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Impact of Starter Fertilizer On Growth, Development, and Yield Parameters of Corn.

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Introduction

Starter fertilizer placed 5×5 cm below and to the side of planted corn seeds increases early-season growth and development.[1] Increased early season growth has occurred, under cool and wet conditions; however, grain yield responses have been variable.[1] Variability in emergence and growth reduces grain yield.[2, 3]

Research Objectives

- Identify how starter fertilizer affected the progression of corn development and variability in growth.
- Identify the correlation of this in early-season growth variability from starter fertilizer on final grain yield. (*due to space limitations, this is not addressed on this poster*)

Materials & Methods

- Plots were located near Ames, IA and Nashua, IA in 2011 and 2012. Data presented here from Ames, IA in 2011.
- Treatments were arranged in a complete factorial RCBD and included three DuPont Pioneer hybrids (P0448XR, PO461XR, and P0463XR), three seeding rates (74,100, 88,900, and 104,700 seeds ha^{-1}), and with and without starter fertilizer (10-34-0) at 75 L/ha.
- **Biomass measurements** (Fig 1.) were taken at approximately V2, V4, V6, V9, V15, and R2 on 10 "tagged" (Fig 2.) plants per plot and 5 "non-tagged" (Fig. 3) plants per plot for destructive sampling.
  - Developmental stage (Fig. 1) recorded during vegetative development to 0.25 accuracy.[4]
  - Stem diameter measured between the 7th and 8th node at the widest part of the elliptical stalk and extended leaf height from soil surface.
  - Dry weights were measured for destructively sampled plants.
    - Model developed to correlate stem diameter and height measurement to biomass of destructively sampled plants using PROC REG.[5] (Fig.4)
- **Root measurements** were taken at V2 and V4 on destructively sampled plants:
  - Biomass, root length, surface area, average diameter, number of tips and number of forks analyzed using WinRHIZO.[6]
- **Silking and anthesis** recorded on "tagged plants".
- **Grain yield components** were collected on "tagged plants".
- **Grain yield and moisture** on harvest rows were collected.

Fig. 1. Effect of starter fertilizer on growth (estimated biomass) and developmental stage. "Estimated biomass" calculated using parameters defined by non-destructive measurements and destructive sampling of "non-tagged" plants. Corn was developmentally stage to 0.25 accuracy based on a fine-tuning of the leaf collar method.[4] Differences between growth stage are noted with an *.

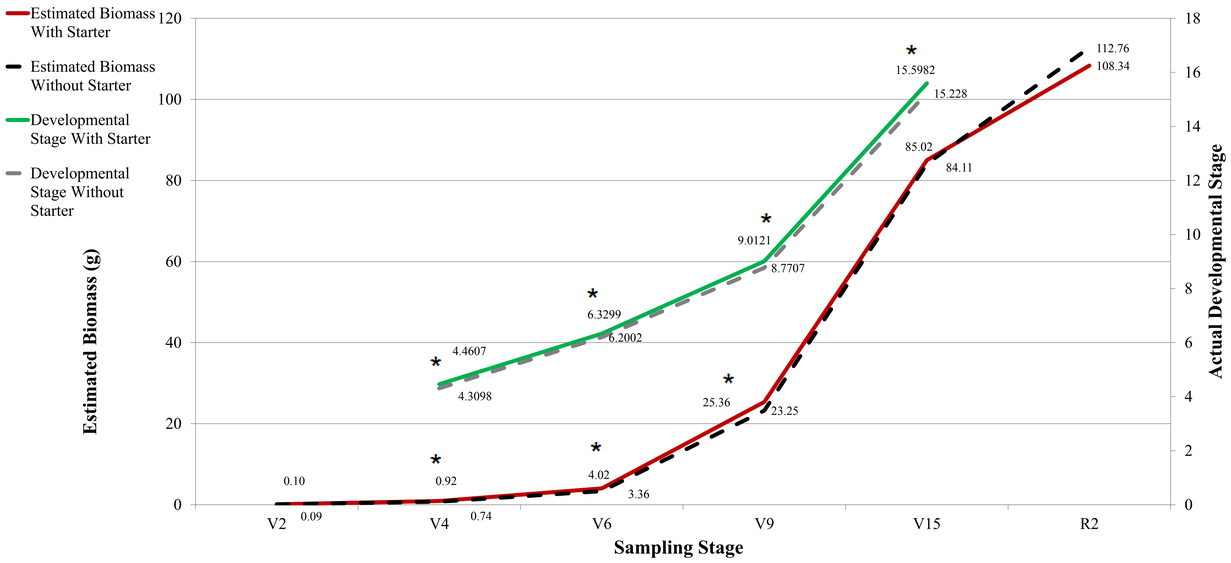
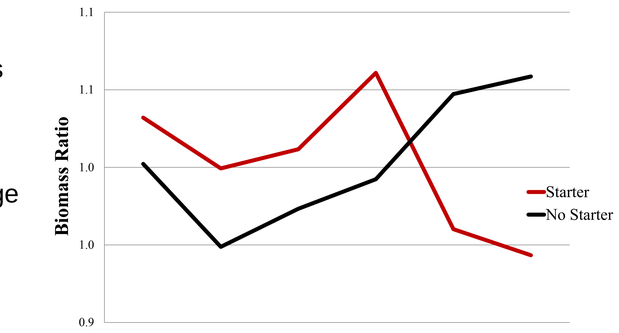


Fig 2. Orange stakes placed next to plants considered "tagged plants". White stakes (marked with arrows) were used to record date of emergence.

