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Jagadishchandra Hiremath
Assistant Professor of PMA, KRC College of Horticulture, Arabhavi, Karnataka, India

Gangadharappa PM
Dean, COH, Munirabad, Karnataka, India

Hegde NK
Dean, COH, Sirsi, Karnataka, India

Kuknoor L
Professor, RHR&EC Kumbapur Farm, Dharwad, Karnataka, India

Mastiholi AB
Professor, RHR&EC Kumbapur Farm, Dharwad, Karnataka, India

Mukund Shirgur
Assistant Professor of FLA, KRC College of Horticulture, Arabhavi, Karnataka, India

Mallikarjun Awati
Assistant Professor, COH, Bagalkot, Karnataka, India

Corresponding Author:
Jagadishchandra Hiremath
Assistant Professor of PMA, KRC College of Horticulture, Arabhavi, Karnataka, India

Influence of integrated nutrient management on growth and yield of Safed Musli (*Chlorophytum borivilianum* Sant. and Fernand.)

Jagadishchandra Hiremath, Gangadharappa PM, Hegde NK, Kuknoor L, Mastiholi AB, Mukund Shirgur and Mallikarjun Awati

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Abstract
An experiment on "Influence of integrated nutrient management (INM) on growth and yield of safed musli" was carried out at KRC college of Horticulture, Arabhavi, Gokak, Karnataka during 2018-19 as a part of Ph.D programme. The result revealed that plant supplied with humic acid recorded maximum plant height (29.99 cm) which was on par with the panchagavya (29.76 cm). Significantly maximum total dry matter production of 1.66 g plant^{-1} and maximum fresh root yield was observed in (0.70 kg plot^{-1} and 33.42 q ha^{-1}, respectively) observed in panchagavya drenched plants. Among inorganic and organic application, 100 per cent RD NPK 50:40:40 kg ha^{-1} recorded significantly maximum plant height (31.53 cm), maximum number of leaves (17.48 plant^{-1}), total dry matter production (2.18 g plant^{-1}) and significantly highest fresh root yield per plot and per hectare (0.74 kg plot^{-1} and 36.26 q ha^{-1}, respectively). Among interaction effect, panchagavya (3%) + 100 per cent RD NPK 50:40:40 kg ha^{-1} recorded maximum plant height (33.10 cm), total dry matter production (2.30 g plant^{-1}) and significantly highest fresh root yield per plot and per hectare (0.81kg and 38.34q, respectively).

Keywords: Growth, yield, INM, panchagavya

Introduction
Safed musli (*Chlorophytum borivilianum* Sant. & Fernand.) is one of the important medicinal root crop with high demand commonly called as Swetha musli/Safed musli in Hindi, belongs to Liliaceae family, growing naturally in the Arawali hills of India, has a good internal demand and export potential. Due to its aphrodisiac property dried roots are considered as one of the most important drug in Indian system of medicines *viz*., *Ayurveda*, *Unani* and *Siddha*. Primarily major contents are saponins and alkaloids impart medicinal value. It's naturally grown in hilly areas of Gujarat, Rajasthan and Madhya Pradesh. Foreign demand has been estimated as 300-700 tons annually (Kothari and Singh, 2003) [11]. Among various cultural practices conducive for enhancing the tuber yield, nutrient management plays an important role in enhancing the tuber yield per unit area. Application of nitrogen, phosphorous, potassium and along with it organic and bio-formulations accelerate the growth which in turn provide efficient frame work for high rate of nutrient absorption and net assimilation for productive metabolism and may enhance the yield. In this connection the present investigation was undertaken to standardize integrated nutrient management to increase the root yield.

Material and Methods
The investigation was laid out in factorial randomized block design comprising sixteen treatments replicated thrice during the year 2018-19. There were two factors namely bio-formulation drench and second one inorganic and organic application. Among bio-formulations, O_1: panchagavya (3%), O_2: humic acid (1%), O_3: jeevamruta (5%), O_4: control (No drenching). With respect to inorganic and organic *viz*., F_1: 100% RD NPK 50:40:40 kg ha^{-1} (as per GAP, DMAPR compiled by Jat *et al.*, 2015) [8], F_2: 50% RD NPK 25:20:20 kg NPK ha^{-1}, F_3: 50% Rec. N through FYM (5 t ha^{-1}) + 50% of Rec. N through vermicompost (2.5 t ha^{-1}) and F_4 was control. Whereas, 15 t ha^{-1} of FYM was applied uniformly to all the treatments. Raised beds were prepared with specified measurement of 1.8 m x 1.2 m and planted the

fesciculated roots at a spacing of 30 cm between rows and 15 cm between plants. A spacing of 0.5 m between raised beds was provided for easy cultural operations. The fertilizers were applied in both organic and inorganic combinations as per the treatment specifications. Starting from the planting, organic solutions (panchagavya, jeevamrutha and humic acid) were drenched at 15 days interval.

