

# WA State Biofuel Cropping Opportunities and Challenges

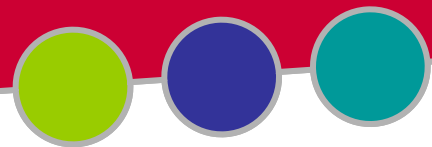
*Bioenergy Research Symposium*

*Seattle WA, Nov. 8, 2010*

*Bill Pan*

*Dept Crop and Soil Sciences*

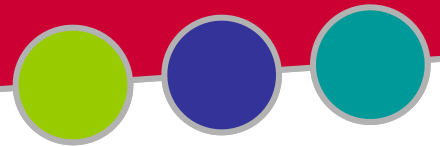
*Washington State University*



## 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



## Focal Questions

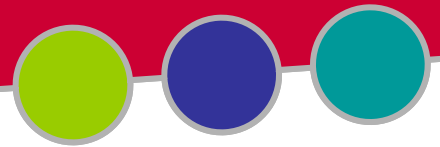
- Energy, climate change, air quality, declining rural communities
- How will farming systems evolve?
- How will management decisions alter?
- How do these crops grow/develop?

## Outcomes

- Local, sustainable biofuels & bioproducts
- Site- specific system development
- Best Management Practices
- Fundamental process understanding

## Impacts

- Enhanced communities, Secure energy, Climate change mitigation
- Integrated food, feed, fuel, fiber feedstock
- Efficient farm resource mgt, economic returns
- Re-write the textbooks



