

Evaluating Corn Yield and Plant and Soil Nutrient Concentrations under Application of Synthetic Fertilizer and Dairy Manure

Tajamul Hussain ¹, Muhammad Fraz Ali ²¹ Oregon State University, OR, USA, ² Northwest A&F University, Yangling, China

INTRODUCTION

- Corn silage is a key component of animal feed in the U.S. dairy industry.
- Applying manure to field corn can sustain yields while reducing reliance on synthetic fertilizers.
- Using manure to supply crop nutrients will help managing manure surplus and associated environmental risks on dairy farms.

OBJECTIVE

Evaluate the effects of synthetic fertilizer and dairy manure on corn growth, yield, nutrient recovery, and nutrient dynamics in soil profile.

METHODS

Field Trial:

- **Experimental design:** RCBD with four replications
- **Field plots:** 25 × 8 ft plot having four rows of corn with 2.5 ft of row-row distance
- **Treatments:** Synthetic fertilizer (NPK) and dairy manure applied at 5-, 10- and 15-ton acre⁻¹ in addition to a non-fertilized control.

Data Collection:

- **Plant height:** measured at harvest.
- **Biomass:** Harvested plants from 4 ft length from central two rows to determine total aboveground biomass. Selected three hills to determine fresh and dry weights of leaf, stems and cobs.
- **Nutrient concentration and analysis:** NO₃⁻-N, NH₄⁺-N, P₂O₅, K⁺ and SO₄-S



Photo 1: Monitoring soil profile, plant sampling at harvest and sample preparation for nutrient analysis. (Credit: Tajamul Hussain)

Data Analysis:

- Assessed effects of applied treatments on field corn growth, yield and plant and soil nutrients.
- Significance identified at $\alpha = 0.05$ and means separated using Fisher's Protected LSD.

RESULTS & DISCUSSION

In-season Leaf Nutrient Concentration

- N, K and S: significantly influenced (Figure 1A, B)
- P: no significant effect
- N, K and S: highest in NPK treatment.

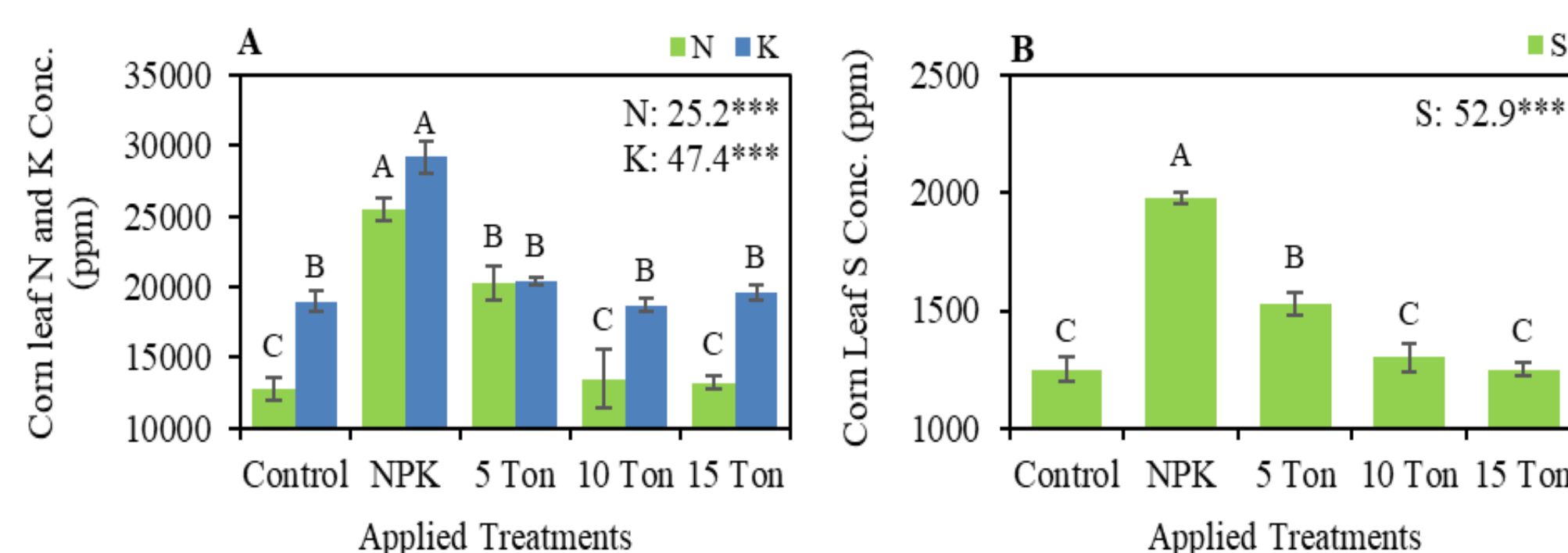


Figure 1: Impact of synthetic NPK and manure application on leaf N, K (A) and S (B) concentrations.

