



DEVELOPMENT OF AGROFORESTRY MODELS

Agri-silvi-horticulture Model : Casuarina - - Maize

Agroforestry

Agroforestry is a collective term for land-use systems and technologies where woody perennials are deliberately used in the same land management unit as crops (and /or animals) in some form of spatial arrangement.

Agrisilviculture

This term is used to denote combinations of trees and agricultural crops on the same unit of land in some form of spatial mixture or sequence.



Casuarina - Maize Model

Tree species : *Casuarina equisetifolia*

Casuarina (known locally as 'savukku' in tamil, 'chulamaram' in malayalam and 'janglisaru' in hindi) is an useful multipurpose tree (MPT). It is drought resistant, nitrogen fixing and fast growing with desirable stem, crown and branch characteristics for agroforestry. It is an ideal tree which can be used as shelterbelts and windbreaks around farmlands. It produces excellent, sturdy poles which are suited for scaffolding and farm construction. Wood is excellent as fuelwood with high calorific value (4950 kcal/kg) and the pulp is valued in paper and rayon industry. Casuarina grows under a wide range of edapho climatic climatic conditions. Intercropped with Casuarina and the economic production worked out.

Agricultural crops

Crops such as maize, fodder sorghum, bajra, ragi, pulses, sesamum, groundnut etc. can be cultivated with Casuarina under rainfed conditions. Under irrigated conditions tomato, lady's finger, brinjal, turmeric, plantain and chilli can also be planted as intercrops. In the present model maize (*Zea mays*) was intercropped with Casuarina and the economic production worked out.

Establishment of the model

Normally, the land is prepared for growing agricultural crops just before the onset of south-west monsoon (May-June). Raising of agricultural crop and planting of Casuarina seedlings is carried out simultaneously. Parallel watering channels are taken 7m apart. Three month old potted seedlings of Casuarina are planted in pits of size 30cm³ at 2m distance between plants in each channel. Thus the density of Casuarina remains as 650 trees/ha. A basal dose of 25gm each of N, P & K fertilizer and 1kg farm yard manure (FYM) is added in each pit at the time of planting. Biofertilizers like Frankia or Azospirillum are mixed with the soil in the pits for better establishment. Application of biofertilizers can also be done in the nursery while raising the seedling. Maize (*Zea mays*) is dibbled at 60x25 cm apart as per package of practices in the interspace between Casuarina rows.

Management of the trees

Casuarina grows well and fast under irrigated conditions. The seedlings are watered once in a week for the initial two months and later on, no separate watering to the tree seedlings is given. The seedlings share the water with the agricultural crop as and when the crop is irrigated. However, during the post harvest period and during the dry season, tree rows are irrigated at fortnightly intervals. Casualty replacement is done within a month's period. Periodical cultural operations such as weeding, soil working etc. are carried out twice a year. Lower lateral branches of the trees upto nearly half the height of canopy are pruned during the second and third year and the pruned material can be used as fuelwood.

Growth performance

The seedlings attain an average height of 2.4 m in the first year, 3.9m at two years and 6.7m at the end of third year. Similarly, the basal girth also increases from 14.7cm in first year to 28cm overbark at the end of third year. At this stage the trees can be harvested and marketed. By the end of the third year the tap root grows to a depth of 1.8m. The longest lateral root may extend upto 2.0 -2.4m. However, most of the lateral roots are clustered around the taproot within a radius of 0.6 - 0.75m.

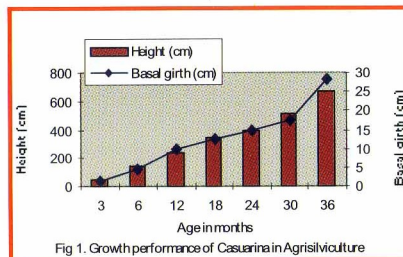


Fig 1. Growth performance of Casuarina in Agrisilviculture

Economic returns

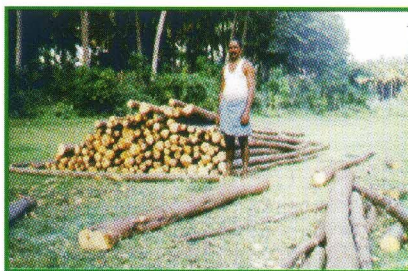
Casuarina trees attain required basal girth and height at the end of the third year and can be harvested. Each tree yields a pole of size 3-3.5m length, 28cm basal girth and 10cm top girth (ob). The economic returns from the model is given in Table 1. *Zea mays* was intercropped between the tree rows. No perceptible reduction in maize yield was noticed upto third year. The average grain yield of maize amounted to 2 t/ha and stover yield 1.5t/ha. The net income from the tree component (poles and fuelwood) amounted to Rs 27,332/ha. This is in addition to the net income from agricultural crop which amounts to Rs 6,250/ha. The average annual net income from the model works out to Rs 15,360/ha/year.

Table 1. Economic returns (Rs/ha) from Agrisilviculture model (Casuarina-Maize)

Tree: Casuarina (espacement 7 X2 m; density 650 trees/ha, age 3yrs)	
No of poles /ha.....	650
Income from poles @ Rs 45/pole.....	29,250
Fuel wood (t/ha).....	2.6
Income from fuel wood @ Rs 700/ton.....	1820
Total income	31,070
Expenditure.....	3738
Net income.....	27,332
Average annual net income (Rs/ha/yr).....	9110

Agricultural crop: Maize

Grain yield (t/ha/yr).....	2.0
Stover yield (t/ha/yr).....	1.5
Income from grain @ Rs 4000/t.....	8000
Income from stover @ Rs 500/t.....	750
Expenditure.....	2500
Net income from Maize (Rs/ha/yr).....	6250
Average annual net income from the model.....	15,360
NPV at 12% discount rate.....	28,071



Harvested poles of Casuarina from
Agroforestry model

Insect pests and diseases

Pests and disease problems are not of serious nature to Casuarina in agroforestry. However, incidence of stem wilt or black blister bark of grown up trees caused by fungus *Trichosporium vesiculosum* and defoliation in young saplings by insect borer *Indarbela quadrinotata* occurs depending upon edaphic and climatic factors. This can be controlled by management practices like preventing soil moisture stress conditions, removal of dead and diseased plant parts from the field and prophylactic treatments with suitable fungicides like Carbendazim (0.05%).

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