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### Performance of noni (*Morinda citrifolia*) in coconut garden as a mixed crop in southern dry zone of Karnataka

**Siddappa R, Basavaraju TB, Maheswarappa HP and Manjunath Hubballi**

#### Abstract

*Morinda citrifolia* known commercially as Noni, grown widely throughout the pacific and is one of the most significant source of traditional medicinal plant among pacific island societies. It prefers tropical humid island and coastal climate for its natural growth and development including of flowering and fruit setting round the year An experiment was carried out Horticultural research station, Arsikere during 2008. The Noni plants of seedlings and tissue culture plants are planted in 40 years of old coconut garden at a spacing of 7.5 X7.5 m. The Number of fruits per plant and fruit yield (kg/ ha) was higher with tissue culture plants (807, 9893) compared to seedlings (6.49, 8476) at end of 6<sup>th</sup> year of planting. The weight of the fruits per plant was also higher with the tissue culture (23.81Kg/Plant) plants compared to seedlings (27.79Kg/Plant). The juice content and TSS were similar both seedling and tissue culture plants. The biomass addition through leaf litter was higher in tissue culture plants (1643kg/ha) compared to seedlings (1455kg/ha). There was improvement in fertility status of soil due to addition of leaf litter. The coconut yield was unaffected by the intercropping of Noni in coconut garden. The net returns were higher in the mixed cropping system of tissue culture plants with coconut compared to seedlings. Based on the net returns coconut and Noni from tissue culture plants (Rs 244768/ha) was higher compared coconut with Noni seedling (Rs 224415/ha). Hence it can be recommended for commercial cultivation in southern karnataka under irrigated condition.

**Keywords:** Coconut, Noni, tissue culture plant, juice content.

#### Introduction

Coconut (*Cocos nucifera* L.) which increases the livelihood of many farming community which provides nutritious food and refreshing drink, oil for edible and non edible uses, fiber for commercial value, shell for industrial uses. Yield play an important role in the productivity of the coconut crop. The annual production of the coconut in India is about 20440 million nuts from an area 1.97 million hectare with productivity of 10345 nuts/ha. Whereas, Karnataka stood third place in productivity among different states in India (Anon, 2016) [1]. Noni is an evergreen small tree bearing flowers and fruits throughout the year. It prefers topical humid island and coastal climate for its natural growth and development. Noni is relatively easy to propagating from seeds or rooted cutting. It was also observed that vegetative propagated planting materials maintain inform productivity. An ancestors of Polynesian are believed to have brought many plants with them as they migrated from south east Asia about 2000 years ago was reported (Tabrah and Evelengh, 1966) [8]. Micro propagation using tissue culture is the other possibility of multiplication of planting materials. A noni after harvesting the fruit within a week at ambient temperature and also because of its short storage life, the fruit cannot be transported to the distance places even within the country. To overcome this problem of harvesting the fruits with pedicel to maintain better quality and market acceptability as the higher spoilage of fruits was observed in fruits harvested without pedicel. Of the 12 most common plants they brought, Noni was the second most popular plant used in herbal remedies to that various common disease and to maintain overall good health was reported (Krauss, 1993) [3].

To convert this wild crop into domestic crop we have to find an elite plant and it should be multiplied vegetatively to maintain in parents nature.

Cuttings are the easy and cheaper method of vegetative propagation. The information available on the inter crops of noni with coconut is meager. Hence growing of inter crops /mixed crops in coconut garden will not only increase the utilization of natural resources but also enhances the productivity and income. To keeping this view study will taken up on Performance of Noni (*Morinda citrifolia*) in coconut garden as a mixed crop in southern dry zone of Karnataka.

### Material and methods

The Horticulture Research station, Arsikere is located in the maidan tracts of Karnataka. Which is the area laying to the east of malnad region in Karnataka. The area is located in longitude of 76.5°E, Latitude 13°15' N altitude 800 m MSL, the mean minimum temperature 13.84 °C, the mean maximum temperature 34.62 °C. The average annual rainfall 694 mm received in 46 raining days having bimodal distribution with peak in May-June and sept-oct. The soil type is medium black and with PH-7.5 to 8.0. The seedling and tissue culture noni plants are planted in a 40 year old coconut garden during 2008-09 with a spacing 3.75 m plant to plant in between coconut rows with a spacing 7.5 x 7.5 m during 2009 with unreplicated trails. Recommended cultivation practices were followed in coconut and noni planting. The orchard was irrigated through drip irrigation. The palms are generally planted at a wider spacing 7.5x7.5 m due to their morphological features. The yield of coconut per palm was recorded periodically at each harvest from July to June and pooled to get nut yield per palm per year. The growth parameters like plant height, number of branches, plant spread were recorded. The yield and quality parameters like number of fruits/ plant, weight of fruits (kg/plant), fruit yield (kg/ha), coconut yield (nuts/palm/year), Juice content (%) and TSS (brix), biomass addition (kg/ha) were observed and also cost of cultivation will be worked out of noni crop.

