

Evaluation of Fall and Spring N Rates Effect on Cereal Rye Forage Crude Protein and Tillering using NDVI and Canopeo to make infield Nitrogen Rate Decisions

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Objective

Use spring NDVI readings to assist making spring nitrogen application management decisions and determine if fall applied nitrogen increases density and protein in cereal rye.

Methods and Materials

- This study took place at the Ohio State University North Central Agricultural Research Station in Fremont, Ohio.
- The experiment is a randomized complete block split-plot design with four nitrogen (N) rates in the fall (0, 30, 60, and 90 lbs./ac) and four nitrogen rates in the spring (25, 50, 75, and 100 lbs/ac) over the fall rates in cereal rye (*Secale cereale*).
- Rye was planted in October 2023 and harvested in May 2024.
- Nitrogen fertilizer was applied as Urea.
- NDVI and Canopeo readings were taken in late November before fall dormancy and in March after green up to determine the greenness and density of green matter in an area.
- Data was analyzed in Rstudio, package Agricolae.



Results

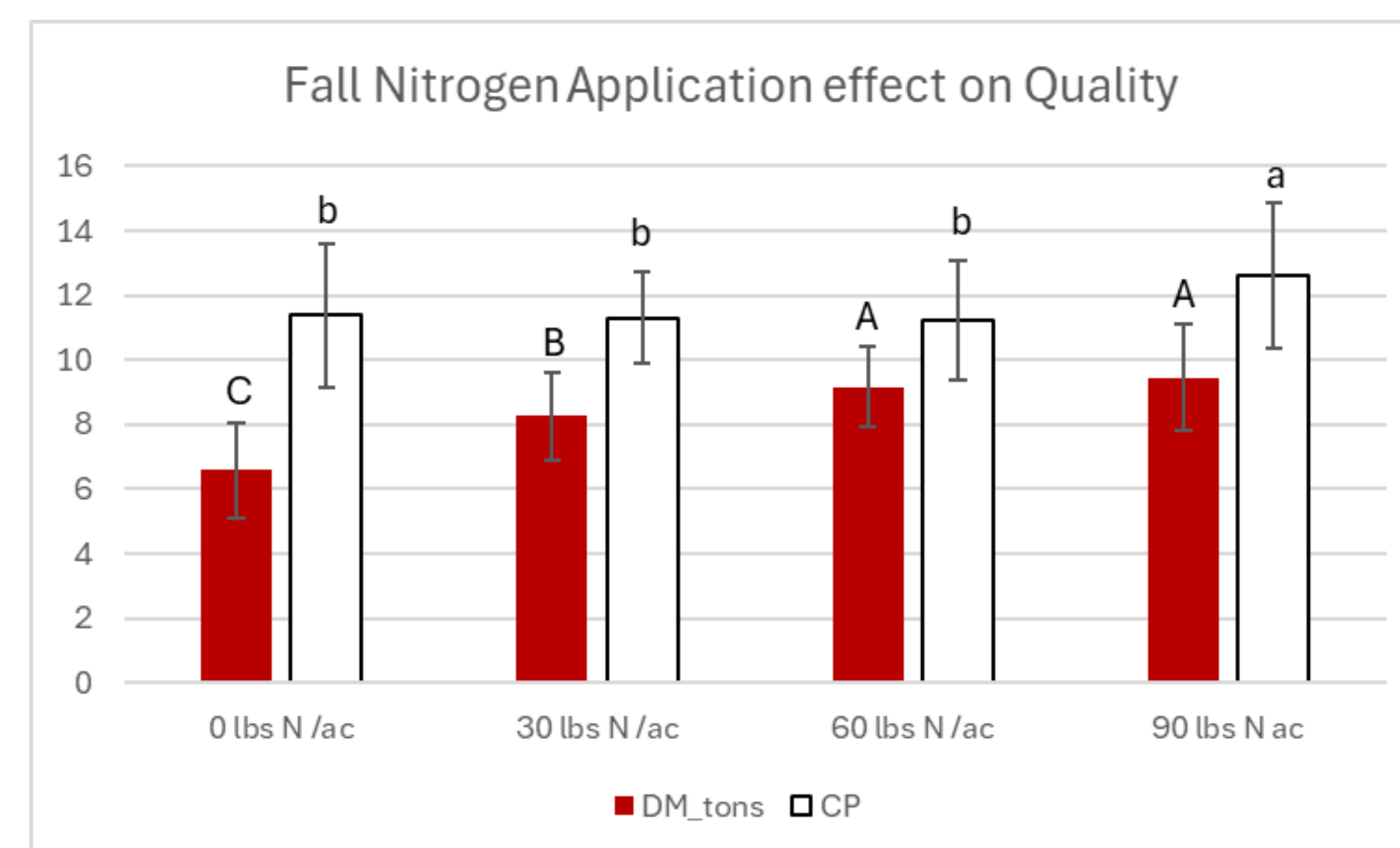


Fig 1. (above)
Significant differences for fall nitrogen applications on Dry Matter per Tons (DM_tons) and Crude Protein (CP) analyzed separately in Rstudio.

