Growth, yield and fruit quality of noni (*Morinda citrifolia* L) as influenced by integrated nutrient management under mixed cropping in coconut garden

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ABSTRACT

An experiment was carried out on noni (*Morinda citrifolia* L) grown as a mixed crop in a coconut garden to study the effect of integrated nutrient management (INM) practices on growth, yield and fruit quality of the former. The study revealed that the adoption of INM practices with organic manure, in situ green manure, biofertilizers and inorganic fertilizers was more effective in improving growth, yield and fruit quality of noni as compared to application of inorganic fertilizers alone. The treatment combinations of 75 per cent recommended dose of fertilizers (RDF) from inorganic sources + 25 per cent RDF from organic sources resulted in significant increase in plant height (32.9%). Application of nutrients 50 per cent from inorganic and 50 per cent from organic sources resulted in maximum fruit weight (34.24 g), fruit length (6.4 cm), yield (87.59 q/ha) , total soluble solids (10.72 ^{o}Brix) and minimum acidity (0.24%) of matured fruits.

Keywords: Noni; mixed crop; INM; green manuring; vermicompost; RDF; fruit quality; yield

INTRODUCTION

Noni, *Morinda citrifolia* L is a less exploited fruit crop but mostly popular as a medicinal plant. It is classified as small evergreen shrub or tree belonging to family Rubiaceae. Plants are generally less than 3 m in height occasionally rising to 6 m and largely confined to the tropical areas like west cost of India, Andaman and Nikobar islands, Australia, Hawaii, South Pacific and Caribbean islands. Fruits (botanically syncarp) are yellowish-white, fleshy, oblong and soft and believed as appetizers and brain stimulants. Xeroxine- the primary nutrient of noni fruit provides several health benefits. The crop is easy to grow and least infested by diseases and pests. The importance and usefulness of the crop however need the standardization of its commercial cultivation to increase the yield and quality of fruits particularly through organics. The crop is also best suited to be grown as a mixed crop inside the coconut garden to utilize the available natural resources. Keeping above facts in view a study was carried out to know the effect of integrated nutrient management (INM) on fruit quality and yield of noni crop grown as a mixed crop in coconut garden under Odisha conditions.

MATERIAL and METHODS

The experiment was carried out on a ten year old noni plantation at the Coconut Research Station, Department of Fruit Science and Horticulture Technology, OUAT, Bhubaneswar, Odisha to study the effect of integrated nutrient management on noni crop during 2013-14. The test crop was raised as a mixed crop in the coconut garden. Prior to the experiment the soil nutrient status was determined. The experiment was conducted in randomized block design with 7 treatment combinations replicated thrice. The various treatments were T_1 (Control), T_2 (100% recommended dose of fertilizer (RDF) from inorganic sources), T_3 (75% RDF from inorganic sources + 25% RDF from FYM), T_4 (50% RDF from inorganic sources + 50% RDF from FYM), T_5 (25% RDF from inorganic sources + 75% RDF from FYM), T_6 (100% RDF from FYM, green manure and biofertilizers), T_7 (100% RDF from organic sources such as FYM, green

manure and vermicompost). Observations were recorded on growth, yield and yield attributing characters as well as quality parameters of noni fruits. The TSS of the fruit was determined by hand refractometer; the acidity was recorded and expressed in per cent citric acid as per the method described by Ranganna (1997).

RESULTS and DISCUSSION

The data presented in Table 1 reveal that noni plant responded well to application of fertilizers with respect to plant height. The maximum increase in plant height (32.9%) was recorded in the plants which received recommended fertilizers (75% from inorganic and 25% from organic sources) followed by 50 per cent inorganic + 50 per cent organic sources where the incremental growth in plant height was 30.0 per cent. But the organic treatments recorded slow growth rate as compared to inorganic or inorganic + organic combination treatments. The increase in plant height could be due to improvement in physical properties of soil, availability of balanced nutrition with higher uptake and increased activity of microorganisms which were reflected in the form of enhanced growth as explained by Kumar et al (2008).

