Abstract

Woodlands cover about 80% of the total land area in Kenya, support 60% of the livestock and are important sources of fuelwood especially charcoal for urban areas. The woodlands of Naivasha, Kenya are dominated by a tree/shrub species Tarchonanthus camphoratus L. which is used for charcoal production using traditional earth kilns. A study focussing on woodland characterisation with respect to species composition and stocking and distribution of T camphoratus and its regeneration characteristics was carried out in 01 Morogi ranch which forms part of these woodlands. Biomass equations to estimate the woody biomass of T camphoratus were developed and carbonisation and economic efficiencies of the improved earth and a portable metal (portable Japanese) kiln using T camphoratus were compared.

A total of 34 (20m x 20m) plots were laid out along a transect running across a relatively undisturbed area and covering many of the habitats where T camphoratus occurs. Within each plot erect woody species were enumerated and identified and their diameters and crown sizes measured. For T camphoratus, diameter at stump height, crown dimensions and height were recorded. Environmental factors such as slope, aspect and surface soil conditions such as stoniness and deduced drainage were also recorded for each plot.

Cluster analysis (SPSS programme) was used to group plots into stands of similar species composition and density. Biomass estimation equations were developed using multiple regression techniques. Conversion efficiency and economic efficiency analysis of the improved earth kiln and the portable metal kiln (Japanese portable kiln) were carried out. Economic analysis and conversion efficiency of the kilns was done using the net present value (NPV) and benefit cost ratio (BCR) method and percentage recovery respectively.

The study indicated that the T. camphoratus woodland was not homogenous. It can be delineated into distinct stands on the basis of species composition and density of T.camphoratus. The woodland was characterised into Riverine stand, Flat ridge side almost pure stands and Ridge side highly mixed stands. Diameter size class distribution in the Riverine stand and the Flat ridge side stand follow a reverse 'J' distribution while size distribution in the Ridge side highly mixed stands had a major deviation from the reverse 'J' model. Among the developed biomass equations, the equation $JB = 0.134dsh + 0.0579dsh\,2 + 0.317\,ht$ where dsh is diameter at stump height, B is woody biomass and ht is the total tree height provided the best estimates of woody biomass with R^2 of 0.963 and a standard error of estimate of 4.87 kgs.

The improved earth kiln had a conversion efficiency of 17.5% while the portable metal kiln had a conversion efficiency of 19.6%. The improved earth kiln had a higher NPV and BCR when compared to the portable metal kiln. It was concluded that the woodland is homogenenous with normal diameter size distributions and T. camphoratus has a high regenerative capacity. Furthemore its woody biomass can be easily estimated using linear empirical models. The earth kiln is more cost effective in charcoal production. It was recommended that further investigation of the woodland dynamics is needed and more emphasis should be put in the development of earth kilns.