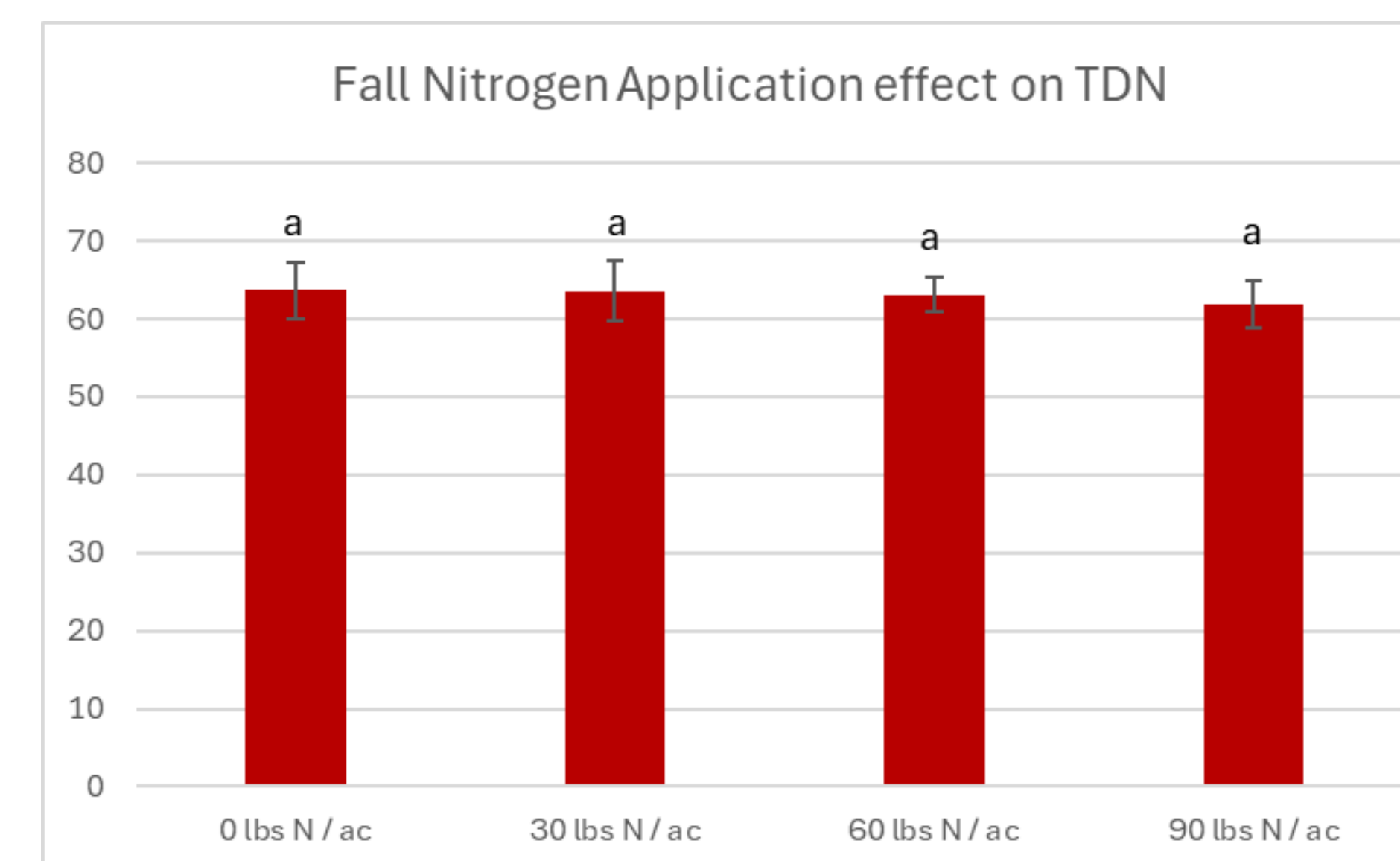


Fig 2. (above)
Significant differences for fall nitrogen applications on Total Digestible Nutrients (TDN) analyzed in Rstudio.

