flax, coriander, caraway, cumin, anise, dill, and fennel) following winter wheat. The overall economics of the 3-year rotation winter wheat/oilseed crop/fallow will be assessed. The field trial was established in 2015 at two locations: the Columbia Basin Agricultural Research Center at Pendleton and at Moro, OR. Due to lower precipitation and unsatisfactory results in Moro, the field trial in 2016 and 2017 will be conducted at Pendleton only. Data collected over three growing seasons will provide information about the production costs and returns as well as the agronomic feasibility of the selected crops for Oregon and the surrounding states.

Characterizing Nitrous Oxide Emissions Over a Canola Crop in the Inland Pacific Northwest Using Automated Static Chambers and the Flux Gradient Technique

Sarah Waldo¹, Patrick O’Keeffe³, Shelley Pressley¹, Brian Lamb¹, Kirill Kostyanovsky², David Huggins³, and Claudio Stickle⁴
¹Dept. of Civil and Environmental Engineering, WSU; ²Dept. of Crop and Soil Sciences, WSU; ³USDA-ARS; ⁴Dept. of Biological and Agricultural Engineering, UI

The addition of fertilizer nitrogen (N) makes agricultural soils the main anthropogenic source of N₂O, a greenhouse gas and ozone-depleting substance. Furthermore, gaseous losses of N from the field (in the form of both N₂O and N₂) constitute an economic loss for the grower: less N is available for the crop, reducing nitrogen use efficiency. N₂O emissions are difficult to characterize at the local and regional levels because of their high degree of both spatial and temporal variability. In this study, we used both static chambers and the flux gradient technique to monitor N₂O emissions at two agricultural fields both growing canola in the inland Pacific Northwest of the US. One field was under no-tillage management and nitrogen fertilizer was applied at a rate of 87 kg N/ha (CAF-N/NT), while the other used conventional tillage and received 101 kg N/ha of fertilizer (CAF-CT). The chamber results indicated that total annual emissions were 2.7 ± 1.6 kg N₂O-N/ha from CAF-N/NT and 4.4 ± 3.2 kg N₂O-N/ha from CAF-CT. The flux gradient results agreed with the chamber measurements at CAF-N/NT, but indicated much lower emissions at the CAF-CT site. The total emissions determined via the flux gradient method were 2.1 ± 0.4 and 1.7 ± 0.3 kg N₂O-N/ha from the CAF-N/NT and CT sites, respectively. Given typical relationships between N₂O and N₂ emissions, the total gaseous N losses (excluding other N species) from CAF-N/NT were 16% to 20% of the applied fertilizer N, and from CAF-CT accounted for 11% to 29% of the applied fertilizer N.

Spatial variability was investigated as a contributing factor to the discrepancies between methods, and it was found that the resolution of the spatial variability may explain the lack of agreement at CAF-CT. Despite the lack of agreement in the overall emissions estimates, the two methods captured similar patterns in emissions. Maximum emissions occurred following the first rainfall event after fertilization at both sites, and other rainfall events also spurred emissions. Higher temperatures were associated with higher emissions at both sites. Continued monitoring coupled with the use of models will be necessary to determine defensible field-scale and regional estimates of annual N₂O emissions from cropping systems in the inland PNW, and to investigate how changing climate will affect emissions.

Comparison of Rhizosphere Soil Microbial Communities for Winter Canola and Winter Wheat at Paired Field Sites

Jeremy Hansen², Tara Sullivan², Bill Schilling³, and Ann Kennedy¹
¹USDA-ARS Northwest Sustainable Agroecosystems Research Unit; ²Dept. of Crop and Soil Sciences, WSU

Canola as a rotation crop in the inland Pacific Northwest has expanded in recent years with the increased demand for canola-based products. Market prices, a major crushing facility at Warden, WA and reported rotational benefits have attributed to canola acreage expansion. Suppression of fungal root pathogens is one of the reported rotational benefits. Canola plants contain glucosinolates (GSLs), which upon cell rupture and during the decay of residue hydrolyze to...
produce isothiocyanates (ITCs). The production of ITCs is the mechanism responsible for what is referred to as the "biofumigation effect". The biofumigation effect is largely considered positive; however, the non-selectivity of ITCs has potential to impact beneficial soil organisms. Canola root GSLs and ITCs often have greater concentration and toxicity in the root. Toxicity, and close proximity of ITCs to soil microorganisms, would potentially create changes in the rhizosphere soil microbial community. Preliminary data from a related field study near Reardan, WA (see article on page 19) suggest that winter canola may suppress mycorrhizal fungi associations of wheat following canola. The objective of this research is to determine the differences and similarities in the rhizosphere microbial communities of canola and wheat. To accomplish this, canola and wheat rhizosphere soil (Fig. 1) is being collected from six farms located in Adams and Douglas Counties. Each farm is a paired site with winter canola and winter wheat grown in adjacent fields having similar soil properties, landscape position, and crop history. Samples from the farms of Derek Schafer, Rob Dewald, and Curtis Hennings near Ritzville, WA and Doug Poole, Tom Poole, and Denver Black near Mansfield, WA have been collected. Rhizosphere microbial community composition will be determined using phospholipid fatty acid (PLFA) analysis, and polymerase chain reaction (PCR) based community profiling techniques focused on the bacterial (16S), and fungal (18S) rRNA regions. This study will determine the influence of canola on soil rhizosphere microorganisms, and deliver information to supplement the findings of the winter canola rotation benefit study at Reardan. Collectively, these studies will provide research-based information to growers, scientists, and industry personnel of the influence that brassica crops have on soil microbial communities.

Figure 1. Field collection of rhizosphere samples and separation of rhizosphere soil from roots for analysis. Rhizosphere soil is defined here as soil adhering to canola or wheat roots after extraction.

Exploring Early Planting Dates for Winter Canola to Improve Seedling Establishment

JIM B. DAVIS, MEGAN WINGERSON, AND JACK BROWN
DEPT. OF PLANT, SOIL, AND ENTOLOGICAL SCIENCES, UI

Drier than average summers and falls during the past 10 years have caused dryland winter canola growers to have difficulty establishing their crops due limited soil moisture during mid to late August. Since seed zone moisture is available earlier in the summer, winter canola could be planted earlier to achieve better crop establishment. To investigate this potential, we initiated a four-year time-of-planting trial in 2010. Sites throughout the inland Pacific Northwest were chosen to represent the wide variety of micro-climates found in the region and included Kalispell, MT, Moscow, ID, LaCrosse, WA, and Pendleton, OR. Three well adapted cultivars (Athena, Baldur and Amanda) were tested in mid to late June, mid to late July, and mid to late August. A variety trial with 40 entries was planted in mid-June for two years at Moscow and LaCrosse.