

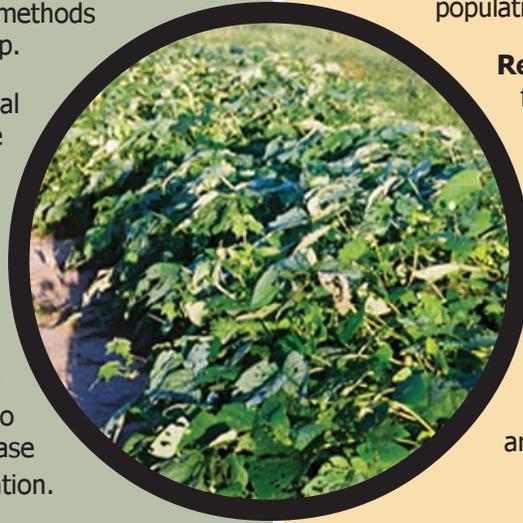


## SOIL AND NUTRIENT MANAGEMENT: Cover Crops

### STEPS TO SUCCESS:

Decide if cover crops fit your production system and select the appropriate cover crops for your farm:

1. Do a cost-benefit analysis (fertility, soil quality, nutrient management, pest management vs. labor, expense, moisture loss).
2. Assess placement in the cropping sequence or rotation, method of establishment, legume or nonlegume, appropriate methods of terminating the cover crop.
3. Select the species and cultural measures that give the desired amount of biomass/fertility/C:N/allelochemical just prior to establishment of the subsequent cash crop.
4. Choose a cover crop that has a strong root system. Cover crops that are allowed to decompose in the field increase soil stability and water retention.



### BENEFITS OF COVER CROPS:

**Improve health of agrosystem:** Cover crops work to increase soil aeration, moderate soil temperature, improve soil structure by adding organic matter and increase water penetration. These improvements help to reduce soil loss due to erosion and tillage.

**Reduce pests and pathogens:** Certain cover crops can suppress insect, nematode and pathogen populations.

**Reduce weed pressure:** Cover crops fill an open niche and protect areas from weed invasion. These crops are called "smother crops" when grown in sequence with cash crops and "living mulches" when grown simultaneously with cash crop.

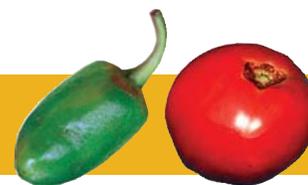
**Cash crop production:** Cover crops may provide an additional income source as many cover crops are utilized as forage and animal feed.

**Figure 1.** Velvetbean as a cover crop. Photograph by: Amanda Collins.

### SELECTING A COVER CROP:

- Select a cover crop appropriate for the season of production.
  - Cool season cover crops for Florida include rye, black oat, hairy vetch and crimson clover.
  - Sorghum-sudan grass, cowpea, velvetbean or sunnhemp are appropriate for use as warm season cover crops.
- Use legumes to provide nitrogen.
- To prevent leaching, use non-legumes as catch crops to scavenge and cycle nitrogen especially in crops with high fertilizer requirement.
- Choose a problem to address when selecting a cover crop:
  - For nematode management, the specific cultivar of the cover crop is important, i.e. 'Iron Clay' cowpea.
  - For biofumigation select *Brassica* cover crops (i.e. white mustard and brown mustard) with high glucosinolate content and ensure maximum tissue disruption during incorporation.

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### COVER CROP SELECTION CHECKLIST:

