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Effect of Organic manures and Inorganic fertilizers on nutrient uptake and economics of sweet basil (*Ocimum basilicum* L.)

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ABSTRACT

An experiment was carried out during early summer season of 2019 to study the effect of organic manures and inorganic fertilizers on nutrient uptake and economics of sweet basil (Ocimum basilicum L.). The research was conducted in completely randomized block design with ten treatments in three replications. The treatments consists the different levels of RDN through organic manures and inorganic fertilizers in combination and in alone. Results showed that organic manures and inorganic fertilizers had significant effect on nutrient uptake and economic growth and yield parameters of sweet basil. The treatment T_8- 50% RDN through urea + 50% RDN through poultry manure recorded the maximum nitrogen uptake of nitrogen (100.34 kg/ha), phosphorous (27.76 kg/ha), potassium (108.46 kg/ha) and where as T9 i.e. 25% RDN through FYM + 25% RDN through vermicompost + 25% RDN through neem cake + 25% RDN through poultry manure had the highest nutrient availability of nitrogen (170.30 kg/ha), phosphorus (42.92 kg/ha) and potassium (165.75 kg/ha).

Key words: *Sweet basil, Organic manures, Inorganic fertilizers, nutrient uptake and economics.*

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INTRODUCTION

The essential oils and perfumes play a very important role in many ways in the life of people of India since time immemorial. The ancient literature of almost all countries have full of references to the fragrances and even today. By virtue of a wide variety of soil, climate and altitude, India is one of the few countries in the world ideally suited for the cultivation of large number of essential oil bearing plants [1]. Sweet basil (*Ocimum basilicum* L.) is one of the important oil producing aromatic plant of lamiaceae family and native to tropical regions from central Africa to Southeast Asia.

Environmental pollution due to excessive application of chemical fertilizers is one of the most important environmental and social concerns throughout the world especially in developing countries. In response to this concern, there is a worldwide concerted effort to use green manuring, legumes and organic manures alone or in combination of chemical fertilizers to produce the same amount of food with less inorganic fertilizer [15]. The contribution of poultry manure was an improvement not only for the conditions of fertilization due to additional source of organic water and nutrients but also for the soil microorganisms which had a stimulating effect on microbial activity [2].

Continuous use of chemical fertilizers leads to worsening in soil chemical, physical, and biological properties, and soil health. The harmful impacts of chemical fertilizers, coupled

with escalating prices, have led to escalating interests in the use of organic fertilizers as a source of nutrients [3].

Organic materials such as vermicompost, FYM, poultry manure and neem cake, these supplies all major nutrients (N, P, K, Ca, Mg, S,) indispensable for plant growth, as well as micronutrients (Fe, Mn, Cu and Zn). Farmyard manures improve soil properties through increasing moisture-holding capacity [4] and positively modulate soil chemical properties by lowering pH whereas increasing C/N ratio, cation exchange capacity hence facilitate ion uptake by plant roots [5]. Likewise, organic manures contain a high level of relatively available nutrients which stimulate plant growth and improve soil structure and biodiversity [6, 15-17]. Basil is a high nutrient demanding plant, so, its yield is dependent on the quality and quantity of soil fertilization. Continuous usage of inorganic fertilizer affects soil structure. Hence, organic manures can serve as an alternative to mineral fertilizers for improving soil structure [7] and microbial biomass [8, 14].

In present study, some organic manures along with inorganic fertilizers were compared with chemical fertilizer application on nutrient uptake by plant and nutrient availability in soil of sweet basil crop.

