COVER CROPS IN CENTRAL OREGON

Central Oregon Farm Fair – February 6, 2019

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Central Oregon

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Situation in Central Oregon

• Irrigated, annual *(often)* cropping systems that are intensively managed

• Require excellent soil quality to be productive
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• Irrigated, annual (often) cropping systems that are intensively managed

• Require excellent soil quality to be productive

• Central Oregon soils tend to be:
  • Shallow, low in organic matter, sandy, irrigated, subject to frequent tillage
    = susceptible to degradation!
Enter the intermediate, non-cash crop...
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“Where no kind of manure is to be had, I think the cultivation of lupines will be found the readiest and best substitute. If they are sown about the middle of September in a poor soil, and then plowed in, they will answer as well as the best manure”

- Columella, 1st Century, Rome
What are Cover Crops?

- Nutrient scavenger
- Dual purpose
- Pest fighter
- Green manure
- Allelopathic
- Weed suppressor
- Erosion fighter
- Soil builder

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Benefits of Cover Crops

- Improve soil structure -> water storage and water infiltration
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- Add nitrogen to the soil -> legumes
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- **Add carbon to the soil system** -> including *active C*
How do cover crops support the system?

Cover Crops

Microbial Community
- produce glue-like substances to help with aggregation, creating **beneficial soil structure**
- stimulate decomposition, **mineralization of N, P & S**
- fuel activity of **antagonists** against pathogens

Soil Quality
- Water holding capacity
- Water infiltration
- Nutrient availability
- Disease Suppression
Cover Crops in Central Oregon

• How are cover crops being used locally?
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• Short season cover crops before carrot, bluegrass or mint planting
• Overwintering cover crops that provide grazing
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• Short season cover crops before carrot, bluegrass or mint planting

• Overwintering cover crops that provide grazing

• Anecdotal evidence of increased water holding capacity or water infiltration, and improved yields
Planted May 14, picture taken June 22...

< 6 weeks of growth!
Planted May 1, picture taken June 22...

Rolled and disked
Discussion with a couple neighbors...

• What appeals to you about using cover crops?

• What are your hesitations?
Cover Crop Trials at COAREC in 2018
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- Original audience small-scale vegetable growers
  - Treated organically – no herbicides, organic fertilizer
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- Objectives: Establishment, Weed suppression, Biomass production
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- Different species/varieties, different planting times
  - Brassica, legume, grass
  - Spring, summer, fall planting
Spring Cover Crop Trial

- Planted April 16, 2018, 2” soil temp 47ºF
- Organic fertilizer—applied 40lbs N/ac, 20lbs P/ac, 20lbs S/ac
Spring Cover Crop Trial

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  - Organic fertilizer– applied 40lbs N/ac, 20lbs P/ac, 20lbs S/ac
- 6 replicated species (3 reps), 6 demonstration plots
  - Planted with 5’ drill, plots 10ft x 60ft
Spring Cover Crop Trial

- Species planted
  - ‘Attack’ Mustard
  - ‘Anaconda’ Radish
  - ‘Caliente’ Mustard
  - Crimson Clover – 20lbs/ac
  - ‘Horizon’ Spring Pea
  - Cereal Rye – 70lbs/ac
  - 10lbs/ac
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- OREGON STATE UNIVERSITY
- 29
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Attack Mustard – 2wks, 1st leaves
Attack Mustard – 4wks, ~6”
Attack Mustard – 8wks, ~40”
Anaconda Radish – 2wks, 1st leaves
Anaconda Radish – 4wks, ~5”
Anaconda Radish – 8wks, ~32”
Cereal Rye – 2wks, ~2.5”
Cereal Rye – 4wks, ~4”
Cereal Rye – 8wks, ~8”
Spring Pea – 2wks, 1st/2nd shoot
Spring Pea – 4wks, ~6"
Spring Pea – 8wks, ~28”
Spring Trial – measurements taken

• Plant samples taken at full flower, two 0.5m² quadrats/plot
  • Mustard and radish plots sampled 8 weeks after planting (6/12/18)
  • Cereal rye and pea plots sampled 9 weeks after planting (6/19/18)

• Weed counts conducted at termination, two 0.5m² quadrats/plot

• Soil samples taken at termination and 2 weeks after termination
## Spring Trial Results

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<tr>
<th>Cover crop</th>
<th>Biomass (lb/ac)</th>
<th>Crop height (inches)</th>
<th>C to N ratio</th>
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<td>2267</td>
<td>40</td>
<td>27</td>
<td>35</td>
<td>1.7</td>
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<tr>
<td>Radish</td>
<td>2322</td>
<td>32</td>
<td>23</td>
<td>39</td>
<td>0.6</td>
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<tr>
<td>Spring pea</td>
<td>2691</td>
<td>28</td>
<td>13</td>
<td>90</td>
<td>1.8</td>
</tr>
<tr>
<td>Cereal rye</td>
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<td>8</td>
<td>22</td>
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Spring Trial Results

• Cereal rye and pea species grew quickest in cool soils (~50-60°F), but mustard and radish species caught up as soils warmed later in May.
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• All four species competitive against weeds (<2 weeds/ft²), but radish’s broadleaf canopy excelled at weed suppression
Spring Trial Results

