Outline

- Getting the most benefit out of a cover crop is directly related to the quality of the stand.
- Establishing a good stand is dependent on:
  - seeding date, seeding rate and weather.
- As the cash crop season approaches the cover crop must be killed out in preparation for the cash crop
  - Roller crimp
    » Effectiveness of different covers with roller
  - Herbicide
  - Strip terminate
- Timing of termination is key to successful integration of cover crops into agricultural systems
Planning For Success

- Ensure good seed depth placement and seed-soil contact
  - Ideal depth is usually 2-3x the diameter of the seed
- Adequate soil moisture
- Adequate soil temperatures
  - Rye 34° F
  - Field Peas 41 ° F
  - Buckwheat 50 ° F
  - Cowpeas 58 ° F
  - Sorghum Sudan 65 ° F
- Inoculate legumes with correct inoculum
- Apply manure?
  - Applied nutrients may be passed to the next crop via the cover crop biomass
  - Opportunity to apply manure to comply with food safety regulations for fruit and vegetable crops
Cover Crop Seeding Methods

Broadcasting, Aerial Seeding

- Seeding depth and placement may be variable, resulting in un-even stands
  - Higher seeding rates
- Doesn’t require specialized equipment
- Hand broadcasting only feasible on small areas; will require tillage pass to push large seeded species to depth

Drilling

- Seeding depth and placement is consistent
  - Lower seeding rates
- Mixes of species that require different seeding depths may be difficult to manage
- Ideal for large areas
Cover Crop Seeding Equipment

- Low tech, low cost
- Higher cost, and more technical
  (Multiple boxes for different species)
Seeding Rate Calibration

- **Low Tech, Broadcasting**
  - *Know your area size (X)*
    - $X \text{ sq ft.} / 43,560 \text{ sq. ft.} = \text{Amount of acre x seeding rate per acre} = \text{amount of seed need for the area}$
  - *Adjust seeder to seed size*

- **Seed Drill**
  - Set drill for seed size
    - Mixes, use the predominant species
  - 100’ test run with drive wheel
  - In field test depth placement
  - *Consult seed drill calibration guides for mixes*
Planting Dates

Winter Cover Crops

- Limiting factor: shortening days and temperature
- Establish legumes and brassicas late summer before cold temperatures
  – In Arkansas: September
- Vernalization of cool season grasses must occur for elongation and optimum biomass production
  – Exposure to cold temperatures induces plant to enter reproductive stages
- Adequate soil temperatures

Summer Cover Crops

- Limiting factor: soil moisture and high heat
- More flexibility where long summers occur
- Time seeding to achieve optimum biomass production prior to next cover crop
  – In AR Late May to Early June
- Adequate soil moisture
- Adequate soil temperatures
Effects of Seeding Date on Biomass

• Seeding date is more critical for fall established winter cover crops
  – Shorter days and cooler temperatures moving into fall restrict plant growth
• Later planting dates in fall have been shown to impact biomass amounts the following spring\(^5\).
  – Low biomass cover crops will compete poorly with weeds in no-till systems.
• Short windows between cash crops and low rainfall in mid-summer also require timely seeding of summer cover crops for proper establishment
• Timing of establishment is important to achieving the goals set for the cover crop; treat the cover crop like a cash crop!
**Cover Crop Termination Methods**

**No-Till**
Terminate by herbicide, roller crimper or a combination of the two and left on the soil surface.

**Strip-Till**
Cover crop terminate in-strips by mowing and tilled into the soil 2-4 weeks before planting. Results in a clean soil surface where rows will be placed and cover crop for weed control in row middles.

**Tilled**
Terminate by mowing and tilled into the soil 2-4 weeks before planting. Results in a clean soil surface.
Cover Crop Roller Crimper Termination

A roller mechanically lodges the crop and the crimper cuts the stems

↑ Click for video
### Percent Termination of Various Cover Crops by Roller Crimper Alone

<table>
<thead>
<tr>
<th>Season</th>
<th>Cover Crop</th>
<th>% Kill</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summer</td>
<td>Sorghum Sudan</td>
<td>40-60%</td>
<td>Some re-sprouting of the stems was observed</td>
</tr>
<tr>
<td></td>
<td>Pearl Millet</td>
<td>90-95%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cowpea</td>
<td>0-10%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sunflower</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Winter</td>
<td>Austrian pea</td>
<td>15-20%</td>
<td>When planted with a grass, improved roller crimper termination of the grass observed</td>
</tr>
<tr>
<td></td>
<td>Winter wheat</td>
<td>75-80%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cereal Rye</td>
<td>80-90%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Crimson Clover</td>
<td>0-10%</td>
<td></td>
</tr>
</tbody>
</table>

*Assessments are based off of roller-crimper alone. Herbicide can be combined with a roller crimper in order to get a higher rate of termination. Data is from preliminary trials conducted in AR. Other studies have seen different results with just a roller. Cover crops were terminated at or just after flowering.*
Cover Crop Termination Equipment

Roller crimper
Herbicide Sprayer
Walk Behind Mower
Tillage Implements
Flail Mower

10 feet
Cover Crop Termination in Plasticulture Systems

- Cover crop termination in a plasticulture system should be timed to ensure adequate biomass decomposition prior to laying plastic
  - Un-decomposed biomass may interfere with bed laying equipment or tear the plastic
- The biomass should be incorporated in the soil “Green” and should be buried and allowed to sit for 2-4 weeks
- Decomposition rates will be influenced by soil moisture, soil temperature and C:N ratio of the material
  - Grasses that are highly lignified will be slower to decompose
Termination Timing for No-Till Systems

- Roller-crimpers are most effective on grasses and legumes after they have reached their reproductive stage
  - At pollen shed or later is ideal for many grasses
- Nitrogen content is highest in legumes around flowering but prior to seed set
- Termination should occur before cover crops set seed
  - Become weeds later
  - Nitrogen is tied up in the seed
  - Grasses become more lignified at and after pollen shed -> they will break down more slowly
- If pollinator habitat is desired the cover crop should be allowed to flower
Herbicide Termination Timing

- Effectiveness of herbicide termination is dependent on:
  - Herbicide used
  - Herbicide rate
    - Higher rates may be required on young cover crops
  - Coverage
    - Good spray coverage will ensure effective termination
    - Systemic vs. contact herbicides
  - Growth stage of the cover crop
    - After flowering cover crops tend to be more susceptible to herbicide.
  - Air temperature and weather
    - Herbicides are more effective during warm and dry weather
Potential Problems

• If cover crop germination fails and it is too late to re-seed
• If biomass is in-sufficient to achieve weed control in a no-till system
  – Tillage or herbicide application maybe the only course of action
• The cover crop goes to seed and becomes a weed in a later cash crop
• Roller-crimper or herbicide kill is in-sufficient
  – Cover crop re-sprouts

Sorghum Sudan re-sprouting after roller-crimping
Crimson clover germinating after self-sowing
Watermelon in a no-till failure
Take Home Message

• Choose your seeding rate and methods carefully based on the equipment available
• Spend time calibrating seeding equipment
• Plan for the termination method and timing prior to planting the cover crop
• Have a “plan B” if things don’t go as planned
Authors and Acknowledgements

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Resources and Sources


4 Summer Cover Crops Horticulture Information. Leaflets. https://content.ces.ncsu.edu/summer-cover-crops

5 Cover Crop Establishment and Potential Benefits to Arkansas Farmers. https://pdfs.semanticscholar.org/d837/f33acb4bd764597d356f1c5eed1a6b8fb3b2.pdf