The results also reveal that the fruit weight and fruit length varied significantly in noni plants receiving different combinations of organic and inorganic fertilizers. The fruit weight was recorded as maximum (34.24 g) in T_4 and minimum (30 g) in T_1. A similar trend was also observed in case of fruit length where the longest fruit (6.4 cm) was recorded in T_4 and shortest (6.0 cm) in T_1. The results are in line with the findings of Faqir et al (2000) in guava.

Integration of inorganic fertilizers with organics increased the number of fruits, mean yield per plant and total yield but the maximum number of fruits (360/ plant), weight of fruits (12.32 kg/plant) and yield (87.59 q/ha) was recorded under the treatment T_4 wherein combined application of FYM and chemical fertilizers was made to get equal proportion of nutrients from organic and inorganic sources. However the inorganic nutrition alone increased the number of fruits by 26 per cent, weight of fruits by 7 per cent and yield per plant by 35 per cent as compared to control (Table 2). The increase in both number and weight of fruits could be due to better accumulation of the nutrients and increase in assimilating area which improved the portioning to the economic part and hence improved yield as also described by Dalal et al (2004) in sapota. Among the organic treatments use of biofertilisers in T_6 was found more effective in producing higher number of fruits (308) and fruit weight (30.7 g) indicating the superiority of use of biofertilisers over vermicompost in T_7. The reason could be the benefical effect of biofertilizers which had direct role in nitrogen fixation, production of phytohormones and increased uptake of nutrients. Observations are in agreement with the findings of Patel and Naik (2010) in sapota.

The response of fruit yield to integrated nutrient sources was found maximum in T_4 (52%) followed by T_3 (47%) compared to control. The

Table 1. Influence of different nutrient combinations on growth of noni (*Morinda citrifolia* L)

Treatment	Plant height (m)		Increase in plant height (%)	Rate of increase/ month (cm)
	Oct 2013	Jun 2014		
T_1	2.04	2.47	21.1	3.58
T_2	2.03	2.62	29.1	4.92
T_3	2.37	3.15	32.9	6.5
T_4	2.20	2.86	30.0	5.50
T_5	2.33	2.90	24.5	4.75
T_6	2.08	2.60	25.0	4.33
T_7	2.42	2.89	19.4	3.91
SEm±	0.17	0.216	-	-
$CD_{0.05}$	NS	0.641	-	-

T_1: Control, T_2: 100% recommended dose of fertilizer (RDF) from inorganic sources, T_3: 75% RDF from inorganic sources + 25% RDF from FYM, T_4: 50% RDF from inorganic sources + 50% RDF from FYM, T_5: 25% RDF from inorganic sources + 75% RDF from FYM, T_6: 100% RDF from FYM, green manure and biofertilizers, T_7: 100% RDF from organic sources such as FYM, green manure and vermicompost

Table 2. Influence of different nutrient combinations on yield contributing traits, total yield and fruit quality of noni (*Morinda citrifolia* L)

Treatment	Number of fruits/plant	Length of fruit (cm)	Fruit weight (g)	Mean fruit yield/ plant (kg)	Yield (q/ha)	TSS of fruit (°Brix)	Fruit acidity (%)
T_1	270	6.0	30	8.1	57.5	10.07	0.36
T_2	340 (26)	6.1	32.10 (7.0)	10.9 (35)	77.4 (35)	10.55	0.35
T_3	350 (30)	6.2	34.04 (13.5)	11.9 (47)	84.6 (47)	10.62	0.35
T_4	360 (33)	6.4	34.24 (14.1)	12.32 (52)	87.59 (52)	10.72	0.24
T_5	344 (28)	6.3	33.6 (12.0)	11.6 (43)	82.4 (43)	10.52	0.33
T_6	308 (14)	6.2	30.7 (2.4)	9.4 (16)	66.8 (16)	10.68	0.28
T_7	292 (8)	6.1	30.07 (0.2)	8.7 (7)	61.8 (7)	10.48	0.34
SEm±	8.789	0.108	0.221	0.099	0.16	0.16	0.01
$CD_{0.05}$	26.112	0.321	0.656	0.295	0.47	0.47	0.02