Observation recorded

Observations were recorded on various growth parameters. Five plants in each plot were selected at random and the selected plants were tagged for recording the various observations. The plant height was measured from the collar region of the plant to the tip of the longest leaf using metre scale and mean length was calculated in centimetre. The number of leaves per plant was counted and recorded from the tagged plants. Oven dried weight (drying at 60° C at constant weight) of plant was recorded after proportion of whole plant into roots and leaves at 60 days after planting. The sum of mean dry weight of above ground part and roots represents the total dry matter per plant (g). The fresh root yield was recorded in each plot at the time of harvest. Then fresh yield per hectare was estimated on the basis of fresh root yield per plot. The crop was harvested by digging out the fesiculated roots for peeling at two to three months after complete maturity as indicated by withering and drying up of leaves (approximately all together 6months). Harvested fesiculated roots were cleaned to remove adhered soil and attached roots, then manually peeled and dried in shade. After peeling of roots from each labeled plants, they were dried in hot air oven at 60°C and their weight was recorded and the expressed the average in gram per plant and estimated dry root yield per hectare on the basis of dry root yield per plot.

Result and Discussion

Treatment humic acid (O_2) recorded significantly maximum plant height (29.99 cm) which was on par with the panchagavya (O_1) of 29.76 cm. This might be due to humic acid has positive impact on soil physico-chemical properties and soil microbial community structure activity, resulting in availability of higher nutrient content for plant growth. Significantly maximum number of leaves (16.03 plant^{-1}) and total dry matter production (1.66 g plant^{-1}) were observed in panchagavya (O_1) drenched plot. This could be due to high photosynthetic rate inturn contributed maximum percentage of total dry matter. Similarly, panchagavya contains many macronutrients and micronutrients, vitamins, amino acids and growth promoting factors. The minimum plant hieght (26.31 cm), number of leaves per plant (14.32) and total dry matter production (1.45 g plant^{-1}) was observed in control (O_4). Similar results of increased plant height, number of leaves and dry matter production due to application of panchagavya and humic acid have been reported by Issac (2007) [7] in gladiolous, and Suresh *et al*. (2018) [21] in japanese mint. Application of 100% RD NPK *i.e.*, 50:40:40 kg ha^{-1} (F_1) showed significantly maximum plant height (31.53 cm), maximum number of leaves (17.48 plant^{-1}) and total dry matter production (2.18 g plant^{-1}) as compared to control. There was gradual increase in plant height, number of leaves and total dry matter production with increase in nutrient doses. It is evident that when there is more availability of nutrients, crop puts up better vegetative growth. Balashanmugam and Subramanian (1991) [1] also reported maximum plant height in turmeric with the application of higher doses of potassium. Higher NPK dose resulted in increase in vegetative growth parameters. These are in line with the findings of Somnath *et al.* (2005) [19], Hossain *et al.* (2007) [6] and Mastiholi (2008) [12] in medicinal coleus and Rahul *et al.* (2016) [13] in *Gloriosa superba*.

In the interaction of O_1F_1 recorded significantly maximum plant height (33.10cm) as compared to control (21.77 cm). There was no significant result with respect to number of leaves, however maximum leaves was reported in O_1F_1. The highest total dry matter production (2.30 g plant^{-1}) was observed in the treatment combination of O_1F_1 and it was on par with O_2F_1 (2.26 g plant^{-1}) at 60DAP. Increase in growth parameter might be due to fact that nutrient released from both inorganic and organic fertilizers would have resulted in the increased nutrient availability, ascribed to improvement in soil health and supplied both macro and micro nutrients, which in turn enhanced the translocation of photosynthates and improved vegetative growth attributes. The maximum increase in growth parameters might also be due to creation of environment by bio-formulations and inorganic around rhizosphere which helps in better availability and uptake of nutrients by plants. The results obtained are in agreement with the findings of Vastrad (1999) [22] in ginger, Somanath (2002) [18] in medicinal coleus, Joy *et al.* (2005) [9] in black musli and Sadashiv and Kattimani (2012) [14] and Sathiyaraj (2017) [15] in medicinal coleus.