### Result and Discussion

The data relating to certain morphological character of the plant is presented in Table-3. The Plant height was recorded higher in noni seedling (3.70m) compared to noni plants with tissue cultured plants (3.59 m) at the 6 years of planting. Whereas number of Primary branches and secondary branches, plant spread were higher in noni which are raised from tissue culture plants (62.3, 87.15 & 4.0) compared to seedling (61.6, 52.6, & 3.69) respectively during 2013-14. Similar study was reported by Singh *et al.* (2007) [5] in coffee, the growth of vegetative plants under open grew faster and get 4 branches and reached reproductive stage.

The number of noni fruits/plant was recorded higher in tissue cultured plants (807.7) compared to seedling (648.9). Whereas weight of noni fruits (kg/plant) and fruit yield was significantly lower in seedling Noni plants (23.81, 8476) compared to higher recorded in tissue culture noni plants (27.79, 9893) in coconut garden. These results are further

supported by findings by Nelson (2001) [4] that to obtain yield of 7 tone/ha/year in second after planting to 70 tonne/ha after fourth year of planting in noni.

The Juice content was recorded significantly higher in tissue cultured plants (59.5) compared to lowest record in seedlings (58.2). Whereas highest TSS was recorded in seedling (12.93) compared to (12.23) at the end of 6<sup>th</sup> year of planting. Nelson (2001) [1] reported that Juice extraction rate 50% from 1 hectare can thus an yield around 35 tonnes of juice, however many factors may affect yield and most producer don't get such good results because of diseases and poor agriculture practices in noni. These results further supported by Subramani *et al.* 2007 [6] that better growth with zero percentage mortality was observed and micro propagation plants in noni.

The data relating to yield parameter is presented in Table-3. Highest yield nuts per palm and nuts per ha (109.20 nuts/palm, 19101 nuts / ha) was obtained in coconut with noni tissue culture plants compared to coconut with noni seedlings plants (109.05 nuts/ palm, 19084 nuts/ ha), yield of coconut is obtained was lowest in monocrop (105.4 nuts/palm, 18445 nuts/ha) respectively. Similar findings have been recorded by Jassogone *et al.* (2013) [2] in inter cropping of coffee with banana could be counter protective for their coffee yield.

Data regarding economics of mixed cropping is presented in table-4. The gross income was lowest in coconut with noni seedling (Rs. 312115) compared to highest recorded in coconut tissue cultured plants (Rs.332468). B:C ratio was recorded higher in tissue culture plants (3.79) compared to coconut with seedling (3.56). Whereas net returns were higher in tissue culture plants (Rs 244768) compared to seedlings (224415). Similarly least cost benefit ratio was recorded in coconut with monocrop (Rs 138350). similar findings have been observed by Singh, (2006) [5] that five year noni plantation in bay islands gave a gross income of Rs.468750 with net income of Rs.200731.

The data relating to biomass addition is presented in Table-5. Biomass addition was higher in tissue cultured plants (4.09) compared to plants which as raised from seedlings (4.62). Similarly biomass addition kg/ha was higher in plants from seedlings (1455) compared to tissue culture plants (1643). There was improvement in fertility status of soil due to addition of leaf litter. The coconut yield was unaffected by the intercropping of noni in coconut garden. Wairagi *et al.* (2014) [9] reported that banana and coffee yield can only be sustained by the addition of manures and compost.

### Conclusion

Growing of noni as mixed crop in coconut garden is remunerative than mono cropping of coconut. The net return was higher in the mixed cropping system of noni with coconut compared to noni plants from seedlings. Hence Noni (*Morinda citrifolia*) is suitable for southern dry zone of Karnataka as inter crop with coconut.