MATERIAL AND METHODS

This study was conducted in the experimental field at College of Horticulture Venkataramannagudem, Andhra Pradesh from January to April of 2019 with ten treatments of experiment *Viz.*, T_1 (75% RDN through urea + 25% RDN through FYM), T_2 (75% RDN through urea + 25% RDN through vermicompost), T_3 (75% RDN through urea + 25% RDN through neem cake), T_4 (75% RDN through urea + 25% RDN through poultry manure), T_5 (50% RDN through urea + 50% RDN through FYM), T_6 (50% RDN through urea + 50% RDN through vermicompost), T_7 (50% RDN through urea + 50% RDN through neem cake), T_8 (50% RDN through urea + 50% RDN through poultry manure) T_9 (25% RDN through FYM + 25% RDN through vermicompost + 25% RDN through neem cake + 25% RDN through poultry manure) and T_{10} (100% RDF (control) (125:75:60 NPK kg/ha). Treatments were replicated thrice in a randomized complete blocks design. Physical and chemical properties of the initial experimental soil are presented in (Table 1). Organic manures were applied by broadcasting uniformly in individual plots as per the treatment before one month of transplanting. The inorganic NPK nutrients were supplied in the form of straight fertilizers like urea (125 kg N ha^{-1}), single super phosphate (75 kg P_2O_5 ha^{-1}) and muriate of potash (60 kg K_2O ha^{-1}). One fourth of N and the entire dose of K_2O and P_2O_5 were applied as basal application. The remaining dose of $3/4^{th}$ nitrogen was applied in two equal splits at 25 and 50 days after transplanting.

Table 1. Physical and chemical properties of soil of experimental site before planting sweet basil crop

Properties	Value
A. Physical composition	
Sand (%)	70
Silt (%)	20
Clay (%)	10
Textural class	Red Sandy loam
B. Chemical composition	
Soil pH	7.12
Organic carbon (%)	0.29
Electrical conductivity (dS/m)	0.3
Available Nitrogen (kg/ha)	143
Available Phosphorus (kg/ha)	20
Available Potassium (kg/ha)	160

Each experimental plot size was 2.7 m long and 1.8 m wide with spacing of 30 cm between the plants and 45 cm between the rows. There was a space of 30 cm between the plots and 60 cm between replications. Basil variety Cim- Saumya (CIMAP) was sown in plug trays

with 99 cells. The plug trays were filled with a mixture of coco peat, vermiculite and perlite were used in 2:1:1 ratio. Thirty five days old healthy and uniformly rooted seedlings of sweet basil were transplanted to the field. Weeding was done manually and flood irrigation was given in intervals of 3-4 days and subsequently irrigation was given depending on the soil moisture condition. The crop was harvested at ground level during the last week of April 2019. Fresh weight from each plot was converted to per hectare and it was expressed in tones (t). Dried plant samples were ground to a fine powder and analyzed for determination of total nutrients content by adopting standard methods. The total nitrogen (%) was determined by Micro- kjeldhal method as outlined by Piper [12], total phosphorus (%) was estimated by Olsen's method [10] using spectrophotometer. Total potassium was estimated from di-acid extract by using flame photometer [9].

Total plant nutrient uptake was calculated by following the equation:

$$\text{Nutrient uptake (kg/ha)} = \frac{\text{Dry matter yield (kg/ha)} \times \text{nutrient content (\%)}}{100}$$

Gross income, net income, benefit cost ratio were also calculated as per the formulas given below.

Gross income

Gross income was calculated based on the prevailing market price of the produce.

Net income

The net income per hectare was calculated on the basis of gross income and cost of cultivation per hectare as follows:

Net income = Gross income - Cost of cultivation

Benefit: Cost ratio

The benefit: cost ratio was worked out using the following formula:

$$\text{Benefit: Cost ratio} = \frac{\text{Gross income (Rs/ha)}}{\text{Total costs of cultivation (Rs/ha)}}$$

Statistical Analysis

The data was analysed as per ANOVA outlined by Panse and Sukhatme [11]. Statistical significance was tested by 'F' value at 5 per cent level of significance. The critical difference at 0.05 levels was worked out for the effects which were significant.

