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Influence of integrated nutrient management on major nutrients in mullai (*Jasminum auricultatum*)

A. ANBURANI **AND** M. GAYATHIRI

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See end of the article for authors' affiliations

Correspondence to:

A. ANBURANI
Department of Horticulture, Faculty of Agriculture, Annamalai University, ANNAMALAI NAGAR (T.N.) INDIA

ABSTRACT

Mullai, one of the important commercial flower crops fetches heavy demand for its fresh flowers. Being perennial in nature it removes large amount of fertilizer which can't be offered by an average farmer. Hence, an alternate system of nutrient management is important. Having this idea as background, the present investigation was conducted to study the influence of INM on nutrient status in mullai. The experiment was carried out in FRBD consists of 18 treatments with three replications. The organic manures *viz*. farm yard manure @ 25 t ha^{-1}, press mud @ 25 t ha^{-1} and vermicompost @ 5 t ha^{-1} were applied in soil along with 100% and 75% recommended dose of inorganic fertilizers (120:240:240 kg NPK ha^{-1} and along with bio fertilizers application (B_0 - no bio fertilizer application and B_1-application of *Azospirillum* and phosphobacteria @ 2 kg ha^{-1}). The parameters like nutrient uptake and post harvest soil nutrient status for major nutrients were studied. It was recorded that the plants which received farm yard manure @25 t ha^{-1} along with 100%of the recommended dose of inorganic fertilizers (120:240:240g plant $^{-1}$) combined with bio fertilizers recorded the highest nutrient uptake whereas the maximum post harvest nutrient status was recorded when application of press mud @ 25 t ha^{-1} along with 75 % of the recommended dose of inorganic fertilizers @ 90:240:240 g/plant was applied.

Key words : Bio fertilizer, Jasmine, Inorganic, Organic, Plant nutrient, Post-harvest soil nutrient status.

Jasmine (*Jasminum auriculatum*), a member of family oleaceae is one of the leading loose flower in India. It takes most important position among the commercial flower crops. Tamilnadu is the leading producer of jasmine in the country with an annual production of 77,247 tonnes from the cultivated area of 9360 ha (Anon., 2004). It is especially appreciated for its fragrance in India where most people have a love for fragrant flowers. Fresh flowers are highly valued and are used in making garlands, bouquets, veni, religious offering and ceremonial purpose. It is widely used in the preparation of cosmetics throughout the world and attempt was being made to improve the production of flower and extraction of oil for export. Nutritional requirement is one of the key factors that governs the growth and development of plants. The natural deposits of nutrients in soils are inadequate to meet the demands of the plants in context of increased pressure for maximizing the productivity. Further, continuous growth of crops depletes the fertility of the soil. Therefore, it becomes an essential need to supplement the crop with organic and artificial sources of nutrients in the form of nitrogen, phosphorus and potassium and other micronutrients to the soil.

Integrated Nutrient Management (INM) is one of the most important components to obtain sustainable crop production. The integrated nutrient management associates available, accessible and affordable plant nutrients to increase soil fertility and plant nutrient supply to achieve a given level of crop production, through optimizing the benefits from all possible sources of plant nutrients. It implies the most efficient use and management of organic, inorganic sources of major nutrients to attain higher levels of crop productivity and to maintain the fertility of the soil.

MATERIALS AND METHODS

The experiment was carried out in a farmer's field at C. Mutlur village located 10 km away from Annamalai Nagar during 2004-2005. Three year old bushes already existing in the field were used for the present investigation. Before imposing the treatments they were pruned at a height of 45 cm from the ground level. The soil of the experimental field was sandy clayey loam. The treatment consists of application of various organic manures *viz*., FYM @ 25 t ha^{-1} (O_1), press mud @ 25 t ha^{-1} (O_2) and neemcake @ 5 t ha^{-1} (O_3) applied in the soil as basal application combined with three levels of inorganic fertilizers *viz*., 50 (I_1), 75 (I_2) and 100 % (I_3) of the recommended dose of inorganic fertilizers @ 120:240:240 g bush^{-1}. The bio fertilizers were applied in two levels (B_0- without bio fertilizers application and B_1- with bio fertilizers application (*Azospirillum* and phosphobacteria @ 2 kg ha^{-1} each). There were totally 18 treatment combinations in three replications and the experiment was

