The Variable Response of Dryland Corn Yield to Soil Water Content at Planting

David C. Nielsen, Merle F. Vigil, and Joseph G. Benjamin
USDA-ARS, Central Great Plains Research Station, Akron, CO

ABSTRACT
Farmers in the central Great Plains would like to diversify crop rotations from the monoculture of the traditional winter wheat-fallow system. Corn could work well as a rotation crop, but inputs are expensive and farmers would need information on the yield response of corn to available soil water at planting to determine if there is a consistent predictive relationship that will aid farmers in making a crop choice at time of planting.

Objective
 quantify corn yield response to available soil water at planting to determine if there is a consistent predictive relationship that exists that will aid farmers in making a crop choice at time of planting.

Introduction
Reduced tillage systems have made no-till storage of soil water available such that dryland cropping systems can be intensified from the traditional wheat-fallow system. Corn is a potential crop to be included in intensified cropping systems, but input costs are high. If corn yield is related to available soil water at planting, then a predictive relationship could be determined that would help farmers determine the potential for successfully producing a profitable corn crop before planting.

Materials and Methods
Location: Akron, CO
Source data: Alternative Crop Rotation Study (1992-2001)
• Soil water prior to corn planting by TDR (0-30 cm) and by neutron probe (150, 180, 210, 240, 270, 300 cm). Available soil water computed by subtracting alfalfa Evap (15 cm, 45 cm, 90 cm) and soil water prior to specific crops (in italics).
• Soil type: Weld silt loam (fine, smectitic, mesic Aridic Argiustolls)
• Variations in soil water content at corn planting resulted from intensity of rotation and previous crop water use.

Conclusions
• Corn grain yield was linearly correlated with available soil water content at planting (yield increasing with increasing available water).
• The linear relationship varied greatly depending on the amount of precipitation that occurred during the critical 6-week period of 15 July to 25 August (pre-tassel through mid-grain fill [R3-R4]).
• The slope of the response of grain yield to available soil water at planting increased with increasing amount of precipitation received from 15 July to 25 August.
• Although there is no consistent relationship between available soil water at planting and corn grain yield, dryland producers can be assured that all management decisions that reduce tillage, conserve surface residues, and increase available soil water at planting will increase yield.

Acknowledgements
We express our sincere appreciation for assistance in plot maintenance and data collection to Karen Couch, Albert Figueroa, Hubert Lagat, Kris Lindahl, Dona Scott, Chad Kuntz, Mike Perry, Mike Randall, Nathan Nelson, Gene Usher, Deborrt Shadeg, Carr Baude, Linda Hardesty, Carolyn Branden, Cindy Johnson, Donna Pfeiffer, Anna Shames, Elizabeth Slusser, and Bob Pflanz.

Alternative Crop Rotation Experiment
24 July

Growing season precipitation varies widely in distribution and amount across years.

Data from all rotations and all years appear to show that there is no relationship between corn grain yield and available soil water content at planting.

The response of corn grain yield to available soil water at planting (regression slope) increases as amount of critical period precipitation increases.

1994 did not fit the pattern, showing high yield response under low critical period precipitation.

Years with similar rainfall during the critical 15 July to 25 August period had similar yield responses to available soil water at planting (except 1994).

Conclusions
• Corn grain yield was linearly correlated with available soil water content at planting (yield increasing with increasing available water).
• The linear relationship varied greatly depending on the amount of precipitation that occurred during the critical 6-week period of 15 July to 25 August (pre-tassel through mid-grain fill [R3-R4]).
• The slope of the response of grain yield to available soil water at planting increased with increasing amount of precipitation received from 15 July to 25 August.
• Although there is no consistent relationship between available soil water at planting and corn grain yield, dryland producers can be assured that all management decisions that reduce tillage, conserve surface residues, and increase available soil water at planting will increase yield.

Acknowledgements
We express our sincere appreciation for assistance in plot maintenance and data collection to Karen Couch, Albert Figueroa, Hubert Lagat, Kris Lindahl, Dona Scott, Chad Kuntz, Mike Perry, Mike Randall, Nathan Nelson, Gene Usher, Deborrt Shadeg, Carr Baude, Linda Hardesty, Carolyn Branden, Cindy Johnson, Donna Pfeiffer, Anna Shames, Elizabeth Slusser, and Bob Pflanz.