The maximum fresh root yield (0.70 kg plot^{-1} and 33.42 q ha^{-1}, respectively) was recorded in panchagavya (O_1) drenched plot and the lowest was recorded in control. The dry root yield (0.125 kg plot^{-1} and 5.92 q ha^{-1}, respectively) was highest in the treatment of panchagavya (O_1). However, highest dry root yield per plot was on par with humic acid (O_2), and jeevamruta (O_3), whereas, highest dry root yield per hectare was on par with and humic acid (O_2). The increase yield in panchagavya might be due to higher growth and dry matter production in same treatment. Similar findings are also reported by Kanimozhi (2003) [10], Sathiyaraj, (2017) [15] in medicinal coleus and SenthilKumar and Ganesh (2019) [16] in tuberose. Among inorganic and organics, F_1 recorded significantly highest fresh root yield (0.74 kg plot^{-1} and 36.26 q ha^{-1}, respectively) and dry root yield (0.137 kg plot^{-1} and 6.33 q ha^{-1}). The increased yield in F_1 was mainly because of increased yield attributes and higher available nutrient that resulted from increased availability of nutrient in NPK interaction than control. The similar results are also presented by Harinkhede *et al.* (2005) [5] in safed musli, Joy *et al.* (2005) [9] in black musli, Sivasankar and Manivannan (2015) [17] in glorililly and Bijit (2016) [2] in sarpagandha,

The interaction effect of bio-formulations and inorganic and organic was found significant on fresh root yield. Significantly highest fresh root yield (0.81kg and 38.34q, respectively) was recorded in O_1F_1 and the lowest were recorded in O_4F_4. There was no significant effect due to interaction for dry root yield per plot and per hectare. However, maximum dry root yield was reported in O_1F_1. The increased trend in fresh and dry root yield might be due to increased photosynthetic rate as a result of highest vegetative growth observed in higher dose of nutrients. The increase in root yield might also due to the fact that organic bio-formulation along with inorganic improved the physical condition of soil and provided better condition for uptake of nutrients which lead to better growth of plant. These results are in conformity of Chauhan *et al.* (2005) [3] and Gaikwad *et al.* (2011) [4] in safed musli, Sudhakar (2005) [20] in coleus, Vijaya (2010) [23] in ashwagandha and Sivasankar and Mannivannan (2015) [17] in glorililly.

Table 1: Effect of integrated nutrient management on growth and total dry matter production of safed musli

Treatments	Plant height (cm)	Number of leaves per plant	Total dry matter production (g plant^{-1})
Bio-formulations (O)			
O_1	29.76	16.03	1.66
O_2	29.99	14.99	1.60
O_3	28.51	14.55	1.59
O_4	26.31	14.32	1.45
S Em±	0.12	0.21	0.02
CD (P=0.05)	0.39	0.71	0.05
Inorganic and organics (F)			
F_1	31.53	17.48	2.18
F_2	29.91	15.84	1.34
F_3	28.20	14.15	1.73
F_4	24.93	12.41	1.05
S Em±	0.12	0.21	0.02
CD (P=0.05)	0.39	0.71	0.05
Interactions (O x F)			
O_1F_1	33.10	19.07	2.30
O_1F_2	31.13	16.83	1.39
O_1F_3	28.55	15.20	1.84
O_1F_4	26.24	13.00	1.13
O_2F_1	32.03	17.53	2.26
O_2F_2	31.21	15.77	1.39
O_2F_3	29.90	14.00	1.63
O_2F_4	26.80	12.67	1.10
O_3F_1	31.23	17.33	2.15
O_3F_2	29.97	15.03	1.32
O_3F_3	27.93	13.40	1.81
O_3F_4	24.90	12.43	1.10
O_4F_1	29.75	16.00	2.01
O_4F_2	27.31	15.73	1.26
O_4F_3	26.40	14.00	1.64
O_4F_4	21.77	11.53	0.90
S Em±	0.27	0.49	0.04
CD (P=0.05)	0.77	NS	0.10

Bio-formulations (O) O_1= Panchagavya (3%) O_2= Humic acid (1%) O_3= Jeevamruta (5%) O_4= Control (No drenching)	Inorganic and organics (F) F_1: 100% RD NPK *i.e.*, 50:40:40 kg ha^{-1} F_2: 50% RD NPK (25:20:20 kg NPK ha^{-1}) F_3: 50% Rec. N through FYM (5 t ha^{-1}) + 50% of Rec. N through vermicompost (2.5 t ha^{-1}) F_4: Control NS: Non significant

Table 2: Influence of integrated nutrient management on fresh and dry root yield at harvest in safed musli.

