POSTER 01

Economic, Financial and Environmental Decision Tools for Farmers, Ranchers and Land Managers

Clark Seavert, Jenna Way, Susan Capalbo, and Laurie Houston,
Oregon State University, Department of Applied Economics.

AgBiz Logic™, *AgTools™* and *AgEnvironment™* are online web-based decision tools which can empower farmers, ranchers, land use managers (a) to understand how decisions about new USDA programs, management options and technologies/varieties may impact their net returns and livelihoods, (b) to use data unique to their specific farming operations to develop management pathways that best fits their operations under a changing climate, and (3) to better envision which actions farmers can take to build resilience to a changing climate. *AgBiz Logic™* is an online interface that gathers and stores user information and data. *AgTools™* , currently consists of a suite of software programs - *AgProfit™*, *AgLease™*, and *AgFinance™*, which uses return and cost information to measure the net present value of capital investments and alternative crops or livestock enterprises. A new module named *AgEnvironment™* is an environmental accounting tool that tracks changes in key environmental measures resulting from a change in crop rotations, implementation of a new technology, conservation practice, etc. that may be linked to projected climate changes. As modifications are made to annual cost and return budgets the capacity to compare the environmental as well as economic and financial impacts of a grower's decision will provide a powerful tool.

POSTER 02

Does it Make Economic Sense to Grow Canola in My Rotation? Enterprise Budget Tools for Assessing Costs, Returns, and Rotational Impacts of Canola in Eastern Washington

Jenny R. Connolly and Vicki A. McCracken Washington State University
Kathleen M. Painter University of Idaho

Enterprise budget tools are available to help farmers, researchers, educators, and agriculture industry personnel compare costs and returns among rotations with and without canola. Inserting canola into traditional rotations may have rotational impacts such as changes in chemical use, machinery operations, weed control in subsequent crops, and yield in subsequent crops. These changes can affect overall farm returns. Enterprise budgets allow users to modify inputs, machinery operations, other costs, and returns for different crop and rotation scenarios. Canola and non-canola rotations can be modified separately to determine how rotational impacts from growing canola affect overall farm returns. Budgets from the University of Idaho are completed for the low rainfall (<12") and intermediate rainfall (12-16") regions in Washington. Additional rotations will be added for these regions in addition to budgets for the high rainfall (>17") and the irrigated growing regions. Default budget settings are based on model farms, designed to reflect typical farm operations in Eastern Washington. These enterprise budgets will be available on computers at our booth for conference participants to utilize. Information will be collected on additional rotations needed. Budgets will soon be available online in Excel format through WSU Extension.

POSTER 03

A comparison of machinery costs for direct seeding: Results of a longitudinal survey of wheat producers in the Inland Pacific Northwest

Hilary Donlon Davis, Kathleen Painter University of Idaho
Dennis Roe, Washington State University

Comprehensive economic data are collected annually from a group of 45 dryland wheat producers in the Inland PNW, with annual precipitation ranging from 12 to 24 inches. These producers are participating in a longitudinal survey of wheat growers as part of the Regional Approaches to Climate Change, Pacific Northwest Agriculture (REACCH) project. All of these producers use direct seed techniques to some degree. Per acre machinery costs and returns for wheat production vary considerably, however, due mainly to regional precipitation differences. Calculating machinery costs per acre or per bushel is a time-consuming, data intensive endeavor. In order to calculate these costs for each piece of machinery or equipment, one must estimate its current market value, projected years of service, salvage value, annual repair costs (parts and labor), and annual hours (or miles) of use. Machinery costs averaged $95 per acre for the annual cropping region, $80 per acre for the intermediate cropping region (fallow one year in three), and $54 per acre for the wheat-fallow region. Net returns averaged $170 per acre in the annual cropping region, $73 per acre in the intermediate cropping region, and $39 per acre in the grain-fallow cropping region.

POSTER 04

Farmer to Farmer: Multi-media case studies to build adaptive capacity among cereal-based farmers in the Pacific Northwest

Georgine Yorgey and Sylvia Kantor, Washington State University, Seattle, WA
Kathleen Painter, Hilary Donlon, Kristy Borrelli, and Leigh Bernacchi,
University of Idaho, Moscow, ID
Dennis Roe, Washington State University, Pullman, WA
Chad Kruger, Washington State University, Wenatchee, WA

Using case studies, farmers who are adopting innovative practices can share their experiences with management practices that increase resiliency in the face of ever-changing market pressures and continuing climate uncertainty. To support farmer to farmer learning, we have developed a set of multimedia producer case studies for cereal-based cropping systems in the Pacific Northwest as part of the Regional Approaches to Climate Change in Pacific Northwest Agriculture (REACCH-PNA) project. Innovative strategies highlighted to date in the dryland area include precision nitrogen application, enhancing crop diversity, flex cropping, and use of the stripper header and undercutter sweep. In-depth interviews with each producer were used to produce a video segment and a detailed written document. Participants explain their processes for successful adaptation of these various risk-reducing practices, their perspectives on benefits and challenges, and their thoughts on risk and climate change.

POSTER 05

Water Budget Analysis of Cereal-Oilseed Cropping Systems

Aron Boettcher, Hayley Peters-Contesse, Mandy Wuest, & Dan Long
USDA-ARS, Pendleton

Plant available water is of vital importance in dryland farming regions, so it is necessary to identify farming practices that allow plants to optimize water use and maximize crop yields. Soil water measurements were taken during the 2014 growing season to discern the soil water balance and water use efficiency for four crop rotations in a dryland cropping system study near Echo, OR. Soil moisture, rainfall, and yield were compared among spring and winter crops, tillage systems, and cropping system. The rotations and crops examined in this study were then ranked according to their water use efficiency and yield. Post-harvest soil water content did not significantly differ between various spring and winter crops nor among winter wheat-summer fallow and more intensive three-year rotations comprised of reduced tillage fallow, winter cereal, and spring oilseed; and reduced tillage fallow, winter oilseed, and spring cereal. Oilseeds potentially can help diversify the traditional winter wheat-summer fallow system

POSTER 06

Detecting Variance of Oil Concentration in Canola

John McCallum and Dan Long
USDA-ARS, Pendleton, OR

Since oil is the most valuable component of canola, it is important to look at how much oil is produced rather than just seed yield. We are studying the variance of oil content in seed within a plant, from plant to plant, from field to field, and from geographic region to region, in addition to variances due to time and seasonal changes. Oil content is modeled with near infrared (NIR) spectroscopy for prediction and field mapping. Spectroscopic methods for detecting oil have been developed, but the usefulness of this information may be mitigated by the naturally occurring variance in the oil content of seed. Within field differences, and their causes, may be significantly limiting the use of oil concentration as an inherent plant characteristic. These causes of variance have been found to be varietal, but also strongly affected by nutritional, geographic, seasonal, and possibly phenological differences. With canola being known as indeterminant, variance in oil content may be as dependent on local conditions as on genetic determination.

