WA State Biofuel Cropping Opportunities and Challenges

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Overall Program Objective
Increase sustainable regional crop feedstock production to support regional biofuel industries.

*Increase the current ~20-30,000 acres feedstock crops to ~500,000-1,000,000 acres to meet near term ground and air transportation demands.*
Vertically Integrated Systems Research/Outreach

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<th>Focal Questions</th>
<th>Outcomes</th>
<th>Impacts</th>
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<td>• Energy, climate change, air quality, declining rural communities</td>
<td>• Local, sustainable biofuels &amp; bioproducts</td>
<td>• Enhanced communities, Secure energy, Climate change mitigation</td>
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<tr>
<td>• How will farming systems evolve?</td>
<td>• Site-specific system development</td>
<td>• Integrated food, feed, fuel, fiber feedstock</td>
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<td>• How will management decisions alter?</td>
<td>• Best Management Practices</td>
<td>• Efficient farm resource mgt, economic returns</td>
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<td>• How do these crops grow/develop?</td>
<td>• Fundamental process understanding</td>
<td>• Re-write the textbooks</td>
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Dedicated Biofuel Crops

**Oilseeds**
- Canola
- Camelina
- Safflower
- Sunflower
- Soybean

**Cellulosics**
- Switchgrass
  - Arundo
  - Bamboo
Oil and Meal Characterization
Oil Composition

Figure 5. WSU GC analysis of fatty acid composition of canola, rapeseed (high erucic acid type), and camelina.
Regional Production Zones and Grower Cases

Case Study Locations

- **Region 1**: 17” - 25” Rainfall Cropland - 1325321 acres
- **Region 2**: <17” Rainfall Cropland - 2339258 acres
- **Region 3**: Irrigated Cropland - 996071 acres
- **Region 4**: Western Washington Cropland - 62453 acres

Crop data is from the 2009 Cropland Data Layer from the National Agricultural Statistical Service of the U.S. Department of Agriculture. Map projection is Universal Transverse Mercator, zone 11, WGS 1984. Map created by Richard Rupp, Department of Crop & Soil Sciences, Washington State University.
Inland PNW Zone Acreage

- Crop-Fallow (Region 2) 50%
- Irrigated (Region 3) 18%
- Annual Crop (Region 1) 24%
- Transition 8%
Crop Diversification Benefits

- Market diversification
- Improved weed control
- Soil tilth, C sequestration
- Improved WUE, NUE
- Higher wheat yields
Regions 1, 2 – Eastern WA (rainfed)

Production Issues for WA Canola

- Fall germination in dry soils
- Winter kill
- Spring frost kill
- Fertilizer sensitivity
- Heat stress at flowering
- Weed, insects, pathogens
Regions 1 and 2 Oilseed Adaptations

Zone 2-fallow

• Mid-summer seeding of winter canola into fallow; replacement of winter wheat
• Biennial canola: early seeded winter canola: yr 1-forage, yr 2-grain
• Flex cropping spring oilseed into wheat-fallow
• Oilseed replacement for transitional zone fallow
• Spring oilseed alternative to spring legumes or cereals

Zone 1-annual cropping
Biennial Canola: Forage + Grain
Oilseeds: N Catch and Release

- High N supply requirement
- High residual N uptake efficiency
- High N in crop residues
Okanogan Collaborative
Region 3 – Irrigated Central WA

- Canola (~2.5 T/A), safflower (>1 T/A) under deficit irrigation at Prosser and Paterson
- Low irrigation requirement; more water for high value crops (i.e. potatoes), and reduced electricity (pump) costs
- Switchgrass, Arundo for high cellulose, high soil C
Region 4 - Western WA

- Brassica seed production district restrictions
- Goose damage and waterlogging; not frost damage
- Winter canola yielded >5,000 lb/acre at Puyallup; organic canola meal is highly valued and in demand in western WA
Best Prospects for Near Term WA Biofuel Feedstocks

- Spring canola and camelina replacement of other spring crops or chemical fallow.
- Early seeded winter (biennial) canola, camelina in summer fallow
- Organic canola in western WA.
- Winter canola for high WUE, NUE in irrigated crop rotations.
- CRP conversion.
- High biomass perennial cellulosic crops under irrigation.

See posters for details!
WA state support has provided seed funding for larger federal projects