DOES TWO-SIDED BANDING OF NITROGEN AND SULFUR FERTILIZERS IMPROVES CORN YIELD IN MIDWESTERN CROPPING SYSTEMS

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ABSTRACT

Efficient fertilizer management is essential for improving corn (*Zea mays* L.) productivity while reducing environmental risk. Fertilizer timing and placement help synchronize nutrient availability with crop demand. In Midwestern corn systems, fertilizer is traditionally banded on one side of the row. This study evaluated two-sided banding of nitrogen (N) and sulfur (S) using a split-application strategy in an Iowa corn production system. Fertilizer timing and placement did not significantly affect grain yield but did increase stover biomass ($p < 0.05$) relative to the unfertilized control. Results suggest that applying all fertilizer as a starter, particularly in a wet growing season, may reduce field operations compared with split application, though potential N loss from early-season leaching remains a concern. These practices may be considered for Midwest corn–soybean systems depending on seasonal conditions and management priorities.

INTRODUCTION

Nitrogen management remains a major component of achieving high and sustainable corn yields in Iowa and the greater U.S. Midwest, where N is typically the most limiting nutrient. Although required in smaller quantities, sulfur plays an important role in N assimilation and crop growth. Declines in atmospheric S deposition have increased the occurrence of S deficiency in cropping systems. Previous research has highlighted the benefits of S fertilization in corn across diverse agroecosystems (Kovar, 2021).

Traditional fertilizer placement in corn often involves banding nutrients on one side of the row, which may limit uniformity in early nutrient uptake. Two-sided banding, placing fertilizer on both sides of the seed furrow, may enhance nutrient accessibility and improve early plant growth. Liquid N fertilizers that also supply S such as UAN + ATS which can influence both N assimilation and crop vigor (Liu et al., 2020).

This study assessed the effects of two-sided banding of liquid N and S fertilizers (UAN + ATS) and spring fertilizer timing on corn performance. The objectives were to:

1. determine whether split application (starter + side-dress) improves crop response compared with applying all fertilizer as a starter or solely as a side-dress.

2. evaluate whether two-sided starter banding provides agronomic or operational advantages such as reducing equipment passes.

MATERIALS AND METHODS

The study was conducted at the Iowa State University Agricultural Engineering and Agronomy Farm in Boone, Iowa. Six fertilizer treatments were arranged in a completely randomized design (CRD) with four replications (24 plots total). Plot dimensions were 15.24 m × 4.57 m. The two treatment factors were fertilizer timing (starter vs. side-dress) and placement method (one-sided vs. two-sided banding). Treatments were:

1. 0-0_0-0: no starter and no side-dress (control).
2. ST1-0_202-0: one-sided banding of 202 kg N/ha at planting; no sidedress.
3. ST1-SD2_56-146: one-sided banding of 56 kg N/ha at planting and two-sided side-dress of 146 kg N/ha.
4. ST2-0_202-0: two-sided banding of 202 kg N/ha at planting; no side-dress.
5. ST2-SD2_56-146: two-sided banding of 56 kg N/ha at planting and two-sided side-dress of 146 kg N/ha.
6. 0-SD2_0-202: no starter and two-sided side-dress of 202 kg N/ha.

Corn was planted at 36,000 seeds/ha. Liquid fertilizer was applied as UAN + ATS at rates totaling 202 kg N /ha, corresponding to the treatment design. Biomass and grain yield were collected at R6. Data were analyzed using R version 4.3.1 (R Core Team, 2023), and treatment means were separated with Tukey's test at $p \leq 0.05$.

RESULTS AND DISCUSSION

Grain Yield

Corn grain yield showed minimal response to fertilizer placement–timing treatments (Figure 1). All fertilized treatments produced similar yields, indicating that neither two-sided banding nor split N application improved grain production compared with the one-sided starter or side-dress-only treatments. These results suggest that total N availability across the season was sufficient for achieving maximum grain yield, and that placement method did not restrict root access to N.