POSTER 07

Management of Fresh Wheat Stubble for Irrigated Winter Canola Production

Bill Schillinger and John Jacobsen, Washington State University, Lind
Tim Paulitz, USDA-ARS, Pullman
Jeff Schibel, Irrigated canola grower, Odessa

We are currently in the third year of field experiment with five irrigated wheat stubble management treatments to better understand the physiological mechanism(s) governing the health of winter canola when planted into heavy, newly-harvested wheat stubble. No root or foliar diseases in canola were detected in 2013 or 2014 crop years in any of the treatments. Winter canola seed yields among treatments in 2013 ranged from 2988 to 3246 lb/acre. In 2014, all canola in the direct seed into stubble and broadcast into wheat before wheat harvest treatments was killed by cold winter temperatures. Many, but not all, canola plants in the stubble chopped + moldboard plow treatment were also killed in the winter. Canola in the stubble burned + disk and the stubble burned + direct seed treatments suffered the least winter damage. Canola seed yields in the three surviving treatments in 2014 ranged from 1830 to 2830 lb/acre. The height of the crown and length of hypocotyl were greater in canola when direct seeded into stubble and broadcast into standing wheat before wheat harvest. Crowns and growing points are formed at the end of the hypocotyl, so a longer hypocotyl means the crown is further from the ground and possibly more prone to freeze damage.

POSTER 08

Feral rye (*Secale cereale* L.) control in winter canola (*Brassica napus*) in the Pacific Northwest

Frank Young, USDA-ARS, Pullman WA
Dale Whaley, Ian Burke, Dennis Roe, Washington State University, Pullman WA

In the Pacific Northwest (PNW), where feral rye (*Secale cereale L.*) is considered a noxious weed in WA, very little research has been conducted on its biology, ecology, and management. Thus far, one study in 1977 evaluated paraquat and barban for control of feral rye in winter wheat (*Triticum aestivum*) and a second study in 1984 evaluated the effect of various herbicides on feral rye seed germination. Since then no research has been conducted with feral rye in PNW crops. With the introduction of winter canola into the winter wheat/fallow region an opportunity exists for growers to better manage feral rye in their production systems. In OK, clethodim, quizalofop, and glyphosate effectively controlled cereal rye in winter canola as measured by weed seed reduction compared to the nontreated check. In north central WA a 2-yr study was conducted to evaluate these three herbicides on a natural stand of feral rye in winter canola. In the 2011-2012 experiment the most effective treatments were when quizalofop and glyphosate were split-applied in the fall and spring. These treatments decreased greatly feral rye plant population and seed population and increased substantially canola yield compared to the nontreated check. In the 2013-2014 experiment, the rye density was heavy, moisture was lacking, and weed completion was severe. Winter canola as unharvestable in the nontreated check and no viable rye seed was produced. The most effective treatments as measured by crop yield and decreased plant population were Quizalop and glyphosate either fall applied or split-applied (fall+spring).

POSTER 09

A Summarization of Past, Current, and Future Winter Canola Research in the PNW

Frank Young and Larry McGrew, USDA-ARS, Pullman WA,
Dale Whaley, William Pan, Lauren Young, Dennis Roe, Laban Molsee and Karen Sowers, Washington State University, Pullman WA

In 2007 we began to introduce winter canola into the winter wheat-summer fallow region of north central WA of the Pacific Northwest (PNW). When we initiated our research, < 225 ha of winter canola had been planted and currently >12,000 ha of winter canola are being grown in this region. Our initial studies were to determine the optimum winter canola seeding rate and date. Current and future research include variety testing, feral rye management in winter canola, and the use of high residue cereal crops and the stripper header to allow no-till winter canola planting. Planting methods and seeding date and rate studies have reduced the risk of planting winter canola. Fourteen winter canola varieties including conventional varieties, Roundup resistant varieties, and SU and IMI tolerant varieties are being planted in 4 to 6 winter wheat-summer fallow locations. Feral rye is a major weed infesting the wheat-fallow region. Experiments have been concluded in Okanogan and Douglas Co. examining the efficacy of Select, Assure II, and Roundup on feral rye control in winter canola. In the summer of 2011 a 6-m stripper header was purchased for research at the Ralston no-till research site. This current phase of research is investigating planting tall cereal varieties and harvesting with a stripper header to increase residue and seed zone moisture and reduce soil temperatures.

POSTER 10

Canola and Wheat Seedling Root and Root Hair Behavior in the Presence of Deep-Banded Urea

Isaac Madsen, William Pan, and Ron Bolton, Washington State University, Pullman

An issue involved in the incorporation of Canola into a wheat rotation is the fertilizer placement. Fertilizer banded below the seed has potential to hydrolyze ammonia inhibiting germination or damaging young plants. An exploratory series of high temporal and spatial resolution images of canola roots demonstrate the effects of below seed banded urea on canola root lateral development, root hair thinning, root girth shrinking, and root discoloration. A similar series of images taken of a wheat plant, but with a lower temporal resolution show stunting on one seminal axis while two other seminal roots continue growing past the urea band. The high temporal and spatial resolution of the canola images allows for the examination of root and root hair behavior in the presence of urea fertilizer.

POSTER 11

Winter Canola Water Use in Low Rainfall Areas of Eastern Washington and Planting Date Effects

Megan Reese and Bill Pan, Washington State University, Pullman
Bill Schillinger, Washington State University, Lind Dryland Research Station
Frank Young, USDA-ARS, Pullman

An on-farm winter canola seeding date trial was initiated in the summer of 2013 in Ritzville. Plots were established on June 10, June 26, August 5, and August 12, 2013. Clear differences in water use due to planting date were observed; the earliest date used 8.25 inches before winter dormancy, compared to 3.13 inches by the latest date. Canola extracted moisture below six feet, though water was first accessed in the top foot. Unfortunately, this study was terminated due to excessive winter-kill. More fall water use and increased crown height correlated to higher winter mortality. For the 2014 season, canola water use patterns were monitored in variety trial plots seeded around August 20 in Okanogan, Pomeroy, and Asotin. Soil depth was incredibly variable at Asotin, and this factor largely determined total profile water content. Okanogan and Pomeroy received similar amounts of rainfall, but Pomeroy canola accumulated more biomass. Canola in Okanogan used 0.87 inches of water before winter, compared to 5.89 inches in Pomeroy. Moisture measurements will be continued in spring, and yield characteristics will be determined at harvest. This water use study will be continued next year, along with a repeated season of the planting date study in Ritzville

POSTER 12

The Impact of Research and Extension on Oilseed Production in Washington State.

