

## Effect of soil and foliar application of organic nutrients on NPK uptake, herbage yield and inflorescence yield of sweet basil (*Ocimum basilicum* L.)

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### ABSTRACT

An investigation was carried out to find out the effect of organic nutrients on yield and NPK uptake of sweet basil at the Department of Horticulture, Faculty of Agriculture, Annamalai University, Annamalai Nagar, during 2007-2009. Based on the findings of the present study it can be concluded that combined application of FYM @ 25 t ha<sup>-1</sup> + *Azospirillum* + Phosphobacteria + Panchagavya 3 per cent as foliar spray has improved the fresh herb yield as well as essential oil content of sweet basil.

Patel, K.D., Barad, A.V., Savaliya, J.J. and Butani, A.M. (2011). Generation mean analysis for fruit yield and its attributing traits in okra (*Abelmoschus esculentus* (L) Moench), *Asian J. Hort.*, 6 (1) : 195-198.

**Key words :** Sweet basil, Flowering, Herbage yield, FYM, Vermicompost and Panchagavya

*Ocimum basilicum* L. belonging to family Lamiaceae is annual herbaceous shrub popularly known as Indian Basil or sweet basil. The essential oil obtained by hydro-distillation from shoot bio-mass has high commercial value that is used in cosmetic products as flavouring agents, in food industry, in fragrances and aroma therapy and traditional rituals and medicines (Rameshkumar *et al.*, 2008). Organic farming helps to improve the physical, chemical and biological properties of the soil and maintains the ecological balance as well as productivity of life supporting systems for the future generation. Hence, the present study was carried out to find out the effect of organic nutrients on NPK uptake, herbage yield and inflorescence yield of sweet basil.

### MATERIALS AND METHODS

The experiment was conducted as pot study in completely randomized block design with 14 treatments in three replications during 2007-2009 at orchard, Department of Horticulture, Faculty of Agriculture, Annamalai University. The soil type was clay loam, pH of the soil was 7.5, EC of 0.67 dsm<sup>-1</sup> and available N was 210.5 kg ha<sup>-1</sup>, P was 10.3 kg ha<sup>-1</sup> and k was 249.4 kg ha<sup>-1</sup>.

<sup>1</sup>. Treatments consisted of two organic manures, Farm yard manure and vermicompost at two different levels and bio-fertilizers (*Azospirillum* and Phosphobacteria) along with Panchagavya 3 per cent and neem cake 20 per cent as foliar spray. The following are the treatments T<sub>1</sub>-FYM @ 12.5 t ha<sup>-1</sup>+*Azospirillum* and Phosphobacteria @ 2 kg ha<sup>-1</sup>, T<sub>2</sub> – FYM @ 25 t ha<sup>-1</sup>+ *Azospirillum* and Phosphobacteria @ 2 kg ha<sup>-1</sup>, T<sub>3</sub> – Vermicompost @ 2.5 t ha<sup>-1</sup>+*Azospirillum* and Phosphobacteria @ 2kg ha<sup>-1</sup>, T<sub>4</sub> – Vermicompost @ 5 t ha<sup>-1</sup>+ *Azospirillum* and Phosphobacteria @ 2 kg ha<sup>-1</sup>, T<sub>5</sub> – T<sub>1</sub> + Panchagavya @ 3% foliar spray, T<sub>6</sub> – T<sub>2</sub> + Panchagavya @ 3% foliar spray, T<sub>7</sub> – T<sub>3</sub> + Panchagavya @ 3% foliar spray, T<sub>8</sub> – T<sub>4</sub> + Panchagavya @ 3% foliar spray, T<sub>9</sub> – T<sub>1</sub> + Neemcake extract @ 20% foliar spray, T<sub>10</sub> – T<sub>2</sub> + Neemcake extract @ 20% foliar spray, T<sub>11</sub> – T<sub>3</sub> + Neemcake extract @ 20% foliar spray, T<sub>12</sub> – T<sub>4</sub> + Neemcake extract @ 20% foliar spray, T<sub>13</sub> – Recommended dose of inorganic fertilizer (120: 100: 100 kg ha<sup>-1</sup>), T<sub>14</sub>–Control. Nitrogen content in the plant sample on dry weight basis was estimated with a di-acid extract by micro Kjeldhal method (Humpries, 1956) and expressed in percentage, phosphorus content in the plant sample on dry weight basis was estimated with a triple

acid extract by adapting vanadomolybdate phosphoric method (Jackson, 1973) and expressed in percentage. Potassium content in the plant sample on dry weight basis was estimated by reading in the flame photometer values of triple acid extract (Jackson, 1973) and expressed in percentage. The fresh weight of the herbage was taken and the mean was expressed in terms of gram per plant. The fresh weight of inflorescence was taken and the mean was expressed in terms of gram per plant. The data on NPK uptake, herbage yield and inflorescence yield per plant were recorded.

