2022 USAFRI Research Project Objectives

Improving Alfalfa Forage System by Addressing Boron and Sulfur Deficiency
Kansas State University - Pedreira

Project Award: $48,651

Justification:

- To better know the alfalfa (Medicago sativa L.) hayfield yield potential is needed to understand the soil characteristics (soil texture and nutrient availability), and based on that a fertility program can be defined to achieve the system's goals. High yields and quality are desirable characteristics due to their impact on profitability. Yield, quality, regrowth, and stand persistence of an alfalfa field are driven by essential elements, such as sulfur and boron. Sulfur deficiencies were not a common subject among Kansas growers, but the recent decline in atmospheric sulfur deposition has been highlighting sulfur deficiency. The issue is particularly common in fields where soil organic sulfur and mineralization capacity are limited. In addition, alfalfa's removal factor for sulfur is higher than many other field crops (5 to 6 pounds per ton of dry matter).

  Alfalfa has also a higher demand for boron than most other crops. Boron deficiency in alfalfa has been recognized for many years in southeastern Kansas, where symptoms will occur typically after the first cutting. Boron deficiency can cause shortened internode spacing and bunching of the top leaves and is commonly on sandy loam soils. The State of Kansas has more than 380 thousand acres of dryland alfalfa fields, mostly in the central and eastern regions. The weather conditions in the eastern region are favorable to grow alfalfa, but the majority of the fields have soils with limited nutrient conditions. In the last few years, the boron and sulfur soil tests reported in the alfalfa fields were from 0.001 to 0.8 and 1 to 4 ppm in southeast Kansas. Thus, after several cuts without the proper nutrient replacement, alfalfa forage yield will be limited despite the plant's ability to adapt to the low-fertility environment. Under low nutrient supply, yield, tissue nutrients concentrations, and root growth will be limited (He et al., 2017), and stand persistence may be compromised (Lissbrant et al., 2009).

  Additionally, fertilizer prices have increased in recent years, which does not encourage alfalfa growers to establish a strong fertility program, ultimately limiting forage yield and quality, and reducing the net income from alfalfa fields. Although a few studies have been highlighting the importance of alfalfa boron and sulfur fertilization, more information is needed on how dryland alfalfa responds to the combined application of boron and sulfur in Eastern Kansas to improve the decision-making in nutrient management, which impacts farm profitability.

  Our hypothesis is that by knowing the limitations and co-limitations of boron and sulfur in an alfalfa field, growers will be able to set a fertility program to achieve a determined level of yield and forage quality according to the fertilizer and hay prices.

Objectives:

- The objectives of this project are to 1) Quantify the effects of boron and sulfur fertilization on forage yield and forage quality in eastern Kansas; 2) Assess the boron and sulfur limitations and co-limitation in an alfalfa field to support profitable fertility programs; and 3) Disseminate the project findings to stakeholders (e.g., extension agents, growers, industry personnel).