Farming Systems Approaches to Concomitantly Increase Corn Yield and Nitrogen Use Efficiency (NUE)

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Introduction

Optimizing nitrogen (N) application and plant utilization is essential for assisting key-stakeholders and for closing corn yield gaps. Increasing N use efficiency (NUE) is approached via integration of best nutrient and crop production management practices.

Objective

Quantify corn yield response to fertilizer N application and source under diverse treatment combinations.

Material and Methods

Table 1. Treatments Description. Hybrid DKC64-69rib. Planting time in the last week of April at both sites (Topeka and Scandia, KS) under irrigation.

Factors	Treatments							
	Check	OTech	FP	NTech	Adv	NonLim	Adv+	PrecN
Fertilizer size	No	Urea	Urea	Pellets	Pellets	Pellets	Pellets	Urea
Rates (kg N ha^{-1})	No	280	84/196	280	280	224/56	224/56	56/112/112
Application timing	No	Planting	Planting/V_6	Planting	Planting	Planting/V_6	V6 - 56	Planting/V_6/V_{12}
Nitrification inhibitor	No	No	No	No	Yes	Yes	Yes	No
Row spacing (cm)	76	76	76	76	76	76	38	38

Check
OTech= Old Technology
FP = Farming Practice
NTech = New Technology
Adv = Advanced
NonLim = Extra N
Adv+ = Advanced plus
PrecN = Precision N

Seasonal physiological traits were determined: leaf area index, plant growth, photosynthesis, nutrient concentration, canopy cover, and yield traits.

Results

Early corn growth did not show any significant difference between vegetative structures (stem, leaf, and root) in treatments evaluated. Dry weight was obtained as the average of 20 plants.

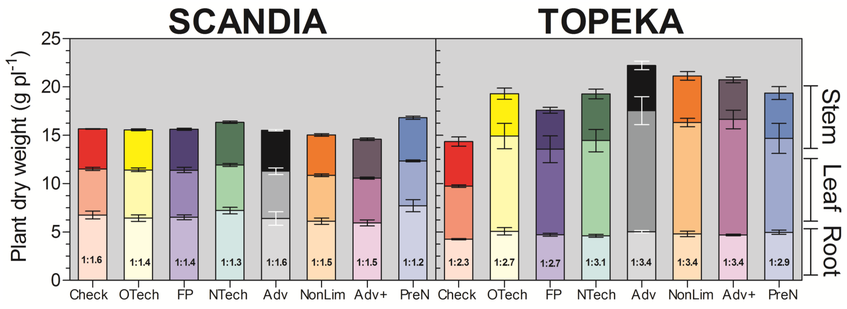

Figure 1. Dry mass plant partitioning (leaf, stem and root) at V6 growth stage at both sites (Scandia and Topeka, KS). Values within the bars refer to the root:shoot mass ratio.

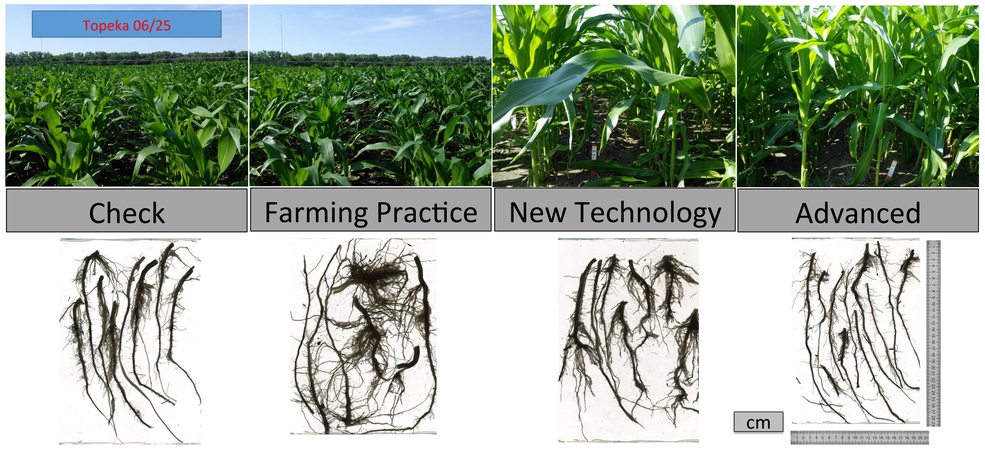

Figure 2. Picture of shoot (stem + leaf) and root biomass at V6 stage, Topeka, KS.

Results (continued)

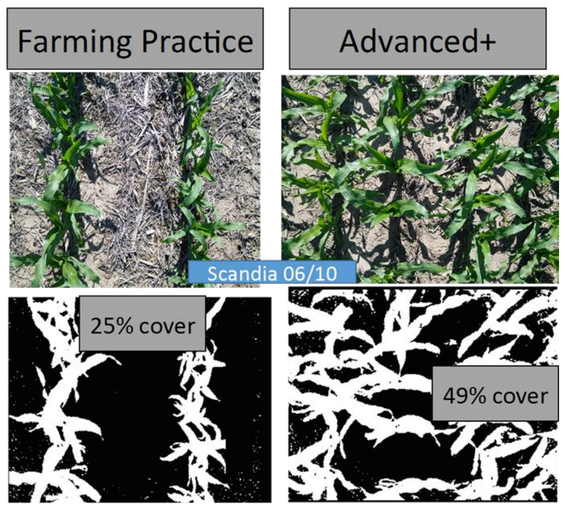

Figure 3. Canopy coverage at V6 growth stage.

- Plant dry weight fractioning at R6 growth stage did not present critical differences between vegetative components (leaf vs. stem) and under different plant canopy strata for all systems evaluated.
- Plant dry mass was obtained as the average of 10 plants.
- Larger stem and leaf biomass was documented for the lower & middle canopy.

