CONSERVATION TILLAGE FACTS

Estimating Corn Yields From Precipitation Records

A Method for Assessing Adapted Environments and Production Risk

Corn can be grown under dryland conditions in the central Great Plains, but not all areas in all years will produce profitable crops. This note describes a method for making a simple assessment regarding corn yields that could be expected in various locations in northeastern Colorado based on precipitation records.

Corn Yield Sensitivity to Water Deficits

Corn is very sensitive to water deficits and water stress during tasseling, silking, and early grain-filling. From weather records and yields at Akron, CO, we determined that precipitation during the 6-week period of July 15 to August 25 was the most highly correlated with grain yield. We combined the Akron yield data with data from Sterling and Stratton, and found that 70% of the yield variability was explained by the amount of precipitation during this 6-week period (Fig. 1).

Even though 70% of the yield is determined by a factor that a producer has no control over (precipitation from July 15 to August 25), production practices can have a large impact on yield during dry years. Variability in the relationship shown in Fig. 1 increases at low rainfall because yield is more a function of stored soil water under these conditions. Consequently, good weed control and residue management practices during non-crop periods can provide sufficient stored water to stabilize yields during dry years. The relationship shown in Fig. 1 is based on good management practices (adequate population, nitrogen fertilization, weed control, etc.), and producers should be aware that deficiencies in these areas will affect the yield/precipitation relationship.

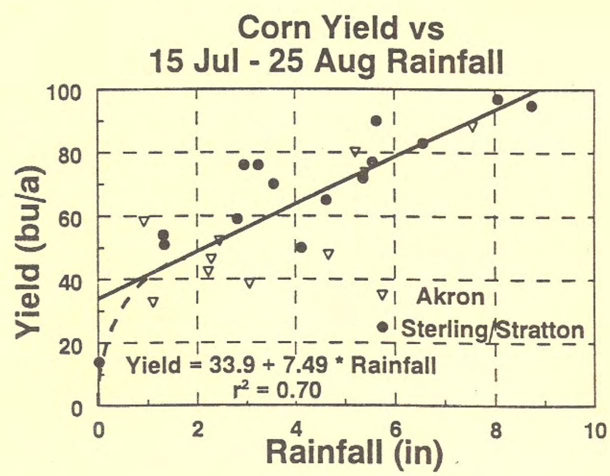

Fig. 1

Long-term Corn Yield Estimation

Using this simple yield/precipitation regression with long-term precipitation records, we assessed the long-term yield range and variability for several sites in northeastern Colorado (Fig. 2). The sites and number of years of precipitation records are Julesburg (70 yr), New Raymer (32 yr), Akron (88 yr), Byers (45 yr), and Stratton (37 yr). The frequency distribution of estimated corn yields for the five sites is shown in Fig. 3. The height of each bar is the percentage of the total years of record in which the corn yield fell in the specified range. The number at the top of the bar is the

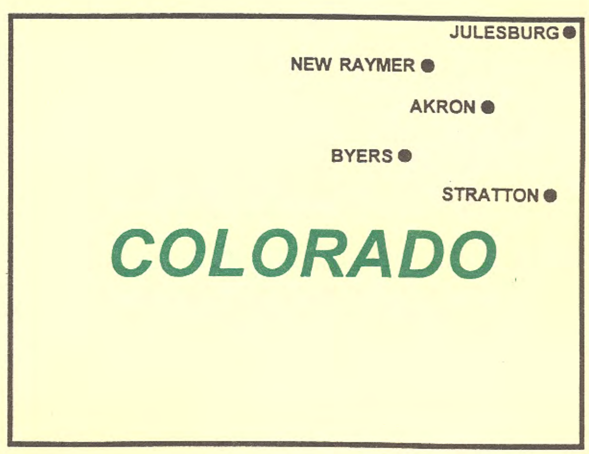

Fig. 2

Conservation Tillage Fact Sheet #2-96. Published by USDA-ARS, USDA-NRCS, and Colorado Conservation Tillage Association.
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recorded number of years with estimated corn yield in the specified yield range. The bar for the 40-50 bu/a yield range is split to show the proportion of years with yield above and below 45 bu/a.