conducted in Factorial Randomized Block Design. The required quantity of organic manure was applied as basal application as per the treatment immediately after pruning. The bio fertilizers were applied in 4 equal doses as basal application after rejuvenation of new shoots at bimonthly intervals. The inorganic fertilizers were also applied in 4 equal split doses at bimonthly intervals. The manures and fertilizers were applied in 15 cm deep furrows opened around the plants beyond 30 cm from the trunk. Irrigation, weeding and plant protection measures were carried out as per the requirement of the crop. Randomly selected plants from each treatment were tagged for the purpose of recording various observations. The parameters like nutrient uptake and post harvest nutrient status major nutrients were recorded and these parameters were subjected to statistical analysis as given by Panse and Sukatme (1978).

RESULTS AND DISCUSSION

Data presented in Tables 1, 2 and 3 revealed that among the individual factors that tested application of farmyard manure, 100% recommended dose of inorganic fertilizers and bio fertilizer recorded a significant response in relation to increase in nutrient uptake. With regard to two factors interaction a significant increase was noticed in all possible combinations for all the nutrients. Among the three factor interactions the maximum plant nitrogen uptake (2.99%) was obtained when plants treated with FYM @ 25 t ha^{-1} + 100% RDF (120: 240: 240 g NPK $plant^{-1}$+ bio fertilizers. This might be due to the richness of FYM with respect to humus forming substances, nitrogen fixers and P content and its nature of improving the physico-chemical properties of the soil. Nutrient content in the leaf was a factor largely governed by the inter-relationships of the other nutrients and such a

Table 1: Effect of nutrient management on plant nitrogen content (per cent) in mullai

Levels	Without bio fertilizer application (B_0)				With bio fertilizer application (B_1)				I × O			
	O_1	O_2	O_3	Mean	O_1	O_2	O_3	Mean	O_1	O_2	O_3	Mean
I_1	2.590	2.550	2.510	2.550	2.670	2.633	2.590	2.631	2.630	2.591	2.550	2.590
I_2	2.870	2.710	2.670	2.750	2.950	2.830	2.790	2.857	2.910	2.770	2.730	2.803
I_3	2.910	2.790	2.750	2.816	2.990	2.950	2.910	2.950	2.950	2.870	2.830	2.883
Mean	2.790	2.683	2.643	2.705	2.870	2.804	2.763	2.812	2.830	2.743	2.703	2.759
		I	O		B	O × I	I × B		O × B		O × I × B	
S.E. ±		0.005	0.005		0.004	0.009	0.007		0.007		0.013	
C.D. (P=0.05)		0.011	0.011		0.009	0.019	0.015		0.015		0.027	

Table 2: Effect of nutrient management on plant phosphorus content (per cent) in mullai

Levels	Without bio fertilizer application (B_0)				With bio fertilizer application (B_1)				I × O			
	O_1	O_2	O_3	Mean	O_1	O_2	O_3	Mean	O_1	O_2	O_3	Mean
I_1	0.197	0.193	0.187	0.192	0.205	0.201	0.197	0.201	0.201	0.197	0.192	0.196
I_2	0.227	0.209	0.205	0.213	0.235	0.223	0.221	0.226	0.231	0.216	0.213	0.220
I_3	0.231	0.219	0.213	0.221	0.241	0.235	0.231	0.235	0.236	0.227	0.222	0.228
Mean	0.218	0.207	0.201	0.209	0.227	0.219	0.216	0.221	0.222	0.213	0.209	0.215
		I	O		B	O × I	I × B		O × B		O × I × B	
S.E. ±		0.0004	0.0004		0.0003	0.0007	0.0006		0.006		0.001	
C.D. (P=0.05)		0.0008	0.0008		0.0007	0.0015	0.0012		0.0012		0.002	

Table 3: Effect of nutrient management on plant potassium content (per cent) in mullai