**Table 1:** Growth and yield of Noni plants from seedlings as a mixed crop in coconut garden.

Growth and yield parameters	Plants from Seedlings					
	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
Plant Height (m)	1.35	1.76	2.75	3.17	3.52	3.70
No. of primary. branches/plant	3.8	15.2	40.5	43.0	61.1	61.6
No. of sec. Branches/plant	-	-	26.6	31.6	45.3	52.6
Plant spread (m)	0.82	1.15	1.96	2.73	3.26	3.69
No. of fruits/plant	-	26.6	41.4	243.9	526.8	648.9
Weight of fruits (kg/plant)	-	0.15	0.85	11.54	21.62	23.81
Fruit yield (kg/ha) (356 plants/ha)	-	53.2	302.6	4108	7694	8476
Juice content (%)	-	-	62.5	60.6	59.0	58.2
TSS (°Brix)	-	-	11.03	10.89	11.53	12.93

**Table 2:** Growth and yield of Noni plants from tissue cultured plants as a mixed crop in coconut garden.

Growth and yield parameters	Plants from tissue cultured plants					
	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
Plant Height (m)	0.92	1.74	2.49	3.13	3.58	3.59
No. of primary. branches/plant	8.0	27.0	37.9	42.6	62.2	62.3
No. of sec. branches/plant	-	-	28.0	49.9	63.2	87.15
Plant spread (m)	0.87	1.48	2.35	3.23	3.60	4.00
No. of fruits/plant	-	62.5	64.0	359.3	650.2	807.7
Weight of fruits (kg/plant)	-	0.43	1.75	16.06	25.19	27.79
Fruit yield (kg/ha) (356 plants/ha)	-	154.1	623.0	5717	8968	9893
Juice content (%)	-	-	60.9	59.4	59.6	59.5
TSS ( <sup>0</sup> Brix)	-	-	10.90	11.24	11.67	12.23

**Table 3:** Growth and yield of Noni plants from tissue cultured plants as a mixed crop in coconut garden.

Growth and yield parameters	Plants from Seedlings (2013-14)	Plants from tissue cultured plants (2013-14)	F- test
Plant Height (m)	3.70	3.59	NS
No. of primary. branches/plant	61.6	62.3	NS
No. of sec. branches/plant	52.6	87.15	*
Plant spread (m)	3.69	4.00	*
No. of fruits/plant	648.9	807.7	*
Weight of fruits (kg/plant)	23.81	27.79	*
Fruit yield (kg/ha) (356 plants/ha)	8476	9893	*
Juice content (%)	58.2	59.5	NS
TSS ( <sup>0</sup> Brix)	12.93	12.23	NS

**Table 4:** The yield of Noni fruits during stabilized bearing period (Mean of 5th and 6th year of planting (2012-13 to 2013-14) and economics of mixed cropping.

Particulars	Coconut + Plants from Seedlings	Coconut + Tissue culture plants	Coconut + Sloe crop
Yield of coconut (Nuts/palm)	109.05	109.20	105.40
Yield of coconut (Nuts/ha)	19084	19101	18445
Yield of Noni fruits (kg/plant)	22.72	26.49	0
Yield of Noni fruits (kg/ha)	8085	9431	0
<b>Gross Income (Rs./ha)</b>			
1. Coconut	190840	191010	184450
2. Noni	121275	141458	0
Total	<b>312115</b>	<b>332468</b>	<b>184450</b>
<b>Cost of cultivation (Rs./ha)</b>			
1. Coconut	46100	46100	46100
2. Noni	41600	41600	0
<b>Total</b>	<b>87700</b>	<b>87700</b>	<b>46100</b>
Net Returns (Rs./ha)	224415	244768	138350
B:C ratio	3.56	3.79	4.00

Note: The cost and returns were calculated based on 2013-14 prices

**Table 5:** The yield of coconut in the intercropping system of Noni with coconut.

Planting material	Yield of nuts (No's/palm/yr)						
	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	Mean
Coconut + Noni Seedlings	75.5	76.2	111.8	92.1	116.0	102.1	95.6
Coconut + Noni tissue culture	74.6	77.4	115.3	95.8	114.3	104.0	96.9
Sole crop of coconut	70.9	73.9	105.0	91.0	112.0	98.8	91.9

**Table 6:** The Biomass addition (leaf litter) from Noni plants in coconut garden.

S. No.	Planting material	Biomass addition (kg/plant)			Biomass addition (kg/ha)		
		2012-13	2013-14	Mean	2012-13	2013-14	Mean
1	Plants from Seedlings	3.41	4.76	4.09	1214	1695	1455
2	Tissue culture plants	4.15	5.08	4.62	1477	1808	1643

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