

# Effect of multi-management factors on morphological characteristics of corn ears

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## INTRODUCTION

- In 2024, approximately 1.3 million hectares of corn were harvested for grain purpose in Ohio.
- Corn yield is directly determined by ear morphology components.
- Understanding the impact of multi-factor cropping components on corn ear traits is important for long-term improved and sustainable corn production.

## OBJECTIVES

- Assess the impact of management factors on corn ear components.
- Evaluate the more affected and the least affected morphological traits.
- Identify the best management combination for long-term sustainable corn yield.

## MATERIALS & METHODS

### Split-Split Block Design:

- Cover crop - main block
- Tillage and Nitrogen - sub-block
- Crop rotation - sub-sub block

### Treatment Levels:

- Cover crop:** Absence and presence (cereal rye)
- Tillage:** Conventional and strip-till
- Nitrogen:** Standard (224.17 kg per ha) High (additional 44.83 kg per ha)
- Crop rotation:** Corn, corn-soybean, and corn-soybean-wheat

### Measurements:

Five corn ears randomly sampled from each plot. Data collected included number of kernel rows per ear, number of kernels per row, total number of kernels per ear, dry kernel weight per ear, and 1000 kernel weight.

### Data analysis:

- Analysis of Variance (ANOVA) in R version 4.4.1.
- Means of separation using Tukey's HSD test ( $p \leq 0.05$ )
- Data visualization using the ggplot2 package in R.



(A) Corn seedling, (B) Corn field, (C) Black layer at R6 stage, (D) Harvested corn samples, (E) Hand corn sheller, and (F) Corn kernels.

## EAR MORPHOLOGY RESULTS – 2024 GROWING SEASON

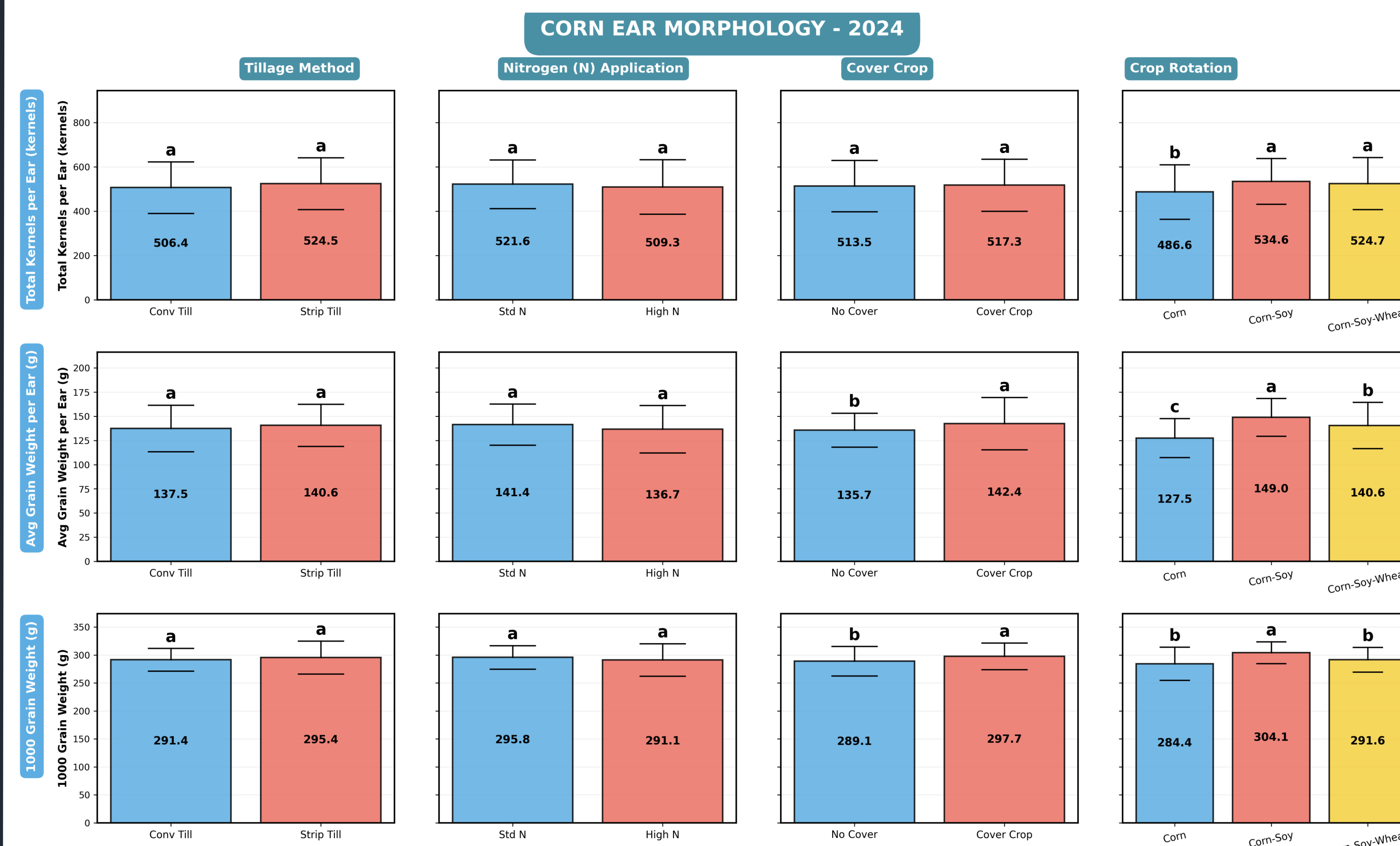


Figure 1. Effect of agronomic management factors on corn ear traits.