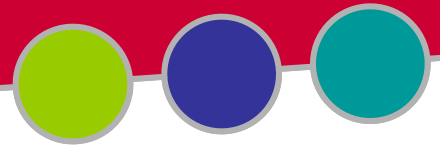
## Oilseeds

- Canola
- Camelina
- Safflower
- Sunflower
- Soybean

## Cellulosics

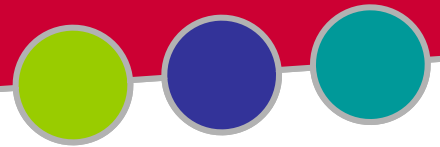
- Switchgrass
  - Arundo
  - Bamboo





# Oil and Meal Characterization





# Oil Composition

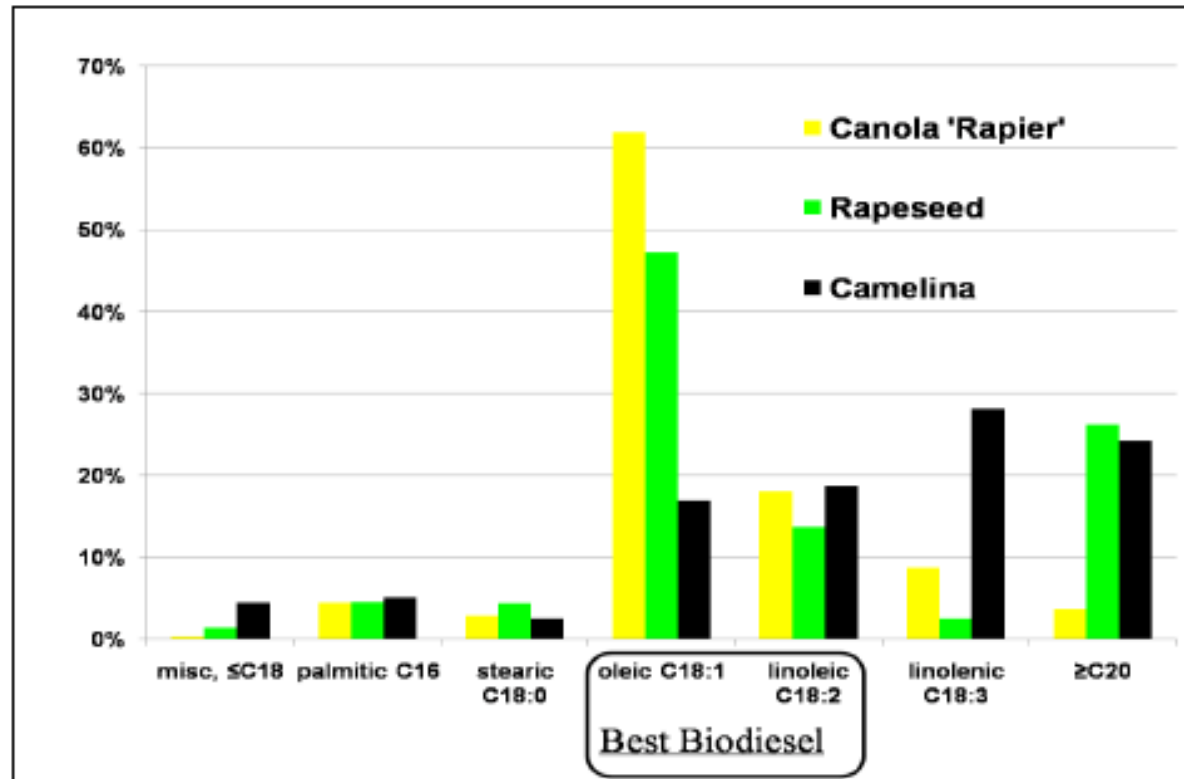
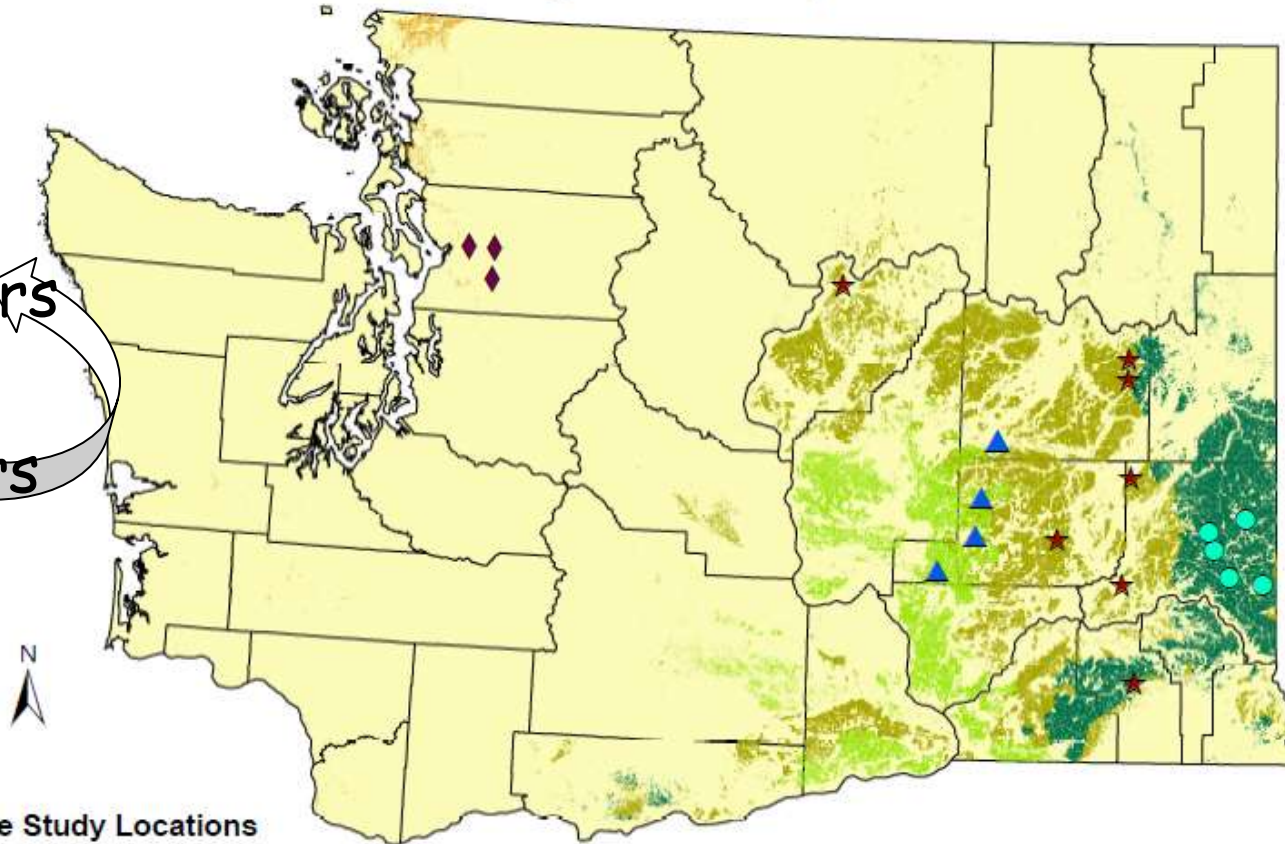
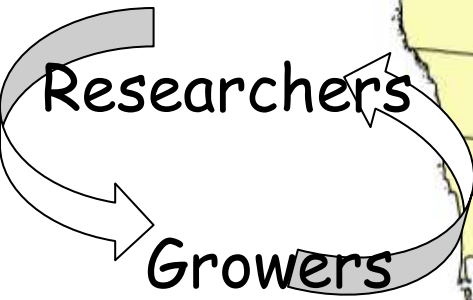


