International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2020; 8(1): 12-14

Received: 09-11-2019
Accepted: 13-12-2019

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Influence of growing condition and integrated nutrient management on growth and yield of patchouli

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DOI: https://doi.org/10.22271/chemi.2020.v8.i1a.8298

Abstract
An investigation on "Effect of growing condition and integrated nutrient management on growth and yield of patchouli" was carried out at college of Horticulture Sirsi. The experiment was conducted in open and natural shade of forest trees. The result revealed that plants grown under open condition recorded the maximum plant height, number of branches, plant spread and fresh herb yield. The highest fresh herbage yield was recorded when the crop was supplied with N: P: K @ 150:50:50 kg ha^{-1} + FYM @ 12 t ha^{-1} + *Pseudomonas fluorescens* + *Glomus fasciculatum* + foliar spray of panchagavya.

Keywords: Growth, yield, FYM, NPK

Introduction
Patchouli is native to the Philippines and is now cultivated on a commercial scale in Indonesia, Malaysia, China, Brazil and India. Oil of patchouli is obtained by steam distillation of shade dried herbage. The oil has a strong fixative property and is known to improve tenacity. The first attempt to introduce patchouli to India was made in Madhya Pradesh about 60 years back. Later systematic studies on development of agro technology of this crop were initiated in 1962 by CIMAP in Bangalore. Currently, only meagre quantities of patchouli oil is produced in India, the bulk oil requirement is met by imports.

The growth, yield and quality in any crop depend on several factors. The major factors are varietal characters, properties of the soil, nutrient uptake by plants, spacing, growing condition, method of harvesting and post harvest technology which in turn influence the essential oil content and yield in several aromatic crops. Therefore, it is necessary to adopt the improved cultivation practices and supplementing the crop with optimum nutrition to maintain the overall balance, resulting in maximum efficiency for yield and oil content. Keeping in view of above facts, the present investigation was undertaken to standardize integrated nutrient management along with improvement of herbage yield through growing in different environmental conditions.

Material and Methods
The experiment was conducted in open and *betta* land. Under *betta* land condition the crop was grown under the partial shade of forest trees. The experiment was laid out as Split plot design with three replications.

Main plot (M): Growing condition (M_1 and M_2), M_1: Open area, M_2: Natural shade (*Betta* land)

Subplot treatments *
T_1: Control: N:P:K (150:50:50 kg ha^{-1}) + FYM (12 t ha^{-1})
T_2: T_1+ PGPR (*Pseudomonas fluorescens*)
T_3: T_1+ *Azospirillum*
T_4: T_1 + PSB (*Pseudomonas striata*)
T_5: T_1 + VAM (*Glomus fasciculatum*)

T_6: T_1 + PGPR (*Pseudomonas fluorescens*) + VAM (*Glomus fasciculatum*) + foliar spray of panchagavya (3%)
T_7: T_1+PGPR (*Pseudomonas fluorescens*) + VAM (*Glomus fasciculatum*) + foliar spray of vermiwash (10%).
T_8: T_1 + Dolomite (5 q ha^{-1})
T_9: T_1 + Neem cake (10 q ha^{-1})
* Biofertilizers were used @ 5 kg ha^{-1}

Observation recorded

Observations were recorded on various growth parameters. Five plants in each plot excluding border rows were selected at random. The selected plants were tagged for recording the observations. The height of the plant was measured from the ground level to the tip of the plant with the help of meter scale and the average value of five plants was computed and was expressed in centimeter (cm). The East- West and North-South spread of the plants was recorded with the help of meter scale. The total number of branches per plant was counted and recorded from the tagged plants. The fresh herbage yield was recorded in each plot at the time of harvest. Then fresh yield per hectare was estimated on the basis of fresh herbage yield per plot.

Harvesting was done when the characteristic patchouli alcohol smell was noticed and before the oldest leaves started turning yellow. Top portion of entire plant was cut at 20-25 cm above ground level.