T_1: Control, T_2: 100% recommended dose of fertilizer (RDF) from inorganic sources, T_3: 75% RDF from inorganic sources + 25% RDF from FYM, T_4: 50% RDF from inorganic sources + 50% RDF from FYM, T_5: 25% RDF from inorganic sources + 75% RDF from FYM, T_6: 100% RDF from FYM, green manure and biofertilizers, T_7: 100% RDF from organic sources such as FYM, green manure and vermicompost; Figures in parentheses show per cent increase over control

effect of integrated nutrient management practices on physical, chemical, biological and nutritional properties of soil might have influenced the crop growth particularly monthly growth rate 3.91 to 6.5 (T_3) per cent as compared to 3.58 under control (Table 1).

Among the quality parameters of fruits the TSS varied significantly among different treatments. The maximum TSS (10.72°B) was recorded under the treatment receiving 50 per cent inorganics + 50 per cent organics (T_4) followed by T_6 (10.68°B). However the least value (10.07°B) was recorded with T_1 (control). The FYM and vermicompost contain appreciable amount of micronutrients especially ferrous which indirectly increases the rate of respiration and hence that might have increased the total soluble solid content (Tien et al 1989). On the other hand the maximum acidity (0.36) was recorded in control and the minimum (0.24%) in T_4. The TSS and acidity of noni fruits were influenced inversely indicating the effect of INM on fruit quality. The fruit quality might have improved due to balanced nutrient supply and proper induction of growth hormones. The TSS of fruits got improved whereas the acidity decreased with integrated doses of FYM. Similar results in strawberry and litchi have been reported by Rana and Chandel (1999) and Dutta et al (2010).

CONCLUSION

The chemical fertilizers possess negative residual effect on soil as well as crop quality when used. Organic sources of nutrients such as FYM, vermicompost and biofertilizers though contain lesser amount of the major nutrients as compared to the inorganic ones but contain large number of primary and secondary nutrients and have a beneficial effect on soil and plants. The present experiment indicated that integrated nutrient management practices mainly the nutrient combination of 50 per cent RDF + 50 per cent organics was more effective in bringing out improvement in plant growth as well as fruit quality, fruit weight and number of fruits per plant and hence yield in noni crop.

REFERENCES

Dalal SR, Gonge VS, Jogdande ND and Moharia A 2004. Response of different levels of nutrients and PSB on fruit yield and economics of sapota. PKV Research Journal **28:** 126-128.

Dutta P, Kundu S and Biswas S 2010. Integrated nutrient management in litchi cv Bombai in new alluvial zone of West Bengal. Indian Journal of Horticulture **67(2):** 181-184.

Faqir M, Shakir MA and Salik MR 2000. Effect of Individual and combined application of organic and inorganic manures on the productivity of guava plants. Pakistan Journal of Biological Sciences **3(9):** 1370-1371.

Kumar D, Pandey V and Anjaneyulu K 2008. Effect of planting density and nutrient management on growth, yield and quality of micro-propagated banana Rasthali (AAB-Pathkapoora). Indian Journal of Horticulture **65(3):** 272-276.

Morselli TBGA, Sallis MDG, Terra S and Fernandes HS 2004. Response of lettuce to application of vermicompost. Revista Cientifica Rural **9:** 1-7.

Patel DR and Naik AG 2010. Effect of pre-harvest treatments of organic manures and inorganic fertilizers on postharvest shelf-life of sapota cv Kalipatti. Indian Journal of Horticulture **67(3):** 381-386

Rana RK and Chandel JS 1999. Effect of biofertilizers and nitrogen on growth, yield and fruit quality of strawberry. Progressive Horticulture **35(1):** 25-30

Ranganna S 1997. Handbook of analysis and quality control for fruit and vegetable products. Tata McGraw-Hill Publishing Co Ltd, New Delhi, India, 1112p.

Tien TM, Gaskins MH and Hubbell DH 1989. Plant growth substances produced by *Azospirililum brasilense* and their effect on the growth of pearl millet (*Pennisetum americanum* L). Applied and Environmental Microbiology **37(5):** 1016-1024.