Figure 5. WSU GC analysis of fatty acid composition of canola, rapeseed (high erucic acid type), and camelina.



# Regional Production Zones and Grower Cases

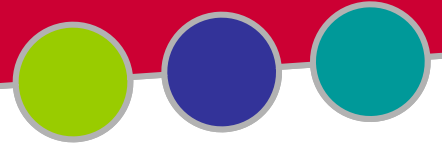


Case Study Locations

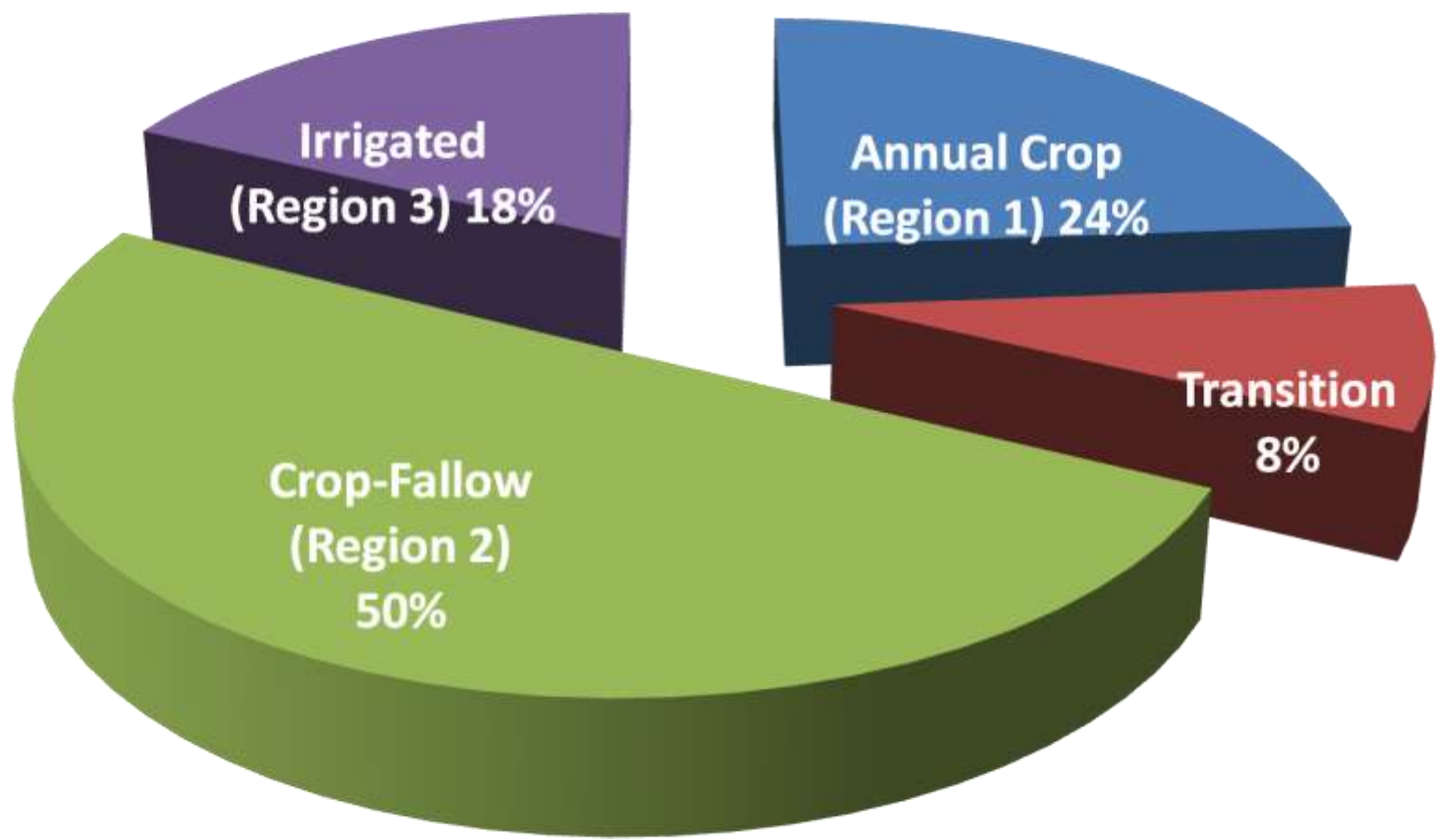
- Region 1
- ★ Region 2
- ▲ Region 3
- ◆ Region 4

