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Productivity and Growth Indices of Intercrops in Agri-Horti-Silvi System in Arid Rajasthan

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Abstract: Mung bean (*Vigna radiata* (L.) R. Wilczek) and clusterbean (*Cyamopsis tetragonoloba* (L.) Taub.) were grown as inter crops under agri-horti-silvi system with 9-year-old plantations of citrus (*Citrus aurontifolia*), mopane (*Colophospermum mopane*) and shisham (*Dalbergia sissoo*) at Research Farm of Central Arid Zone Research Institute, Regional Research Station, Bikaner, during kharif 2011. Highest total biological yield and seed yield of mung bean (1412.5 and 471.3 kg ha^{-1}, respectively) and clusterbean (1352 and 419.8 kg ha^{-1}, respectively) was recorded in intercropping with citrus. Highest leaf area $plant^{-1}$ and chlorophyll content in clusterbean (2.44 mg g^{-1} FW) and mung bean (2.62 mg g^{-1} FW) intercropped with citrus were responsible for more seed yield due to accumulation of more photosynthates in plants. Higher leaf water potential of clusterbean (-3.18 MPa) and mung bean (-3.28 MPa) was recorded in intercropping with mopane. Among different tree leaves, leaf water potential was highest in mopane (-6.99 MPa) followed by citrus (-5.51 MPa) and shisham (-3.58 MPa).

Key words: Agri-horti-silvi system, arid, clusterbean, mung bean, productivity.

The climatic conditions of arid Rajasthan are not very conducive to agricultural production especially during kharif season due to occurrence of frequent droughts. Thus the farmers go only for one season cropping due to lack of irrigation facilities. Now with the commencement of Indira Gandhi Nahar Paryojna (IGNP) and development of tube wells, efforts are being made to develop arid lands through agri-horti, agri-silvi and agri-pasture systems. Researchers have shown that growing location-specific crop in combination with tree/grasses not only mitigate the risk of total crop failure, but can also increase resource use efficiency and replenish soil fertility (Soni *et al.*, 2007).

The success of any system will depend upon the competitiveness of trees and crops when grown together. The common hypothesis which restricts to combine the trees and crops together is that the tree production is realized only at the expense of crop growth (Cannell, 1996). If the trees deprive the crop of shared resources in limited supply, crop production in agroforestry will be impaired (Anderson and Sinclair, 1993). It is therefore critical for the success of agroforestry that competition for resources between trees and crops is avoided, or at least minimized.

Hence, a major challenge for management of agroforestry is to control competition and encourage 'complementarity' between trees and crops. Complementarity occurs when components of mixed vegetation utilize spatially or temporally distinct sources and consequently avoid competition (Anderson and Sinclair, 1993). If trees are more deep rooted than crops, and seasonal rainfall is sufficient to cause infiltration beyond the crop rooting zone, trees are able to utilize water that would otherwise have been lost as drainage. The complementarity in use of below ground resources is achieved by utilizing tree species with deep root systems that have few superficial lateral roots. Such ideal trees would show spatial complementarity with crops in use of below ground resources. Studies on intercropping of the horticultural trees with annual crops has been carried out (Reddy *et al.*, 1992; Reddy and Willey, 1981). However, no information is, available on suitability of intercrop which can be grown in association with citrus, mopane and shisham in arid region. The present experiment was therefore, conducted to study the suitability of intercrops in agri-horti-sivi systems of citrus, mopane and shisham under sprinkler irrigation.

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