



PERFORMANCE OF MORINDA CITRIFOLIA AS MIXED CROP IN COCONUT GARDENS FOR COASTAL CONDITIONS OF ANDHRA PRADESH

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ABSTRACT

An experiment was conducted to study the performance of *Morinda citrifolia* tissue cultured plants and seedling plants as mixed crop in coconut during 2008-09 to 2013-14. The yield performance of coconut grown with *Morinda citrifolia* and the growth and yield parameters of *Morinda citrifolia* tissue culture plants and seedling plants was also compared. Initial and final nutritional status of the soil was analysed and finally the economics of mixed cropping system was worked out. The yield of coconut grown with *Morinda citrifolia* seedling plants increased by 14.28% as compared to 9.6% in coconut grown with *Morinda citrifolia* tissue culture plants and 2.04% increase in monocrop coconut. Maximum yield of *Morinda citrifolia* (3001kg/ha) was recorded in seedling plants compared to tissue culture plants (2527kg/ha). Thus the study revealed that *Morinda citrifolia* as mixed crop increased productivity of coconut and the performance of seedling plants was better than tissue culture plants with B: C ratio of 1.86.

Key words : Coconut, noni, mixed crop

In Andhra Pradesh, Coconut is grown in an area of 1.21 lakh hectares producing 1258 million nuts annually. Though, the state has the highest productivity of 10322 nuts per hectare (www.nhb.gov.in), the net returns per unit area are low. Generally the farmers in the coastal district adopt monocropping of coconut mainly under irrigated condition at a spacing of 7.5 x 7.5 m which does not fully utilize the natural resources like soil, space and solar radiation. Therefore, the remaining interspaces could be profitably exploited for cultivation of intercrops suitable for the agroclimatic condition and there is a good scope of increasing the productivity and net returns from coconut plantation. Studies revealed that sole crop of adult coconut plantations spaced at 7.5 x 7.5 m apart effectively uses only 22.3 per cent of land area, while the average air space utilization by the canopy is about 30 per cent and solar radiation interception is 45-50 per cent (Bavappa *et al.*, 1986). Adoption of coconut based intercropping/mixed cropping systems is one of the ways to utilize the natural resources effectively. The negative effects of coconut monoculture system of cultivation and impact of the application of inorganic fertilizers alone without ensuring a natural organic recycling in reducing the soil health are well known. Being a small holders' crop world over and more specifically in India, it does not provide adequate income and gainful employment to the dependent families. Unlike in annuals, the potential for increasing productivity per unit area of land, time and inputs is considerably higher in perennial crops (Bavappa and Jacob, 1982). An agronomically desirable system should ensure that all the components of production are exploited at optimal level ensuring the long term production capability of the system as a whole is not affected.

Morinda citrifolia popularly known as Indian Noni or Indian mulberry is an ever green small tree bearing flowers and fruits throughout the year. It belongs to the family Rubiaceae. It is grown in tropical regions of the world. It is one of the most significant sources of traditional medicines among Pacific islands. Noni has been used in folk remedies by Polynesians for over 2000 years and is reported to have a wide range of therapeutic effects including antibacterial, antiviral, antifungal, antitumor, analgesic, anti-inflammatory and immune enhancing effects (Mathivanan *et al.*, 2005).

Morinda citrifolia (Noni) is compatible perennial medicinal plant in coconut based cropping system. Hence study was initiated to evaluate the performance of *Morinda citrifolia* tissue culture plants and seedling plants as mixed crop in coconut.

MATERIALS AND METHODS

The trial was conducted at Horticultural research station, Ambajipeta during 2008-2014. The experiment was laid out in 33 years old Godavari ganga garden spaced at 8.0 x 8.0m. The soils are coastal alluvial type with impeded drainage. The average annual rainfall during experimental period was 1207 mm and mean temperature ranged from minimum of 26.7°C to maximum of 30.7°C. The average relative humidity varied between 65.7 and 87.2%.

Morinda citrifolia was planted in August 2008 as a mixed crop in coconut at 3.75m distance at the centre of two rows of coconut palm. The experiment was maintained as organic plot by applying 25 kg of Farm Yard Manure, 10kg of vermicompost and 2kg of neemcake to coconut. 5kg of vermicompost and 2 kg of neemcake was applied to Noni. Initial and final soil

Table-1 : Yield of coconut intercropped with *Morinda citrifolia*.

Coconut Yield	Coconut+ Noni tissue culture plants		Coconut+ Noni seedling plants		Monocrop Coconut	
	Per Palm	Per ha	Per Palm	Per ha	Per Palm	Per ha
Initial Yield	104	15600	98	14700	98	14700
Final Yield	114	17100	112	16800	100	15000

Table-2 : Growth and yield parameters of *Morinda citrifolia* under coconut.