Karen Sowers, Bill Pan and Dennis Roe, Washington State University, Pullman, WA

The Washington State Oilseed Cropping Systems (WOCS) Research and Extension project was initiated in 2007 with funding from the state legislature to evaluate alternative crops with the goal of dramatically increasing biofuels crop production. Washington State University and the WA Department of Agriculture recognized that cropping systems research was the key to overcoming the knowledge gaps and other limitations to producing oilseed crops across the state. The WOCS project team has produced numerous publications, a patent, abstracts and presentations at regional and national conferences and workshops, annual field days and tours, a dedicated website, and an annual oilseed production and marketing conference that has developed into a major annual event with the inclusion of the PNDSA, drawing nearly 500 participants in 2014. Research projects are focused on spring and winter canola and camelina, with topics ranging from canola variety performance to developing Group 2 herbicide resistant camelina to residue management. According to USDA statistics, WA canola production more than doubled from 15,000 acres in 2012 to 45,000 acres in 2014, partially attributable to the WOCS research and extension activities and products

POSTER 13

Winter Canola Yield and Survival as a Function of Environment, Genetics, and Management

Michael Stamm, Yared Assefa, and Kraig Roozeboom, Kansas State University, Manhattan

Growing winter canola creates cropping system diversity and provides rotation alternatives for producers. The objective of this research was to investigate the impact of environment, crop management, genetics and their interactions on canola stand establishment, survival, yield, and oil and protein contents. Two datasets were analyzed: data from the National Winter Canola Variety Trials (NWCVT) conducted from 2003 to 2012 and data from experiments conducted for three years (2010-2012) in Manhattan, Kansas, to assess the impact of planting date, tillage, and cultivar on canola yield and survival. Canola has the potential to yield up to 6200 lb/acre; however, actual yields were usually in the range of 850 to 3500 lb/acre. The average oil content of canola seeds was 40% with potential for 47%. Environment, defined as a combination of year and location, was responsible for the majority of variation in yield, oil content, stand establishment, and survival of winter canola. In only a few cases did tillage improve winter survival and yield compared to no-tillage. Cultivars differed significantly in yield, survival, and crown height, but no cultivars were consistently superior under no tillage or with planting outside of the recommended time frame.

POSTER 14

Uptake Efficiency and Partitioning of Soil and Fertilizer N Sources by Canola, Wheat, and Pea

Tai McClellan Maaz, Taylor L. Beard, William L. Pan
Washington State University, Crop and Soil Sciences

Soil N supply is often not factored into many N use efficiency equations. In order to determine the relative contribution of soil derived N to plant N uptake, a greenhouse study was conducted in which wheat, inoculated field pea, and canola plant received labeled $(^{15}NH_4)_2SO_4$ fertilizer at rates of 6, 60, 180 or 420 mg N kg^{-1} soil. The proportion of plant N derived from fertilizer (%Ndff), soil (%Ndfs), and atmosphere (%Ndfa) was measured. Multiple nitrogen recovery indices were calculated, including the recovery of ^{15}N fertilizer by crops, N uptake efficiency, available N use efficiency, and the apparent fertilizer N recovery. Canola and wheat derived similar proportions of plant N from fertilizer, ranging from 4 to 65%. N fertilization had a significantly negative impact on %Ndfa by field pea, which declined from 53-3%. The majority of plant N was derived from fertilizer only when fertilizer N contributed to more than 62% of the N supply. For all crops, N uptake efficiency and apparent fertilizer N recovery generally exceeded ^{15}N crop recovery. Our results highlight the importance of soil N in supplying N under limiting conditions, and support the inclusion of total N supply in N use indices.

POSTER 15

The Effects of Silicon and Fiber Composition from Canola and Wheat Residue on Soil Quality

T.L. Beard, T. McClellan Maaz, and W.L. Pan, Washington State University, Pullman, WA

Silicon (Si) has been linked to pan formation in soils within the Pacific Northwest. The main goal of this research is to determine if degradation of crop residues containing Si contribute to surface crusting commonly seen in drier areas. Oilseeds have lower amounts of Si and higher amounts of lignin compared to grasses such as wheat. In order to compare the effects of rotation history, a soil incubation was conducted with two soil types. The first soil was collected from a field traditionally grown in a winter wheat-fallow rotation and the second soil was collected from a spring canola-fallow rotation. Three rates of silica solution (SiO_2), representative of amounts that would be found in wheat and canola residues, were added to each soil type. The treatment with the highest amount of Si solution combined with the soil previously cropped in wheat increased soil crust thickness (25.4 mm) and surface resistance (7.6 kg(f)/m^2). Therefore, it may be beneficial to consider crops with lower amounts of Si when planning crop rotations in areas where soil crusting can be a concern.

POSTER 16

Yield, Oil Content and Water Use of Summer-Planted Winter Canola in Semiarid Oregon

Don Wysocki and Alan Wernsing, Oregon State University, Pendleton

Winter canola has customarily been planted in early September in dryland fields in eastern Oregon. Stand establishment is very difficult at this time because of low seedzone water content and high surface soil temperature. To avoid these severe limitation, winter canola was planted in June and July when seedzone water content and soil temperatures are more favorable. Four winter canola cultivars were sown in a 4 replication split plot experiment at 3 planting date in 2010, 2011, and 2012. Planting date was the main plot treatment and cultivar the subplot variable. Stand establishment and yield were best when winter canola were planted in June or July and poorest when planted in September in 2010 and 2011. In 2012, stand establishment was equal for all planting dates, and yield greatest in the September planting. Soil water content in June and July plantings were 50 to 75 mm lower in March just prior to bolting than September plantings. After harvest, soil water content was equal for all planting dates. Planting date influenced when soil water was utilized but didn't influence the total water used. Oil content was not affected by planting date. Summer planting of winter canola in dryland Oregon is a practice that increases stand establishment and lowers risk. Soil water is depleted earlier in the crop year, so yields can be expect to be lower in years of early spring drought.

POSTER 17

Twenty Years of Canola Variety Performance in the Pacific Northwest.

Bradley Pakish, Jim B. Davis, Megan Wingerson and Jack Brown
University of Idaho, Moscow, ID

The Pacific Northwest (PNW) has a comparatively long history of growing canola and rapeseed. Initially, a major constraint on increasing acreage was the availability of suitably adapted cultivars. Over the past 20 years, the University of Idaho Canola Breeding Program has conducted regional winter and spring cultivar trials throughout the PNW region with sites in Idaho, Oregon and Washington. In those trials, 160 winter cultivars from 20 companies and 266 spring cultivars from 25 companies have been tested. Over that period, yield potential for winter canola has increased from 3,400 kg ha^{-1} to over 4,400 kg ha^{-1}, and 1,900 kg ha^{-1} to 2,500 kg ha^{-1} for spring canola. Yield improvements were due to both advances in crop genetics and agronomic practices throughout the region. In winter canola genetic improvements were responsible for yield increases of 604 kg ha^{-1} (or 55% of total increase), and in spring canola genetics accounted for 470 kg ha^{-1} (70%), while the remaining yield increase was attributed to agronomic advances. In recent years, the acreage of canola in the PNW has risen quite dramatically and continues to increase. Greater availability of new and adapted cultivars, combined with availability of local crushing, has resulted in higher canola seed prices to the farmer.

