

TREE - CROP INTERACTIONS IN AGROFORESTRY SYSTEMS INVOLVING DIFFERENT TREE SPECIES

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The present experiment was conducted to quantify the variation of soil water content and growth of the annual crop when grown in agroforestry systems involving different tree species as contour-hedgerows. The final objective is to select a tree species which has a minimum of negative interactions (i.e. competition) and a maximum of positive interactions with the annual crop.

The experiment was conducted at Pallekelle in the mid-country intermediate zone (IM₃) during the yala season in 1997. The experimental site contained five tree species established as hedgerows along contours at an inter-hedgerow distance of 4 m. The five tree species were *Calliandra calothyrsus*, *Desmodium ransonii*, *Flemingia congesta*, *Gliricidia sepium* and *Tithonia diversifolia*. Bush bean (var. Top crop) was grown as the annual crop between hedgerows at a spacing of 30 cm x 8 cm. Soil water content was measured gravimetrically in two soil depths (0-10 cm and 20-40 cm) at three distances (0-30 cm, 150-180 cm and 300-360 cm) from the hedgerow. Measurements were made at 10-day intervals. Annual crop growth was measured by taking the total dry weight of bush bean at flowering. Dry weight measurements were done at six distances (30, 90, 150, 210, 270 and 330 cm) from the hedgerows. Measurements were also made in a control treatment which was a sole crop of bush bean without a hedgerow. Each treatment had three replicates.

The soil water content at both depths varied significantly with varying distance from the hedgerow on all dates of measurement. Moreover, there were significant differences between soil water contents under different hedgerow species at both depths of sampling. The effect of interaction between species and distance from the hedge was not significant. Plots with hedgerows had a significantly greater soil water content in the surface soil layer (0-10 cm depth) as compared to the sole crop control on all dates of measurement except at 30 days after sowing (30 DAS). This could probably be due to the shading effect of the hedgerows which would reduce evaporation from the surface layers of the soil. *Calliandra* and *Desmodium* had consistently higher soil water contents in the surface layers. On the other hand, *Tithonia* had consistently lower surface soil water contents. The soil water content of the 0-10 cm depth layer decreased significantly as the distance from the hedgerow increased. The greater soil water availability in the surface soil layers closer to the hedgerows could probably be due to the greater shading effect near the hedges.

Plots with hedgerows had significantly greater soil water contents at 20-40 cm depth than the sole crop control on all dates of measurement. Consistently greater levels of soil water content were observed at this depth under *Calliandra*, *Desmodium* and *Flemingia*. Conversely, plots with *Gliricidia* had consistently lower soil water contents at 20-40 cm depth. In contrast to the 0-10 cm layer, at 20-40 cm depth, the soil water content closer to the hedge (0-30 cm) was significantly lower than at 150-180 cm and 300-330 cm distances.

Total dry weight of bush bean plants showed decreases of varying magnitudes in crop rows closer (30 cm) to the hedgerows. This growth decline was observed under all hedgerow species whereas no such decline was observed in the sole cropped control. At a distance closer to the hedgerow (30 cm), bean plants had a lower total dry weight than the control under all tree species except *Desmodium*. Conversely, at a distance of 150 cm from the hedgerows, bean plants under all tree species except *Flemingia* had greater total dry weights than the control. The distance from the hedgerow at which bean plant dry weight was maximum varied for different tree species. This indicated that different tree species exerted varying levels of competition on the annual crop. The least competition was exerted by *Desmodium* followed respectively by *Gliricidia*, *Calliandra*, *Tithonia* and *Flemingia*.

There are significant differences between tree species in the degree of environmental interaction and competition exerted by them on the annual crop in agroforestry systems involving tree species as contour hedgerows.