### Cover crop and rotation prominently affected corn ear measurements (Figure 1)

#### Cover cropping

- The average grain weight per ear increased by 4.9% and 1000-grain weight by 3%, while maintaining similar kernel numbers per ear.

#### Tillage system

- Both conventional and strip till had no significant impact on corn ear morphological characteristics across all measured traits ( $\eta^2 \leq 0.006$ ).

#### Nitrogen application

- High nitrogen application had no significant improvements in ear morphological characteristics.
- Under 2024 conditions, standard nitrogen rates produced numerically higher values for most traits.
- The marginal effect on average grain weight ( $p = 0.051$ ) was not significant.

#### Crop rotation

- Corn-soybean rotation consistently outperformed continuous corn across all measured variables, showing 9.8% kernel increase per ear, 16.9% higher grain weight per ear, and 7% higher 1000-grain weight.

#### Correlation

- The strongest correlation between kernels per row and total kernels per ear ( $r = 0.900$ ) indicates that ear length is the primary determinant of total kernel number (Figure 2).

#### Treatment combination normalized performance score

- the best treatment combination 0.96
- the worst treatment combination 0.05 (Figure 3)

Normalized performance: 0 = worst performing treatment, 1 = best performing treatment

**BEST treatment:**  
Corn-Soybean

**WORST treatment:**  
Continuous Corn

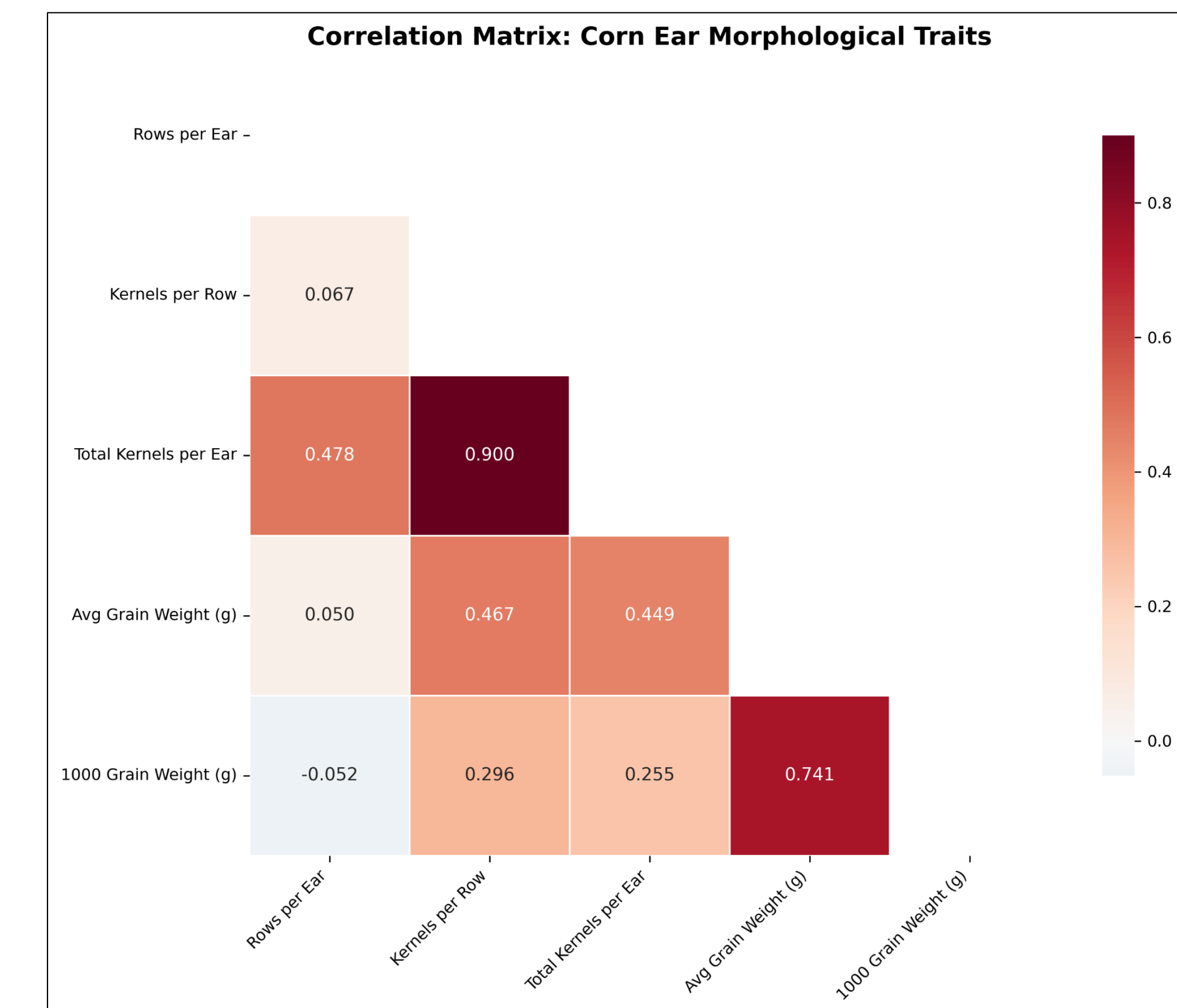


Figure 2. Correlation among the corn ear response variables.