Treatments	Fresh root yield (kg plot^{-1})	Dry root yield (kg plot^{-1})	Fresh root yield (q ha^{-1})	Dry root yield (q ha^{-1})
Bio-formulations (O)				
O_1	0.70	0.125	33.42	5.77
O_2	0.64	0.121	32.21	5.59
O_3	0.62	0.121	32.51	5.61
O_4	0.57	0.115	31.50	5.34
S Em±	0.01	0.001	0.22	0.06
CD (P=0.05)	0.03	0.004	0.75	0.20
Inorganic and organics (F)				
F_1	0.74	0.137	36.26	6.33
F_2	0.61	0.115	31.23	5.34
F_3	0.66	0.121	32.59	5.62
F_4	0.53	0.109	29.55	5.03
S Em±	0.01	0.001	0.22	0.06
CD (P=0.05)	0.03	0.004	0.75	0.20
Interactions (O x F)				
O_1F_1	0.81	0.145	38.34	6.71
O_1F_2	0.71	0.116	31.48	5.37
O_1F_3	0.73	0.126	33.60	5.82
O_1F_4	0.56	0.112	30.25	5.17
O_2F_1	0.74	0.137	36.28	6.35
O_2F_2	0.59	0.115	30.64	5.33

O_2F_3	0.69	0.121	32.22	5.60
O_2F_4	0.55	0.110	29.68	5.08
O_3F_1	0.72	0.137	36.39	6.34
O_3F_2	0.58	0.116	31.33	5.36
O_3F_3	0.64	0.122	32.55	5.64
O_3F_4	0.57	0.110	29.78	5.10
O_4F_1	0.70	0.128	34.01	5.91
O_4F_2	0.57	0.114	31.47	5.29
O_4F_3	0.59	0.117	32.00	5.40
O_4F_4	0.43	0.103	28.51	4.77
S Em±	0.02	0.003	0.52	0.14
CD (P=0.05)	0.06	NS	1.50	NS

Bio-formulations (O) O_1= Panchagavya (3%) O_2= Humic acid (1%) O_3= Jeevamruta (5%) O_4= Control (No drenching)	Inorganic and organics (F) F_1: 100% RD NPK *i.e.*, 50:40:40 kg ha^{-1} F_2: 50% RD NPK (25:20:20 kg NPK ha^{-1}) F_3: 50% Rec. N through FYM (5 t ha^{-1}) + 50% of Rec. N through vermicompost (2.5 t ha^{-1}) F_4: Control NS: Non significant