Result and Discussion

At harvest significantly higher plant height was recorded in open condition (55.65 cm) compared to natural shade (51.70 cm). Plants grown under open situation received higher PAR resulting in increased plant height. Low light intensity inhibits the plant growth by affecting the gas exchange. The results obtained are in agreement with the findings of Gregorious *et al*. (2007) [4] in olive and Kumar *et al*. (2014) [5] in marigold. Nutrition treatment had significant influence on plant height. At harvest treatment T_6 recorded higher values for plant height (64.61 cm) and was found to be on par with T_7. Increase in plant height could be attributed to the effective utilization of *Glomus fasciculatum* that enhanced availability of nutrients along with the production of some growth promoting substances, which might have caused cell elongation and multiplication. *P. fluorescens* helps in suppression of plant pathogenic microbes and production of growth stimulating plant harmones. Panchagavya contains the favourable macro and micro nutrients, growth hormones and bio fertilizers which enhanced the plant height. Similar results were also reported by Singh *et al*. (2012) [7] and Sumathi *et al*. (2012) [8] in patchouli.

Higher number of branches during growth of main crop was observed under open condition (27.01) compared to natural shade (14.87). The decrease in number of branches under shaded condition might be attributed to lower PAR under natural shade reduced the uptake of nutrients leading to reduction in number of branches per plant. Kumar *et al*. (2014) [5] in marigold observed that number of branches per plant decreased with increasing shading. Nutrition treatment also showed significant influence on number of branches per plant at all the stages of growth. The maximum number of branches per plant (27.23) was recorded in treatment T_6 and the minimum (14.93) was observed in T_1 at harvest. The production of higher number of branches might be due to the fact that release of bio-active substances which help in breaking the apical dominance and also division of cells which accelerate the branch production. Panchagavya contains growth enzymes (Auxins) which might have favoured rapid cell division and multiplication leading to increased number of branches per plant.

The plants grown under open condition (M_1) recorded significantly increased plant spread. This might be due to the better interception of the PAR under open condition produced the higher number of branches and leaves which in turn have increased the plant spread. Significantly higher plant spread was recorded when the crop was supplied with N: P: K @ 150:50:50 kg ha^{-1} + FYM @ 12 t ha^{-1} + *Pseudomonas fluorescens* + *Glomus fasciculatum* + foliar spray of panchagavya (3%). VAM application increased the availability of nutrient elements and higher water uptake leads to increased plant growth (Christopher *et al*., 1994) [2]. The auxin content in panchagavya leads to the activation of cell division and cell elongation in the auxiliary buds which had a promoting effect in increasing plant spread.

Higher fresh herbage yield per hectare (16.39 t) was observed in M_1 (Open condition) compared to natural shade (7.20 t). The increase in yield under open condition may be attributed to the fact that PAR affects photosynthesis which in turn is related to vigorous vegetative growth and accumulation of biomass with modified plant physiology and higher photosynthetic capacity (Devkota and Jha, 2010) [3]. Among nutrition treatments, the maximum fresh herbage yield per hectare (18.01 t) was recorded in T_6. The reason for the increased fresh herbage yield might be due to higher root colonization in plants inoculation with AM fungi and *P. fluorescens* with increased solubilization of mineral phosphate and contribute to biogeochemical P cycling, thus promoting a sustainable nutrient supply to the crop for higher yield. Similar results were observed by Padmapriya *et al*. (2010) [6] in *Gymnema sylvestre*, Anuja and Jayasri (2011) [1] in sweet basil under Tamil Nadu condition, Suresh and Senthinathan (2018) [9] in *Solanum trilobatum*.

Table 1: Effect of growing condition and integrated nutrient management on plant height, number of branches and plant spread (N-S) in patchouli at harvest.

Growing condition / Nutrition treatment	Plant height (cm)			Number of branches			Plant spread (N-S)		
	M_1	M_2	Mean	M_1	M_2	Mean	M_1	M_2	Mean
T_1	43.62	38.60	41.11	19.07	10.80	14.93	44.00	29.21	36.61
T_2	62.48	60.16	61.32	29.20	15.13	22.17	54.50	47.49	51.00
T_3	53.17	52.75	52.96	26.40	15.20	20.80	53.99	44.17	49.08
T_4	51.16	49.32	50.24	26.20	15.27	20.73	52.96	45.67	49.31
T_5	59.67	57.58	58.62	31.13	13.80	22.47	53.16	44.81	48.99
T_6	69.22	60.01	64.61	34.20	20.27	27.23	62.05	54.47	58.26
T_7	66.06	58.20	62.13	31.78	17.07	24.42	58.93	50.05	54.49
T_8	47.39	43.85	45.62	20.80	13.33	17.07	44.33	40.16	42.25
T_9	48.05	44.87	46.46	24.27	13.00	18.63	46.53	43.62	45.08

