Snow Redistribution and Soil Water Storage as Impacted by Surface Residue

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Spatial variation of available soil water has important environmental and economic effects and implications by affecting crop yield and quality and effective fertilization recommendation. Studies show that no-tillage (NT) practices, compared to conventional tillage (CT), result in more soil water storage by retaining more snow in stubble, enhancing infiltration and reducing evaporation. We hypothesized that the residue also affects the spatial variation of soil water. Our objectives were to evaluate residue effects on snow redistribution and the spatial variation of soil water in the Palouse area of the PNW. Two side-by-side farms near Pullman, WA, one under NT, the other under CT, were surveyed for snow depth, snow water equivalent (SWE), and resultant soil water storage during the winter season of 2007-2008. Results indicated that snow pack was distributed more evenly and had less spatial variation under NT. Compared to CT, NT retained 10-20 cm more snow by its standing residue at the ridge top for the events surveyed. Snow water equivalents also showed larger spatial variation in CT. The soil water in the spring was the lowest at the ridge top areas, and highest at valleys in both treatments. However, under CT, soil water at the ridge top area was 6% less than, and in valleys 17% more than, the average over the entire treatment area. Such variation was much smaller in NT where soil water at the ridge top was only 4% less than, and in valleys 6% more than, the treatment average. Although many factors may have contributed to the spatial variation of soil water, residues under NT retarded the generation of runoff, retained more snow at the ridge top and steep-sloped areas, and likely reduced the soil water spatial variation.

Preserve CRP Soil Quality by Direct Seeding

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As growers approach the end of Conservation Reserve Program (CRP) contracts, they are faced with the decision of how to manage these lands as they return to crop production. Lands returning to production after enrollment in CRP can be managed to maintain the many improvements in soil quality that have occurred over the life of the CRP contract, such as higher organic matter, increased water infiltration and improved soil structure. CRP lands are an excellent place to begin direct seeding and avoid some of the issues normally associated with the transition from conventional tillage to direct seeding. We assessed changes in soil quality with conservation and conventional practices in lands that were eligible to return to production after ten years of enrollment in CRP. When tillage was used, soil quality measurements quickly changed for the worse in the first year! Soil organic matter fractions were quickly degraded and lost to the air as CO_2. In conventionally-tilled plots, soil organic matter fractions and pH were lower after only one year compared to CRP grassland. In additional studies, we found that with tillage not only did organic matter decline, but nutrient and water contents were lower; soil microbial communities shifted away from those found in CRP; water infiltration decreased; and the amount of soil vulnerable to water and wind erosion increased. We found that the soil quality of direct seed CRP takeout was similar to the original CRP with respect to pH, soil enzymes, the soil microbial community and organic matter fractions than conventionally tilled soils. Direct-seed management maintains soil quality in lands previously enrolled in CRP. Direct seeding of crops into CRP lands will preserve the soil quality benefits accrued during the years in grassland. CRP takeout can be used to assist in a smooth transition to direct seed cropping systems.

Wheat Grain Yield Trends in Whitman County, Washington

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More wheat is produced in Whitman County than in any other county in the United States. Since 1934, countywide average wheat grain yield has increased from 24 to 76 bu/acre. Before 1960, wheat varieties could not respond to years of high precipitation because their grain yield potential was low and/or the soil was deficient in nitrogen. Grain yields increased with the widespread availability and use of nitrogen fertilizer in the 1950s followed by the release of high-yield-potential semi-dwarf wheat varieties in the 1960s. By the 1980s and onwards countywide average wheat yields continued to increase despite many years of lower than average precipitation (data not shown). Separate countywide average winter wheat and spring wheat yield data in Whitman County are available beginning in 1972. From 1972 to 2007, winter wheat yield increased by an average of 0.91 bu/acre per year (49 to 81 bu/acre, Fig. 1). Countywide spring wheat grain yield also increased during this time period at an average rate of 0.69 bu/acre per year (30 to 55 bu/acre, Fig. 1). Thus, the grain yield gap between winter wheat and spring wheat in Whitman County has grown from 19 to 26 bu/acre in the last 35 years.