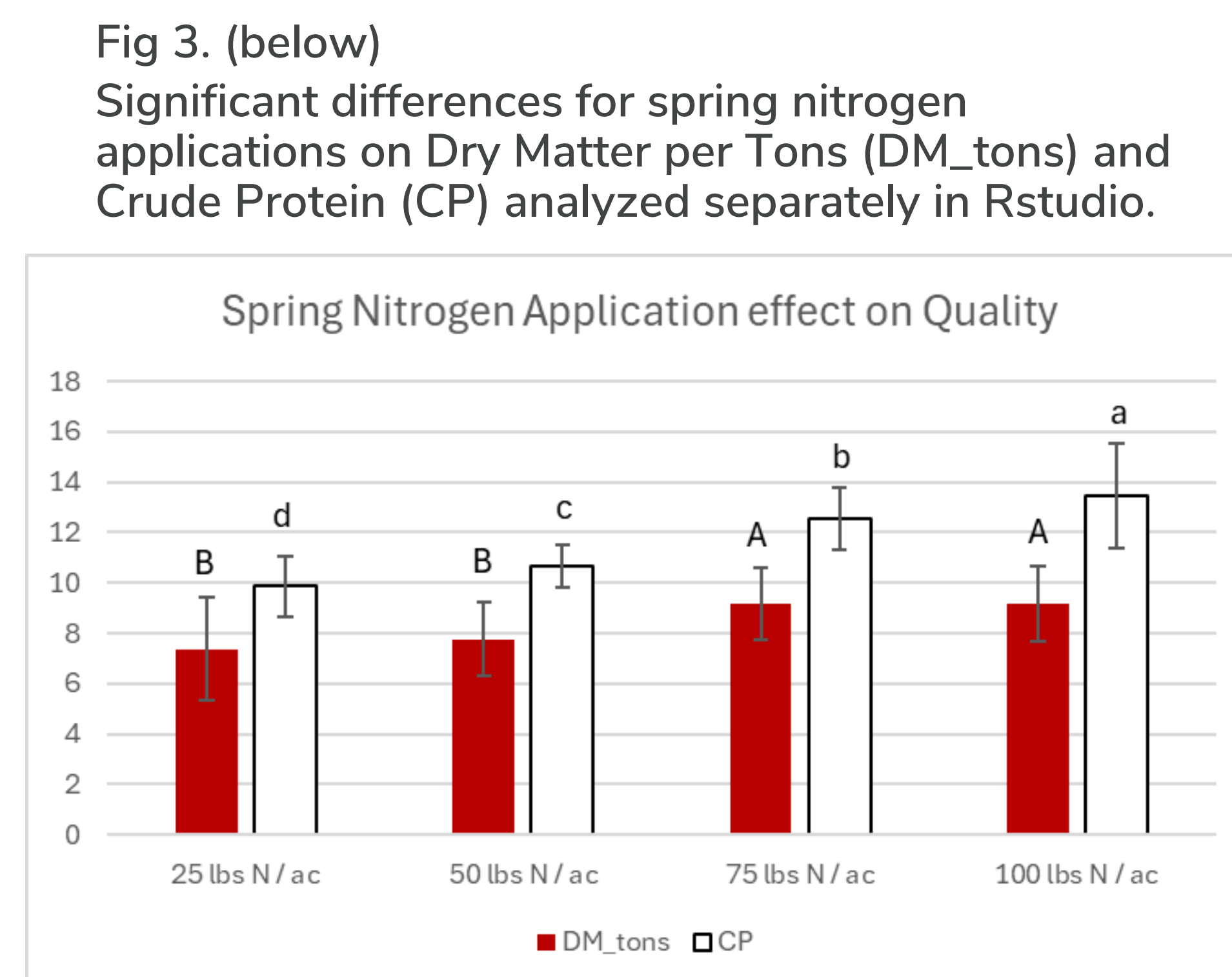


Fig 3. (below)
Significant differences for spring nitrogen applications on Dry Matter per Tons (DM_tons) and Crude Protein (CP) analyzed separately in Rstudio.

