

# Reduced Tillage Crop Rotation Study In Western South Dakota

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## Project Investigators:

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## Objectives:

- a) To determine the effect of crop rotation intensity and diversity on:
  1. Productivity,
  2. Economic returns,
  3. Weed pressure and dynamics.
- b) To determine the performance of alternative crops (oilseeds, pulse crops and annual forages/cover crops) in a rotation

## Deliverables:

- The study is fully published in the West River Annual Progress Report and is available on the internet at <http://wrac.sdstate.edu/pubs/plant/plant.html> Producers can review this publication and determine all the management practices and costs of production that goes into each rotation.
- Hard copies of about 300 annual reports each year are distributed to growers in the region.
- Annual crop tour at the rotation study draws growers from western South Dakota and Nebraska. This is the biggest crop tour west of the Missouri river.
- The study provides an avenue for conducting graduate students research projects and extension educator training.

## Justification:

Cereal growers in the semi-arid regions of South Dakota are struggling to maintain long-term profitability without government subsidies. Alternative crops, including oilseed crops, pulse crops and annual forages targeted for semi-arid and arid agro-ecozones have the potential to transform the economy of the region. Alternative crops grown in rotation with cereal crops have potential to increase sustainability, profitability and reduce pest problems (weed, insect and disease).

The typical rotation in southwestern South Dakota when this study started in 1994 was winter wheat-fallow. This study was initiated to determine if no-till rotations with continuous cropping and more crop diversity could be successful in the region. Currently the study has nine rotations ranging from two to six years with a conventional winter wheat-fallow rotation as a comparison. No-till production practices are used to grow all the crops except for the winter wheat in the conventional fallow treatment. The results have shown that the inclusion of broadleaf crops sunflower, safflower and peas; along with warm season grass crops like corn and millet, helps to break weed and disease cycles and improves winter wheat yields.

However, several years of drought in the early 2000's, have adversely affected yield of most crops making it difficult to achieve consistent profitability. We continue to make cropping changes in an attempt to improve crop performance under dry conditions. For example, we have lowered plant populations for corn and sunflowers. The last few dry years have shown us that our plant populations were probably unrealistically high for our semi-arid climate and have

increased row spacing on the corn from 20 inches to 40 inches to save some soil moisture for later in the season. We have introduced cover crops to treatments that were formerly chemical fallow to try and increase crop diversity and soil microbial activity.

**Materials and Methods:**

This long-term rotation study was started in 1994 near Wall, South Dakota. The experimental design is a randomized complete block design with treatments replicated four times. Plots are 80 ft. x 25 ft. in size. This small size allows all the plots to be located on the same soil type and reduces variability due to soil characteristics. Currently a total of nine rotations, ranging from two to six years in duration, are being evaluated and one full cycle for each rotation has been completed. All phases in each rotation are grown each year.

A remote weather station is located at the research site and provides additional information on crop stresses during the growing season. The variety of crops planted within the rotation study requires that we be at the plots each week during the growing season (planting, spraying, harvesting and taking notes). This is the most time consuming study we conduct during the year. Presently we are collaborating closely with other agronomy researchers from SDSU and USDA to maximize use of the already established long-term crop rotation plots and evaluate weed population shifts, crop diseases and crop water use.

Detailed records of all the cultural practices including spraying for insect pests, diseases and to control weeds are kept and cost of each practice assessed. This allows for yield and economic comparisons to be made each year. Measurements that are taken each growing season include;

1. Weed pressure assessment three times per years (April, July, and October).
2. Grain yield and test weight for each grain crop.
3. Protein content for cereal grain crops.
4. Forage yield and quality for forage crops.
5. Soil sampling for nutrient content and organic matter for each plot series.

**Project Duration:** This is an on-going long-term study. We expect to continue with this study as long as the results are relevant to the region. This is the only long-term rotation study west of the Missouri river and one of the few in the High Plains region.