Previous Management Alters Residue Characteristics and Yield of Corn after Corn

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Question: Does the previous crop year's management influence the inherent yield loss of corn following corn?
Objective: Identify proactive approaches to managing corn residue to enhance subsequent crop yield.

Introduction:
- Producers that grow corn (Zea mays L.) after corn must consider all management decisions to achieve the highest level of productivity.
- The previous year's corn management decisions (hybrid, nitrogen rate, and foliar protection) could play a role in the magnitude of the rotation effect.
- Potential effects of a late-season fungicide application on that crop's residue and the following year's grain yield are unknown.
- Hybrids grown in continuous corn vary in their sensitivities to corn-on-corn, and to the same hybrids' residue.
- Corn residue has a C:N ratio that promotes soil nitrogen immobilization, and as a result, higher rates of inorganic nitrogen fertilizers are typically utilized in corn after corn systems.

Research approach:
Three field experiments were conducted at Champaign, Illinois to evaluate different previous season managements of corn on the following year's grain yield. Trials were conducted on a Flanagan silty clay loam soil, and planted on 20 April, 2016, 18 May, 2017, and 28 April 2018. Each trial had a setup year focused on a single crop management factor, and the subsequent year was planted without tillage to corn after corn (Figure 1).

The factors evaluated were:
1) Foliar Protection:
- Fungicides were backpack-sprayed at VT/R1 in aqueous suspension at 140 L H₂O ha⁻¹ and mixed with surfactant Masterlock at 0.45 kg ha⁻¹. Treatments were:
  - Untreated,
  - Headline AMP at 1.01 kg ha⁻¹,
  - Trivapro at 0.96 kg ha⁻¹.

2) Nitrogen Rate:
- Setup year nitrogen rates were applied at planting as Limus urea (46-0-0) at the rates of: 0, 67, 135, 202, and 269 kg N ha⁻¹ in 2016, with an additional rate of 336 kg N ha⁻¹ in 2017.

3) Hybrid:
- Three genetically diverse Croplan hybrids were grown for the setup year, and in year two each hybrid was grown in all three of the hybrids' residues.

Setup foliar protection and hybrid trials, along with all subsequent year plots received 179 kg N ha⁻¹ as urea ammonium nitrate (UAN; 28-0-0) broadcast at planting in 2017 and as Limus urea at V5 in 2018. In all trials, plots were seeded to achieve 89,000 plant ha⁻¹. Values for grain yield, aboveground biomass, and nitrogen uptake are all expressed at 0% moisture.

Research findings:

Results and Discussion:

- Foliar protection enhanced grain yield by 0.9 and 0.7 Mg ha⁻¹ with Headline AMP and Trivapro, respectively, in the year of application (Figure 2). As yield increased in the setup year, uptake of nitrogen in both the grain and stover increased (data not shown). Residual effects of fungicide on the following grain yield tended to follow the same trends as the initial year's grain yield, however, to a much lesser magnitude.

- Setup year nitrogen rate significantly affected total aboveground biomass accumulation (Table 1). When no nitrogen fertilizer was applied, biomass and nitrogen uptake was limited. Biomass was greatest when 202 and 269 kg N ha⁻¹ was added in 2016. When any nitrogen fertilizer additions were made in 2017, biomass production was greater than the zero nitrogen control. Nitrogen uptake tended to increase with each addition of nitrogen fertilizer in both setup years.

- Grain yield increased in both setup years with additional nitrogen fertilizer (Figure 3). Yield peaked with 135 kg N ha⁻¹ in Setup Year 1 and with 202 kg N ha⁻¹ in Setup Year 2. In one of the two subsequent year trials, grain yield tended to increase from increased nitrogen rate treatments of the previous year. This trend in subsequent grain yield followed that of the setup year nitrogen accumulation in the aboveground biomass (Table 1).

- The hybrid that achieved the highest grain yield during the setup years (6110SS; data not shown), accumulated the most biomass and nitrogen (Table 1). Although always moderately yielding, 6594SS had the tendency to accumulate the least amount of nitrogen each year.

- Subsequent year grain yield was significantly altered by hybrid (Table 2). Select hybrids grown in their own residue tended to yield less when grown in another hybrid's residue.

Conclusions:
1. Does previous year foliar protection impact grain yield the following year?
   - No, although fungicides tended to boost yields, residual effects only modestly followed these trends.

2. Can residue quality and subsequent grain yield be altered by nitrogen rate?
   - Yes and no, residue accumulation and nitrogen uptake increased with nitrogen input, however, subsequent grain yield was unchanged regardless of previous year nitrogen rate.

3. Will previous hybrid residue affect yield reductions associated with corn after corn?
   - No, yield only tended to be less when grown in the same hybrid's residue.