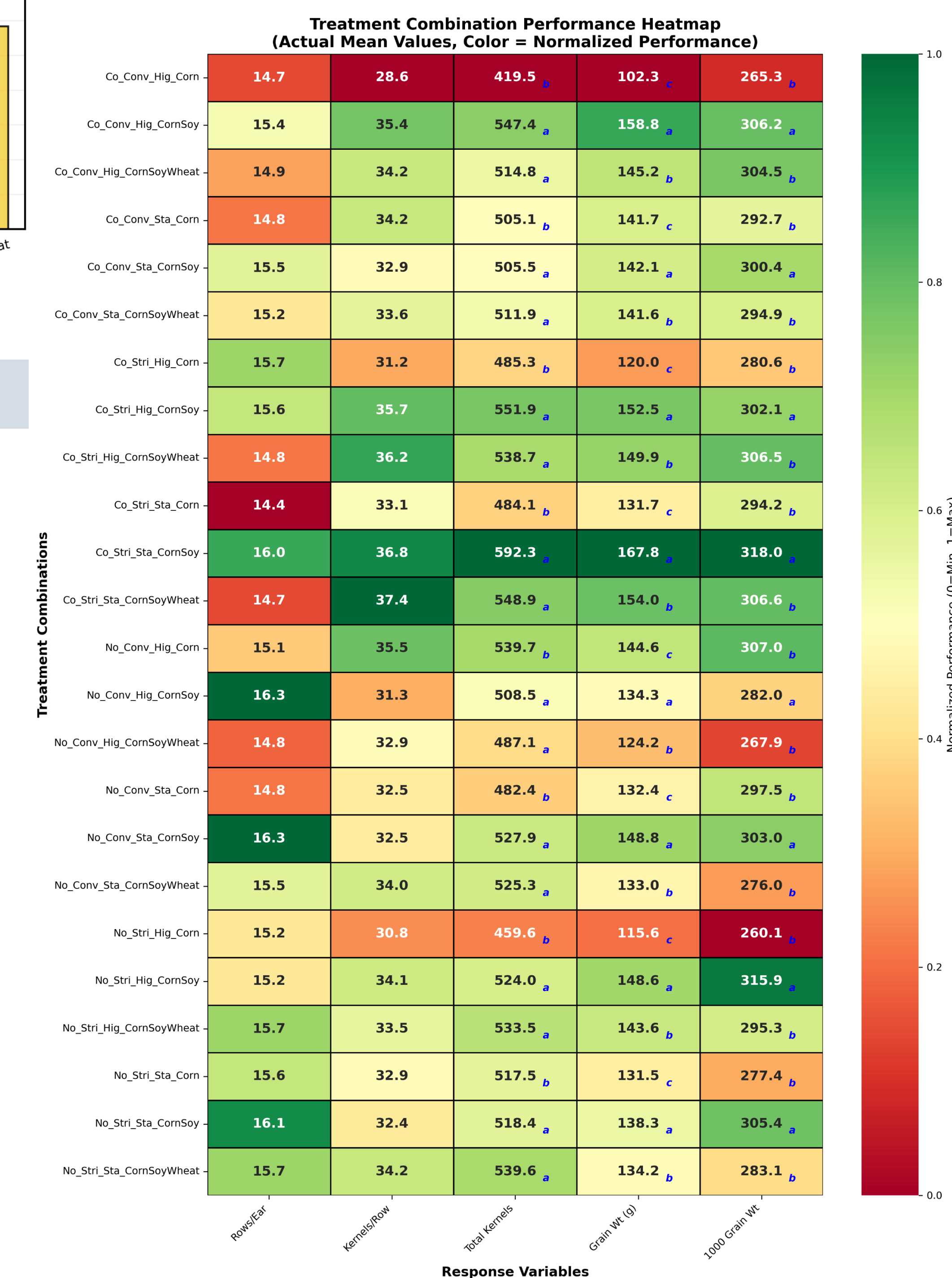


Figure 3. Heatmap – effect of all factor combinations on corn ears.

## Main Take-Aways from 2024

- Cover crop increased grain weight without affecting total kernel number.
- Tillage decisions can be based on other agronomic considerations without compromising ear characteristics.
- No effect reported with the high nitrogen rate.
- Crop rotation was the dominant management factor affecting corn ear morphology.
- Field trials being repeated in 2025, 2026, and 2027 for long-term understanding of management factors and corn ear morphology relationships.

