"THE SPATIAL AND TEMPORAL DISTRIBUTION OF THE ACTIVE ROOTS OF *Cassia siamea* Lam. AND *Zea mays* L. (cv. Katumani Composite B), IN ALLEY CROPPING UNDER SEMI-ARID CONDITIONS IN MACHAKOS DISTRICT, KENYA".

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ABSTRACT

A study on root competition in alley cropping was carried out in Machakos district, Kenya (Latitude 1^{o} 33′ South and Longitude 37^{o} 14′ East). The study was carried out in an alley cropping agroforestry system, involving *Cassia siamea* Lam. and maize (*Zea mays* L. cv. Katumani composite B). The aim of this study was to assess the existence and seriousness of root competition in top soil space as manifested by the distribution of the active roots of cassia and maize, both in space and time.

Maize was planted in three rows in the alley boarded by two cassia hedgerows. Distribution of the active roots of cassia and maize in space was investigated at 4 different distances, at an interval of 45 cm from the cassia hedgerow, and in 3 soil depth positions. Roots were sampled by an auger from these positions at a sampling interval of 2 weeks, starting from about 32 days after sowing (DAS) maize, and continued upto about 98 DAS. The experiment was done during 2 successive crop seasons. The first crop season was during the short rains of 1989/1990, while the second crop season was during the long rains of 1990.

During both the short and long rains crop growing seasons, the distribution of cassia root length was consistently significantly different ($p < 0.001$)

between the depths. Depth L_1 (0 - 10)cm had significantly less roots ($p < 0.01$) than depth L_2 (20 - 30)cm and depth L_3 (40 - 50)cm. Depths L_2 and L_3 had same amount of root length. There was no significant difference in cassia root lengths among the four distances away from the hedge. Thus, the cassia roots are uniformly distributed across the alley, the distribution differing only between depths. There was no interaction between the distances and the depths. The root length of cassia at any depth level does not vary statistically significantly over different distances and vice versa. In the case of maize, the root distribution was affected by both the distances and depths. This could possibly be explained by the fact that the distribution of maize roots depends on the age of the plants and on spacings and is more responsive to moisture status.

The root length density of maize was by far greater than that of cassia in the top 0 - 10 cm space, implying that cassia is not competing with maize for water and/or nutrients at that depth. However, at critical growth stages there is a serious overlap of roots of the two plants in the remaining depths, differing with distance from the hedge, with cassia roots occupying more or near-equal soil volume compared to maize, thus a likeliness of competition. The distribution of overlapping roots appears to explain at least part of the surprising maize yield

depressions in the middle rows compared to the rows adjacent to the cassia hedges. Due to the extensive overlap of the roots in soil layers below 10 cm, competition may be expected under limiting water and/or nutrient conditions. Thus, cassia may not be a suitable choice for alley cropping under semi-arid conditions, unless most of its active roots can be properly managed to absorb resources below the feeding rhizosphere of the active roots of maize. In order to achieve this, either or both suggestion(s) could be considered for trial: Lopping cassia hedges to heights greater than 50 cm above the soil surface.
Alteranatively, when the hedges are being established, cassia tree seedlings could be planted in sunken holes about 30 cm deep in the soil.