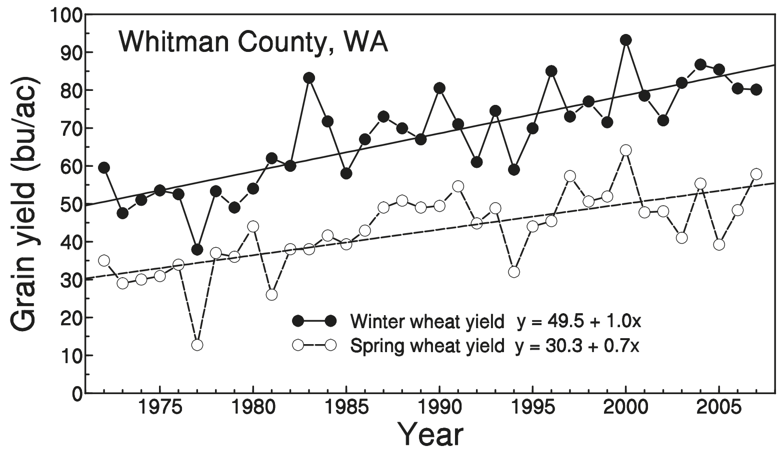

Fig. 1. Countywide winter wheat and spring wheat grain yields in Whitman County, WA from 1972 – 2007. Data show that winter and spring wheat yields have increased by an average of 0.91 and 0.69 bu/acre per year, respectively, over the past 35 years. Data are from USDA-National Agricultural Statistics Service.

Historic Winter Wheat Yields in Adams County, Washington

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The first successful wheat crop was harvested in Adams County in 1880. Accurate countywide grain yield data have been available since 1929. In the past 80 years, average countywide wheat yields have increased from 15 bu/acre to about 50 bu/acre, an increase of 0.42 bushel per year (Fig. 1). Essentially all dryland farm acreage in Adams County is in a winter wheat – summer fallow rotation. Better winter wheat varieties, herbicides, fertilizers, tillage management, and so forth continue to drive grain yields upward. Figure 1 clearly shows that, before the introduction of nitrogen fertilizer in the 1950s, wheat did not make productive use of rainfall during wet years. Although the amount of annual precipitation has fluctuated widely from year to year, there are no consistent long-term trends during the past 80 years. However, since 2000, crop-year precipitation has been less than the long-term average in all years expect 2006.

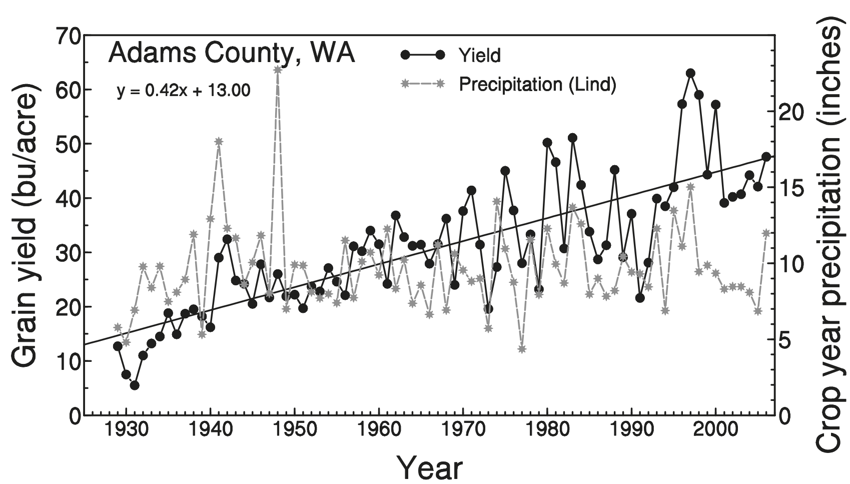

Fig. 1. Long-term average countywide dryland wheat grain yields for Adams County, Washington, superimposed with crop-year precipitation from Lind, WA. Long-term average precipitation at Lind is 9.52 inches. Yield data are from USDA-National Agricultural Statistics Service.