ALFALFA AND CORN FORAGE QUALITY IS RELATED TO SOIL ANALYSIS AND PLANT TISSUE MINERAL CONTENT

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INTRODUCTION:

- Forage quality is a substantial influencing factor for dairy cattle performance and feed conversion efficiency.
  - The relationship between agronomic measures or inputs and forage quality is poorly understood.
  - Dairy farmers and crop growers will benefit from further understanding the relationships between agronomic practices and forage quality. The objective of this field study was to determine if correlations exist between agronomic and forage quality measures.

FIELD STUDY METHODOLOGY:

- Three growers were enrolled in an intensive sampling study from April through September 2021, in Southern WI, USA.
- Alfalfa and corn fields, 3 to 5 and 4 to 6 per grower, respectively, were enrolled based upon soil analysis P (Bray-1) and K (Bray-1) results of samples collected within the previous 4 years.
- Plant tissue (PT) samples were collected at VT stage in corn and vegetative stage in alfalfa, and analyzed by Rock River Laboratory, Inc. (Watertown, WI)
- Freshly chopped alfalfa (ALF) and corn samples (CS), were collected at harvest for nutrition analysis by NIR, using commercial models developed by Rock River Laboratory, Inc.
  - 189 chopped alfalfa and 89 whole-plant chopped corn samples
  - Alfalfa samples were collected from 1st, 2nd, and 3rd cuttings
- Nutritional quality distribution for freshly chopped alfalfa and whole-plant corn are presented in Figures 1a and 1b.

DATA ANALYSIS METHODOLOGY:

- Observational data analysis was conducted using the Generalized Regression procedure with elastic net option in SAS JMP Pro v15.0.
  - This approach is appropriate for observational data, where autocorrelations can hinder data analysis and interpretation
- Grower was included as a fixed effect and data were analyzed separately for each forage.
- Significant correlations were identified at $P<0.05$, trends at $P<0.15$.

RESULTS AND DISCUSSION:

- Forage TDN, Relative Feed Value (RFV), aNDF, starch, 7h *in situ* rumen starch digestibility (starchD, % starch) and Total Tract NDF Digestibility (TTNDFD, % aNDF; Combs, 2013) were related to plant tissue and soil mineral concentrations following generalized regression analysis.
  - These parameters were chosen to represent nutritionally impactful measures in forage quality
- Following data analysis, many significant relationships and trends in correlations were identified.
  - Not all potential relationships are presented here, understanding these field observations represent a single year of an observational study
- Intriguing significant (*) or trend (**) - or + parameter estimates are presented in Table 1.
- While correlation does not imply causation, these observations warrant further investigation
  - Additional observation across years will be important to identify if interactions exist with growing season and conditions
- These observations may provide direction for growers and researchers to improve forage quality by means of improving soil or plant nutrition

REFERENCES:

Lopes, F., K. Ruh, and D. Combs. 2015. Validation of an approach to predict total-tract fiber digestibility using a standardized in vitro technique for different diets fed to high-producing dairy cows. J Dairy Sci. 98:2592-2602.

Table 1: Notable correlations between fresh chopped alfalfa (ALF) or whole-plant chopped corn (CS) nutrition analysis results and soil or plant tissue (PT) mineral measures.

	Alfalfa	Corn Silage
Soil OM	+RFV*, -NDF*	-TDN**, -TTNDFD*
Soil P	-TDN*	+StarchD*
PT S	-TDN**	
PT P	+RFV, NDF*	-Starch*, +TTNDFD*
PT Mg		+Starch*, -TTNDFD*
PT Cu		-Starch*, +TTNDFD**

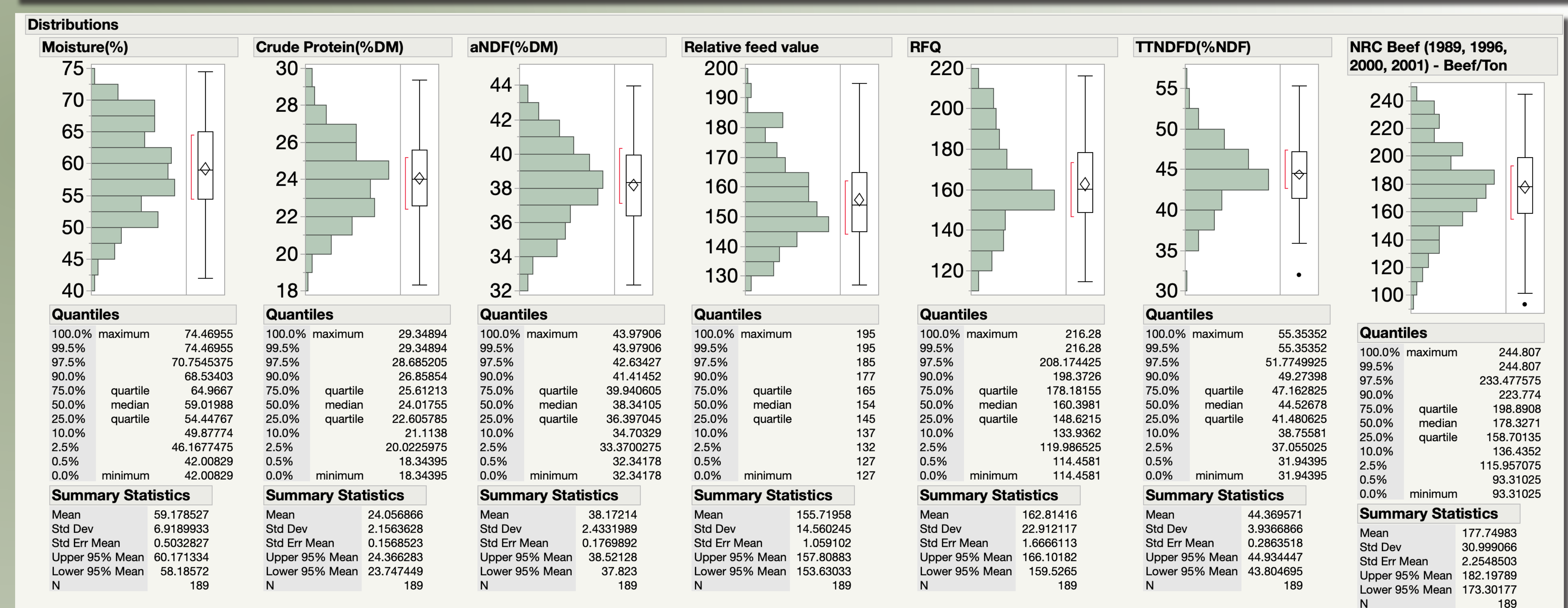Figure 1a: Freshly chopped alfalfa analysis distributions.

Figure 1b: Freshly chopped whole-plant corn nutrition analysis distributions.