Planting material	Plant height (m)	Stem girth (cm)	No. of branches per plant	Fruits per plant	Fruits per hectare	Total fruit weight per plant (kg)	Yield kg/ha (356 plants/ha)
Tissue cultured plants	3.8	40.6	40.0	94.8	33748	7.1	2527
Seedlings	4.6	30.5	49.0	118.	42008	8.4	3001

Table-3 : Biomass production and quality parameters of *Morinda citrifolia* under coconut.

Planting material	Leaf Bio mass (Dry) (kg/tree)	TSS	Juice percentage
Tissue cultured plants	7.4	11.8	50
Seedlings	9.5	10.8	51

Table-4 : Soil analysis data as influenced by Noni.

Treatments	Nitrogen (Kg/ha)	Phosphorus (Kg/ha)	Potassium (Kg/ha)
Before experiment(2008)	160	18.6	280
After experiment(2014)	180	20.5	300

Table-5 : Economics of Noni as mixed crop in coconut.

Treatment	Cost of cultivation (Rs/ha/year)	Gross Returns (Rs/ha/year)	Net Returns (Rs/ha/year)	B:C ratio
Coconut+ Noni seedling plants	68250	1,27,220	58970	1.86
Coconut+ Noni tissue culture plants	68250	1,18,940	50690	1.74
Monocrop Coconut	54238	73493	19255	1.35

analysis was done. The growth and yield observations of Noni *i.e.*, plant height, stem girth, no. of branches per plant, fruits per plant and per hectare, total fruit weight per plant and per hectare for both tissue cultured plants and seedlings were recorded. Juice percentage and TSS ($^{\circ}$ Brix) were also recorded. The leaf biomass produced per tree was also recorded. The yield observations of coconut *viz* number of nuts per palm and per hectare were recorded in Noni tissue cultured plot and noni seedlings plot. The economics of cropping system was calculated including labour cost, input cost, irrigation and other miscellaneous charges.

RESULTS AND DISCUSSION

Yield of Coconut : The yield of coconut as influenced by mix crop of *Morinda citrifolia* is presented in Table 1. Mean five year yield data indicated that nut yield increased by 14.28 % in coconut grown with seedling plants of Noni compared to 9.6 % increased in nut yield in coconut grown with tissue culture Noni plant. Average initial yield was 14,700 nuts /ha which

increased to 16,800 nuts/ha in coconut grown with seedling Noni plants where as average initial yield of coconut was 15600 nuts /ha which increase to 17100 nuts /ha in coconut grown with tissue culture noni plants and in monocrop coconut, yield increased from 14700 nuts/ha to 15000 nuts/ha (2.04%) The additional increase in yield of coconut under mix cropping of Noni could be due to synergistic effect of crop combination. Similar observation was also reported by Chowdary *et al* (1997). He concluded that there is only 17% increase in coconut yield when grown as intercrop compared to 109.8% and 83% increased yield when grown as mixed crop.

Growth and yield of *Morinda citrifolia* : The growth and yield performance of *Morinda citrifolia* as mix crop in coconut was presented in Table-2. Maximum height (4.6 m) and no. of branches per plant (49) and fruits per plant (118) were found in seedlings than tissue culture plants with 3.8 m plant height, no of branches per plant (40) with 94.8 fruits per plant. Total fruit per plant is also more (8.4 kg) in seedlings than in tissue culture plants (7.1 kg). Maximum yield of 300 kg /ha

was obtained in Noni seedling plant compared to 2527 kg/ha in tissue culture plants. The maximum yield in seedling plants than tissue culture plants could be due to faster growth rate of seedling plants and more production of food material over tissue culture plants. Similar findings were also reported by Khandekar et al 2014. Juice percentage (50 -51 %) and TSS (10.8 -11.8° brix) are almost similar in tissue culture to seedling plants. Similarly, more biomass production per plant (9.5 kg / tree) was recorded in seedling plants than tissue culture plants (7.4 kg/tree) (Table-3).

Soil nutrition status : The nitrogen phosphorus and potassium content of soil as influenced by mix crop of *Morinda citrifolia* in coconut is presented in Table- 4. It was observed from the data that nitrogen increased from 160 to 180kg/ha, phosphorus increased from 18.6 to 20.5kg/ha and potassium content of soil increased from 280 to 300kg/ha. Varghes et al 1978 also reported improvement in soil fertility under mix crop of cocoa in coconut.

Economics of mix cropping system : The economics of mixed cropping *Morinda cotrifolia* in coconut is presented in Table 5. Maximum gross returns are recorded in seedling plants (Rs.1,27,220/-) than tissue culture plants (Rs.1,18,940/-) and monocrop coconut (Rs. 73,493/-). The highest B:C ratio was observed in seedling plants (1.86) than tissue culture plants (1.74) and monocrop (1.35).

CONCLUSION

The study revealed that *Morinda citrifolia* as mixed crop

increased productivity of coconut and the performance of seedling plants was better than tissue culture plants with B: C ratio of 1.86. Hence it can be concluded that *Morinda citrifolia* (Noni) is compatible perennial medicinal plant in coconut based cropping system for coastal conditions of Andhra Pradesh.

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