

Abstract

Selected tree and shrub species were evaluated for soil fertility improvement and fodder production on three sites in the highlands of western Shewa, Ethiopia. The indigenous species included were *Acacia abyssinica*, *Buddleja polystachya*, *Cordia africana*, *Dombeya torrida*, *Hagenia abyssinica* and *Senecio gigas*. Exotic species included were *Acacia decurrens*, *A. melanoxylon*, *A. mearnsii*, *A. saligna*, *Chamaecytisus palmensis*, *C. proliferus*, *Eucalyptus globulus*, *E. camaldulensis*, *Grevillea robusta* and *Sesbania sesban*. Soil samples were collected at different depths and horizontal positions from the bases of the trees to analyze pH, organic C, total N, available P, exchangeable bases and some micronutrients. Similarly, plant samples were collected to determine macronutrients, micronutrients, fodder nutritional parameters and other indicators for green biomass quality. In Luvisol areas (> 2900 m.a.s.l), the foliage N content in *B. polystachya*, *D. torrida*, *H. abyssinica* and *S. gigas* was comparable with *C. palmensis*. The foliage, flower bud and stem P content in *C. palmensis* was low as compared to *B. polystachya*, *D. torrida*, *H. abyssinica* and *S. gigas*. A higher foliage, flower bud and stem K content was found in the *S. gigas*. The foliage and flower bud soluble phenolic content in *C. palmensis* was the lowest. The *in vitro* dry matter digestibility of the foliage and flower bud from *H. abyssinica* and *C. palmensis* was reasonably high. The soil organic C and total N content under *H. abyssinica*, *S. gigas*, *C. palmensis* and *D. torrida* were comparable in the top 0-15 cm depth. In comparison with below the other species, the soil under *H. abyssinica* and *S. gigas* had a high content of exchangeable K at the 0-15 cm depth of the 75, 150 and 225 cm horizontal positions. The contents of organic C, total N, available P, exchangeable K, Ca and Mg showed a decreasing pattern from 0-15 to 30-50 cm soil depths and from the 75 to the 150 and 225 cm horizontal positions. In Vertisol areas (2200 m.a.s.l), *A. decurrens*, *A. mearnsii* and *E. globulus* had attained the highest height growth 64 months after planting as compared to *A. abyssinica*, *A. melanoxylon*, *C. africana*, *A. saligna* and *S. sesban*. *Acacia mearnsii* and *A. saligna* had produced high biomass 40 and 64 months after planting. *Sesbania sesban* had high N and P concentrations in its foliage and stems at 12 and 40 months. Total N under *A. abyssinica*, *A. saligna* and *S. sesban* was slightly greater at 40 months than 12 months. In Nitisol areas (2400 m.a.s.l), *G. robusta* exhibited slow height growth and wood production as compared to *A. decurrens*, *C. palmensis*, *C. proliferus*, *E. globulus* and *E. camaldulensis*. *Acacia decurrens* provided the highest mean dry biomass at 64 months. Foliar N levels in *A. decurrens*, *C. palmensis* and *C. proliferus* were significantly higher than *H. abyssinica*, *G. robusta*, *E. globulus* and *E. camaldulensis*. *Hagenia abyssinica* had higher K levels in the

foliage and wood. *Eucalyptus* species tended to deplete soil fertility whereas *C. palmensis* and *C. proliferus* improved soil fertility. The foliage and flower bud of *H. abyssinica*, *B. polystachya*, *D. torrida* and *C. palmensis* can be used as sources of fodder with a proper feeding management scheme. *Hagenia abyssinica*, *S. gigas* and *C. palmensis* can play a soil management role in the farmlands of high altitude areas, where soil erosion and nutrient depletion are critical problems. *Acacia mearnsii* and *A. saligna* are superior tree species on Vertisols in terms of biomass production whereas *Chamaecytisus* species and *A. decurrens* can be short-term options for soil fertility improvement and sources of fuel wood in Nitisol areas.

Keywords: Soil fertility, Ethiopia, amelioration, biomass, indigenous plants