References

1. Balashanmugam PV, Subramanian KS. Effect of split application of potassium on turmeric. South Indian Hort. 1991; 39(3):139-142.
2. Bijit KS. Effect of INM practices in *Rauwolfia tetraphylla* in Assam condition. Hort. Flora Research Spectrum. 2016; 5(3):238-241.
3. Chauhan HS, Singh A, Singh HP, Singh AK, Chattopadhyay A, Ra Kumari. Influence of FYM and NPK fertilizers on growth and yield of safed musli (*Chlorophytum borivilianum*) production. J Med. Aromatic Pl. Sci. 2005; 27(2):280-282.
4. Gaikwad VP, Patel JJ, Bhosale ND, Shinde VT. Effect of bulky and concentrated organic manures yield and economics of safed musli (*Chlorophytum borivillianum*, sant. and fern.). International Journal of Forestry and International Forestry Crop Improvement. 2011; 2(2):211-212.
5. Harinkhede DK, Tripathi RK, Khare AK. Effect of organic and inorganic sources of nutrients on growth and root yield of safed musli (*Chlorophytum borivillianum* L.). Vaniki Sandesh. 2005; 29(4):24-26.
6. Hossain KL, Wadud MA, Kashem E, Santosa MS Ali. Effect of different nitrogen and potassium rates on agronomic characters of Aloe indica. Bul. Agron. 2007; 35(1):58-62.
7. Issac S. Studies on influence of growth regulators and bio-inoculants on breaking dormancy and prolonging viability in gladiolus (*Gladiolus grandiflorus*) seed corm's, *M. Sc. (Hort) thesis*, Univ, Agri, Sci., Bangalore (India), 2007.
8. Jat RS, Nagaraja Reddy, Ruchi Bansal, Manivel P. Good agricultural practices for saffed musli. Extension bulletetin, ICAR – Directorate of Medicinal and Aromatic Plants Research Boriavi, Anand, Gujarat, 2015, 1-10.
9. Joy PP, Savithri KV, Samuel MJ, Kochurani K. Effect of sole and combined application of FYM and fertilizer on growth, yield and quality of black musli (*Curculig orchioides*). J Med. Arom. Plant. Sci. 2005; 27:454- 461.
10. Kanimozhi S. Organic production package of *Coleus forskohlii*. *M.Sc. (Hort.) Thesis*, Horticultural College and Research Institute, Tamil Nadu Agric. Univ., Coimbatore (India), 2003.
11. Kothari SK, Singh K. Production techniques for the cultivation of safed musli (*Chlorophytum borivilianum*). J Hort. Sci. Biotechnol. 2003; 78(2):261-264.
12. Mastiholi AB. Effect of spacing, time of harvest and NPK levels on growth, yield and quality of medicial coleus (*Coleus forskohlii* Briq.) under irrigated condition. *Ph. D. (Hort.) Thesis*, University of Agricultural Sciences, Dhawad (India), 2008.
13. Rahul SP, Laxminarayan Hegde, Vijay kumar, Narayanpur Hegde NK. Effect of nutrient doses on growth, seed yield and tuber yield of glory lily (*Gloriosa superba* L.). Res. Environ. Life Sci. 2016; 9(5):634-636.
14. Sadashiv N, Kattimani KN. Integrated nutrient management in coleus (*Coleus forskohlii*), Karnataka J Agric. Sci. 2012; 25(3):407-408.
15. Sathiyaraj. Integrated Nutrient Management Combination with Biofertilizers and Plant Growth Substances on yield and quality of medicinal coleus (*Coleus forskohlii* Briq.). Int. J Curr. Microbiol. App. Sci. 2017; 6(11): 3329-3339.
16. Senthil Kumar S, Ganesh S. Influence of fertigation and consortium of biological sources on growth and flower yield of tuberose (*Polianthes tuberosa* L.) cv. 'Prajwal'. International Journal of Chemical Studies. 2019; 7(1):2494-2497.
17. Sivasankar S, Manivannan K. Effect of integrated nutrient management (INM) on growth and yield of glory lily (*Gloriosa superb* L.). Int. J Curr. Adv. Res. 2015; 4(8):275-277.
18. Somanath S. Effect of FYM, fertilizers (NPK) and sources of potassium on growth, yield and quality in *Coleus forskohlii* Briq. *M.Sc. (Hort.) Thesis*, University of Agricultural Sciences, Bangalore, Karnataka (India), 2002.
19. Somnath S, Bhaskar S, Sreenivasmurthy CA. Influence of FYM, inorganic Fertilizer (NPK) and sources of potassium on yield of Coleus forskohlii. J Med. Arom. Plant Sci. 2005; 27:16-19.
20. Sudhakar DH. Standardization of organic farming practices in coleus (*Coleus forskohlii* Benth). *M.Sc. (Hort.) Thesis*, Univ. Agril. Sci., Bengaluru (India), 2005.
21. Suresh VJ, Preethi F, Saranya V, Sarithra S, Tamilselvan K. Effect of FYM, coirpith, vermicompost, humic acid and panchagavya on growth and yield of mint (*Mentha arvensis*). Horticult. Int. J. 2018; 2(6):417-419.
22. Vastrad N. Effect of light intensity and vermicompost on crop production and micro propagation in ginger (*Zingiber offinale*). *M.Sc. (Ag.) Thesis*, University of Agricultural Sciences, Dharwad, Karnataka (India), 1999.
23. Vijaya N. Effect of organic manures and inorganic fertilizer on growth and root yield of ashwagandha (*Withania somnifera*). *M. Sc. (Hort.), Thesis*, Univ. Agric. Sci., Dharwad (India), 2010.