and winter wheat (WW) in 2006-07. Regardless of the rotation system produced during the transition phase, soil inorganic N levels were similar among all systems (102 lbs acre^{-1}) at the start of organic production. However, SW had higher grain yields (3427 lbs acre^{-1}) following intensive FOR or GRM than systems that contained small grains for at least one year during the transition (2514 lbs acre^{-1}). Although organic soil properties improved following legumes compared to small grains, mid-season mowing of GRM and FOR reduced weed pressure throughout the transition and resulted in higher SW yields during certified organic production. Effective weed control strategies and management proved to be as important as increasing soil N for successful organic wheat production. Winter wheat was more competitive with weeds than SW. Higher WW yields (3748 lbs acre^{-1}) were found following systems that included legumes for at least one year of the transition compared to cereal or grain intensive systems (3006 lbs acre^{-1}). Spring and WW protein levels were higher when legumes were included for at least one year during the transition. Soil inorganic N levels (60 lbs acre^{-1}) were low across all systems following two years of organic wheat production and supplementing soil N throughout organic production is recommended. Additionally, further research should identify crop types and cultivars that are competitive in low-input, organic production systems.

Management of Wheat Density to Optimize Nitrogen and Water Use: Implications for Precision Agriculture

Tabitha T. Brown[1], David R. Huggins[1,4], Jeff L. Smith[1,4], and Chad Kruger[2]
[1]Dept. Crop and Soil Sciences, WSU; [2]Center for Sustaining Agriculture and Natural Resources, WSU, Wenatchee; [3]USDA-ARS, Land Management and Water Conservation Unit

In the Palouse region of the Pacific Northwest, USA, relationships between productivity, N dynamics and cycling, water availability, and environmental impacts result from intricate spatial and temporal variability. This complicates application of precision agriculture principles to improve crop and soil management. This research aims to investigate site-specific factors regulating nitrogen use efficiency (NUE) and the fate of N throughout the growing season of winter wheat (*Triticum aestivum L.*). Nitrogen and plant density field trials with winter wheat are underway at the Washington State University Cook Agronomy Farm near Pullman, WA under long-term no-tillage soil management. A key objectives of this research is to evaluate yield-water availability-NUE relationships among three landscape positions differing in yield potential and soil properties to improve overall N management. Preliminary data show that plant density manipulation combined with precision N applications resulted in greater wheat yield with less seed and N inputs. These findings indicate that improvements to NUE and sustainability of Pacific Northwest dryland agriculture should consider landscape-scale patterns driving productivity.

Tillage Strategies to Control Blowing Dust and PM_{10} Emissions from Williston Reservoir Beaches in British Columbia

W. F. Schillinger[1], P. Shannon[1], D.W. Fryrear[2], and W.G. Nickling[3]
[1]Dept. of Crop and Soil Sciences, WSU; [2]Custom Products, Big Spring, TX [3]Dept. of Geography, Univ. of Guelph, Guelph, Ontario

Williston Reservoir in northern British Columbia was created when BC Hydro constructed Bennett Dam on the Peace River in 1968 to generate hydroelectric power. Williston Reservoir is the largest body of freshwater in British Columbia with a surface area of 685 square miles and a shoreline of 1100 miles. The First Nation Tsay Keh band was forced to relocate to the north end of the reservoir as a result of the water impoundment. When reservoir levels are at low pool in the spring, 25,000 acres of beach is exposed. Beaches are exposed for only two months during May and June and are covered with water during the remainder of the year. High winds of more than 20 miles per hour cause dust storms from exposed beaches that impacts visibility and air quality in Tsay Key village. With funding and coordination by BC Hydro, we conducted a comprehensive 3-year field research project to evaluate methods to control blowing dust with various tillage practices. The basic tactic for the tillage is to bring silt-clay soil from the subsurface to the surface to provide durable roughness. Measurements included sand transport on the tilled versus check treatments using BSNE traps, detailed GPS mapping of sand transport into the tilled treatment from the check borders, surface roughness, and measurement of PM_{10} concentrations with E-Samplers. These measurements were obtained after every wind storm. A separate tillage spacing experiment, using both twisted-point chisel and lister implements, was conducted to evaluate the comparative effectiveness of the implements and determine whether the entire beach area needs to be tilled to control blowing dust or if alternating strips of tilled and non-tilled ground would be adequate. Results show that when there is silt or clay within 12 inches of the soil surface, tillage will produce a rough and stable soil surface. We know from our experiences that, to minimize blowing dust from Williston Reservoir, as much beach area as feasible should be tilled as any non-tilled areas will serve as source areas of blowing dust.