POSTER 18

Optimal Agronomic Conditions for Spring and Winter Canola Production in Northern Idaho

Katie Reed, Jack Brown, Jim B. Davis, Megan Wingerson, and Bradley Pakish
University of Idaho

Lack of economically viable alternative crops to grow in rotation with small grain cereals has increased producers interest in growing spring and winter canola. Higher yielding canola cultivars combined with competitive prices has resulted in an increase of canola acreage in the Pacific Northwest region; although adapted canola cultivars are now available to growers, few attempts have been made to optimize productivity through agronomic management of the crop. The aim of this two-year study is to optimize growers' productivity and profitability with a range of adapted winter and spring canola cultivars in specific environments. Agronomic factors examined include planting date, seeding rate, and fertility management in two different tillage systems. This POSTER presents a portion of the results obtained in the spring trials. Interactions between cultivars and agronomic factors were often significant but small compared to the main effects. In general spring canola cultivars produced higher yields when planted early, at intermediate seeding rates and with moderate to high nitrogen availability; although cultivars responded differently to nitrogen availability. Highest spring yield was 2,684 kg ha^{-1} for the cultivar DKL 30-42 with 249 kg N ha^{-1}. Information from this project is valuable to growers to aid in the correct choice of cultivar and management practices to optimize profitability.

POSTER 19

Regional Canola Grower Survey

Katie Reed, Jack Brown, Jim B. Davis, Megan Wingerson, and Bradley Pakish
University of Idaho

Small grain cereal crops dominate throughout the Pacific Northwest dryland region. Adoption of spring and winter canola as a rotation crop has been limited by lack of information about optimal agronomic conditions for maximum crop productivity and seed quality. Despite being a relatively new crop to the region, many farmers now have experience growing canola but with different degrees of success and frustration. Over the past two seasons, the University of Idaho has been conducting a survey of canola growers in the Pacific Northwest region. Information collected includes pre-planting (field history, tillage system, and fertility management), mid-season (weed, insect and disease infestations and their control, and pre-harvest practices), and harvest (yield, quality, and marketing). In the two year survey, 63% of growers grew winter canola and 37% grew spring canola, and canola was most commonly grown following wheat. Average winter canola yield was 2,490 lb. $acre^{-1}$ and spring yield 1,490 lb. $acre^{-1}$. The majority of spring cultivars were herbicide tolerant (GMO) while 56% of winter growers used non-GMO cultivars. Crop establishment was the biggest challenge facing growers; although all surveyed had concerns on planting and harvest.

POSTER 20

Environmental Effects on Oil Quality of High Oleic-Low Linoleneic (HOLL) and Low Linoleneic (LLIN) Spring Canola

Megan Wingerson, Jim B. Davis and Jack Brown, University of Idaho, Moscow, ID

Research has shown that partially hydrogenated fats, which contain *trans* fatty acids, have adverse effects on human health. Traditional canola oil requires partial hydrogenation to avoid off-flavors when used for high temperature frying. Rancidity and off-flavors in oil are caused by oxidation of linoleneic acid, which has led to the development of high oleic - low linoleneic acid (HOLL) and low linoleneic acid (LLIN) canola cultivars. To examine the fatty acid stability of HOLL and LLIN canola, four LLIN lines, four HOLL lines, and two standard canola cultivars ('Westar' and 'Profit') were tested over two years in multiple location field trials throughout the Pacific Northwest. Prior to flowering, racemes were covered with Delnet® pollination bags to avoid cross pollination. At harvest, seeds from the covered plant racemes were harvested by hand and used for fatty acid testing, and the remainder of each plot was combine harvested. Cultivar x year, cultivar x site, and cultivar x year x site interactions were found for oleic and linoleneic acid, although these were all small compared to cultivar differences. HOLL and LLIN breeding lines were identified with high yield combined with stable oil quality.

POSTER 21

Oilseed Production Feasibility in the Pacific Northwest

Pedee Ewing, Jack Brown, Jim Davis, and Megan Wingerson
University of Idaho

The United States remains highly dependent on fuel imports and interest in producing bio-jet fuel from vegetable oils, including oil from Brassicacaea species, has increased. Some Brassicaceae oilseed species have shown potential as valuable rotation crops with small grain cereals that predominate in northern Idaho and other dryland areas of the Pacific Northwest. However, few studies have examined the physiological growth pattern, basic plant morphology, and reaction to local pests and diseases of these crop species. In this study we examined three fall-planted species (Brassica. napus, B. rapa and Camelina. sativa) and six spring-planted species (B. napus, Sinapsis. alba, B. juncea, B. caranata, B. rapa, and C. sativa) to determine how each species is impacted by abiotic and biotic stresses and to determine how each species performs in regards to yield, oil content, meal characteristics, and rotational benefits. Results from the first year of this study are presented and discussed.

POSTER 22

Investigating Cover Crops in Dry land Pacific Northwest Winter Wheat Rotations

Sage McClintick-Friddle, Jim B. Davis, Megan Wingerson, Jack Brown, and Bradley Pakish.
University of Idaho

Cover crops have the potential to provide multiple benefits in a cropping system. There is a renewed interest in these crops due to their potential role in reducing chemical inputs and improving soil quality. However there have been mixed results in the efficacy of cover crops to prevent erosion, improve soil's physical and biological properties, supply nutrients, suppress weeds, improve the availability of soil water, and break pest cycles along with various other benefits. The objective of this study is to examine the effects of growing a variety of spring planted cover crops compared to spring seed crops (i.e. canola, wheat, barley, and pea) and their impact on subsequent winter wheat production and profitability. Factors examined include soil organic matter, soil fertility, soil moisture, plant biomass, and yield from seed crops. It is hoped that with this information growers will be able to determine the economic, environmental, and sustainable feasibility of utilizing cover crops in the dry land regions of northern Idaho. Results from the first year of cover crops and spring seed crops is presented and discussed.

