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Using No-Till to Minimize Extreme Weather Impacts

The Great Plains region is not a stranger to extreme weather, and too much or too little rain is often a problem when managing agricultural land. No-till management is one option for adapting to the impact highly variable and highly destructive weather can have on crop production.

No-Till Management

No-till farming in Nebraska is nothing new, but this management system is not widely used. According to a statewide survey in 2004 (date of last state-wide survey), 27% of all crop acres in Nebraska are managed under no-till, but that number is expected to be much higher now.

No-till uses a systems approach to crop production where crops are grown with minimal soil disturbance and the soil is kept covered with crop residue to conserve soil and water. Continuous no-till and crop rotation, intensity, and diversity are keys to making no-till successful and building the soil system while minimizing potential problems. No-till is not a one-year management plan. It requires continually planting crops, every year, without tillage to get the full benefits. Management of residue, nutrients, pests, equipment, and other factors must be a part of the no-till systems approach.

Producers often use a selected tillage system based on familiarity and tradition. Each tillage system has its advantages and disadvantages, which producers must consider before changing systems. For no-till, the major advantages are soil moisture conservation, erosion control, minimum fuel and labor costs, and benefits to soil structure and health. Some disadvantages are increased dependence on herbicides, no incorporation of residue, manure, or fertilizer, and slow soil warming on poorly drained soils.

Climate and Weather of the Plains

The geographic location of the Great Plains creates a scenario for highly variable weather. In the shadow of the Rocky Mountains and thousands of miles

Photo by David Keto

from any ocean, the middle part of the U.S. can have some of the most extreme weather in North America. Average precipitation ranges from less than 10 inches in western Wyoming and Montana to over 40 inches in southeast Kansas and Missouri. For Nebraska, the average precipitation ranges from around 12 inches in the west to near 35 inches in the southeast, with a statewide annual average of 22 inches. The driest year on record for Nebraska was 2012, when the average precipitation was 13.36 inches. The wettest year on record was 1915, with an average of 35.50 inches of precipitation.

Annual precipitation does not tell the whole story. The timing of the precipitation and temperature patterns make a big difference in the impact on crop production. More than 75% of Nebraska's annual precipitation comes during the growing season (April – September), and this is when it is most critical for crop production. Since 2000, Nebraska has had three growing seasons in the top 10% driest and two in the top 10% wettest (out of 121 years). We also had three years in the top 10% of the warmest growing seasons since 2000 and 1993 is the most recent year to be in the top 10% coolest.

It may be obvious that precipitation can be highly variable, but there is some concern that this variability will increase in the future. According to Wilhite, et al. 2014, a decrease in soil moisture of 1-10% (varies by emissions scenario) is projected by the end of the 21st century. These changes reflect the combined effect of increasing temperatures and seasonal changes in precipitation. Wilhite, et al. also mention that the Great Plains has seen a 16% increase in heavy rainfall events from 1958-2012. Both these scenarios create difficulties for crop production, especially when you need to be prepared for either one in the same year.

No-Till for Moisture Management

Precipitation is often the limiting factor in crop production in non-irrigated or limit-irrigated fields. Conserving this moisture can be critical to the success of the crop. Compared to fields without residue cover, no-till farming not only reduces the erosion potential with residue cover, it also reduces evaporative losses with residue cover. A four-year study conducted in North Platte, Neb., by the University of Nebraska – Lincoln (UNL) showed that residue cover saved more than 2.5-5.0 inches of water per year and corn yields were 17-25 bushels higher and soybean yields were 8-10 bushels higher than in bare-soil plots.

Excess precipitation can also be a factor when it results in saturated soils, ponding, or erosion. Long-term no-till management reduces runoff and increases infiltration rates by creating better soil structure. In a UNL rainfall simulator demonstration near Sidney, Neb., more than 3.75 inches of water was applied in 90 minutes to no-till soils before runoff started. In comparison, runoff started in only 20 minutes when 1.0 inch of water was applied to plowed soil. No-till will allow the field to better withstand heavy rainfall events by reducing the potential for surface ponding and the amount of runoff. In many instances, heavy rainfall events are a valuable source of moisture in water-limited areas, and good soil structure allows you to capture more of this valuable moisture.

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