for April to Oct.	$4.50/lb for under 50lb $3.50/bl for over 50lb	15 lbs (will cover all three loi which are 5,590 sqft/.128 an acre.	$4.50 x 15 = $67.50 (plus shipping) $3.50 x 15 = $175 for 50lb (**plus $37 shipping via USPS)= $212**
Total estimated annual cost of cover (without irrigation) for a 5,590 sq. ft area: $280 x 2 = $560, $149.50, $212= **$921.50**			

*Consider using cover crops that can 'rest' the fields and build soil health from November -March when it is hard to work the land or grow crops. For shorter rotations of cover crops during the Summer and Fall, choose varieties that will grow fast and can be terminated within 1.5 to 3 months so that the loi can be periodically flooded and drained. Grow salt tolerant cover

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crops that are suitable for the high-rain and low sunlight from Nov-March. Consider doing a cost-benefit assessment on controlling nematodes using a soil amendment verses a cover crop.

Decisions to discuss as a group at the workshop:

- ☐ Species selection
- ☐ Termination
- ☐ Timing of termination

☐ Small to medium to smallish-large scale size equipment that can help with termination of cover crop.

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