POSTER 23

Results of the 2014 Pacific Northwest Canola and Mustard Trials

Jim B. Davis, Bradley Pakish, Megan Wingerson, and Jack Brown , University of Idaho, Moscow, , Alan Wernsing and Don Wysocki, Oregon State University, Pendleton,

The agricultural community in the Pacific Northwest continues to show a strong interest in winter and spring canola (*Brassica napus* and *B. rapa*) and in condiment mustard (*Sinapis alba* and *B. juncea*). Canola and mustard offer growers an alternate crop for rotation in an agricultural system predominated by small cereal grains. Comprehensive yield trials are needed to evaluate new cultivars and to determine which areas of the Pacific Northwest are best suited to the available cultivars. With this objective in mind, researchers at the University of Idaho established the Pacific Northwest Canola Variety Trial in the mid-1990s. In 2014, the winter canola trial had 23 entries grown at seven locations, the spring canola trial had 30 entries at seven locations, and the mustard trial had 14 entries at eight locations. Averaged across locations, winter canola yields ranged from 2,461 to 4,260 lbs. per acre, spring canola yields ranged from 1,467 to 2,420 lbs. per acre, and mustard yields ranged from 1,307 to 1,824 lbs. per acre. The trials are funded by the PNW Canola Research Program, the University of Idaho, and by fees paid by the commercial companies that submit their cultivars for testing

POSTER 24

Camelina response to soil moisture variability and harvest time

Henry Y. Sintim[1], Valtcho D. Jeliazkov[1, 2], and Augustine K. Obour[3 1]Univ. of Wyoming, Dept. of Plant Sciences, and Sheridan Res. & Ext. Center, WY;[2]Oregon State University, Columbia Basin Agri. Res. Center, OR[3,] Kansas State University, Agricultural Research Center- Hays, *KS*

An oilseed crop with promise for dryland crop production in the Great Plains is camelina (*Camelina sativa* L. Crantz), because it is well adapted to the water-limited environments in the Great Plains. Nonetheless, uneven maturity of camelina results in yield losses due to pod shattering. This suggests the need to determine the best harvest time for camelina that will increase seed yield without significant effects on the quality. Thus, the objectives of this study were to a) determine the effects of harvest time on camelina yield and quality and b) assess whether there is any relation between spatial soil moisture variability and level of uneven maturity in camelina. Camelina was harvested at three stages (when 50%-early; 75%-mid and >90%-late of the silicles were brown in color) of maturity. In addition, ten 1 m by 1 m area were demarcated from portions of the plots showing different levels of uneven maturity, and soil moisture measured randomly from the area with a TDR probe at 20 cm soil depth. Harvesting at mid (975 kg ha^{-1}) and late (831 kg ha^{-1}) stages significantly reduced the seed yield relative to early harvest (1051 kg ha^{-1}). However, harvesting at mid maturity stage resulted in highest oil content, and as such, there was no difference in biodiesel production between early and mid harvests. Standard deviation of soil moisture showed a positive correlation with level of uneven maturity observed. The results showed that soil moisture variability affects uniform maturity of camelina and subsequent seed yield, suggesting the need for swathing in order to minimize pod shattering.

POSTER 25

Improving germinability and vigor enhancement of Sunflower (*Hellianthus annus* L.) Hybrid seed under low temperature through seed priming

Muhammad Bilal Chattha and Muhammad Nasir Subhani, University of the Punjab, Lahore
Muhammad Umer Chattha, University of Agriculture, Faisalabad, Pakistan

Slow germination due to low temperature at early growth stages severely affects the performance of spring planted sunflower crop. Experiments were conducted in the laboratory and in greenhouse in the Institute of Agricultural Sciences, University of the Punjab, Lahore, Pakistan during spring season 2014 to examine the effect of seed priming on germination and emergence of hybrid sunflower at 18^0C with organic sources like Jaman leaf extract, Moringa leaf extract, Arjun leaf extract, growth hormones like Manitol, ascorbic acid, salicylic acid and halopriming with calcium chloride, hydrogen peroxide and potassium nitrate in a quadruplicated experiment. All the priming treatments were more or less effective in improving germination rate and subsequent seedling growth as indicated by lower time to 50 % germination (T50), mean germination time, higher final germination percentage, germination index, final emergence percentage and enhanced root shoot lengths and seedling fresh and dry weights as compared to that of untreated seeds. Highest response was given by the seed treated with growth hormones followed by halopriming agents while least effect was shown by the leaf extracts. Regarding cost effectiveness of these priming treatments; plant extracts were found to be most economical.

POSTER 26

Oilseed Flax as a Dryland Broadleaf Rotation in the Pacific Northwest

Tomas Endicott, Willamette Biomass Processors, Inc., Rickreall, Oregon

Grass seed and grains (primarily wheat) prevail on large acreage parcels throughout the Pacific Northwest region. Growers and researchers alike realize the benefit of rotating grasses and grains with broadleaf crops, but dryland rotation options are limited based on moisture, temperature and the length of growing season of different areas. Oilseed flax is a sturdy crop that may be an option on dryland in many different parts of the Pacific Northwest. It can survive heavy rainfall (40+ inches precipitation per year), but it can also survive low-moisture conditions (10-12 inches precipitation per year). Flax can be fall planted, dormant seed planted or spring planted. It has been used successfully to nurse grass seed crops, like fescue. Flax requires low fertilizer input, and it offers excellent in-crop weed control for both broadleaf and grassy weeds. Flax can be swathed or direct cut, and it is harvested with the same combines used for grass seed or wheat. Markets, although currently limited in the Pacific Northwest, are growing consistently, and they offer pricing better than camelina and canola.

POSTER 27

Multiplication Rates of Root-lesion Nematodes on Selected PNW Crops

Richard Smiley, Oregon State University, Pendleton and Moro

Thirty crop species and varieties were assayed in the greenhouse to determine the relative multiplication rates of the root-lesion nematodes *Pratylenchus neglectus* and *P. thornei*. Hosting ability ratings were assigned using the ratio of final versus initial nematode density and also by comparing the final nematode density to that of a susceptible wheat control. Good hosts (efficient multipliers) of both nematode species included Monida oat, Myles chickpea, and Athena and Morton lentils. Good hosts of *P. neglectus* but not *P. thornei* included 10 *Brassica* spp. (5 canola, 2 mustard, and 3 camelina varieties), Sierra chickpea, Piper sudangrass, and the sorghum/sudangrass hybrid Greentreat Plus. Good hosts of *P. thornei* but not *P. neglectus* included Skyline lentil and the pea varieties Granger, Journey and Universal. Poor or minor hosts of both nematode species included Dwelley chickpea, Badminton pea, 2PD08 sunflower, Pembina flax, Pete eastern gamagrass, Blackwell switchgrass, and the safflower varieties Gila, Girard and KN 144. Results of these assays will provide guidance for improving crop rotation and cultivar selection efficiencies in fields where root-lesion nematodes are present.

POSTER 28

Rangeland (CRP) Grasses and Legumes as Hosts for Root-lesion Nematodes

Richard Smiley, Oregon State University, Pendleton and Moro

Eighteen rangeland grasses and legumes were assayed in the greenhouse to determine the relative multiplication rates of the root-lesion nematodes *Pratylenchus neglectus* and *P. thornei*. Hosting ability ratings were assigned using the ratio of final versus initial nematode density and by comparing the final nematode density to that of susceptible wheat controls. Good hosts (efficient multipliers) of both nematode species included Critana thickspike bluegrass, Manchar smooth brome, and the seven wheatgrasses Hycrest, Fairway, Whitmar, Secar, Greenar, Nordan and Vavilov. Good hosts of *P. neglectus* but not *P. thornei* included Rosana western wheatgrass, Sherman big bluegrass, Alkar tall wheatgrass, and the hairy vetches Purple Bounty and Purple Prosperity. Good hosts of *P. thornei* but not *P. neglectus* included Durar hard fescue and Blacksheep sheep fescue. Poor or minor hosts of both of these nematode species included the alfalfa varieties Don and Ladak-65. These assays, together with assays of crop varieties (shown in other POSTERs) will provide guidance for transitioning CRP or open rangeland into crop production in a manner that will minimize the yield-limiting impacts of root-lesion nematodes.

