Title: Incorporating Oilseeds in Intermediate Rainfed Crop Rotations
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Funding term and duration: 2 years

Background and justification: Growers throughout the intermediate cropping zone (13 to 18" of annual precipitation) have been experimenting with oilseeds in their crop rotations for 20 plus years with mixed success. During this time numerous studies have been carried out looking at multiple aspects of production individually with these crops in research plot settings. Starting in 2012, spring oilseed crops have been incorporated into the crop rotation at the WSU Wilke Research and Extension Farm near Davenport, WA. The justification is it to "put its money where its mouth is at" and use the research data collected to demonstrate the value of these crops in rotation with cereal grains and summer fallow to show farmers and their business partners (landlords, bankers, etc) how and where these crops fit into a profitable crop rotation over a duration of time. This serves as a very good platform to provide Extension outreach through field day presentations, oral presentations at grower meeting and published technical bulletins.

Objectives: This project is focused on finding agronomic and economic value in spring planted oilseeds incorporated into a cereal grain rotation. Agronomically weed control plays a major role in finding real long-term economic value especially with the herbicide resistant traits available in spring canola today. With the lack of new chemistries and technology coming into cereal grains in the near future, this will only be accelerated. An example is Clearfield resistant spring canola would be a great fit to help manage the recently identified jointed goatgrass biotype resistant to Beyond herbicide. At the WSU Wilke Farm, canola has been a valuable tool helping manage a well-documented feral rye weed problem. Nutrient management also plays a major role in the economic value of canola and in this project our nutrient program, including micronutrients, is monitored across the complete crop rotation.

Methods: The 320 acre WSU Wilke Research and Extension Farm is divided into eight large plots: four are in a 4-year rotation of no-till fallow, winter wheat, broadleaf, spring cereal; three are in a 3-year rotation of no-till fallow, winter wheat, spring cereal; and the north side is in continuous crop production. The 3-year rotation is what is traditionally practiced across the region. Agronomic and economic data is collected on each plot and rotation and summarized at the end of the year. From 2012-2015 spring canola has been incorporated on the farm as the broadleaf in the 4-year rotation. Oriental mustard was planted in 2016. In 2017 chickpea was planted in the 4-year rotation and InVigor LL233P spring canola was planted in the larger 60 acre plot of continuous crop production. Spring oilseed production will remain within the 4-year rotation or within the continuous crop rotation for a complete comparison to traditional practices.

Outreach includes a technical bulletin published each year summarizing crop year results that include inputs, input cost, production, gross returns and economic return over costs. Nitrogen use efficiency, soil compaction, wireworm population, and soil pH data is also collected 5 GPS referenced spots within each plot and summarized in the

technical bulletin. Field days and grower meeting presentations are also a major outreach component of this project. Having a consistent oilseed crop on the farm has also been instrumental in attracting additional oilseed crop research on the farm.

Results and Discussion:
Over the 5 years, spring oilseed crops have averaged 1,160 lb/ac with the highest in 2013 at 1,748 lb/ac and the lowest in 2015 at only 479/ac. In 2017 Pacific Gold oriental mustard yielded 1,325 lb/ac and produced the highest economic return over input costs of all eight plots at $311/acre. Second was 95 bu/ac Crescent soft white winter club wheat at $263. Overall the 4-year rotation economic return over input costs was the greatest at $170/ac, the 3-year rotation averaged $152/ac, and the continuous crop averaged only $80/ac. Since 2012 when oilseeds have been incorporated, the 4-year rotation has averaged $122/ac, the traditional 3-year rotation has averaged $106/ac and the continuous crop has averaged only $79/ac. Some rotational benefit has also been realized with spring wheat following oilseed crops in the 4-year crop rotation yielding 4.2% greater than spring wheat following winter wheat in the 3-year rotation. Complete summaries can be found in the technical bulletins.

Oilseeds have also been valuable in weed control, especially with feral rye and this has been a major focus of the outreach efforts. During the 2016-17 winter growers meeting season 10 presentations were delivered directly focused on using spring canola herbicide resistance technology as a viable tool to enhance winter annual grassy weed control in winter wheat and preserve Group II herbicides.

Impact/Potential Outcomes: Show and tell over time is one of the major ways to influence change across the area. Incorporating oilseeds into a 4-year crop rotation has been very profitable three out of the five years at WSU Wilke and spring wheat following oilseeds have yielded 4.2% more. This data in combination with enhanced weed control over time will show and demonstrate to farmers and their business partners the value of oilseeds in rotation and will lead to increased successful adoption.

Publications:

Esser, A.D. and D.P. Appel. WSU Wilke Research and Extension Farm production and economic performance 2016. Washington State University Extension. Technical Bulletin. Accepted and in publication.

Esser, A.D. and D.P. Appel. 2016. WSU Wilke Research and Extension Farm production and economic performance 2015. Washington State University Extension. Technical Bulletin TB20.

Esser, A.D. and D.P. Appel. 2015. WSU Wilke Research and Extension Farm production and economic performance 2014. Washington State University Extension. Technical Bulletin TB03.

Esser, A.D. and D.P. Appel. 2015. WSU Wilke Research and Extension Farm production and economic performance 2013. Washington State University Extension. Technical Bulletin TB02.

Affiliated projects, funding, and prospective future funding: These projects are focused on comparing spring wheat, chickpea and spring canola and winter wheat, winter pea and winter canola agronomically and economically over time to develop risk

tools to help farmers determine when one crop is economically more viable to plant over the other and compliments the WOCS project very well. Spring canola variety plots at Wilke are also a portion of this project.

Improving Canola Production and Production Systems with Genetic and Agronomic Advances to Increase Canola Acreage in the Pacific Northwest. USDA/NIFA Grants for Supplemental and Alternative Crops Program. $189,185. P.I.: J. Brown, Co-P.I. J. Davis, K. Painter, K Schroeder, F. Xiao, **A.D. Esser**, D. Wysocki, and C. Chen. (2016 - 2017).

Developing Non-food Grade Brassica Biofuel Feedstock Cultivars with High Yield, Oil Content, and Oil Quality that are Suitable for Low Input Production Dryland Systems. USDA/DOE Grants for Plant Feedstock Genomics for Bioenergy Program. $1,188,161. P.I.: J. Brown and Co-P.I.: J. Davis, **A.D. Esser**, K. Schroeder, F. Xiao and Z. Zhiwu. (7/16-6/19)

Improving Canola Production and Production Systems with Genetic and Agronomic Advances to Increase Canola Acreage in the Pacific Northwest. USDA/NIFA Grants for Supplemental and Alternative Crops Program. $160,081. P.I.: J. Brown, Co-P.I. J. Davis, K. Painter, K Schroeder, F. Xiao, **A.D. Esser**, D. Wysocki, and C. Chen. (2015 - 2016).

Budget needs:

Category	Year 1	Year 2
Wages/benefits		
Goods/Services	$4,000	$4,000
Travel	$1,000	$1,000
Total	**$5,000**	**$5,000**

Good/services include both plot supplies and outreach costs.
Travel includes going to/from plots as well as attending outreach events.

References:

N/A