RESULTS AND DISCUSSION

Nutrient uptake

The data on the nutrient uptake by the plants presented in Table 2. The maximum nitrogen (100.34 kg/ha), phosphorous (27.76 kg/ha) and potassium (108.46 kg/ha) uptake by the plant was recorded in T_8 *i.e.* 50% RDN through urea + 50% RDN through poultry manure followed by T_7 *i.e.* 50% RDN through urea + 50% RDN through neem cake and these were on par with each other, whereas T_9 *i.e.* the application of 25% RDN through FYM + 25% RDN through vermicompost + 25% RDN through neem cake + 25% RDN through poultry manure recorded the lowest uptake of nitrogen (60.50 kg/ha) and phosphorous (12.08 kg/ha) and minimum uptake of potassium observed by T_1 *i.e.* 75% RDN through urea + 25% RDN through FYM (52.36 kg/ha).

Significant difference were observed in nutrient uptake (N, P, and K) by the plant among the treatments may be due readily available nutrients from chemical fertilizers at initial growth and continuous availability of nutrients from organic manures at later growth stage by decomposition of organic manures is accompanied by the release of appreciable quantities of CO_2, which get dissolved in water to form carbonic acid. Carbonic acid is capable of decomposition of certain primary minerals and release of certain nutrients which favors nutrient uptake by plant and these findings are in accordance with earlier results of Vennila and Jayanthi [18] in coleus, Ahmad *et al.* [1] in marjoram and Choudhary *et al.* [4] in fenugreek, the highest N and P uptake noticed by the plants grown with 50% RDN through poultry manure + 50% RDN through inorganic fertilizers, Shivanna *et al.* [14] in kalmegh.

Nutrient availability

Data presented in the Table 2 revealed that the highest available of nitrogen (170.30 kg/ha), phosphorous (42.92 kg/ha) and potassium (165.75 kg/ha) in the soil after harvest

the crop was recorded in T_9 *i.e.* 25% RDN through FYM + 25% RDN through vermicompost + 25% RDN through neem cake + 25% RDN through poultry manure followed by 75% RDN through urea + 25% RDN through FYM (T_1) followed by T_3 *i.e.* 75% RDN through urea + 25% RDN through FYM. The least nitrogen (144.56 kg/ha) and phosphorous (24.88 kg/ha) availability was recorded in the soil applied with 100% RDF (125:75:60 NPK kg/ha) (T_{10}) and the lowest potassium (105.54 kg/ha) available at T_9 *i.e.*50% RDN through urea + 50% RDN through poultry manure. The higher nutrients (NPK) available in T_9 treatment was attributed to the slow mineralization of the nutrients and less leaching effect of nutrients from organic manures.

Economics

Gross returns, net returns and benefit cost ratio was worked out for the entire organic manures and inorganic fertilizers management practices taking into consideration of the inputs used for crop production and the crop produce (economic yield) (Table 3).

Total cost of cultivation (Rs/ha)

The data on total cost of cultivation of french basil by using organic manures and inorganic fertilizers are furnished in Table 3 and the data revealed that the maximum cost of cultivation (Rs. 90945.9) was recorded in treatment 50% RDN through urea + 50% RDN through neem cake (T_7) followed by 25% RDN through FYM + 25% RDN through vermicompost + 25% RDN through neem cake + 25% RDN through poultry manure (RS. 90810.7), while the minimum (Rs.70623.02) cost of cultivation was registered with 75% RDN through urea + 25% RDN through poultry manure (T_4).

Gross returns (Rs/ha)

The data on gross returns of cultivation of french basil by organic manures and inorganic fertilizers revealed that the highest gross income obtained by T_8 treatment *i.e.* application of 50% RDN through urea + 50% RDN through poultry manure (Rs.168518/ha) followed by T_7 *i.e.* application of 50% RDN through urea + 50% RDN through neem cake (Rs.162591/ha), while the lowest was recorded in T_1 *i.e.* application of 75% RDN through urea + 25% RDN through FYM (Rs. 121345/ha).

Net returns (Rs/ha)

The data regarded to the net returns of cultivation of French basil by organic manures and inorganic fertilizers showed that the highest net returns (Rs. 94872.18) obtained by T_8 *i.e.* application of 50% RDN through urea + 50% RDN through poultry manure followed by plants supplied with 100% RDF (125:75:60 NPK/ha) (T_{10}) Rs. 860371/ha while T_9 *i.e.* application of 25% RDN FYM + 25% RDN through vermicompost + 25% RDN through neem cake + 25% RDN through poultry manure incurred the lowest net returns (Rs. 45555.96/ha).