POSTER 29

Weeds as Hosts for Root-lesion Nematodes

Richard Smiley, Oregon State University, Pendleton and Moro

Sixteen broadleaf and grassy weed species were assayed in the greenhouse to determine the relative multiplication rates of the root-lesion nematodes *Pratylenchus neglectus* and *P. thornei*. Hosting ability ratings were assigned using the ratio of final versus initial nematode density and by comparing the final nematode density to that of susceptible wheat controls. Jointed goatgrass was a good host (efficient multiplier) of both nematode species. Good hosts of *P. neglectus* but not *P. thornei* included green foxtail, kochia, large crabgrass, palmer amaranth, redroot pigweed, tumble mustard and wild oat. Good hosts of *P. thornei* but not *P. neglectus* included downy brome and rattail fescue. Poor or minor hosts of both *Pratylenchus* spp. included dandelion, horseweed, lambsquarters, prostrate spurge and Russian thistle. These assays will provide guidance for understanding the role of weeds on densities of root-lesion nematodes in PNW cropping systems.

POSTER 30

Effects of Root-lesion Nematode plus Fusarium Crown Rot on Winter Wheat

Abolfazl Hajihassani, Islamic Azad University, Arak, Iran
Richard W. Smiley, Oregon State University, Pendleton and Moro

Many winter wheat fields are infested by the root-lesion nematode *Pratylenchus thornei* as well as the Fusarium crown rot fungus *Fusarium culmorum*. A combination of these pathogens was compared with their individual effects. Winter wheat growth, yield, and disease parameters were evaluated over a two-year period in trials conducted outdoors in large pots. No supplemental water was added; all watering was from natural rainfall and snow. The nematode was added to soil at rates of 0, 450, 900, or 1,800 nematodes/lb. The fungus was added as 0 or 0.01 ounce of colonized grain seed/lb of soil. The highest inoculum levels are well below those commonly found in PNW fields. Disease severity ratings were much greater in the presence of both pathogens than for just one pathogen. Compared to the pathogen-free control, the nematode alone reduced plant height, shoot weight, root weight and grain yield as much as 19%, 17%, 48% and 31%, respectively. The fungus alone reduced these parameters by 15%, 16%, 22% and 22%. The combination of pathogens caused reductions as high as 27%, 38%, 61% and 63%. The presence of both pathogens reduced grain yield more than would be predicted by an additive effect of individual pathogens, suggesting a synergistic effect on yield depression. Efficient control of Fusarium crown rot will require that nematode populations in soil also be considered.

POSTER 31

Spring Barley Resistance and Tolerance to Cereal Cyst Nematode (CCN)

Juliet Marshall, University of Idaho, Idaho Falls and Aberdeen
Richard Smiley, Oregon State University, Pendleton and Moro

Forty six 2- and 6-row spring malt and feed barleys were evaluated for resistance and tolerance to the cereal cyst nematode *Heterodera avenae* over a 2-year period in irrigated circles near St. Anthony, ID. We planted 30-ft long plots following potato crops. An unregistered nematicide was banded with the seed in half the seed rows. After heading, roots were dug, washed and rated for CCN incidence and severity. Essentially all plants had abnormal root branching, including those in nematicide-treated plots, but severity of that symptom was somewhat lower in nematicide treatments than in untreated plots. Numbers of cyst-forming females on each plant were counted and varieties were assigned rankings from resistant to susceptible. Grain yield and test weight were measured with a plot combine and differences in yield of treated and untreated plots were used to rank entries from tolerant to intolerant. The nematicide reduced CCN reproduction as much as 80%. Soil samples taken after harvest were used to determine numbers of CCN eggs/lb of soil, as an indication of the level of risk to the next cereal crop. Several varieties had acceptable levels of resistance plus tolerance, and other varieties were either notable for resistance or tolerance, but not both.

POSTER 32

Spring Wheat Resistance and Tolerance to Cereal Cyst Nematode (CCN)

Richard Smiley, Oregon State University, Pendleton and Moro
Juliet Marshall, University of Idaho, Idaho Falls and Aberdeen

Thirty nine hard red, hard white and soft white spring wheats were evaluated for resistance and tolerance to the cereal cyst nematode *Heterodera avenae* over a 2-year period in irrigated circles near St. Anthony, ID. We planted 30-ft long plots following potato crops. An unregistered nematicide was banded with the seed in half the seed rows. After heading, roots were dug, washed and rated for CCN incidence and severity. Essentially all plants had abnormal root branching, including those in nematicide-treated plots. Numbers of cyst-forming females on each plant were counted and varieties were assigned rankings from resistant to susceptible. Grain yield and test weight were measured with a plot combine and differences in yield of treated and untreated plots were used to rank entries from tolerant to intolerant. The nematicide improved grain yield as much as 70%, did not affect test weight, and reduced CCN reproduction as much as 92%. Soil samples taken after harvest were used to determine numbers of CCN eggs/lb of soil, as an indication of the level of risk to the next cereal crop. Several varieties had acceptable levels of resistance plus tolerance, and other varieties were either notable for resistance or tolerance, but not both.

POSTER 33

Nematodes: It is Important to Identify Species as well as to Determine Numbers

Richard Smiley, Oregon State University, Pendleton and Moro

Much new information is now available for detecting and managing nematodes in infested fields. Root-lesion nematodes (RLN) and cereal cyst nematodes (CCN) are thought to be the most important groups that are present in PNW fields. RLN are more widespread and have a wider host range than CCNs. But each of these two groups contains at least two species that are important. Identifying the species is as important as determining the presence and/or number of nematodes in a field because crops and varieties respond differently to each of these species. This POSTER uses selected examples to illustrate the importance of identifying the nematode species as well as learning whether or not a nematode group is present. Species identification became easier in 2014, at which time we transferred several molecular testing protocols from our research lab so they could become adopted by commercial diagnostic labs. Western Laboratories (Parma, ID) now offers this DNA-based testing as one of their services. This POSTER will show the clarity of molecular tests that are now available to distinguish between the most important species in each nematode group.

