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Evaluation of Noni (*Morinda citrofolia*) as a mixed crop in coconut garden under South Gujarat condition

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ABSTRACT

A field experiment was conducted on integrated cropping system in coconut to study the effect of noni *(Morinda citrifolia* L.*)* as mixed crop in coconut, during 2010-11 to 2015-16 at Regional Horticultural Research Station, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari. Twenty-five each of tissue culture plantlets and seedlings were planted as non replicated trial under old coconut garden. The growth and yield performance of noni as well as coconut were recorded with economics of the cropping system during 2015-16. The results revealed that, functional leaves on crown of coconut increased from 26.2 to 27.5 & annual leaf production per palm increased from 11.10 to 12.20 during the years 2011-12 to 2015-16. In case of yield of coconut, the initial yield was recorded as 60 nuts/palm which was increased to 74 nuts/palm in the year 2015-16. However, maximum yield of *Morinda citrifolia* was recorded in seedling plants (12.79 kg/plant) than in tissue culture plants (9.52 kg/plant) in the year 2015-16. Whereas, the juice percentage of *Morinda citrifolia* are recorded 60% with TSS of 6.5ºB. The study indicated that inter cropping of *Morinda citrifolia* increased productivity of coconut as well as economics of *Morinda citrifolia* as inter crop indicated profitability of cultivation in coconut than monocrop.

KEY WORDS: Mixed crop, Integrated cropping, Tissue culture, Plantlets, Seedilings

Coconut (*Cocus nucifera* L.) is an important perennial oil-yielding crop of humid tropics and is mainly grown in Kerala, Karanataka, Tamil Nadu, Andhra Pradesh, coastal districts of Maharashtra and Gujarat. Being a small holders crop in India, when grown as monocrop, it does not provide adequate income and employment to dependent families. The adult palm of sole crop of coconut, spaced at 7.5 m × 7.5 m apart effectively uses only 22.3% of land area, while average air space utilization by canopy is 30% and solar radiation interception is 45-50% (Bavappa *et al.* 1986). Thus, coconut gardens offers excellent opportunities for inclusion of compatible component crops in inter spaces, for effective utilization of natural resources. Unlike in annuals, the potential for increasing productively per unit area of land, time and inputs is considerably higher in perennial crops (Bavappa and Jacob, 1982). The coconut-based crop systems evolved in response to the pressure of shrinking land resource base coupled with high population density which necessitated a conscious attempt on the part of farmers to achieve their goals by living within biophysical, ecological and economic constraints (Maheswarappa *et al.* 2013). Noni (*Morinda citrifolia*) is compatible perennial medicinal plant in coconut based cropping system. Its juice has antioxidant properties and targeted the digestive, intestinal, respiratory and immune systems (www. en.wikipedi. org/wiki/*Morinda citrifolia*). Hence study was initiated to evaluate performance of *Morinda citrifolia* as a mix crop in coconut.

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MATERIALS AND METHODS

Field trial on "Performance of *Morinda citrifolia* as mixed crop in coconut garden under South Gujarat region" was conducted at Regional Horticultural Research Station, ASPEE College of Horticulture and Forestry, Navsari (Gujarat) during 2010-11 to 2015-16. The experiment was conducted on 40 years old West Coast Tall garden spaced at 7.5 m × 7.5 m. The Regional Horticultural Research Station is situated on 20°57'

North latitude and 72° 57' East longitudes and has an altitude of 12 m above mean sea level. The mean annual rainfall during 2010-2015 was 1600-1900 mm. The mean maximum temp is 35°C, while minimum temperature is 20°C. *Morinda citrifolia* was planted in June-2010 as a mixed crop in single hedge system at 3.75 m plant to plant distance at the centre of two rows of coconut palm. Twenty five each of tissue culture plantlets and seedlings were planted as non replicated trial. The experiment plot of coconut mixed crop with *Morinda citrifolia* was maintained as per the recommendations. Mulching with coconut leaves were followed in the summer months. Drip irrigation was followed after rainy season *i.e.* October-May for both coconut and Noni. The growth & yield observations of coconut *i.e.*, average no. of functional leaves on the crown, annual leaf production per palm, no. of nuts per palm and no. of nuts per hectare were recorded in 2011-12 to 2015-16. The growth & yield observations of Noni *viz.* plant height (cm), no. of branches per plant, no. of fruits per plant, weight of fruits per plant were recorded during 2015-16. Juice percentage and T.S.S (°Brix) were also recorded on both planting material. The economics of cropping system was calculated including labour cost, input cost, irrigation, other miscellaneous charges for both planting materials and converted into economics per ha.