- |                                   |   |
|-----------------------------------|---|
| <b>Seed cost and availability</b> | <ul style="list-style-type: none"><li>• What is the seed cost and is the seed available in your area?</li></ul>   |
| <b>Growth Habit</b>               | <ul style="list-style-type: none"><li>• What kind of growth habit is needed?</li><li>• When is the growth required, e.g., lots of vigorous late fall growth or rapid early spring growth?</li></ul>                     |
| <b>Overwintering</b>              | <ul style="list-style-type: none"><li>• Does the cover crop need to survive over winter?</li><li>• Would it suit the cropping schedule and soil type if the cover crop winter killed and dried out by spring?</li></ul> |
| <b>Control Options</b>            | <ul style="list-style-type: none"><li>• Will the cover crop become a weed concern?</li><li>• How is it controlled?</li><li>• What options are there for control?</li></ul>  |
| <b>Sensitivity to Herbicides</b>  | <ul style="list-style-type: none"><li>• How sensitive is the cover crop to herbicide residues from other crops in the rotation?</li></ul>   |
| <b>Establishment</b>              | <ul style="list-style-type: none"><li>• What is the best way to plant the seed?</li><li>• What equipment is needed?</li><li>• How easy is it to establish?</li><li>• Will it create a solid cover?</li></ul>            |
| <b>Nutrient Management</b>        | <ul style="list-style-type: none"><li>• Does the cover crop fix nitrogen or does it require nitrogen to grow well?</li><li>• Does it scavenge nitrogen well?</li></ul>  |
| <b>Pest Management</b>            | <ul style="list-style-type: none"><li>• What crop family is the cover crop in?</li><li>• Is it related to other crops in the rotation?</li><li>• Are there pest concerns?</li></ul>                                     |

*Adapted from:* <http://www.omafra.gov.on.ca/english/crops/pub811/2cover.htm#rye>

**Refer to the pg. 36 for the information on the different cover crops.**

### MATCHING PRODUCTION SYSTEM & CROPPING CYCLE:

- Use legumes as a green manure for organic production systems and to decrease the use of mineral fertilizers in sustainable conventional systems.
- Perennial cover crops and hard-seeded cover crops may be appropriate for perennial crops in vineyards, orchards and groves, so that growers do not have to replant annually.
- For organic systems, avoid cover crops that cannot be easily killed by rolling, undercutting or tillage and are otherwise prone to be weedy. Cover crops that are susceptible to pests, pathogens or nematodes that adversely affect the next cash crop in the cropping sequence should also be avoided.



**Figure 2.** Cover crop being used as a green manure. This crop, Sunn hemp, is being rototilled into the soil. Photograph by: UF/IFAS.



### DEFINITIONS:

**C:N Ratio:** Carbon-to-Nitrogen ratio. The C:N ratio of the organic material added to the soil influences the rate of decomposition of organic matter and this results in the release or trapping of soil nitrogen.

**Allelochemicals:** Substances exuded by plants or produced during decomposition of their residues that inhibit the germination and growth of other plants.



**Figure 3.** 'Iron Clay' cowpea cover crop. Photograph by: Amanda Collins.

### AVOIDING PROBLEMS:

- Cover crops may deplete soil moisture in dry climates – plant species that are adapted to dry climates and produce sufficient biomass to be used as mulch.
- Where allelopathic cover crops are used for weed control – avoid phytotoxicity to subsequent cash crops by direct-seeding only large seeded crops or by using transplants, which are usually less sensitive to allelochemicals than seed.
- Non-legume tend to have high **C:N ratios**, which depress available N. (Solve by turning under while still green = lower C:N ratio; plant in mixtures with a legume cover crop).
- Less predictable crop fertilizer requirements – estimate available nitrogen and supplement with a reduced rate of slow release fertilizer as necessary.
- Cover crops have low economic value and tie up land, therefore plant during fallow periods.
- Cover crop residues result in cooler soils and delayed development of subsequent crop:
  - Avoid use where earliness is desirable.
  - Use strip tillage to clear a narrow strip for cash crop establishment.
- Rapid decomposition of some legumes: N leaching – undercut or incorporate just prior to establishment of cash crop.
- Difficulty with residue incorporation with some covercrops – mow during season to ensure stems do not become woody.

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**Table 1.** Description of different cover crops.