Levels	Without bio fertilizer application (B_0)				With bio fertilizer application (B_1)				I × O			
	O_1	O_2	O_3	Mean	O_1	O_2	O_3	Mean	O_1	O_2	O_3	Mean
I_1	2.146	2.141	2.135	2.140	2.160	2.154	2.148	2.154	2.153	2.147	2.141	2.147
I_2	2.192	2.167	2.161	2.173	2.206	2.186	2.180	2.190	2.199	2.176	2.170	2.182
I_3	2.198	2.178	2.174	2.183	2.211	2.205	2.199	2.205	2.204	2.191	2.186	2.194
Mean	2.178	2.162	2.158	2.166	2.192	2.181	2.175	2.183	2.185	2.171	2.166	2.174
		I	O		B	O × I	I × B		O × B		O × I × B	
S.E. ±		0.0008	0.0008		0.0006	0.0013	0.0011		0.0011		0.0019	
C.D. (P=0.05)		0.0016	0.0016		0.0010	0.0020	0.0020		0.0023		0.0039	

relationship primarily led to "tissue dilution". However, due to the concurrent and continuous production of large number of assimilates due to a sink-source relationship causing the translocation of nutrients from the leaves into the flower. This view was supported by the reports of Nandakumar (1976) in *Jasminum auriculatum*. Whereas, minimum (2.510%) plant nitrogen uptake was obtained when plants treated with Neemcake @ 5 t ha^{-1} + 50% RDF (60: 120: 240 g NPK $plant^{-1}$).

The highest leaf phosphorus and potassium content of 0.24% and 2.21% was observed in the treatment which received the combined application of FYM @ 25 t ha^{-1} along with 100 % RDF (120: 240: 240 g NPK $plant^{-1}$) and 0.2% @ bio fertilizers. The lowest phosphorus(0.187%) and potassium content (2.135%) were observed in treatment that received the application of press mud @ 25 t ha^{-1} along with 50% RDF (60: 120: 240 g NPK $plant^{-1}$). The application of FYM increased the concentration of P and K due to solubility effect of certain organic matter present. Further, the increased microbial activity due to the application of FYM enhanced the process of mineralization that lead to more uptake of P and K. Subramanian and Kumaraswamy (1989) reported that appreciable increases in available P and K with integrated nutrient application might be attributed due to increase in the liable P through complex action with cations such as Ca^{2+}, Mg^{2+}, Fe^{3+} and Al^{+} which are responsible for the fixation of soil phosphorus. Further, it might be due to the constant uptake of nutrients with inorganic fertilizers.

It is evident from the Tables 4, 5 and 6 that among the individual factors that tested application of press mud , 75 % recommended dose of inorganic fertilizers and bio fertilizer recorded a significant response in relation to increase in nutrient uptake. With regard to two factors interaction a significant increase was noticed in all possible combinations for all the nutrients. Among the three factor

Table 4: Effect of nutrient management on post-harvest soil nitrogen (kg ha^{-1}) in mullai

Levels	Without bio fertilizer application (B_0)				With bio fertilizer application (B_1)				I × O			
	O_1	O_2	O_3	Mean	O_1	O_2	O_3	Mean	O_1	O_2	O_3	Mean
I_1	2.146	2.141	2.135	2.140	2.160	2.154	2.148	2.154	2.153	2.147	2.141	2.147
I_2	2.192	2.167	2.161	2.173	2.206	2.186	2.180	2.190	2.199	2.176	2.170	2.182
I_3	2.198	2.178	2.174	2.183	2.211	2.205	2.199	2.205	2.204	2.191	2.186	2.194
Mean	2.178	2.162	2.158	2.166	2.192	2.181	2.175	2.183	2.185	2.171	2.166	2.174
		I	O		B	O × I	I × B		O × B		O × I × B	
S.E. ±		0.436	0.436		0.356	0.755	0.616		0.616		1.683	
C.D. (P=0.05)		0.886	0.886		0.724	1.53	1.254		1.254		2.915	

Table 5: Effect of nutrient management on post-harvest soil phosphorus (kg ha^{-1}) in mullai