RESULTS AND DISCUSSION

The growth and yield performance of coconut as influenced by mix crop of *Morinda citrifolia* is presented in Table 1. The average functional leaves on the crown increased from 26.20 to 27.50 whereas, annual functional leaf production per palm showed same trend and increased from 11.10 to 12.20 leaves/palm due to mix crop of *Morinda citrifolia*. Mean five year yield data indicated that nut yield increased 23.33% over pre experimental yield (2011-12 to 2015-16). The yield data revealed that average initial yield of coconut was 10800 nuts/ha which increased to 13320 nuts/ha. due to mixed crop of *Morinda citrifolia*. Results analogous to these finding were also reported by Nair and Balakrishnan (1976) in coconut mixed crop with cocoa. The additional increase in yield of coconut under mix cropping of *Morinda* could be due to synergistic effect of crop combination (Khandekar *et al.* 2014).

The growth and yield performance of *Morinda citrifolia* as mix crop in coconut is presented in Table 2. Maximum plant height (5.68m.), stem girth (16.75cm) and number of branches per plant (24.91) were found in seedling than tissue culture plants. This may be due to faster growth of seedlings than tissue culture plants. However, number of fruits per plant (325), total fruit weight per plant (11.15kg), and yield of fruits (2.78t/ha) was also recorded maximum in seedlings than tissue culture plants (2.38). The juice percentage was similar (60%) in tissue culture to seedling plants with 7.0% T.S.S. 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. Similarly, more biomass production per plant (3.90 kg) was recorded in seedling plants than tissue culture plants (2.00 kg). Similar findings also reported by Khandekar *et al.* 2014 in coconut mixed crop with noni.

The economics of production of *Morinda citrifolia* mix crop in coconut is presented in Table 3. Maximum gross returns were recorded in coconut + seedling

Table 1. Growth and yield of coconut as influenced by mix crop of *Morinda citrifolia*

Treatment	Functional leaves on crown		Annual leaf production/palm		Yield (nuts)				Increase over initial yield (%)
	2008-09 to 2010-11	2011-12 to 2015-16	2008-09 to 2010-11	2011-12 to 2015-16	2008-09 to 2010-11		2011-12 to 2015-16		
					Nuts /palm	Nuts /palm	Nuts /palm	Nuts /palm/ha	
Coconut + noni	26.2	27.5	11.1	12.2	60	10800	74	13320	23.33

Table 2. Growth, yield and quality parameters of *Morinda citrifolia* as mix crop in coconut

Planting material	Plant height (m)	Stem girth (cm)	No. of branches /plant	No. of Fruits /plant	Total fruit weight /plant (kg)	Yield (tonnes /ha)	Juice %	T S S (°B)	Biomass production/ plant (kg)
Tissue cultured plants	4.85	14.82	22.87	190	9.52	2.38	60%	7.0	3.90
Seedlings	5.68	16.75	24.91	325	11.15	2.78			2.00

Table 3. Economics of *Morinda citrifolia* as mix crop under coconut garden

Crop	Yield/ha	Cost of production (₹/ha)	Gross return (₹/ha)	Net return (₹/ha)	Benefit:Cost ratio
Coconut (mono)	13,000 nuts	30,440	91,000	60,550	1.98
Coconut + noni tissue cultured plants	13,320 nuts+2,380 kg noni	50,500	1,88,440	1,37,940	2.73
Coconut + noni seedling	13,320 nuts+2,780 kg noni	45,500	2,04,440	1,58,940	3.49

Selling price: coconut= ₹ 7/nut and noni fruits (avg. price) = ₹ 40/kg

plants (Rs. 204440.00) than coconut + tissue culture plants (Rs. 188440.00) and maximum net return of Rs. 158940.00 with 3.49 B:C ratio. Growing of both tissue culture plants and seedling plants increase in yield than pre experimental yield of coconut. Thus by utilizing same land, resources like space, light, irrigation facility, *Morinda Citrifolia* is a suitable mix crop under cropping system in coconut.

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