	17" - 25" Rainfall Cropland	1325321 acres
	< 17" Rainfall Cropland	2339258 acres
	Irrigated Cropland	996071 acres
	Western Washington Cropland	62453 acres

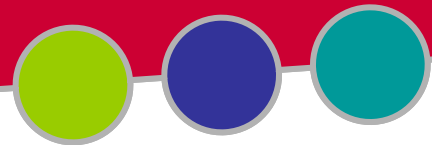
Crop data is from the 2009 Cropland Data Layer from the National Agricultural Statistical Service of the U.S. Department of Agriculture.  
 Map projection is Universal Transverse Mercator, zone 11, WGS 1984.  
 Map created by Richard Rupp, Department of Crop & Soil Sciences, Washington State University.



# Inland PNW Zone Acreage

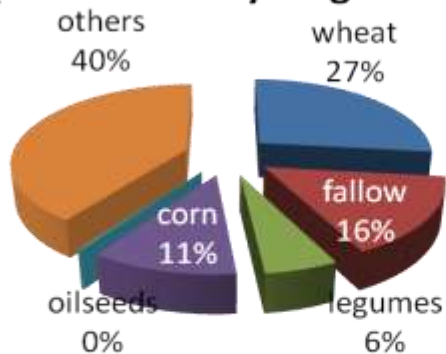




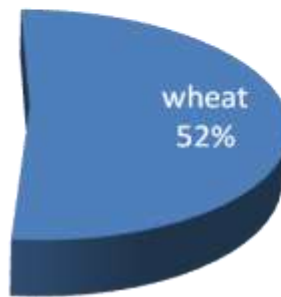
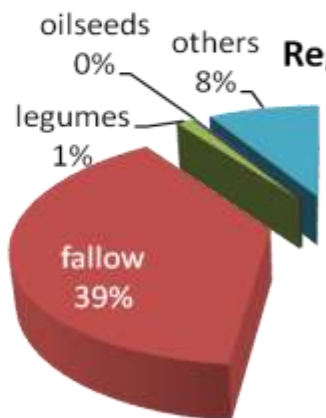