Benefit: cost ratio

The data on benefit cost ratio was indicated that among the different treatments studied in this investigation, the highest benefit cost ratio was recorded in T_8 application of 50% RDN through urea + 50% RDN through poultry manure (2.29) fallowed by T_4 *i.e.* 100% RDF (125:75:60 NPK/ha) (2.09) and the least benefit cost ratio (1.50) was found in T_9 *i.e.* 25% RDN through FYM + 25% RDN through vermicompost + 25% RDN through neem cake + 25% RDN through poultry manure. The higher benefit cost ratio of T_8 treatment was due to the lower cost of poultry manure compared to neem cake, vermicompost and FYM. Similar results were obtained by Patel *et al.* [12] in safed musali.

Table 2. Effect of organic manures and inorganic fertilizers on oil yield, nutrient uptake and nutrient availability in the soil of sweet basil (*Ocimum basilicum* L.)

Treatments	Nutrient uptake (kg/ha)			Nutrient availability (kg/ha)		
	N	P	K	N	P	K
T_1	65.30	15.47	52.36	160.65	33.84	145.65
T_2	68.03	15.47	60.24	164.20	33.52	140.76
T_3	71.99	16.74	66.60	165.00	31.26	138.40
T_4	79.95	17.60	70.45	160.40	30.39	135.55
T_5	75.40	21.59	84.29	157.43	28.40	118.71
T_6	82.00	24.39	103.33	154.47	28.60	112.66
T_7	90.42	25.11	106.89	146.45	26.89	108.11
T_8	100.34	27.76	108.46	144.67	25.23	105.54
T_9	60.50	12.08	60.23	170.30	42.92	165.75
T_{10}	70.00	18.11	81.24	144.56	24.88	130.76
S. Em ±	**3.64**	**1.42**	**4.42**	**3.64**	**2.23**	**4.25**
C D @ 0.05	**10.83**	**4.23**	**13.13**	**10.83**	**6.63**	**12.62**

Table 3. Effect of organic manures and inorganic fertilizers on economics of sweet basil (*Ocimum basilicum* L.)

Treatments	Total cost of cultivation (Rs/ha)	Gross return (Rs/ha)	Net returns (Rs/ha)	Benefit cost ratio (B:C ratio)
T_1	74193.4	121345	47151.64	1.64
T_2	75137.0	136949	61812.29	1.82
T_3	79552.1	146734	67182.32	1.84
T_4	70623.0	147878	77254.84	2.09
T_5	86394.6	152370	65975.47	1.76
T_6	83018.3	150891	67872.51	1.82
T_7	90945.9	162591	71645.32	1.79
T_8	73645.3	168518	94872.18	2.29
T_9	90810.7	136367	45555.96	1.50
T_{10}	72259.0	158297	86037.82	1.64

CONCLUSION

The outcome of the present investigation revealed that among the different combination of organic manures and inorganic fertilizers significantly maximum nitrogen, phosphorous, potassium uptake and the highest B: C ratio was obtained with application of 50% RDN through urea + 50% RDN through poultry manure. Hence, the incorporation of 50% of recommended N through urea and the remaining fifty per cent recommended N through poultry manure may be suggested for basil crop to obtain higher benefit cost ratio of sweet basil. Also revealed that application of organic manure improve the nutrient availability as like 25% RDN through FYM + 25% RDN through vermicompost + 25% RDN through neem cake + 25% RDN through poultry manure due to slow mineralization of the nutrients and less leaching effect of nutrients from organic manures.

