PROJECT TITLE: Nutrient Requirements of Short-Season Dryland Corn Grown in Eastern Washington Using Direct Seeding Methods

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Cooperator-growers: John Aeschliman, Colfax, WA

INTERIM REPORT

PROJECT OBJECTIVES:
1. Determine optimal nitrogen rate and application timing for dryland corn production in eastern Washington using direct seeding methods.
2. Assess the effects of added P, Zn, and S on corn yield to establish sufficiency levels of nutrients most commonly deficient in eastern Washington.
3. Develop a nutrient management extension publication for dryland corn grown in eastern Washington.

KEY WORDS: Nitrogen fertility, dryland corn

STATEMENT OF PROBLEM: Dryland corn is being evaluated as an alternative crop in rotation with wheat in eastern WA. Fertility recommendations are being derived from other areas of the U.S. with summer rainfall patterns. Optimal fertility management may need to be adjusted to match the winter rainfall patterns of this region.

ZONE OF INTEREST: Palouse region of eastern Washington, high to intermediate rainfall zones

ABSTRACT OF RESEARCH FINDINGS: Field sites established in Fall 2001 in the high (20-24 in) rainfall zone at the USDA-Palouse Conservation Field Station near Albion, WA and intermediate (16-20 in) zone at the John Aeschliman farm west of Colfax, WA were used in Fall 2002 to repeat the previous year's study. Both sites have a long-term no-till history. Nitrogen was applied at rates ranging from 15 to 159 lb N/acre (17 to 178 kg N/ha) with two timing approaches: 1) all but 9 lb N/acre applied at planting or 2) 50 lb N/acre applied in the fall with a spoked-wheel injection system and the remainder applied at planting, 2 inches to the side and 2 inches below the seed row. Additional treatments were added to evaluate corn responsiveness to P, S and Zn fertilization under these conditions. Similar to the previous year, corn was responsive to N fertilization at the Colfax site. Corn yields increased from 15 to 28 bu/ac with increasing N rate up to 159 lb N/acre, although yields were substantially less than last year (56 bu/ac). A significant response to S fertilization was observed for grain yield. Forage yields for both sites were calculated based on total dry matter at maturity. No advantage to split fall-spring timing was observed for either grain yield or forage yield. At the Albion site, no significant responses to fertilization were observed despite overall higher yields of up to 60 bu/ac for grain and 2.7 tons/acre for forage.
RESULTS AND INTERPRETATION: Treatments used the previous year were imposed on existing plots in the 2002-2003 season to simulate a corn-corn-wheat rotation. Results were consistent with those of the 2001-2002 season. Lower grain yields were obtained than in the 2001-2002 season, due to low rainfall and possible disease pressure. Maximum yields were 28 bu/ac at Colfax and 60 bu/ac at Albion. Grain yields increased with increasing total N applied up to 159 lb N/ac at Colfax, but splitting N between fall and spring did not improve yields significantly.

![Graph showing the relationship between nitrogen fertilizer and grain yield.](image)

**Fig. 1.** Corn grain yield response to N rate, direct seeded into corn stubble (Aeschliman Farm, 2003)

In contrast, no grain yield responses to fertilization were observed at the Albion site.

Forage dry matter yields were determined at physiological maturity. Maximum yields were 2.2 tons/ac at Colfax and 2.7 tons/ac at Albion. As with grain yield, forage yield increased with increasing total N applied up to 159 lb N/ac at Colfax. Splitting N
between fall and spring did not affect forage yields significantly. No forage yield responses to fertilization were observed at the Albion site.

Nitrogen use efficiency (grain weight/ N supply) and nitrogen uptake efficiency (total plant N at maturity/ N supply) were evaluated for both sites using data from the 2002 season. Both ratios decreased with increasing N applications at both sites. At the Colfax site, there was a significant difference in N use efficiency and N uptake efficiency due to fertilizer timing only at the lowest (59 lb/ac) overall N rate, with the spring only timing having higher efficiencies. There was no significant difference in N use efficiency or N uptake efficiency due to fertilizer timing at the Albion site.

The results of both seasons indicate fall N fertilization of corn is not necessarily advantageous in direct-seed dryland corn in eastern Washington.

**IMPACT:** Fertilizer constitutes a major input cost to dryland producers, and fertilizer management recommendations are needed to optimize its use. A lack of corn responsiveness to fall N applications will save growers the added expense of this operation.

**INTERACTIONS WITH OTHER SCIENTISTS:** Dennis Roe (USDA-NRCS), David Huggins (USDA-ARS) and John Aeschliman were consulted on corn production practices that had been established by early adopters in eastern Washington. Joe Yenish (WSU), Frank Young (USDA-ARS) and John Aeschliman were consulted on weed control management in this alternative cropping system.