**Region 3**

**(1.24 M Mostly Irrigated Acres)**

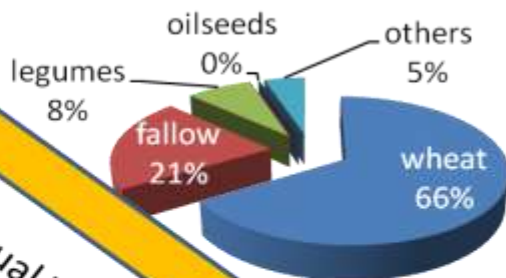


**Region 2 (3.52 M Acres)**

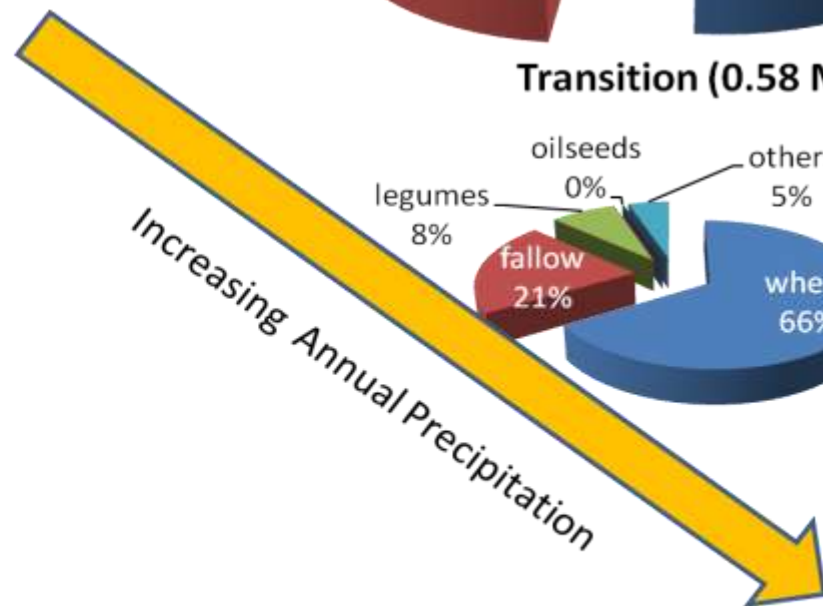
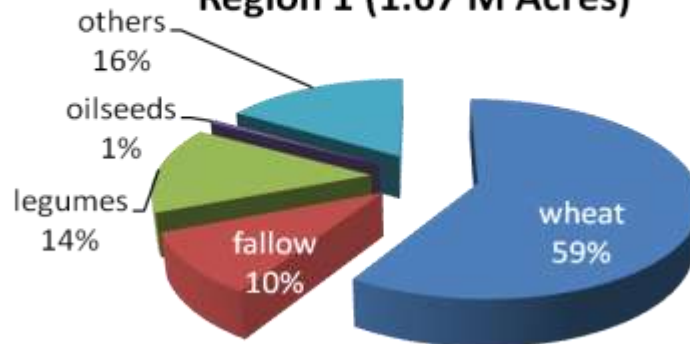


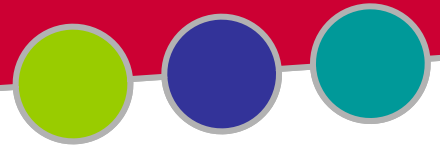
**Inland PNW  
AEZ Crop  
Distributions**

**Transition (0.58 M Acres)**



**Region 1 (1.67 M Acres)**





# Crop Diversification Benefits

- Market diversification
- Improved weed control
- Soil tilth, C sequestration
- Improved WUE, NUE
- Higher wheat yields



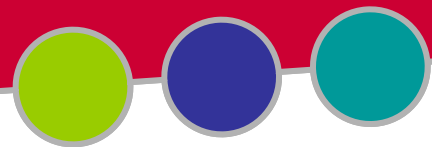


# Regions 1, 2 – Eastern WA (rainfed)

## Production Issues for WA Canola

- Fall germination in dry soils
- Winter kill
- Spring frost kill
- Fertilizer sensitivity
- Heat stress at flowering
- Weed, insects, pathogens