Mean	55.65	51.70		27.01	14.87		52.27	44.41	
For comparing means of									
	S. Em ±	CD at 5 %	CV (%)	S. Em ±	CD at 5 %	CV (%)	S. Em ±	CD at 5 %	CV (%)
Growing condition (M)	0.45	2.74	4.36	0.52	3.15	12.86	0.83	5.07	8.95
INM (T)	0.96	2.77	4.39	0.71	2.04	8.28	1.13	3.25	5.72
T at same level of M	1.36	3.92		1.00	2.88		1.60	4.60	
M at same or different level of T	0.90	4.28		0.87	3.67		1.40	5.87	

Table 2: Effect of growing condition and integrated nutrient management on plant spread (E-W) and yield in patchouli at harvest.

Growing condition / Nutrition treatment	Plant spread (E-W)			Fresh herbage yield (t/ha)		
	M_1	**M_2**	**Mean**	**M_1**	**M_2**	**Mean**
T_1	41.43	33.24	37.34	7.63	3.38	5.50
T_2	58.60	48.00	53.30	20.41	8.76	14.58
T_3	57.88	45.65	51.77	16.70	7.26	11.98
T_4	54.97	46.03	50.50	14.37	6.32	10.35
T_5	56.40	44.21	50.31	18.43	7.77	13.10
T_6	66.46	53.40	59.93	24.14	11.88	18.01
T_7	62.60	49.63	56.12	20.93	9.74	15.34
T_8	45.95	40.13	43.04	11.80	4.50	8.15
T_9	44.17	42.07	43.12	13.09	5.19	9.14
Mean	54.27	44.71		16.39	7.20	
For comparing means of						
	S. Em ±	CD at 5 %	CV (%)	S. Em ±	CD at 5 %	CV (%)
Growing condition (M)	0.98	5.94	10.24	0.19	1.16	8.41
INM (T)	1.22	3.51	6.03	0.46	1.33	9.59
T at same level of M	1.72	4.97		0.65	1.88	
M at same or different level of T	1.60	6.58		0.41	1.99	

References

1. Anuja S, Jayasri P. Effect of soil and foliar application of organic nutrients on NPK uptake, herbage yield and inflorescence yield of sweet basil (*Ocimum basilicum* L.). The Asian Journal of Horticulture. 2011; 6(1): 195-198.
2. Christopher C, Rangaraju, Krishna PK. Importance of VAM. Intensive Agriculture. 1994; May – June: 23-25.
3. Devkota A, Jha PK. Effect of different light levels on the growth traits and yield of *Centella asiatica*. Middle East Journal of Scientific Research. 2010; 5(4): 226-230.
4. Gregorious K, Pontikis K, Vemmos S. Effects of reduced irradiance on leaf morphology, photosynthetic capacity and fruit yield in olive (*Olea europaea* L.). Photosynthetica. 2007; 5: 172-181.
5. Kumar R, Sharma S, Ramesh K, Pathania V, Prasad R. Irradiance stress and plant spacing effect on growth, biomass and quality of wild marigold (*Tagetes mi*nuta L.) an industrial crop in western Himalaya. Journal of Essential Oil Research. 2014; 1-13.
6. Padmapriya S, Kumanan K, Rajamani K. Studies on effect of organic amendments and bio-stimulants on morphology, yield and quality of *Gymnema sylvestre*. African Journal of Agricultural Research. 2010; 5(13):1655-1661.
7. Singh R, Divya S, Awasthi A, Kalra A. Technology for efficient and successful delivery of vermicompost colonized bioinoculants in *Pogostemon cablin* Benth. World Journal of Microbiology and Biotechnology. 2012; 28(1):323-333.
8. Sumathi M, Shashekala SG, Shankaraiah N, Kumar RP, Kavitha V. Effect of nitrogen and vam levels on herbage and oil yield of patchouli (*Pogostemon patchouli* Pellet.). International Journal of Advanced Biological Research. 2012; 2(3):403-411.
9. Suresh V, Senthinathan R. Integrated nutrient management on growth and yield of thuduvalai (*Solanum trilobatum* L.). Journal of Medicinal Plant Studies. 2018; 6(3):01-03.