Cover Crop	Type	Location-Season	Pro's	Con's
Sudan Grass (Sudax) <i>Sorghum bicolor</i> <i>S. sudanense</i>	grass	Florida – Warm	<ul style="list-style-type: none"> <li>• Drought and heat tolerant</li> <li>• Decreases growth of weeds –smother crop (ragweed, redroot pigweed, purslane and foxtail)</li> <li>• Used as a forage crop</li> <li>• Cultivar SX-17 sorghum-sudangrass suppresses root-knot nematodes (<i>Meloidogyne</i> spp.)</li> <li>• Rapid growth builds up organic matter in soil</li> <li>• Some varieties resistant to downy mildew, anthracnose, maize dwarf mosaic virus, head smut and aphids</li> </ul>	<ul style="list-style-type: none"> <li>• Cold sensitive</li> <li>• Host to lesion nematodes (<i>Pratylenchus penetrans</i>)</li> <li>• Does not suppress other <i>Pratylenchus</i> nematodes</li> <li>• Hydrocyanide is released during frost or plant stress</li> <li>• Sudan grass grows 3-8 ft high and will re-grow after harvest until cool temperature or lack of moisture</li> </ul>
Sunn Hemp <i>Crotalaria juncea</i>	legume	Florida – Warm	<ul style="list-style-type: none"> <li>• Organic nitrogen source (green manure)</li> <li>• Suppresses weeds</li> <li>• Slows soil erosion</li> <li>• Reduces root-knot nematode populations</li> <li>• Enhances nematode natural enemies</li> </ul>	<ul style="list-style-type: none"> <li>• Difficult to obtain seed</li> <li>• High seed cost</li> <li>• Susceptible to frost kill</li> <li>• Nematodes can resurge on subsequent crops</li> <li>• <i>Pythium</i> host</li> </ul>
Pearl Millet <i>Pennisetum glaucum</i>	grass	Florida – Warm	<ul style="list-style-type: none"> <li>• Forage crop used for pasture and hay</li> <li>• Fast growing</li> <li>• Nematode resistant</li> <li>• Tolerant of drought, low fertility, low pH</li> </ul>	<ul style="list-style-type: none"> <li>• Some cultivars should not be grazed by horses</li> </ul>
Hairy Vetch <i>Vicia villosa</i>	legume	North Florida – Cool	<ul style="list-style-type: none"> <li>• Cold tolerant</li> <li>• High nitrogen fixing capability</li> <li>• Moderate shade and drought tolerance</li> </ul>	
Cowpea <i>Vigna unguiculata</i>	legume	Florida – Warm	<ul style="list-style-type: none"> <li>• Provides nitrogen</li> <li>• Moderate drought tolerance</li> <li>• Quick to establish</li> <li>• Grows well in hot weather</li> <li>• Nematode-suppressive cultivars – ‘Iron Clay’</li> </ul>	<ul style="list-style-type: none"> <li>• Low cold and shade tolerance</li> </ul>
Crimson clover <i>Trifolium incarnatum</i>	legume	North Florida – Cool	<ul style="list-style-type: none"> <li>• Cold tolerant</li> <li>• Has nitrogen fixation capability</li> <li>• Moderate drought tolerance</li> <li>• Shade tolerant</li> </ul>	<ul style="list-style-type: none"> <li>• Slow to establish</li> </ul>
Velvetbean <i>Mucuna deeringiana</i>	legume	Florida – Warm	<ul style="list-style-type: none"> <li>• Grows well in sandy and infertile soils</li> <li>• Vining and bush types</li> <li>• Fixes nitrogen</li> <li>• Suppresses root-knot nematode</li> </ul>	<ul style="list-style-type: none"> <li>• Large seed than can be damaged in seed drills</li> <li>• Expensive seed, difficult to obtain</li> </ul>
Rye <i>Secale cereale</i>	grass	Florida – Cool	<ul style="list-style-type: none"> <li>• Moderately cold tolerant</li> <li>• Shade tolerant</li> <li>• Drought tolerant</li> <li>• Forage crop for spring hay</li> <li>• Quick to establish</li> </ul>	<ul style="list-style-type: none"> <li>• Volunteers readily so may become a weed</li> </ul>
Black oat <i>Avena strigosa</i>	grass	Florida – Cool	<ul style="list-style-type: none"> <li>• Allelopathic to weeds</li> <li>• Resistant to root-knot nematode</li> <li>• Can be used as forage</li> <li>• Cycles N more effectively than rye</li> </ul>	<ul style="list-style-type: none"> <li>• Susceptible to <i>Helminthosporium avenae</i></li> <li>• Only 1 cultivar available in the US ‘Soilsaver’</li> </ul>