

agronomy news

More Productive Dryland Cropping Systems Incorporate Spring Crops

Dryland corn plays big role in new intensified cropping systems.

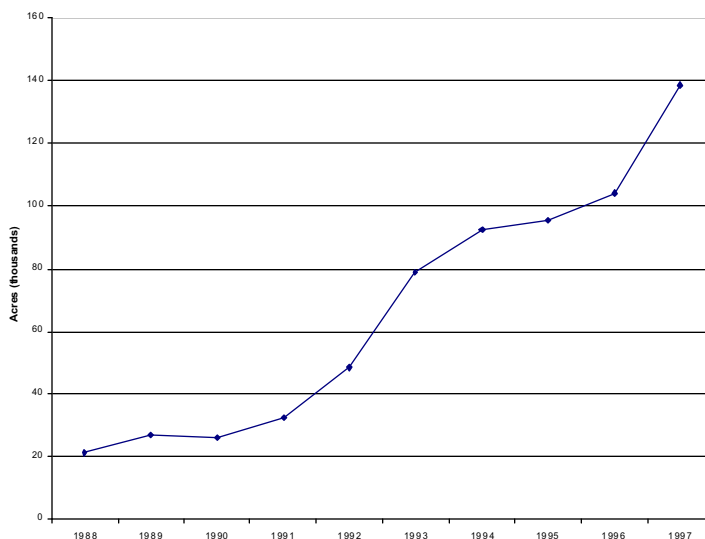
DRYLAND CORN ISSUE INSIDE:

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Dryland corn acreage in northeastern Colorado has increased from 21,000 acres in 1988 to approximately 140,000 acres last year (see figure 1). This expanded acreage reflects a significant shift in cropping systems from the traditional wheat-fallow rotation to three- and four-year rotations including spring crops. By replacing the traditional rotation with a wheat-corn-fallow or wheat-corn-millet-fallow system, dryland

producers can increase average annualized grain production by as much as 74%. Three- and four-year rotations are more productive than the traditional system, and comparable to each other in total grain

Figure 1. Dryland Corn Acreage in Eight Northeastern Colorado Counties from 1988 to 1997.



Data from Colorado Agricultural Statistics (Adams, Kit Carson, Logan, Morgan, Phillips, Sedgewick, Washington, Yuma.)

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Livestock

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production (see figure 2). Corn is a highly productive component of the

new cropping systems (see figure 3). Economic analysis shows this increased grain production is a 25-40% increase in net annual income for producers in northeast Colorado

(The full report is available at <http://www.colostate.edu/Depts/AES/Pubs/tb98-1.pdf>.)

While long term average corn grain yields are near 59 bu/acre, it is possible to achieve yields in excess of 100 bu/acre in eastern Colorado. However, dryland corn yields are strongly correlated with rainfall received during the period between 15 July and 25 August. Drought during these periods can result in poor yields, so a profitable crop is not possible in all areas in all years. The new cropping systems require higher soil fertility than typical Colorado soils, which impacts economic benefits. In southeast Colorado, increased weed control costs for the intensive cropping systems offsets the benefits of increased production. Lower cost herbicide programs may improve the profit margin of new cropping systems in southeast Colorado. Regardless of location, producers wishing to adopt more intensive dryland cropping systems should evaluate risks when deciding if it is right for their operation.

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using the three-year rotation. These revised cropping systems are the result of the Dryland Agroecosystems Project initiated in 1985 by Colorado State University soil scientists Gary Peterson and Dwayne Westfall. The project was initiated to analyze annual yield fluctuations, of concern to growers because stable yields translate into stable income levels for their operations.

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Managing Nitrogen Needs Of Reduced-Till Dryland Corn

Increased grain productions means higher nitrogen requirement for wheat-corn-fallow rotation.

Nitrogen management is different in minimum-till and no-till systems than in plowed and irrigated fields. Surface residue results in cooler spring soil temperatures, which slows down N mineralization. Organic matter accumulation immobilizes N in organic forms and further slows mineralization. Reduced tillage improves water storage in the soil, which increases yields and N uptake by crops; higher soil moisture may also increase denitrification losses of N to the air. Volatilization of

ammonia will also increase in high residue situations, specifically if N fertilizers are surface applied.

Adding corn to a wheat-fallow rotation increases grain production by about 70% and also increases the N fertilizer requirement of the rotation by 44%. Therefore, producers who choose to add corn to their wheat rotation will need to increase N fertilization as well, to

maximize the benefits of dryland corn.

Nitrogen application method and source is more important in higher rainfall areas of the Great Plains than in Colorado. In those wetter areas (>20 inches precipitation/

year), banding N has been shown to increase corn yield by 10-15 bushels per acre, as compared to broadcast applications. In high rainfall years, urea ammonium nitrate (UAN) and ammonium nitrate are more available and have resulted in higher yields than urea.

However, in drier areas of the Great Plains, determining the optimum N application rate is more important

than N placement or source. This rate decision should be based on soil testing (for nitrate and organic matter levels), farmer experience, and expected yield. CSU's maximum N fertilizer suggestion for dryland corn (with an 80 bu/A yield goal) is 100 lb N/A. In wetter parts of the Great Plains, yield response has been measured up to 125 lb N/A.