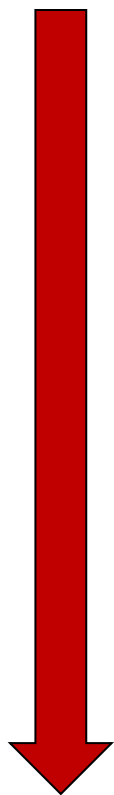




# Regions 1 and 2 Oilseed Adaptations

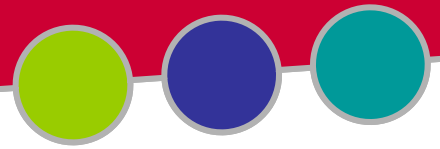
## Zone 2-fallow

- 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



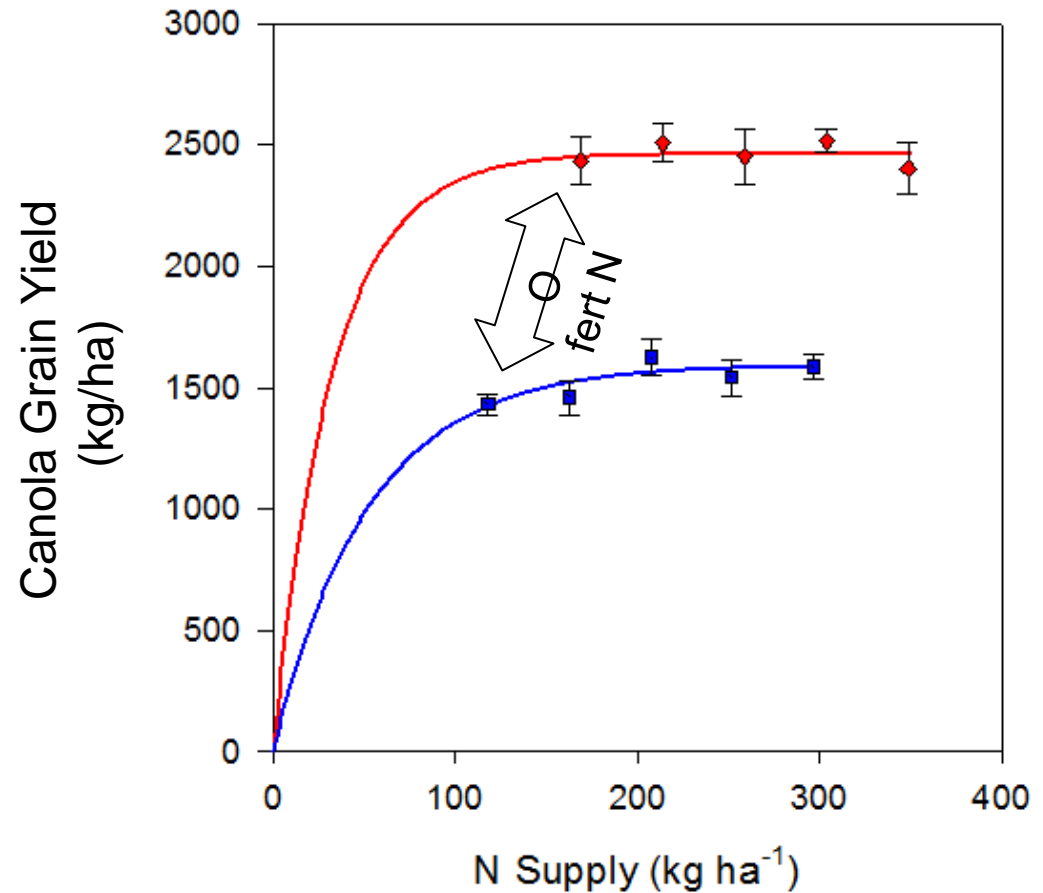
## Zone 1-annual cropping

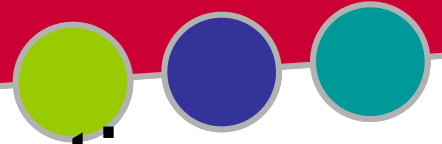




## Oilseeds: N Catch and Release

- ❑ 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

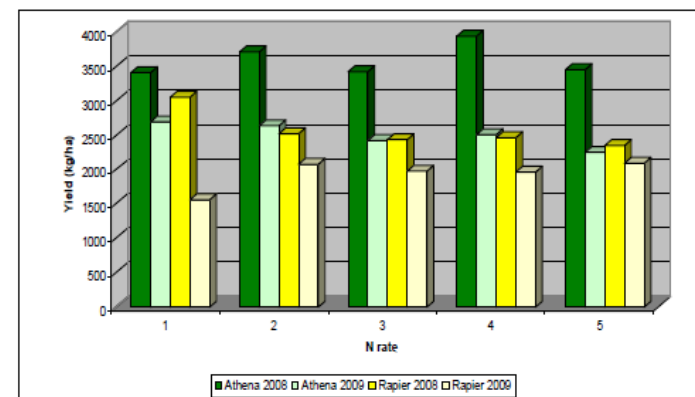
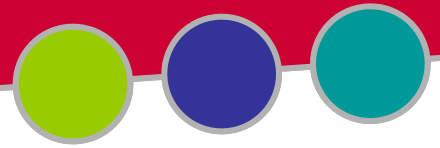


Figure 1: Average yield of two irrigated winter canola varieties over two growing seasons with 5 