Attacking the Yield Plateau: Assessing Nutrient Status of Kentucky Alfalfa Stands

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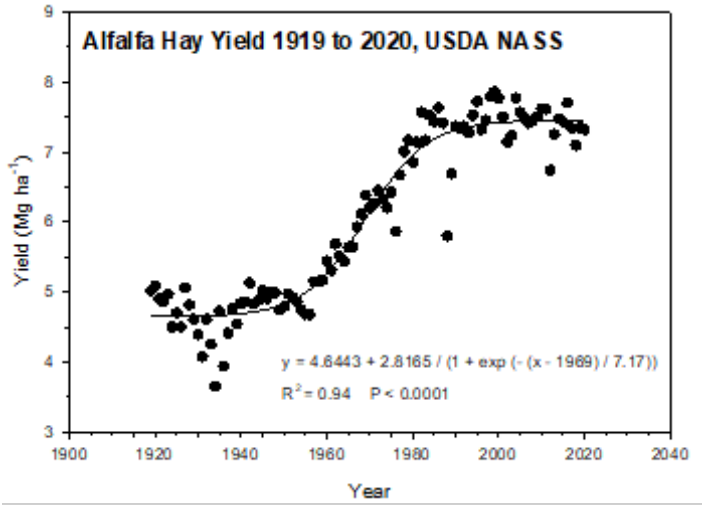
Alfalfa is a perennial forage legume that is grown worldwide, it tolerates a wide range of growing conditions, exhibits high nutritional quality, and may be harvested multiple times in a single growing season. Alfalfa's symbiotic relationship with *Rhizobium* bacteria can result in nitrogen (N) fixation amounting to more than 200 kg N ha^{-1} yr^{-1}. During the 1950s alfalfa yields rose exponentially due to advances in synthetic fertilizers, pesticides, and varietal genetics. In contrast to corn and soybean, alfalfa yields have plateaued since the 1980s (Figure 1). The objective of this 2022 study was to determine the role of soil fertility in the observed yield plateau. To accomplish this objective, nutritional status of alfalfa stands was documented in Kentucky, Oregon, and Wisconsin. Fifty alfalfa stands in each state were sampled to document nutrient status, forage quality, yield, and management practices. Fields included in this survey had to be between one and five years in age and subject to yield and management records. Samples were taken when the stand reached the late bud to early flower growth stage. A representative 6 x 6 m area was selected within each field and all samples were collected within this area. Yield was determined by harvesting six 0.25 m^2 quadrats. The total fresh weight was recorded, and a subsample (200-250 g) was collected for dry matter and forage quality determinations. The subsample was weighed fresh, dried for 3 days at 55 C in a forced air oven, and reweighed. The dried sample was then ground to pass through 2 mm and 1 mm screens using Wiley (Thomas Scientific, Swedesboro, NJ) and Cyclone (Udy Corp., Fort Collins, Co) sample mills, respectively. Forage quality was estimated using near infrared spectroscopy (NIRSC, Berea, KY). Plant tissue nutrient concentrations were determined by collecting the top 15 cm of 30 stems. Stems were dried and ground as described above. Nutrient concentrations were determined on acid digested subsamples using inductively coupled plasma emission spectroscopy. Soil samples were taken to depths of 10, 15 and 30 cm. Soil samples were dried in a forced air oven at 55 C and were sent to the Kansas State University Soil Testing Laboratory for analyses. Samples were analyzed for water and buffer pH, Bray 1 P & K, Mehlich 3 P, K, S, and micronutrients, ammonium acetate K, Ca, and Mg, Olson P, S by calcium phosphate extraction, DTPA extractable Mn, Zn, Cu, Fe, and B, hot water extractable B, OM by LOI, free lime/ CaCO3, texture by hydrometer, EC by saturated paste, and total C/N by combustion. Initial data from the 50 alfalfa stands sampled in Kentucky will be presented.

Figure 1. Alfalfa hay yield in the United States from 1919 to 2020 (USDA-NASS, Washington, DC).



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