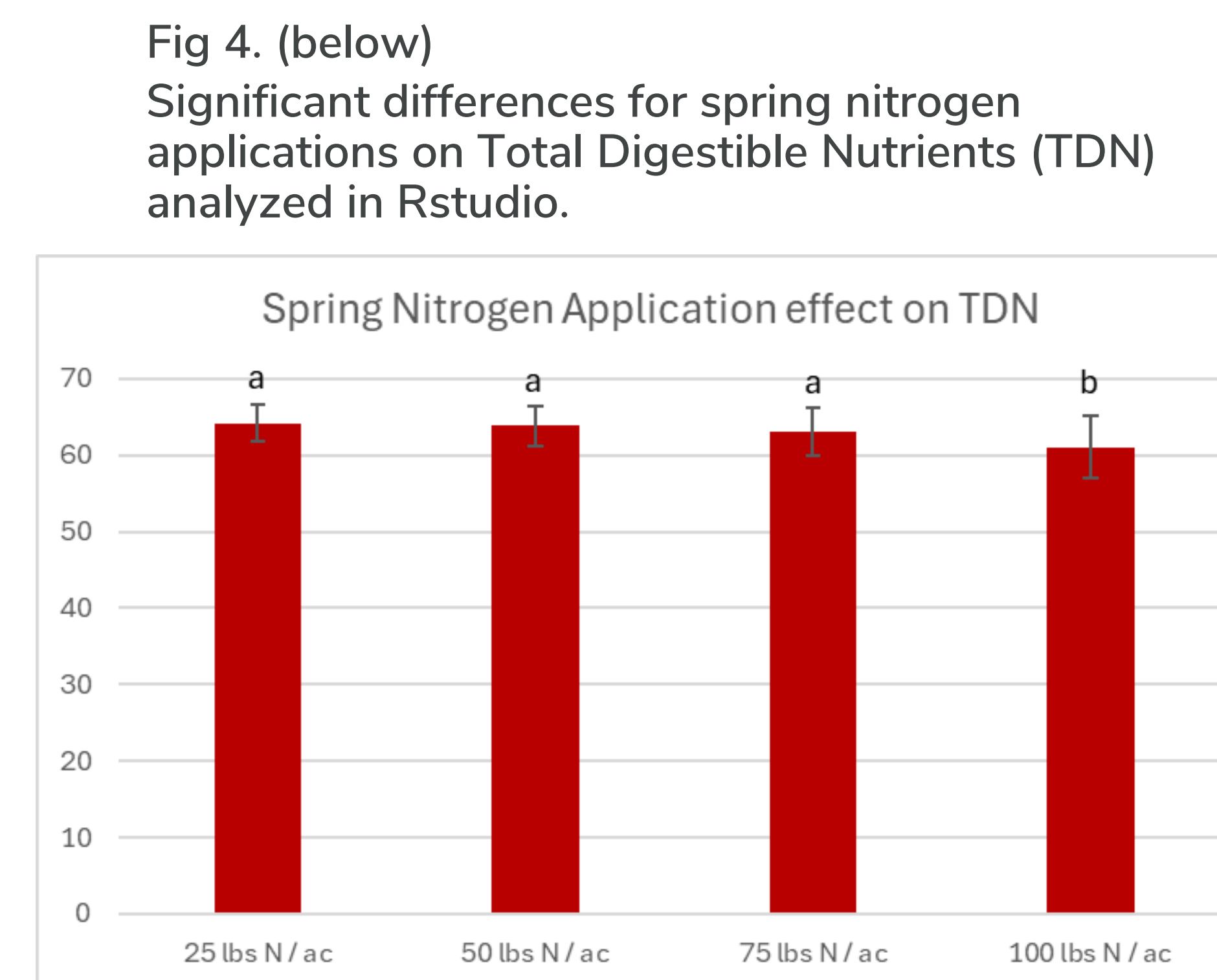


Fig 4. (below)
Significant differences for spring nitrogen applications on Total Digestible Nutrients (TDN) analyzed in Rstudio.

Reading	NDVI	Canopeo
Nspring25	0.7	0.46
Nspring50	0.62	0.44
Nspring75	0.65	0.36
Nspring100	0.76	0.46

Table of Pearson Correlation values for interactions between Normalized Difference Vegetation Index (NDVI), Canopeo and the spring applied nitrogen treatment. Spring nitrogen treatments included 25, 50, 75 and 100 lbs/ac named Nspring25, Nspring50, Nspring75, and Nspring100, respectively.



Discussion

- Nitrogen is a critical factor in forage yield and quality.
- Spring nitrogen is the primary driver of crude protein (CP), but 90 lbs of fall nitrogen statistically increases CP.
- Nitrogen applied in the fall or split between the fall and spring will result in more constant forage production throughout the season compared to one spring application.
- NDVI correlated with all the spring applied nitrogen treatments, whereas Canopeo did not.

Conclusions

- A combination of spring and fall N is needed to maximize forage yield and quality.
- A minimum of 30 lbs of fall N is needed to optimize yield, but when more fall N is applied, lower spring N rates can be used to maximize yield and quality.
- The ability to use NDVI to determine spring N status will help growers make more informed decisions about spring N needs based on their forage needs.

Future Work

- A zero-nitrogen spring application should also be used to better analyze the effects of spring N and fall N both alone and in combination.
- Develop stronger NDVI reading recommendations for assessing fall N uptake of cereal rye crop.