POSTER 34

Effects of Cropping Systems on Root-invading Fungi and Nematodes

Richard Smiley & Stephen Machado, Oregon State University, Pendleton and Moro, OR

Rotations of winter wheat with cultivated fallow in low-rainfall regions are being converted into direct-seed systems that include chemical fallow, spring cereals, and food-legume and brassica crops. Eight cropping systems in an 11-inch precipitation region at Moro were compared over nine years to determine effects of changes on diseases. Fusarium crown rot was more prevalent in wheat following cultivated than chem fallow, and Rhizoctonia root rot was more severe when winter wheat was rotated with chem fallow than with no-till winter pea. Take-all occurred even during the driest years and was more severe on annual spring wheat than on annual spring barley. Inoculum density (picograms of DNA/gram of soil) of pathogens differed among cropping systems for *Fusarium culmorum*, *F. pseudograminearum*, *Gaeumannomyces graminis* var. *tritici* and *Pythium* spp., but not for *Rhizoctonia solani*. We detected *Phoma medicaginis* var. *pinodella* only where winter pea was planted frequently. This was the first report of *P. medicaginis* as a component of the dryland stem rot complex of pea in north-central Oregon. This pathogen was then also found at Pendleton. Results of this investigation will provide guidance for developing crop species with resistance to Fusarium crown rot and black stem of pea.

POSTER 35

Bioclimatic Predictors of Dry-land Agro-ecological Classes and Projected Shifts under Climate Change

[1]Harsimran Kaur, [2]Dave Huggins, [1]Rick Rupp, [3]John Abatzoglou, 1Claudio Stockle,[1]John Reganold,
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Land use classification studies often rely on biophysical variables hypothesized to be key drivers of land use/cover. Weak relationships, however, can occur between delineated land use classification and actual land use. In contrast, classification based on land use/cover that has emerged as a consequence of determinants may be advantageous as the actual land use can then be used for selecting important driving variables. The National Agricultural Statistics Service (NASS) cropland data-layer of actual land use/cover was used to classify the REACCH (Regional Approaches to Climate Change) study region, in the inland Pacific Northwest, into four major agro-ecological classes (AECs): (1) annual cropping (limited annual fallow); (2) annual crop-fallow transition (e.g. 3-yr rotations with fallow every 3rd year); (3) grain-fallow, 2-yr; and (4) irrigated (Huggins et al., 2011). Different climatic parameters and bioclimatic variables were calculated for the REACCH region at 4 × 4 km scale using 30 year (1981-2010) precipitation and temperature data. Bioclimatic variables useful for classifying only dry-land AECs were identified using discriminant analysis. Identified predictors were then used with future climate change scenarios to predict future shifts in the geographic distribution of dry-land AECs in the REACCH region.

POSTER 36

**Climate, Management, and Surface Soil C and N Properties and Processes:
A Soil Health Perspective**

Jason Morrow, Lynne Carpenter-Boggs, John Reganold, Washington State University, Stephen Machado, Oregon State University, Jodi Johnson-Maynard, University of Idaho, Hal Collins, USDA-ARS, Prosser, Hero Gollany, USDA-ARS, Pendleton, Dave Huggins, USDA-ARS, Pullman

Surface soils comprise a critical interface which influences soil health through their role in nutrient cycling and decomposition, soil structure, water infiltration, and erosion potential. In this study we tested multiple surface soil C and N properties and processes across the inland Pacific Northwest. Our objective was to assess the influence of climate and management on surface soil health, and to gain greater understanding of the ability of easily measured soil properties to provide meaningful information about soil health. We measured both active and passive pools of soil C and N. In short, we found mean annual precipitation and temperature were the main drivers of soil C and N properties and processes. Permanganate oxidizeable carbon (POXC) is an easily measured soil property and displayed sensitivity to soil organic matter (SOM) stabilization; POXC was coupled with three different active measures of SOM to provide a more comprehensive view of the influence of tillage and cropping intensity on soil health. These active measures included 24-hour C mineralization, a soil health index comprised of multiple active C and N measures, and 24-hour PRS^{TM} nitrogen (plant root simulator probe, Western Ag Innovations, Saskatoon, Canada); coupled with POXC, each provided unique information about soil health.

POSTER 37

Influence of organic, reduced-tillage crop rotations on earthworms and other indicators of soil quality

Kendall Kahl, Jodi Johnson-Maynard, Ian Leslie
Department of Plant, Soil and Entomological Sciences, University of Idaho, Moscow, ID

Conservation tillage practices in dryland agriculture have become more common in the highly erodible Palouse soils of the Inland Pacific Northwest, but there has been little investigation of organic, reduced-till (ORT) agriculture. When implemented separately, reduced-tillage and organic management frequently provide benefits to soil health. However, their combined impact is less well understood. We measured soil biological, chemical, and physical soil health indicators in three reduced-tillage cropping systems: a 5-year organic alfalfa-wheat rotation (Org-Alf-5yr), and organic and conventional comparisons of a 3-year wheat-winter pea forage rotation (Org-WPW and Con-WPW, respectively). Earthworm density and biomass were sampled annually (2010-2013) in Org-Alf-5yr plots, and in 2010 and 2013 for Org-WPW and Con-WPW. Additionally, in 2013, soil organic carbon (SOC), total nitrogen, pH, bulk density, hydraulic conductivity, aggregate stability and size distribution, and microbial biomass measured by fumigated extractable carbon (FEC) and nitrogen (FEN), were measured in all three cropping systems. Averaged across years, earthworm density was significantly greater in Org-WPW (109 individuals m^{-2}) compared to Con-WPW (51 individuals m^{-2}), and was similar in the two organic systems. Soil pH and SOC were greater in the 0- to 10-cm depth under Org-WPW than under Con-WPW. There was a general trend for greater FEC ($p=0.06$) under Org-WPW (100.32 µg g^{-1}) compared to Con-WPW (76.94 µg g^{-1}). FEN, total nitrogen, aggregate stability and hydraulic conductivity were similar between Org-WPW and Con-WPW. Significant correlations between earthworm density and SOC stocks ($r=0.71$, $p<0.01$), total nitrogen stocks ($r=0.71$, $p<0.01$), FEC ($r=0.58$, $p=0.02$), and between earthworm biomass and FEN ($r=0.53$, $p=0.05$) were observed in the top 10 cm of soil. Overall, the results suggest that soil biological and chemical indicators of soil health respond more rapidly to ORT practices than do physical indicators and that earthworms may have a strong influence on chemical and other biological indicators within these systems.

POSTER 38

Palouse Soil Carbon Just About Open for Business

Ry Thompson and Steve Apfelbaum, Applied Ecological Services, Inc., Brodhead, WI
Tom Stoddard and Kirsten McKnight, NativeEnergy, Inc., Burlington, VT

Applied Ecological Services received a USDA-NRCS Conservation Innovation Grant to develop, with Shepherd's Grain, a large-scale agricultural carbon project in the Palouse region in 2011. This POSTER is a follow up to the presentation by AES and Shepherds Grain at the 2013 annual PNDSA meeting. Since 2013, the team measured soil carbon stocks associated with no-till agriculture practices and developed a carbon accrual quantification methodology. Along with NativeEnergy, a carbon developer and retailer, we are now prepared to engage producers to participate and claim carbon credits from their management practices, specifically direct seeding. In progress to bring the project to the carbon market, NativeEnergy and AES are working to get the methodology and project structure approved by carbon standards. Our latest effort is focused on adapting an existing land-use methodology from the American Carbon Registry to fit the Palouse program. We are looking for no-till producers or producers willing to convert to no-till farming who are motivated to further aid research on improving soil water holding capacity, soil fertility, irrigation efficiency, and crop yield and quality. This POSTER will display the carbon accrual research, outline the costs and benefits for participating producers, and explain the carbon market requirements and opportunity.