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• Attack mustard and Horizon spring pea plots had more upright growth habits that allowed for more weed growth
Spring Trial Results

- Austrian winter pea provided comparable biomass (2668 lb/ac) to the spring pea, and improved weed suppression (0.5 weeds/ft$^2$)
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• Cereal rye/pea and mustard/radish mixtures did not produce as much biomass as the single species counterparts
Summer Cover Crop Trial
Summer Cover Crop Trial

- Planted June 6, 2018, soil temp 71ºF
- Organic fertilizer – applied 40lbs N/ac, 20lbs P/ac, 20lbs S/ac
Summer Cover Crop Trial

- Planted June 6, 2018, soil temp 71°F
  - Organic fertilizer – applied 40lbs N/ac, 20lbs P/ac, 20lbs S/ac

- 6 replicated species (3 reps), 6 demonstration plots
  - 3 fails: cowpea, sorghum, sunn hemp
Summer Cover Crop Trial

- Species planted (successful)
  - ‘Attack’ Mustard – 10lbs/ac
  - Buckwheat – 60lbs/ac
  - Phacelia – 5lbs/ac
  - Sudangrass – 35 lbs/ac
Attack Mustard – 2wks, ~2”
Attack Mustard – 4wks, ~14”
Attack Mustard – 7wks, ~38”
Buckwheat – 2wks, ~2”
Buckwheat – 4wks, ~12”
Buckwheat – 7wks, ~35″
Phacelia – 4wks, ~5"
Phacelia – 7wks, ~23”
Sudangrass – 2wks, ~2”
Sudangrass – 4wks, ~14”
Sudangrass – 7wks, ~46”
Summer Trial – measurements taken

• Plant samples taken at full flower, two 0.5m$^2$ quadrats/plot
  • All plots sampled 7 weeks after planting (7/25/18)

• Weed counts conducted at termination, two 0.5m$^2$ quadrats/plot

• Soil samples taken at termination
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<td>1810</td>
<td>38</td>
<td>21</td>
<td>38</td>
<td>5.3</td>
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<tr>
<td>Buckwheat</td>
<td>2141</td>
<td>35</td>
<td>17</td>
<td>50</td>
<td>4.1</td>
</tr>
<tr>
<td>Phacelia</td>
<td>1750</td>
<td>23</td>
<td>17</td>
<td>39</td>
<td>2.8</td>
</tr>
<tr>
<td>Sudan grass</td>
<td>2096</td>
<td>46</td>
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Summer Trial Results

• Emergence was less successful in the summer planting than the spring trial, with several species struggling to establish well

• Summer annual weed pressure was very heavy, especially from redroot pigweed
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• Summer annual weed pressure was very heavy, especially from redroot pigweed

• Of the four replicated treatments, buckwheat and sudangrass produced the most biomass (~2100 lb/ac)
Summer Trial Results

• All four species struggled to be as competitive against weeds as compared to the spring planting date, but phacelia provided the most weed suppression

• Caliente mustard in the demonstration plots produced the most biomass in the summer series (2850 lb/ac), and Anaconda radish provided the most weed suppression (<2 weeds/ft²)
Trial Thoughts So Far...

• When selecting a cover crop, very important to know *why* you want to use one, then local data can help in selecting a species
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• Anaconda radish and Austrian winter pea great spring choices for weed suppression
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• Anaconda radish and Austrian winter pea great spring choices for weed suppression
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• Buckwheat and sudangrass both good biomass options, buckwheat more $ but offers pollinator benefit
Trial Thoughts So Far...

• When selecting a cover crop, very important to know why you want to use one, then local data can help in selecting a species

• Anaconda radish and Austrian winter pea great spring choices for weed suppression

• Summer cover crops have advantage of fitting in a tight growing window, but weed competition is more of a challenge

• Buckwheat and sudangrass both good biomass options, buckwheat more $ but offers pollinator benefit

• Crimson clover not suited as short season cover crop
Fall Trial
Fall Trial

• Planted September 14, 2019

• 8 replicated treatments that are single and mixed species of legumes, brassicas, and cereals

• Seeing which species/varieties overwinter, will take in depth soil measurements in spring
Fall Trial
Cover crops: a technology to supply soil with active carbon
Cover Crops and Soil Quality

• Conduct a comprehensive soil quality assessment spanning the full range of physical, biological and chemical soil properties
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• Goal to develop a type of ‘cover crop technology’:  
  • system of interdependent decision tools based on a thorough understanding of the underlying processes of how a certain cover crop improves certain soil functions
Next Steps

- Continue and initiate research related to cover crops and soil quality
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- Develop an efficient cover crop technology that:
  - Aims to address not just one soil deficiency but a multitude of benefits
  - Closely matches the rotations, soils, climate & economic constraints of region
Next Steps

- Continue and initiate research related to cover crops and soil quality

- Intention of working directly with growers and industry on research to develop needed technologies

- Specifically interested in working with a group of growers with similar rotations for on-farm research – please let me know!
Next Steps

- Continue and initiate research related to soil quality, right here in Jefferson County

- Intention of working directly with growers and industry on research to develop needed technologies

- Desire to collaborate with growers & industry using *participatory research* – make new steps
Questions?

Thank you for your attention!

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