REFERENCES

1. Ahmad, H., Al-Fraihat., Sati, Y.A., Al-dalain., Ziad, B., Al-Rawashdeh., Mohammad, S., Abu-Darwish., Jalal, A. and Al-Tabbal. (2011). Effect of organic and biofertilizers on growth, herb yield and volatile oil of marjoram plant grown in Ajloun region, Jordan. *Journal of Medicinal Plants Research.* 5(13): 2822-33.
2. Birkhofer, K., Bezemer, T.M., Bloem, J., Bonkowski, M., Christensen, S., Dubois, D., Ekelund, F., Fliessbach, A., Gunst, L., Hedlund, K., Mader, P., Mikola, J., Robin, C., Setala, H., Tatin-Froux, F., Vander, P.W.H. and Scheu, S. (2008). Long-term organic farming fosters below and aboveground biota: implications for soil quality, biological control and productivity. *Soil Biology and Biochemistry.* 40(9): 2297–308.

3. voungyeul, R., Jeonasil, L., Ryun, B.Y. and Lee, J.S. (1996). Property changes in mixed media for pot flower made of several organic materials. *Journal of the Korean Society for Horticultural Sciences*. 218: 291-94.
4. Choudhary, B.R., Gupta, A.K., Parihar, C.M., Jat, S.L. and Singh, D.K. (2011). Effect of integrated nutrient management on fenugreek (*Trigonella foenum graecum*) and its residual effect on fodder pearl millet (*Pennisetum glaucum*). *Indian Journal of Agronomy*. 56(3): 189-95.
5. Dauda, S.N., Ajayi, F.A. and Ndor, E. (2008). Growth and yield of water melon (*Citrullus lanatus*) as affected by poultry manure application. *Journal of Agriculture and Social Sciences*. 4: 121-24.
6. Delgado, M., Rodriguez, C., Martin, J.V., Imperial, R.M., Alonso, F. (2012). Environmental assay on the effect of poultry manure application on soil organisms in agroecosystems. *Science of the Total Environment,* 416:532–35.
7. Mayyard, A.A. (1994). Protecting ground water while recycling nutrients. *Biocycle*. 5: 35-40.
8. Meena, K.B., Alam, M.S., Singh, H., Bhat, M.A., Singh, A.K., Mishra, A.K. and Thomas, T. (2018). Influence of farmyard manure and fertilizers on soil properties and yield and nutrient uptake of wheat. *International Journal of Chemical Studies,* 6(3): 386-90.
9. Muhr, G.R. (1965). *Soil testing in India,* USAID, New Delhi. 120.
10. Olsen, S.R. Cole, C.V. Watanabe, F.S. and Dean, L.A. (1965). Estimation of available phosphorus in soils by extraction with $NaHCO_3$. Cir. *United States Depatment of Agriculture*. 939.
11. Panse, V.G. and Sukhtame, P.V. (1985). Statistical methods for agricultural workers. ICAR, New Delhi.
12. Patel, D.H., Upadhyay, N.V., Patel, M.A., Macwan, S.J. and Sriram, S. (2008). Effect of organic manures and spacing on fasciculated root yield of safed musli (*Chloropyutum borivillianum*). *Indian Journal of Agricultural Sciences.* 42(1): 31-36.
13. Piper, C.S. (1966). Soil and plant analysis (Asian Edition). *Hans Publishers, Bombay,* India.
14. Shivanna, S.G., Ramesh, G. and Santaram, A. (2011). Interactive influence of organic manures and inorganic fertilizers on growth and yield of kalmegh. (*Andrographis paniculata* Nees.). *International Research Journal of Plant Science*. 2(1): 16-21.
15. Singh, K., Chand, S. and Yaseen, M. (2014). Integrated nutrient management in Indian basil (*Ocimum basilicum*). *Industrial Crops and Products.* 55: 225–29.
16. Sundaresh, I. (1982). India's position in the world trade of essential oils and future export possibilities. *Indian Perfumer.* 26(2-3): 167-82.
17. Suresh, K.D., Sneh, G., Krishn, K.K. and Mool, C.M. (2004). Microbial biomass carbon and microbial activities of soils receiving chemical fertilizers and organic amendments. *Archives of agronomy and soil science.* 50: 641-47.
18. Vennila, C. and Jayanthi, C. (2008). Nutrient use pattern and available nutrient balance as influenced by sources of nutrients in medicinal Coleus. *Journal of Farming Systems Research & Development.* 14(1): 73-77.