

Selecting Soils for Alfalfa on the Coastal Plain of the Southern USA

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Interest in alfalfa stimulated research that led to development of additional site selection criteria for sustainable production of this high nutritive value legume on Coastal Plain soils. Coastal Plain soils predominantly are sandy, acid, infertile, and leached by high rainfall and extend from eastern Texas, across the South and into the Atlantic states. Although problems that inhibit sustainable alfalfa production on these soils had not been assessed, it is well known that alfalfa persistence and production require well-drained, well-aerated, high fertility soils with a surface pH near 7.0 or higher. A series of studies to evaluate alfalfa response to liming and plant nutrient application on Coastal Plain soils included establishment and phosphorus (P) rates on eight selected soils sampled to six feet by one-foot depths and analysis of these samples for aluminum (Al), manganese (Mn), and pH. Alfalfa production on these soils varied according to the proximity of phytotoxic levels of subsoil Al (> 1.0 mg/kg in 0.01 M CaCl₂ extract) to the limed surface depth. The highest three-year average yield occurred on Bowie soil that contained no phytotoxic Al within the 6-foot depth. Significantly lower yields occurred on Owentown, Cuthbert, Lilbert, Sawtown, and Darco soils that contained phytotoxic Al at the 2-foot depth and below. Kirvin and Redsprings soils contained phytotoxic Al immediately below the limed surface and each produced significantly less alfalfa than the other soils. Low yields on Kirvin and Redsprings soils and intermediate yields on soils that contained exchangeable Al at the two-foot profile depth and below indicated the inability of alfalfa roots to penetrate these increased concentrations of Al to absorb water from deeper depths as the upper soil depths dried by evaporation and transpiration during low rainfall periods. These data show the necessity of sampling the soil profile and analyzing these samples for pH ≥ 5.5 or above and for Al < 1.0 mg/kg when selecting soils for alfalfa on the Coastal Plain. Based on these results and response to various plant nutrient applications, we tested our site selection criteria on five ranches. Non-irrigated alfalfa production on four of these selected sites averaged 3.8 to 5.2 tons/acre over four production seasons. On a fifth ranch, alfalfa died in the second year due to wet soil in a high rainfall season. To predetermine potentially suitable soils for alfalfa production on the Coastal Plain, we evaluated soil surveys in five selected counties for suborder and great group descriptors such as “aquic,” “aqu,” “fluv,” and “hydr” that indicate potential for wet soils. Other factors such as slope, erosion potential, available water holding capacity, depth, permeability, and stoniness were considered. Favorable land capability classifications included class I through III, and possibly IV. Percentage slope is related to erosion potential and permeability relates to drainage. Subsoil colors favorable for alfalfa included yellow, orange, and red, with gray color indicating excessive wetness. Using these soil classification factors, we determined the potentially suitable soils for alfalfa in these five counties. When producers on Coastal Plain soils ask about growing alfalfa, we request the latitude and longitude of their fields (found on Google Earth), enter these numbers into <http://websoilsurvey.nrcs.usda.gov/app/>, and if favorable soils are available, we advise them to collect soil samples composited by one-foot depths to at least four-feet deep from five random locations across the field and have these analyzed for pH. If pH of these subsoil samples is ≥ 5.5 (1:2 soil: water), the selected soil is favorable and the producer can initiate treatments to prepare the site for seeding alfalfa.