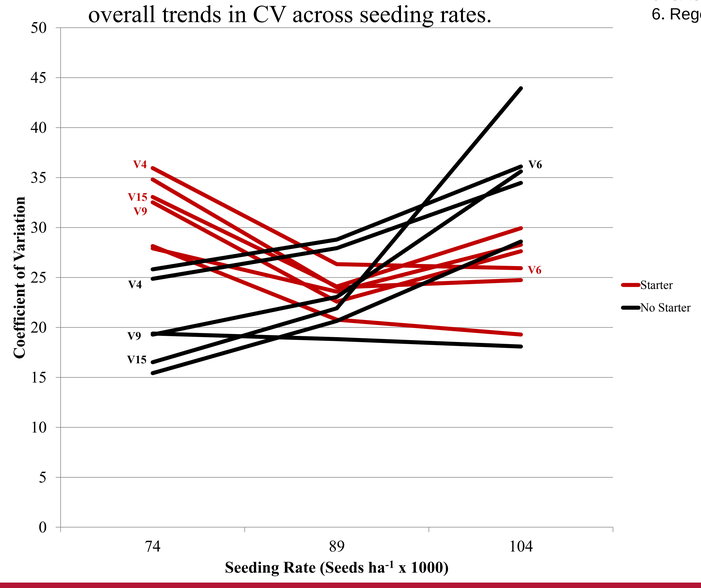
Fig. 3. Photo of plot with orange stakes next to "tagged" and "non-tagged" plants. Non-tagged plants were the first five consecutive plants after the orange stakes and were used for destructive biomass sampling. Non-tagged stakes are marked with orange arrows.

Fig. 4. Ratio of average estimated biomass of "tagged plants" to average biomass of destructively sampled "non-tagged" plants. Estimated biomass calculated using parameters defined by non-destructive measurements and destructive sampling of "non-tagged" plants; r^2 of biomass estimate equations below each sampling stage.



	V2	V4	V6	V9	V15	R2
r^2	0.15	0.75	0.79	0.83	0.70	0.77

Fig. 5. Coefficient of variation for estimated biomass. Estimated biomass calculated using parameters defined by non-destructive measurements and destructive sampling of "non-tagged" plants. Data merged from multiple sampling dates into this graphic to show overall trends in CV across seeding rates.



Results

- **Growth and development**
  - Starter fertilizer increased the average developmental stage of corn (Fig. 1) and decreased the days to silking
  - Starter fertilizer increased the estimated biomass of plants at V4, V6 and V9; final plant size was not different. (Fig. 1)
- **Variability in growth**
  - Starter fertilizer increased estimated biomass CV at a seeding rate of 74,100 seeds ha^{-1} at stages V4, V9, and V15. (Fig. 5)
  - Starter fertilizer decreased estimated biomass CV at a seeding rate of 103,700 seeds ha^{-1} at stages V6. (Fig. 5)
- **Root data**
  - Starter fertilizer increased root biomass at V4. (Fig. 6)
  - The seeding rate of 74,100 seeds ha^{-1} had greater root length, surface area, average diameter, number of tips and number of forks than the seeding rates 88,900 of 103,700 seeds ha^{-1}.
- **Grain yield and yield components**
  - Starter fertilizer had no effect on plot grain yield.
  - Plant grain moisture was lower with starter fertilizer.
  - Kernels per plant and plant yield were greater with starter fertilizer.
  - Increased seeding rate increased per plant grain yield variability.

Conclusion and next steps

- Based on one site year:
  - Starter fertilizer increased growth and development parameters.
  - Starter fertilizer increased plant-to-plant variability at low seeding rates, however decreased plant-to-plant variability at high seeding rates.
- Include data from Ames 2012 and Nashua 2011 and 2012.

References

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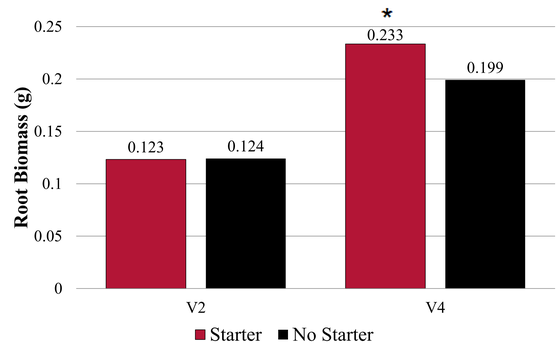
Fig. 6. Root biomass of destructively sampled plants at V2 and V4. Differences are noted with an * .



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