Fig. 1. Tillage experiments at North Davis Flats Beach on Williston Reservoir in 2010. The photo was taken from a helicopter. These experiments covered 385 acres of land area.

Winter Triticale Produces High Grain and Straw Yields in the Dryland Region

Bill Schillinger[1], Ron Jirava[2], Howard Nelson[3], John Jacobsen[1], and Steve Schofstoll[1]; [1]Dept. of Crop and Soil Sciences, WSU, Lind, [2]Producer and research collaborator, Ritzville; [3]Central Washington Grain Growers, Wilbur

Triticale is a cross of wheat x rye that is used as a feed grain. Although triticale has been produced on a small scale for several years, it has not been widely grown in eastern Washington due to the historically low market price of feed grains compared to wheat. This could change soon, however, due to the yield potential of winter triticale and the current high feed grain prices.

Winter triticale has been incorporated into the long-term cropping systems experiment on the Ron Jirava farm near Ritzville. We discovered through experimentation that winter triticale does considerably better than winter wheat from late (mid October or later) planting and we thought that triticale might be a good fit for no-till fallow. Early planting into no-till fallow in late August-early September summer is generally not feasible in the low-precipitation zone due to lack of seed-zone moisture. Winter triticale at the Jirava study is planted into no-till fallow.

The last two crop years at Ritzville have been considerably wetter than normal. With 12.30 inches of crop-precipitation in 2010, we produced 76 bushels/acre of 'Xerpha" winter wheat on tilled fallow and 4250 lbs/acre of late-planted 'TriMark 099' triticale (Fig. 1). Recrop no-till soft white spring wheat yielded 39 bushels/acre, or about half as much grain as the winter wheat and winter triticale.

Due to abundant precipitation in 2010, there was adequate soil moisture for early planting in the no-till fallow, so we planted half of each triticale plot early (Sept. 7) and the other half late (Oct. 20). Precipitation was again plentiful during the 2011 crop year with 13.01 inches received. Early-planted winter wheat yielded 75 bushels/acre whereas early -planted winter triticale yielded 6230 lbs/acre; the equivalent grain mass of 104 bushels of wheat (Fig. 1). The price a grower receives for triticale today (May 1, 2010) in

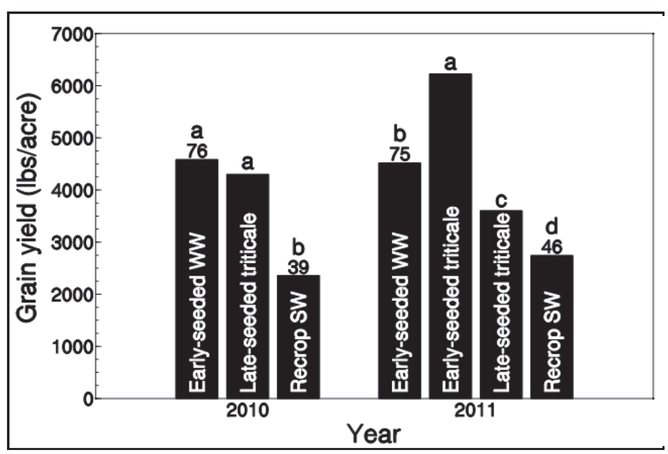

Fig. 1. Grain yield of 'Xerpha' winter wheat planted into tilled fallow, 'TriMark 099' winter triticale planted into no-till fallow, and continuous annual no-till 'Louise" spring wheat in the long-term cropping systems experiment near Ritzville, WA. Within-year grain yields followed by a different letter are significantly different at the 5% probability level.