R6 (Physiological Maturity)

Figure 4. Corn at physiological maturity, Scandia, KS.

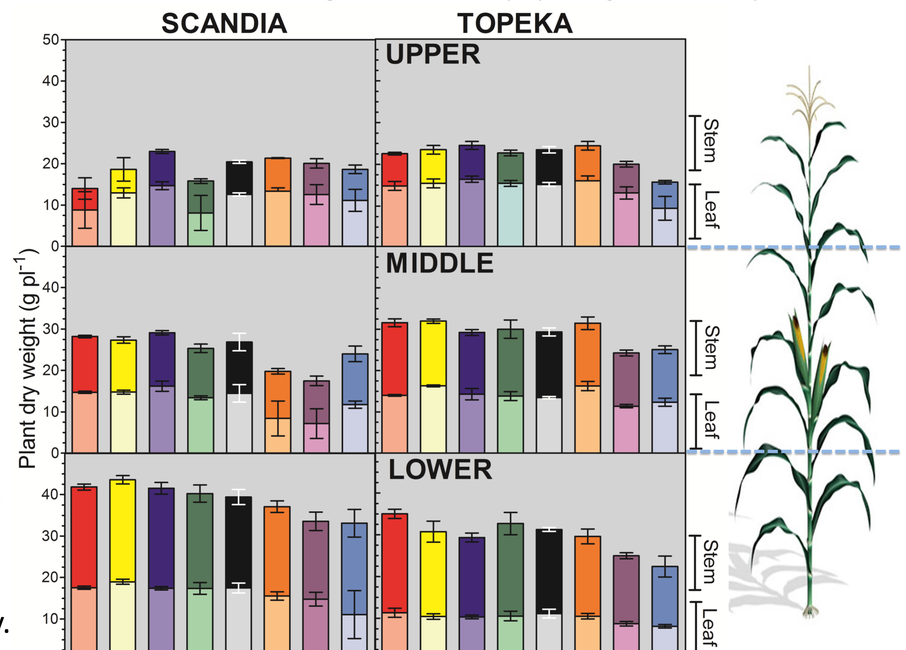

Figure 5. Dry weight partitioning (stem and leaf fractions) at varying corn plant canopy strata for all farming systems approaches evaluated at two phenological stages, R1 (flowering) and two-weeks after (R3 stage).

Grain Yield at Harvest Time

- At both locations, grain yield for the check treatment was the lowest across all the farming systems evaluated ($p<0.05$).
- At Topeka, the new technology (NTech) treatment presented one of the highest yield. At Scandia, both NTech and Farming Practices (FP) did not present a significant yield difference, but yields were superior as compared with the OTech.

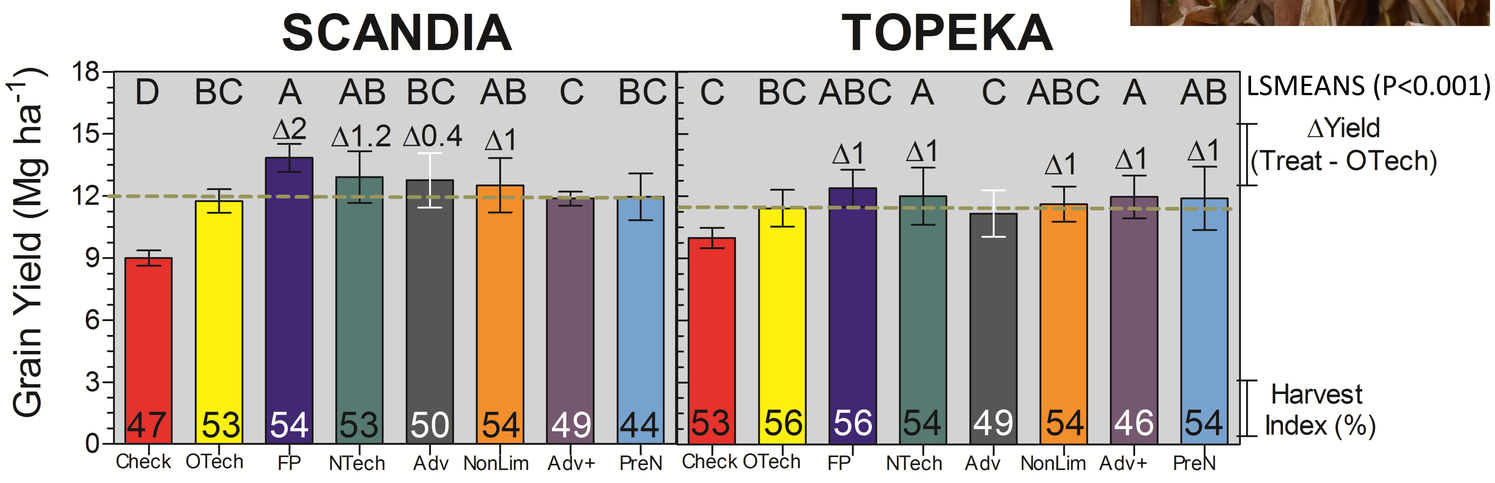

Figure 6. Grain yield, 15.5% moisture, for all systems evaluated at harvest time at Topeka and Scandia, KS (2014). Values within the bars represent the grain harvest index = Grain to Stover biomass ratio (%).

Conclusions

- Yield benefits were obtained from use of new planting technologies relative to farming practices.
- Early (V6), mid-season (flowering, R1), and late-reproductive (R3) plant mass partitioning did not portray a large difference but end-season grain partitioning efficiency (harvest index) was affected.