Smart Agriculture Research

2022 Summary: Exploring Soil Moisture, Weather & Forage Biomass Relationships

Determine how weather, soil and other environmental variables can be used to model and predict forage yield.

INTRODUCTION

Olds College Centre for Innovation (OCCI) worked with Agriculture Financial Services Corporation (AFSC) to identify variables that could improve the accuracy of forage biomass prediction for their forage production insurance products.

Linear modeling and correlation analysis was completed using 12 years of historical weather, soil and forage clip data to determine if strong correlations exist between these variables. OCCI also conducted measurements and assessments during the 2022 growing season to determine the suitability of different soil moisture probes and NDVI measurements for forage yield modeling.

OBJECTIVES

- Determine if implementing soil moisture readings from various commercially available and/or existing government installed soil probes can be used as a representative measure of forage yield.
- Complete correlation analysis of historical data: rainfall and soil measurements, forage clip site yield records, and other relevant and available weather measurements.
- Identify if relationships can be developed between soil moisture, precipitation, other weather measurements and forage yield.

STUDY DETAILS

- Six sites within central Alberta; three sites in Smart Farm fields and three in partner producer fields.
  - Each site included a capacitance moisture and temperature soil probe, two soil water tension probes, a tipping spoon precipitation sensor and a grazing exclusion area for in-season forage measurements.
  - Monthly forage production measurements taken at sites (handheld NDVI and forage yield).
- AFSC provided OCCI with 12 years of historical data to determine if existing measurements already collected could be influential when predicting forage yield.

RESULTS

In-Season Measurements & Correlation

- In 2022, May precipitation had a strong correlation with May, June and July forage yields.
- Soil probes that measure water tension (cb) showed a stronger relationship to forage growth than soil probes that measure capacitance.
- Soil temperature measurements at 50 and 60 cm depth consistently indicated a stronger correlation to forage growth than 10 to 40 cm measurements.

Modeling & Correlation Analysis

- Six different linear models using available data from AFSC were created to estimate forage yields in relation to the weather and soil data.
- The primary variables found to be most valuable to the models included:
  - Soil temperature
  - Precipitation
  - Potential evapotranspiration
  - Plant available water
- Beta coefficients for each variable were estimated at 95 per cent confidence level.
- Township models were able to successfully estimate/represent forage yields; however, these models could not be interpreted to a section level.

FUTURE RESEARCH

Together AFSC and OCCI are continuing this work in 2023, and including the use of machine learning and the Planetary Variable: Soil Water Content for forage yield prediction. They are also studying the variability of soil moisture and forage yield within a township.

Learn more at oldscollege.ca/SmartFarm