(This article is based on Westfall, D.G., J.L. Havlin, G.W. Hergert, and W.R. Raun. 1996. Nitrogen management in dryland

cropping systems. *J. Prod. Agric.* 9:192-199. and Kolberg, R.L., N.R. Kitchen, D.G. Westfall, and G.A. Peterson. 1996. Cropping intensity and nitrogen management impact of dryland no-till rotations in the semi-arid western Great Plains. *J. Prod. Agric.* 9:517-522.)

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Suggested N rates for dryland corn (from CSU factsheet no. 0.538.)

Soil NO ₃ -N (ppm)*	Soil Organic Matter in the Tillage Layer (%)		
	0-1.0	1.1-2.0	> 2.0
0-6	100	90	80
7-12	50	40	30
>12	0	0	0

* Average concentration in the top two feet of soil.

Note: These suggestions are based on an expected yield of 80 bu/A. If your expected yield is different from 80 bu/A, add or subtract 1 lb N/A for every 1 bu/A yield difference.

Dryland Corn Weed Control Strategies

Lower yields, no-till practices, and resistance figure into pesticide choices in dryland corn weed management.

Dryland corn acreage in Colorado has been increasing every year, 150,000 acres in 1998, and is projected to increase substantially in 1999. The rotation to corn has enabled farmers to break away from traditional wheat-fallow rotations and increase profitability by raising two crops in three years, or three crops in four years, depending on the particular rotation sequence. The break from a wheat-fallow rotation has also been advantageous in managing winter annual weeds that compete in winter wheat, such as jointed goatgrass, volunteer rye, and annual brome species.

Weed management in dryland corn is not without problem, as most corn herbicide programs, designed for irrigated corn production, are not cost effective in lower yielding dryland corn. The majority of producers practices no-till farming to conserve the moisture, thus, mechanical cultivation is not an option. Herbicide resistance is prevalent among many weed species that occur in dryland agriculture, and the effectiveness of soil-applied herbicides is dependent upon unpredictable precipitation. Primary weed species in dryland corn are kochia, Russian Thistle, pigweed species, sandbur, witch grass, green foxtail, yellow

foxtail, and bristly foxtail. Much of the kochia present in the Central Great Plains region is resistant to atrazine and/or sulfonylurea herbicides (SU's – Glean, Amber, Ally, Beacon, Accent, etc.) Of the grasses listed, most populations are resistant to, or highly tolerant to atrazine, as are most pigweed populations.

The most common dryland rotations are wheat-corn-fallow or wheat-corn-sunflower (or millet)-fallow. Since corn follows wheat, controlling weeds and volunteer wheat after the mid-summer wheat harvest is important to conserve the moisture for corn to be competitive. Most herbicide programs include a high rate of atrazine (2.0 lbs.) in a mix with Roundup (glyphosate) or Gramoxone (paraquat) applied after wheat harvest to carry over into the corn crop. The cost-effective limit for weed control in dryland corn varies considerably. Traditionally the upper limit was \$10 - \$12/acre, but with unusually high summer precipitation in 1997 and 1998, dryland corn yields have been correspondingly high and producers are willing to pay as much as \$30/acre in some areas of the state.

At the Colorado Conservation Tillage Association (CCTA) meet-

ing in February of 1999 many weed management programs for use in dryland corn were discussed. Changing from 30-inch row spacing to 15-inch row spacing improved weed management, as did increasing corn plant population from 15,000 plants/acre to 19,000 plants/acre, according to Dr. Randy Anderson. These changes produce a more competitive crop canopy, according to Dr. Anderson's research, and reduce weed biomass by as much as 70%. Additional research with reduced herbicide rates under a narrow row system show that farmers can reduce herbicide rates by 75% and still provide effective weed control. Anderson is with the USDA-ARS Central Great Plains Research Station at Akron, Colorado.

A panel discussion on herbicide programs for weed control in dryland corn was presented at the CCTA meeting as well. Participants were farmers, commercial applicators, crop consultants, and an extension weed specialist. The most common programs suggested are set forth in the table on the next page.

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Common Dryland Corn Weed Control Programs