Corn Growth and Yield

- Plant height: significantly influenced (Figure 2A)
- Yield: significantly influenced (Figure 2B)
- Plant height and yield: highest in NPK treatment.

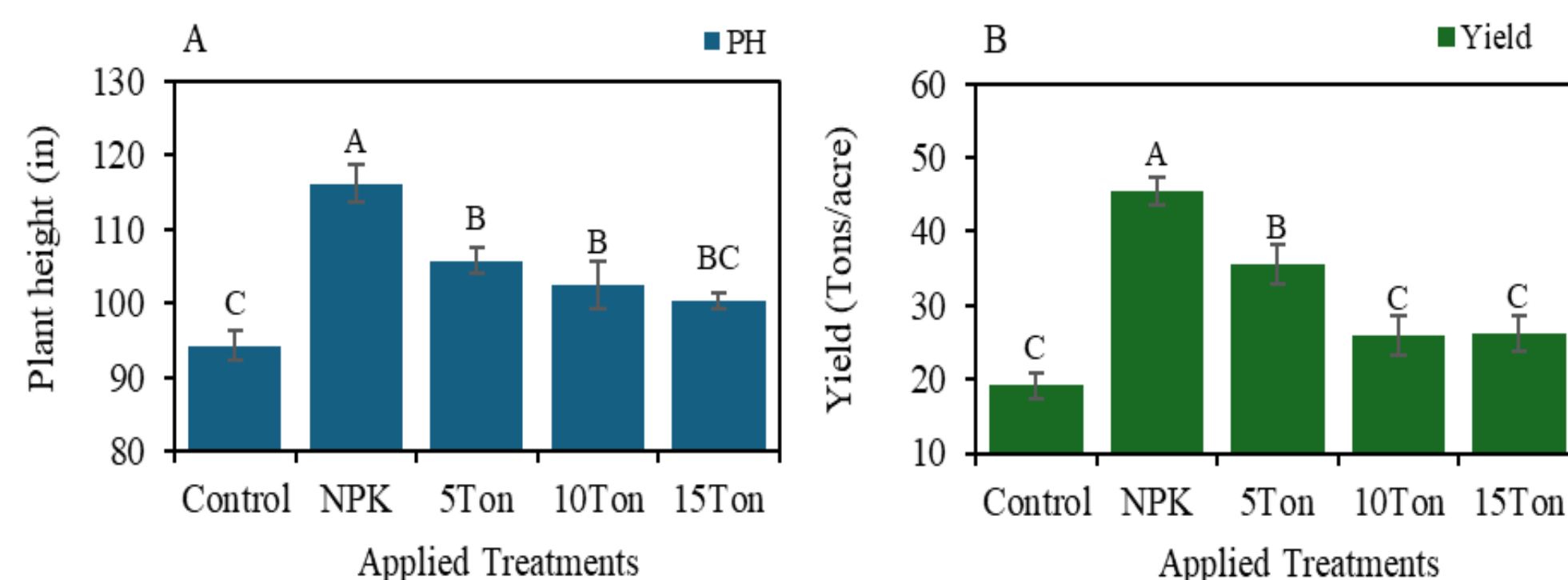


Figure 2: Impact of synthetic fertilizer and manure application on plant height (A) and corn yield (B).

Plant Nutrient Concentrations and Recovery.

Plant Parts	Nutrient Concentration			
	N	P	K	S
Leaves	20.73***	2.63ns	14.1***	8.37**
Stalk	0.94ns	17.53***	0.81ns	0.58ns
Cobs	3.30*	0.30ns	2.58ns	0.49ns
Nutrient Recovery				
Treatments	15.21***	2.78ns	33.25***	20.91***

Soil Nutrients

Effects	NO ₃ ⁻ -N	NH ₄ ⁺ -N	P ₂ O ₅	K ⁺	SO ₄ -S
Treatment	2.08ns	3.68**	0.83ns	0.16ns	1.92ns
Depth	77.25***	35.70***	31.06***	47.10***	49.56***

CONCLUSIONS

- Considering manure at 5 tons acre⁻¹: highest corn yield (35.5 tons acre⁻¹) compared to 10 (25.9 tons acre⁻¹) and 15 tons acre⁻¹ (26.1 tons acre⁻¹).
- Low nutrient recovery and yield under excessive manure application indicates nutrient imbalance
- Combination of synthetic fertilizers and manure might be a practical approach for balanced nutrient supply for field corn.

Further Information: hussain.psu@gmail.com