relatively few benchmark microsites can be cost-effectively monitored, they must be carefully located to be representative of larger areas. *In situ* visible & near infrared (VisNIR) spectroscopy is an established commercial technology capable of rapidly and inexpensively mapping soil properties that influence ΔSOC (e.g., current SOC stocks, texture and mineralogy). Thus, this technology could be used to select benchmark microsites. Laser-induced breakdown spectroscopy (LIBS) is an emerging elemental analysis technology with the potential to provide rapid and accurate analysis of soil constituents, such as carbon, with minimal soil preparation. As this technology matures, lab-based or field-deployable equipment could be employed to provide more cost-effective SOC measurements relative to standard laboratory techniques. Developing viable terrestrial carbon markets will require a synergistic approach using a combination of traditional soil sampling, predictive soil carbon models, satellite-based practice verification, and new SOC measurement technologies.

Investigating Soil and Landscape Variability in Soil Organic Carbon at the WSU Cook Agronomy Farm

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Mitigation of rising greenhouse gases concentrations in the atmosphere has focused attention on agricultural soil organic C (SOC) sequestration. However, field scale knowledge of the processes and factors regulating SOC dynamics, distribution and variability is lacking. The objectives of this study are to characterize the soil profile (0- to 150-cm) and landscape variability in the distribution of SOC within a 37-ha Palouse field under agricultural management. A systematic, non-aligned grid of 177 geo-referenced sample locations was established at the Washington State University Cook Agronomy Farm (CAF) near Pullman, WA. Intact soil cores (0- to 153-cm) were collected, soils were described, classified, the surface divided into 0- to 30-cm increments and then by soil horizon to a depth of 153-cm and analyzed for soil bulk density and SOC. Profile (0- to 153-cm) SOC ranged from 54 to 272 Mg C ha^{-1} over the 37-ha field. The SOC content for the surface (0- to 30-cm) and subsurface (30- to 153-cm) ranged from 26 to 79 Mg C ha^{-1} and 14 to 193 Mg C ha^{-1}, respectively. Thatuna silt loams averaged 149 Mg C ha^{-1} followed by Palouse (125 Mg C ha^{-1}) and Naff (111 Mg C ha^{-1}) silt loam soil series. Landscape SOC redistribution via soil erosion was evident and erosion impacts on field SOC heterogeneity must be quantified if SOC sequestration and management impacts are to be adequately assessed. Furthermore, success in developing precision conservation strategies will require knowledge of site-specific processes and factors contributing to variability in soil productivity, SOC storage and nutrient dynamics.

Part 4. Bioenergy Cropping Systems Research

Progress of Washington State Biofuels Cropping Systems Project

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Biofuel demand and oilseed crop acreage is increasing annually in WA, and the need to provide growers with updated agronomic and production information for these crops is also increasing. After two crop years of research with the Biofuels Cropping Systems Research Project (see www.css.wsu.edu/biofuels), valuable data is being generated that is being utilized to inform growers, industry and other researchers about the potential of oilseed crop production in WA. Highlights of project progress to date include:

Rotation intervals for imazethapyr (marketed under the trade name Pursuit) may need to be increased based on data showing injury to oilseed crops beyond what current labels state.

Four camelina mutant populations have been identified with partial resistance to imi herbicides, and one with SU resistance, with no significant change in yield potential. Research this year will determine if a higher resistance level can be obtained.

We will continue to evaluate the potential of early-seeded winter canola for improved stand establishment and use as a forage and grain crop in eastern WA.

In dryland canola field studies, 80-90% of maximum yield was achieved without N fertilizer, which may lead to revision of current fertilizer N recommendations. Deep well irrigated canola and safflower were successfully grown in central WA with deficit irrigation and low N rates.

Camelina shows potential as an oilseed crop in the winter wheat-summer fallow region. The rotation it will most likely fit in is a 3-year winter wheat-camelina-summer fallow system.

Early (mid-August) planted winter canola produced high yields at Puyallup, with two times the yield as a mid-September planting. Low yields of camelina, mustard and flax at Mt. Vernon may be fertility related; cool, wet weather also has an impact on crop success.

Successful establishment and winter survival of upland versus lowland switchgrass varieties, as well as other warm season grasses, varies depending on planting date and soil temperature.

Introduction of Canola in the Okanogan Region of Washington for Economic and Agronomic Benefits

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Pilot field studies on winter canola were launched in the fall of 2007 near Okanogan in response to a local grower's (Ed Townsend) interest in and request for research on dryland winter canola production in the Okanogan area. A field day was conducted in the spring of 2008 and the project was expanded in the fall of 2008 to include another grower-cooperator, Wade Troutman. A second field day was conducted on May 20 2009.

In 2007, seeding dates into chem. fallow plots were August 21 and September 4 at Okanogan. Seeding rates were 2, 4, and 6 lbs/A using a modified John Deer HZ deep furrow drill.

In 2008, seeding dates were August 12th and 25th for the Okanogan site where we looked at two different planting rates, 4 and 8 lbs/A. The planting methods and machinery used at this site were the same as the 2007 study

In 2009, seeding dates were August 19th and 31st for the Okanogan site where we looked at two different planting rates, 4 and 8 lbs/A. and 2,4, and 6 lbs/acre, respectively. The planting methods and machinery used at this site were the same as the previous two years. Plots will be harvested in July 2010 and crop yield and seed, oil, and meal (for feed) quality will be determined. Winter survival was fair to good at all locations. The plots seeded August 31st at the Townsend site were reseeded to spring canola.

The research results from these studies will be used by Colville Confederated Tribal landowners for growing canola for the Tribal oilseed crushing and bulk fuel plant installation planned an underway. The recent soil and crop survey by the Colville Confederated Tribes shows 100,000 acres of cropland on which Tribal members can produce canola.

Photograph taken February 10, 2010 shows control of feral rye on the right side of the picture in winter canola seeded August 19,2009. Treatment for rye was made October 15, 2009.