The average yields estimated from the precipitation records at all five locations are essentially the same (56-59 bu/a). The distribution of yields is also quite similar for all locations. Yields less than 40 bu/a would occur in about 5% of the years. The majority of yields in the 40 to 50 bu/a range are greater than 45 bu/a at all locations. At all of the locations, except Byers, 7 to 10% of the years had yields greater than 80 bu/a. Approximately 75% of the years across locations have yields between 40 and 70 bu/a.

The regression line in Fig. 1 predicts that we would never have a yield below 34 bu/a. This is probably not true, and the true relationship at low rainfall amounts (< 1inch) probably follows the dashed line in Fig. 1.

Implications for Corn in NE Colorado Rotations

Crop rotation research has demonstrated that northeastern Colorado can support more intensive cropping than winter wheat-fallow. For example, wheat-corn-fallow produces 70% more grain than wheat-fallow at sites near Sterling and Stratton, with profits increased by 40% (See "Sustainable Dryland Cropping Systems: Economic Analysis" by Peterson et al., CSU Technical Bulletin TB93-3, available through CSU or USDA-ARS, Akron). Similar results have been demonstrated at Akron. Corn yields estimated from precipitation records show very similar distributions throughout all of northeastern Colorado, suggesting that corn can be a viable summer crop to grow in rotations throughout the entire region when good residue management and production practices are employed.

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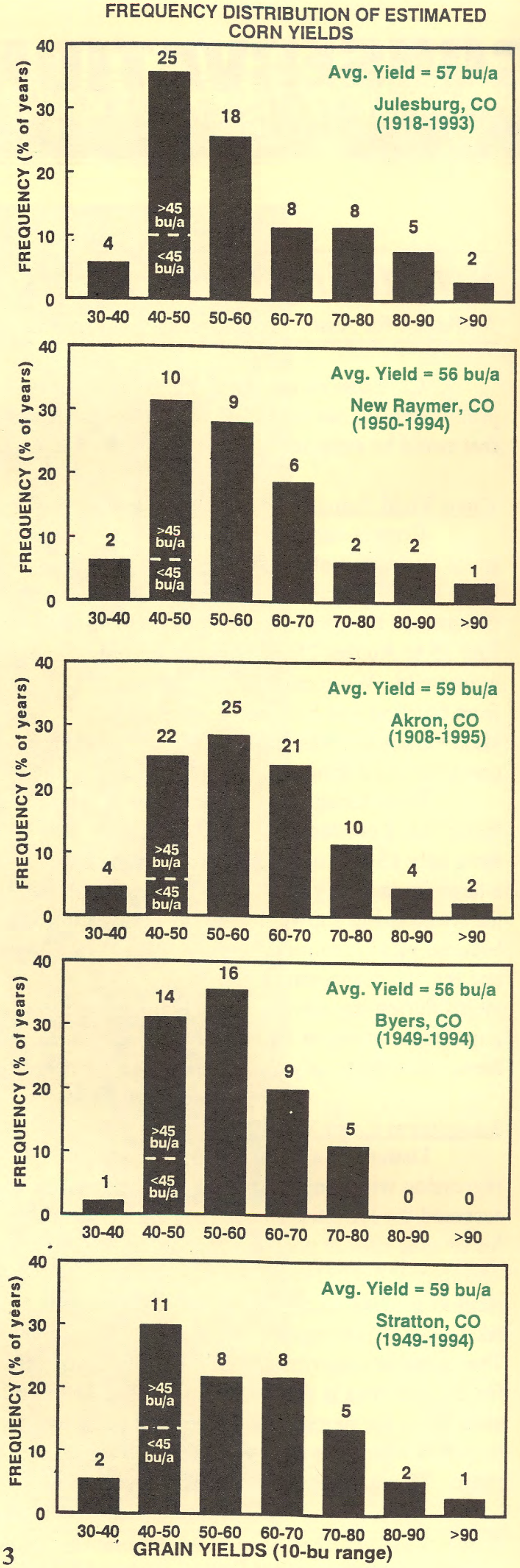

Fig. 3