Levels	Without bio fertilizer application				With bio fertilizer application				I × O			
	O_1	O_2	O_3	Mean	O_1	O_2	O_3	Mean	O_1	O_2	O_3	Mean
I_1	64.43	67.59	61.28	64.43	74.13	70.96	67.80	70.96	69.28	69.27	64.54	67.69
I_2	93.82	96.99	90.17	93.66	97.14	100.38	93.80	97.03	95.48	98.68	91.87	95.34
I_3	80.69	77.51	74.34	77.51	87.02	90.39	83.69	87.03	83.85	83.95	79.01	82.27
Mean	79.64	80.69	75.26	78.53	86.09	87.24	81.68	85.00	82.87	83.97	78.47	81.77
		I	O		B	O × I	I × B		O × B		O × I × B	
S.E. ±		0.395	0.395		0.322	0.684	0.558		0.558		0.967	
C.D. (P=0.05)		0.803	0.803		0.655	1.391	1.135		1.135		1.967	

Table 6: Effect of integrated nutrient management on post-harvest soil potassium (kg ha^{-1}) in mullai

Levels	Without bio fertilizer application				With bio fertilizer application				I × O			
	O_1	O_2	O_3	Mean	O_1	O_2	O_3	Mean	O_1	O_2	O_3	Mean
I_1	374.80	380.26	369.50	374.88	391.82	386.44	381.06	386.44	383.35	383.35	375.28	380.66
I_2	426.48	431.87	419.49	425.94	432.96	438.14	425.67	432.19	429.62	435.00	422.58	429.06
I_3	403.32	397.93	392.53	397.92	414.09	420.29	408.70	414.36	408.70	409.11	400.61	406.14
Mean	401.56	403.35	393.84	399.58	412.89	414.95	405.14	410.96	407.22	409.15	339.49	405.29
		I	O		B	O × I	I × B		O × B		O × I × B	
S.E. ±		0.80	0.80		0.65	1.39	1.14		1.14		1.97	
C.D. (P=0.05)		1.63	1.63		1.33	2.83	2.31		2.31		4.01	

interactions the maximum post harvest soil nitrogen, phosphorus and potassium (196.37: 100.38: 438.14 kg ha^{-1}) were obtained when the plants were treated with press mud @ 25 t ha^{-1} + 75% RDF (90:240:240 g NPK plant^{-1}) + bio fertilizers whereas, the minimum uptake of 153.64: 61.28: 369.50 kg ha^{-1} NPK was recorded when plants were treated with neemcake @ 5 t ha^{-1} along with 50% RDF(60: 120: 240 g NPK plant^{-1}) .

Application of press mud along with inorganic fertilizers application showed an increase in the available nitrogen and phosphorus and potassium content in the present investigation. Similar report was observed by Som *et al*. (1992) in brinjal. It is evident from the results that the nutrient content of itself and its influence on physical and chemical proportion of the soil might have influenced the better availability of applied nutrients when compared to FYM. Further, the application of nitrogen favourably improved the nitrogen status of the soil. The increased dosage of nitrogen consistently increased the soil nitrogen. This may be due to the higher application of nitrogen and also the nitrogen released among the mineralization from the organic matter existing in the soil. Similarly, the application of phosphorus improved the P availability in the soil. This may be due to the high dose of phosphorus applied to the soil. The higher dose of potassium fertilizer application also left high residual potassium in the soil, which in turn improved the available potassium. This is in conformity with the reports of Ponni (2004) in nerium. Moreover, the combined effects of both organic and inorganic nutrients have attributed the increased availability of higher macronutrients from higher quantities of nutrients.

Thus, from the present investigation, it could inferred that, application of farm yard manure @ 25 t ha $^{-1}$along with 100% of the recommended dose of inorganic fertilizers @ 120:240:240 g/plant combined with bio fertilizers recorded the highest nutrient uptake and the post harvest nutrient status was recorded when press mud @ 25 t ha^{-1} along with along with 75% of the recommended dose of inorganic fertilizers @ 90:240:240 g plant $^{-1}$combined bio fertilizers application.

Authors' affiliations:
M. GAYATHIRI, Department of Horticulture, Faculty of Agriculture, Annamalai University, ANNAMALAI NAGAR (T.N.) INDIA

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