different N fertilizer rates, from low to high (1 – 5). Yield was not significantly different with N fertilizer rates.

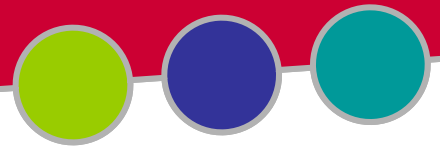




## Region 4 - Western WA

- 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

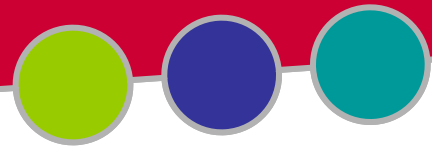




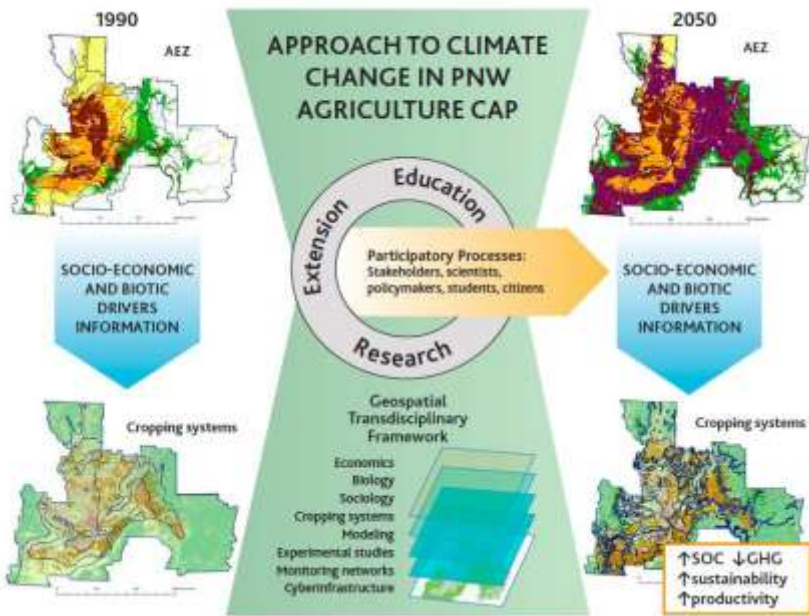
# Best Prospects for Near Term WA Biofuel Feedstocks

- 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





# Collaborating and Supporting Agencies



**Department of Commerce**  
Innovation is in our nature.



United States Department of Agriculture