POSTER 39

Wheat Roots Response to Low pH Soils

Gary Wegner, Columbia River Carbonates, Woodland, WA

Low pH soils are a serious problem in the Inland Northwest. One of the best ways to understand the impact of low pH soil is to access growth and development of wheat plants in areas where low pH status has been verified. Visually, accessing wheat roots is quick and simple process, but can provide valuable information. Low pH soils can have a dramatic effect on wheat performance. The poster shares visual references that should help in understanding the significance of low soil pH "

POSTER 40

Remediation of stratified soil acidity through surface application of lime in no-till cropping systems

Carol McFarland, David R. Huggins, Kurt L. Schroeder, J. Joey Blackburn, L. Carpenter-Boggs, Rich Koenig, Timothy C. Paulitz

Yield reduction and reduced crop vigor, resulting from soil acidification, are of increasing concern in Eastern Washington and Northern Idaho. In this region, soil pH has been decreasing at an accelerated rate, primarily due to the long-term use of ammonium-based fertilizers. In no-till systems, the acidification is stratified and a zone of much lower soil pH is often measured at the depth where fertilizer is applied. It is well known that liming raises soil pH. At the same time the properties of soils in the Palouse region, which include cut-over timber soils as well as those which were natively prairie, are unique and not typical of "acid" soils. The unique properties of Palouse soils mean that they will have different requirements and responses to liming than characteristically acid soils. Lime is traditionally incorporated using tillage, and surface applications of lime in no-tillage systems have not been consistently effective in remediating acidic subsurface zones that result from deep banding fertilizer. Recently, however, a 98% $CaCO_3$ fluid lime with ultra-fine particle size (1 to 2 microns) has become commercially available in the Pacific Northwest region. The fine particles may increase the mobility and reactivity of the lime and be more effective for addressing subsurface acidity in no-tillage systems. Additionally, sugar lime (~85% $CaCO_3$), a byproduct of the sugar beet industry, is also commercially available in the region as an agricultural lime. We surface applied fluid lime and sugar lime at two sites under long-term no-till management. The sites represent soils derived from native vegetation of forest or prairie and had subsurface, stratified soil acidification with pH values as low as 4.2. The lime was applied in the fall with treatments ranging from 200 lbs/ac to 2000 lbs/ac prior to the no-till spring planting of "Billy bean" chickpeas and canola. We found that the top 1" on the soil's surface was impacted by the lime application within six months. Soil pH was increased and plant-toxic levels of aluminum and manganese were significantly reduced with 2000 lbs/ac treatment of both materials.

POSTER 41

Soil pH Survey Lime Project

Paul G. Carter,WSU Extension Regional Extension Educator, Dayton, WA

Terry Bruegman, WACD Columbia Conservation District, Dayton, WA

Columbia County Washington is in the foothills of the Blue Mountain Range and the edge of the Palouse wheat country. The soils of the farming region are mostly a rich silt loam having rainfall ranging from 12 inches to 25 inches north to south respectively with elevations from 1000 to 3200 feet. About 90% of the cropping systems have adopted reduced tillage, direct seeding or no-till, which has been good for the management of soil erosion. In 2013, Conservation District Supervisors and staff indicated the desire to develop an extensive project to survey the landscape to catalogue soil health status. To determine the extent of the soil health concern, a project (2 years) was developed utilizing resources of the local conservation district. The project offered farmers an opportunity to participation in the survey where they can identify locations for intense depth soil sampling and nutrient testing. Locations were distributed across the county landscape so that all rainfall zones (12-16", 16-20", and >20") were represented. The fields were sampled and analyzed for total nutrients and available aluminum. Results across all landscape and rainfall zones indicated 97% all fields with < 6.0 soil pH and 89% < 5.2 pH in the top 12 inches of soil profile and with high available aluminum

POSTER 42

Field-Scale Cropping System N Use Efficiency after 10 Years of Continuous No-tillage

Rachel Unger, Ian Burke, Mark Swanson, and Lynne Carpenter-Boggs, Washington State University, Pullman, WA

Dave Huggins, USDA-ARS, Pullman, WA

Evaluating nitrogen use efficiency (NUE) for a cropping system, rather than a single growing season, may provide an improved assessment of NUE. The overall objective was to use an N mass balance approach to better understand how terrain, no-tillage, and the implementation of multiple crop rotations influence cropping system NUE. A multi-year cropping systems study under no-tillage was initiated in 1999 on a 37-ha field of the Washington State University Cook Agronomy Farm near Pullman, WA. In 1999, soil samples to a depth of 153-cm were collected from 183 geo-referenced locations in a systematic non-aligned grid across the entire field. Laboratory analysis included total soil organic N and carbon (C). Crop rotations initiated in the fall of 2000 and the spring of 2001 consisted of six different 3-year rotations of spring wheat – winter wheat – alternative crop (spring or winter plantings of barley, canola, lentil, or pea). In 2008, soil samples were again collected from the same geo-referenced locations to a depth of 153-cm and analyzed. All N inputs from fertilizer applications and N output from harvested grain were monitored at each of the geo-referenced locations. Site-specific, field-scale assessments of NUE for each cropping system will be presented.

POSTER 43

Soil Organic Carbon and Soil pH in the Pendleton Tillage-Fertility Long-Term Experiment

Rajan Ghimire, Stephen Machado and Prakriti Bista
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Soil organic carbon (SOC) depletion as well as decrease in soil pH has become a major challenge for wheat (*Triticum aestivum* L.) producers in the Pacific Northwest (PNW). We evaluated the effects of tillage and nitrogen (N) management practices on SOC and soil pH during 1995-2010 in a winter wheat – summer fallow (WW-SF) system. The study was established in 1940 at the Columbia Basin Agricultural Research Center near Pendleton, OR and has a split plot design with three tillage systems (Moldboard plow, MP; disc plow, DP; subsurface sweep, SW) as main plot factors and five N rates (0, 45, 90, 135, 180 kg ha^{-1} $crop^{-1}$) as subplot factors. Soil pH was significantly higher under MP than under DP in 0-10 cm depth and higher under DP than under MP in 10-20 and 20-30 cm depths. Soil pH also decreased with increasing N rate across all tillage systems mainly in 0-10 and 10-20 cm depths. Soil pH was not significantly different between 1995 and 2010. Tillage management as well as N rate did not influence SOC content. The decrease in soil pH potentially limited biomass production and thereby influenced SOC accrual in a WW-SF system.