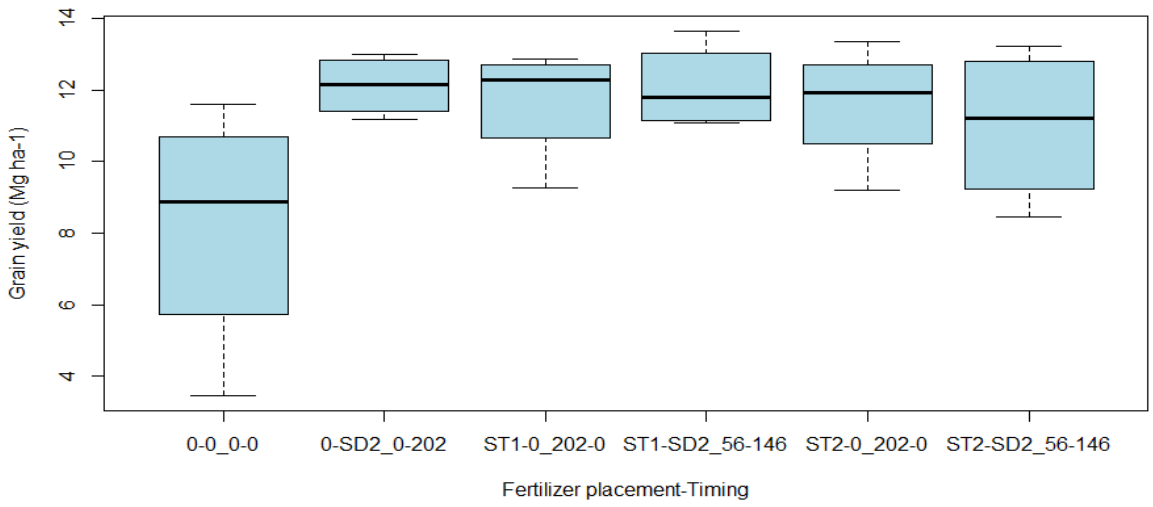

Figure 1. Corn grain yield response to fertilizer placement-timing treatment

The lack of yield differences also suggests that corn compensated for early-season variability in nutrient placement as long as adequate N was supplied later. The wet growing season may have further reduced the advantage of starter versus side-dress timing by enhancing soil N mobility.

Stover Biomass

Stover yield was significantly affected by fertilizer treatments (Figure 2). All fertilized treatments produced greater biomass than the control, demonstrating the importance of N availability for vegetative growth. Two-sided banding tended to increase stover biomass similarly to one-sided banding at comparable N rates.

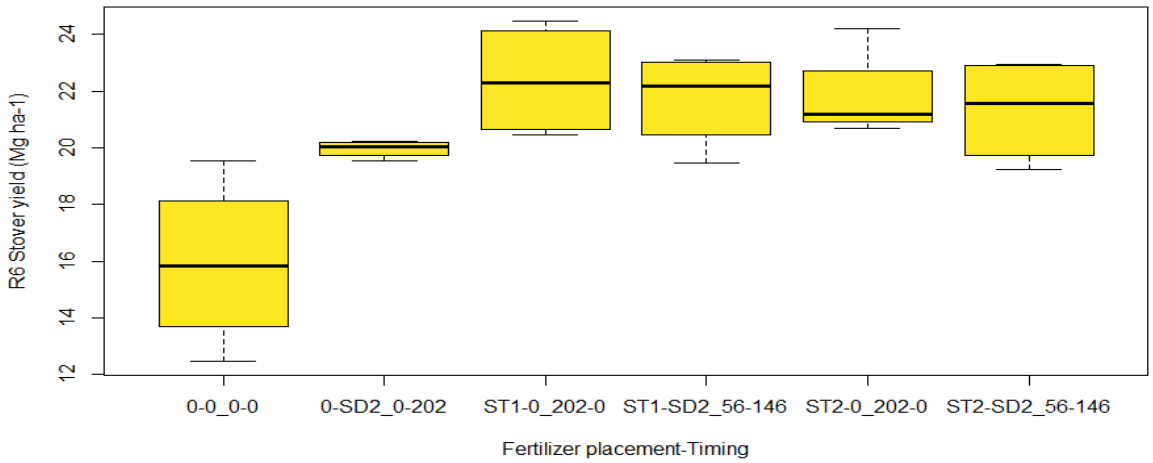

Figure 2. Effect of fertilizer placement–timing on corn stover yield.

The increased biomass under two-sided banding may reflect improved lateral nutrient distribution around the root zone, supporting more uniform early growth. However, applying all fertilizer as a side-dress did not enhance biomass relative to the control, while applying all N upfront with one-sided banding resulted in the highest stover production. Despite differences in vegetative growth, the increased biomass did not translate to grain yield improvements, a trend consistent with other N–S studies (Kovar et al., 2021; Crespo et al., 2025).

Implications

These results indicate that fertilizer placement and timing influence vegetative growth but may not impact grain yield when total N is adequate. Applying all fertilizer as a starter using a one-sided band may offer economic advantages by reducing field passes, fuel use, and labor: an important considerations in Midwestern corn production systems.

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