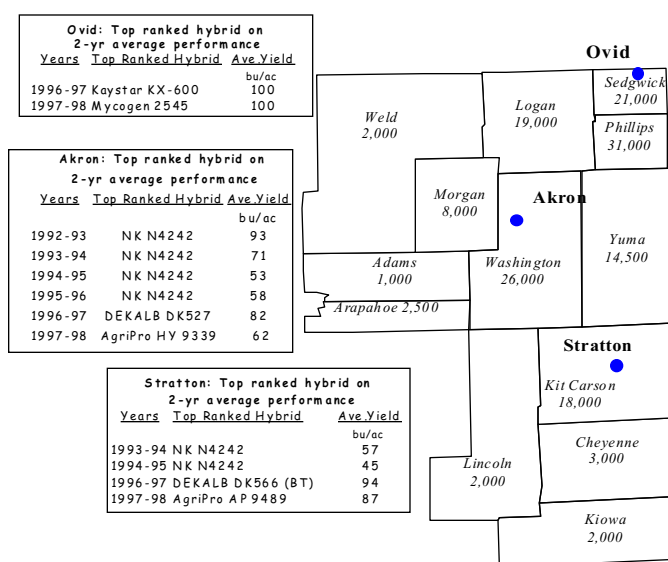
Herbicide	Application	Weeds Controlled
Prowl/Marksman	Early post-emergence	Grass if ample moisture within 10 days of application Kochia
Roundup Ultra	Post-emergence one or two times as needed	Broad spectrum weed control in RR corn
Field master Premix of Harness, Roundup, and atrazine	Pre-emergence	Emerged weeds at planting Residual weed with sufficient moisture
Basis Gold Rimsulfuron + nicosulfuron + atrazine	Early post-emergence	Most grasses and broadleaf weeds except resistant kochia
Lightning imazethapyr + imazapyr	Early post-emergence	Most grasses and broadleaf weeds except resistant kochia
Dicamba or Tough (pyridate) + Lightning or Basis Gold + nonionic surfactant instead of crop oil	Early post-emergence	Most grasses, broadleaf, and resistant kochia

Many Good Choices For Dryland Corn Hybrids In Northeastern Colorado

Crops Testing program provides information about performance to help make decisions.

Northeastern Colorado crop producers have been adopting more intensive dryland cropping systems by adding one or two spring crops to the traditional wheat-fallow rotation. As three-year and four-year rotations have become more prevalent, corn and sunflower acreages have increased dramatically. The increased corn acreage created a market for dryland hybrid seed corn market (now valued at \$1.5-\$2 million annually) that did not exist before this shift in cropping systems. To help Colorado dryland corn producers select the best hybrid for their environments, since 1995 CSU's Crops Testing program has conducted hybrid corn trials in three locations in northeast Colorado. Crops Testing endeavors to provide reliable and unbiased performance information to Colorado producers so they can make better hybrid decisions. All commercial corn seed companies are given the opportunity to enter one or more hybrids in any trial. Other studies of corn hybrid performance indicate that two-year average yields are better indicators of future performance than single-year performance results. Based on two-year averages, the top-yielding hybrid at each of our three locations is provided below.

Three northeastern Colorado dryland corn trial locations and the 1997 dryland acreage



Participation is voluntary so many hybrids are not tested at the same location from one year to the next. Voluntary participation also means that some seed companies with a significant share of the Colorado dryland corn seed market may not enter the CSU trials. However, good yield performance by so many different hybrids at the three locations indicates that there are many good hybrids to be considered by our dryland corn producers. The Northup King (now Novartis) hybrid NK 4242 dominated yield performance from

1992 to 1996. The newer BT version of NK 4242 topped the yield trials at Akron and Stratton and was ranked second at Ovid in 1998 (data not shown). The highest two-year average yield was observed with Kaystar KX-600 and Mycogen 2545 at Ovid and both averaging 100 bu/ac over two-year periods. Top yields have also been observed with DEKALB and AgriPro hybrids listed in the tables on the next page.

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Considering Bt Hybrids For Dryland Corn Production?

Bt corn is a cost-effective pest management tool in southeast Colorado, not so useful in northeast.

There are five key insect pests of field corn in Colorado: Banks grass mite (statewide), European corn borer (east of mountains, primarily northeastern), southwestern corn borer (southeast, as far north as Burlington), western bean cutworm (statewide), and western corn rootworm. Other pests, such as corn earworm in 1998, occasionally may occur, but not often enough to consider preventive measures.

Of these, only western bean cutworm and southwestern corn borer are considered to be important pests of dryland corn. Banks grass mite should be a problem, but for unknown reasons rarely achieves pest status under dryland conditions. European corn borer has very poor egg production and survival in hot dry environments.

Western corn rootworm is capable of significant damage to dryland corn, but is controlled effectively by crop rotation.

Bt corn hybrids are quite effective against southwestern corn borer and should be considered by producers in southeastern Colorado. The lower plant populations used in dryland production should make this approach cost effective relative to conventional insecticides. Keep in mind that producers are required to implement a resistance management plan by planting a certain percentage of their corn acres to a non-Bt hybrid. The exact percentage required is still being debated, but will probably be in the neighborhood of 10 - 20%.

The currently available Bt corn hybrids are not effective against western bean cutworm. The only viable management option for this pest remains properly timed insecticide treatments based on scouting. Consider treatment when >8% of plants are infested with egg masses or larvae and the crop is 95% tasseled. Treatment probably will not be cost-effective if July and early August rainfall has been inadequate. Pyrethroid insecticides have been highly effective against this pest in Colorado State University tests. See the High Plains Integrated Pest Management Guide for registered products and rates.

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web sites

<http://www.colostate.edu/Depts/AES/Pubs/tb98-1.pdf>.

Sustainable Dryland Agroecosystem Management report for 1998.

<http://www.colostate.edu/Depts/SoilCrop/extension/CropVar/index.html>

Colorado State University Crops Testing pages.

<http://www.agry.purdue.edu/agronomy/ext/corn/index.html>

Purdue University Extension Agronomy Corny pages

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