Soil Type Affected Cowpea Forage Nutritive Value

Leonard M. Lauriault, Forage Agronomist, Sangu V. Angadi, Crop Stress Physiologist, and Mark A. Marsalis, Extension Agronomist, New Mexico State University, Las Cruces, NM 88003

Corresponding author: Leonard M. Lauriault. lmlaur@nmsu.edu


Forages are a significant component of ruminant livestock rations, but crude protein (CP), fiber, and mineral content affect animal performance (1) often requiring supplementation, thereby increasing feed costs. Cowpea (Vigna unguiculata) and other annual forages often exhibit micronutrient deficiency in some high pH, high Ca, low P soils (4,5) common to the southwestern USA. Zaiter et al. (5) related iron chlorosis visual ratings to seed yield of edible dry beans. While the effects of Zn deficiency are less pronounced on cowpea straw and sorghum (Sorghum bicolor) stover than on grain (4), micronutrient deficiency symptoms may also be a useful visual indicator of the nutritive value of cowpea forage.

A rainfed (16 inches annual precipitation) study was conducted over two years (2008 and 2009) at New Mexico State University’s Agricultural Science Center at Tucumcari in a field that included three soil types (Canez fine sandy loam: Fine-loamy, mixed, thermic Ustollic Haplargid; Quay fine sandy loam: Fine-silty, mixed, superactive, thermic Ustic Haplicaleids; and Redona fine sandy loam: Fine-loamy, mixed, superactive, thermic Ustic Calciargids) on which ‘Iron and Clay’ cowpea exhibited different levels of micronutrient deficiency. Cowpea (2.5 seed/ft of row) was planted in 30-inch rows on 3 July 2008 and 12 June 2009. Planted rows crossed the soil types and four consecutive rows were considered a replicate in a strip-plot design. All cowpea forage within a 3-ft section of row from each soil type in each of four adjacent replicates was hand-clipped to ground level on 24 September each year. Samples were dried at 140°F for 48 h prior to being submitted to Ward Laboratories (Kearney, NE) for forage nutritive value analysis by near infrared reflectance spectroscopy (NIRS). A single replicate of soil samples also was collected from each soil type (12-inch depth) each year prior to planting and submitted to Ward Laboratories for analysis.

Data were analyzed using SAS Proc MIXED (SAS Institute Inc., Cary, NC) to determine where differences among soils existed. Year and replicate within year were considered random. For significant ($P < 0.05$) F-tests, least squares means were separated by the PDIFF option.

Differences were undetectable among soils for pH, Ca, P, and Zn, which averaged 8.25, 3594 ppm, 19 ppm, and 0.52 ppm, respectively. Copper was greater in Redona than in both Canez and Quay (0.26, 0.19, and 0.45 ppm for Canez, Quay, and Redona, respectively). All soils were different for K (224, 136, and 313 ppm for Canez, Quay, and Redona soils, respectively) and Fe (2.65, 1.80, and 3.95 ppm for Canez, Quay, and Redona, respectively). Several factors, including pH, amount of free carbonates, organic matter content, clay type and content, and cation exchange capacity, have been implicated with differences in plant available Cu and Fe (2,3), but the cause of the differences in the present study were indeterminable.

There were no differences among soil types for cowpea forage CP (25.4 ± 1.3%) or fiber variables, except neutral detergent fiber digestibility (NDFD) such that cowpea forage grown in the Redona soil had higher NDFD than cowpea forage grown in the other soils (58, 48, and 74% NDFD for Canez,