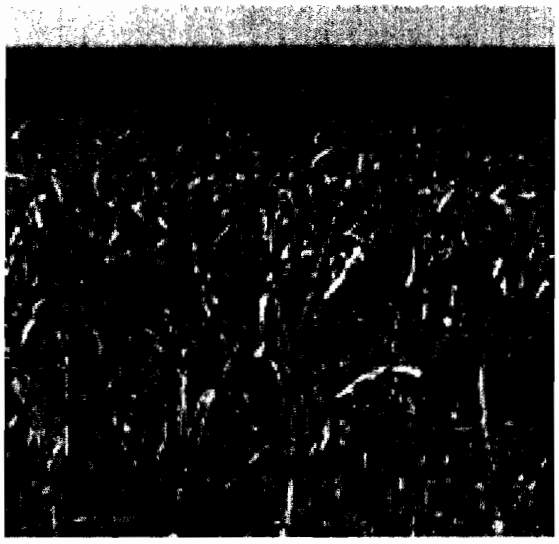
Cooperative Extension
Colorado State University

JULY 2002
VOLUME 22
ISSUE 3

FROM THE GROUND UP
Agronomy News

Dryland Corn Newsletter

INSIDE THIS ISSUE



Dryland Corn Acreage Increasing in Colorado

Intensive cropping systems have higher precipitation use efficiency, thus increasing yield per inch of rain.

Dryland producers in Colorado have been adopting more intensive cropping systems, including dryland corn in rotation with wheat, at an increasing rate since 1990 (Figure 1). Area planted to dryland corn in northeastern Colorado (Adams, Kit Carson, Logan, Morgan, Phillips, Sedgwick, Washington, and Yuma counties) increased from about 20,000 acres per year in years previous to 1990 to 220,000 acres in 1999. Total dryland corn acreage in Colorado increased from 23,700 historically to 340,000 in 2000.

Corn acreage is expanding into areas once thought to be too dry for corn production, as exemplified in Lincoln County, where corn acreage increased from 1500 in 1996, to 4000 in 1997, 8000 in 1998, 18,000 in 1999, and 23,000 in 2000. Producers wishing to get started in dryland rotation farming may consult bulletins published in previous years (www.colostate.edu/Depts/AES/) and/or the CSU Cooperative Extension dryland cropping systems factsheet (no 0.516) by Croissant et al. (1992).

Colorado State University
Knowledge to Go Places

Corn Water Use and Yield Under Dryland Rotations and Limited Irrigation

Variation in yield is correlated to rainfall from July 15 to August 25.

Dryland corn production in Colorado has increased steadily over the past decade with the adoption of reduced tillage, good residue management, and more intensive crop rotations. Irrigated corn production continues strong in the area as well, although there are concerns relative to the continued long-term availability of sufficient water supplies to accommodate fully irrigated corn production. In order to make wise choices regarding the production of dryland corn and the application of limited irrigation, an understanding of corn's response to amount and timing of precipitation and irrigation is important.

When water supplies to growing corn are not severely limited during any one growth stage, yield generally increases linearly with more available water and crop water use. The relationship that has been found applicable for northeastern Colorado is:

yield in bu/acre = 10.4 x (water use in inches - 9.1)

where water use (inches) is the sum of rainfall during the growing season and water extracted by the corn crop from the soil profile. The relationship can be interpreted to mean that yield increases 10.4 bu/acre for every inch of water that is used after about 9 inches of water is used to grow the plant. Growing season rainfall ranges from 5.5 to 19.5 inches (average 11.5 inches) at Akron, CO, and soil water extraction ranges from 0.8 to 10.3 inches (average 4.9 inches). Table 1 shows dryland corn water use from 1993 to 2001 at Akron, CO ranging from 10.9 to 17.3 inches for corn grown in a wheat-corn-fallow rotation under no-till management. Corn yields over that same period ranged from 10 to 84 bu/acre and generally follow the relationship given above, although the relationship does not predict corn yield well when precipitation distribution is skewed.

Table 1. Dryland corn water use and yield at Akron, CO, from 1993-2001.

Year	Water Use (in)	Yield (bu/ acre)	--------Rainfall (in)------		Soil Water Extracted (in)
			4/30-7/14	7/15-8/25	
1993	13.4	39	3.9	4.5	4.4
1994	10.9	30	2.5	2.3	5.5
1995	17.2	33	12.0	1.1	10.3
1996	17.3	83	9.0	3.2	0.8
1997	14.5	27	5.5	4.5	2.9
1998	11.2	53	3.3	1.4	4.1
1999	16.4	84	6.0	7.0	2.3
2000	12.0	10	2.6	3.5	5.4
2001	16.1	72	6.5	3.7	8.2

Corn Water Use and Yield Under Dryland Rotations and Limited Irrigation (cont.)

Corn is very sensitive to water deficits and water stress during tasseling, silking, and early grain-filling. Precipitation during the 6-week period from July 15 to August 25 is highly correlated with corn yield. Previous investigations have shown that 70% of the yield variability of dryland corn production in eastern Colorado was attributed to rainfall during this critical 6-week period. This is illustrated well by the data in Table 1, where very favorable precipitation conditions during vegetative development (April 30 to July 14) in 1995 did not result in high yields, due to very low precipitation during the critical 6-week period.

We have found that corn yields vary with precipitation according to the following relationship:

yield in bu/acre = 33.9 + 7.49*precipitation

where precipitation (inches) is the amount of rainfall occurring from July 15 to August 25.

In situations where irrigation water is limited or there are restrictions on the volume of water allowed to be pumped, a good strategy may be to add water only during the reproductive (tasseling, silking, pollination) and grain-filling growth stages. By irrigating only during these growth stages, the producer can remove water stress during this critical, highly sensitive period, and maintain high yields while reducing the amount of water used. As seen in Table 2, the elimination of vegetative stage irrigation in Akron resulted in a 33% smaller plant, but no yield decrease, with a savings of 6.5 inches in irrigation water.

David Nielsen, Joseph Benjamin, and Joel Schneekloth
Agronomist, Soil Scientist, USDA-ARS; and Eastern Region Extension Water Resource Specialist; Akron, CO

Table 2. Limited irrigation contrasted with full irrigation.

Irrigation Treatment	-----4/30-7/31-------		-------8/1-9/1--------		Total Water	Corn stover at harvest	Corn grain at harvest
	rainfall	irrigation	rainfall	irrigation			
	----------inches----------					lb/acre	bu/acre
full irrigation	6.5	6.5	3.7	7.0	23.7	8020	168
partial irrigation	6.5	0.0	3.7	7.0	17.2	5370	168