## RESULTS AND DISCUSSION

Nitrogen content was highest in the treatment T<sub>6</sub> (2.98 and 2.61 mg plant<sup>-1</sup>) during season I and season II of crop cultivation and the lowest was registered in the treatment T<sub>14</sub> (1.81 and 1.61 mg plant<sup>-1</sup>) in both the seasons. The phosphorus content was highest in the treatment T<sub>6</sub> (0.97 and 0.95 mg plant<sup>-1</sup>) during I and II season of crop cultivation respectively and the lowest was registered in the treatment T<sub>14</sub> (0.74 and 0.72 mg plant<sup>-1</sup>) in both the seasons. The result obtained on the potassium content was highest in the treatment T<sub>6</sub> (2.61 and 2.41 mg plant<sup>-1</sup>) whereas the lowest content was registered in T<sub>14</sub> (2.20 and 2.08 mg plant<sup>-1</sup>) in both the seasons.

FYM contains good C/N ratio and soil gets easily mineralized into available forms which ultimately leads to increased nutrient uptake. The improvement in soil conditions might have enhanced the sweet basil plant ability to draw more nutrients from soil. Organic manures like FYM when added to the soil, with the action of microorganisms, complex nitrogenous compounds were slowly broken down and its availability in the form of nitrate N is steady through crop growth (Budhawant, 1994).

From the data presented in Table 2, it was observed that herb yield per plant was found to vary significantly among the treatments in season-I and season-II. The data on herbage yield showed that the treatment T<sub>6</sub> recorded the highest herbage yield of (256.99 g) which was significantly higher than T<sub>13</sub> (249.84 g) and T<sub>12</sub> (210.00 g) in season-I. Similar results were observed in season-II and the same treatment T<sub>6</sub> registered the highest herbage yield of (239.66 g) followed by T<sub>13</sub> (228.84 g) and T<sub>12</sub> (200.84 g). The treatment T<sub>14</sub> (Absolute control) recorded lowest herbage yield of (191.00 and 187.40 g respectively) in both the seasons. Among the two seasons, season-I excelled season-II in producing maximum fresh weight, irrespective of the treatments.

Bio-fertilizers might have acted in providing a conducive atmosphere in soil for nitrogen accumulation,

**Table 1 : Effect of soil and foliar application of organic nutrients on NPK uptake of sweet basil**

Treatments	NPK uptake per plant					
	N uptake Mg/Plant		P uptake Mg/Plant		K uptake Mg/Plant	
	Season- I	Season- II	Season- I	Season- II	Season- I	Season- II
T <sub>1</sub> - FYM @ 12.5 t ha <sup>-1</sup> + <i>Azospirillum</i> and Phosphobacteria @ 2 kg ha <sup>-1</sup>	1.96	1.56	0.74	0.72	2.28	2.18
T <sub>2</sub> - FYM @ 25 t ha <sup>-1</sup> + <i>Azospirillum</i> and Phosphobacteria @ 2 kg ha <sup>-1</sup>	2.00	1.80	0.86	0.83	2.53	2.14
T <sub>3</sub> - Vermicompost @ 2.5 t ha <sup>-1</sup> + <i>Azospirillum</i> and Phosphobacteria @ 2 kg ha <sup>-1</sup>	2.03	1.76	0.78	0.75	2.20	2.10
T <sub>4</sub> - Vermicompost @ 5 t ha <sup>-1</sup> + <i>Azospirillum</i> and Phosphobacteria @ 2 kg ha <sup>-1</sup>	1.93	1.52	0.84	0.81	2.41	2.24
T <sub>5</sub> - T <sub>1</sub> + Panchagavya @ 3% foliar spray	2.45	1.90	0.91	0.89	2.43	2.26
T <sub>6</sub> - T <sub>2</sub> + Panchagavya @ 3% foliar spray	2.98	2.61	0.97	0.95	2.61	2.41
T <sub>7</sub> - T <sub>3</sub> + Panchagavya @ 3% foliar spray	2.33	2.11	0.88	0.85	2.42	2.26
T <sub>8</sub> - T <sub>4</sub> + Panchagavya @ 3% foliar spray	2.36	2.21	0.81	0.79	2.43	2.21
T <sub>9</sub> - T <sub>1</sub> + Neemcake extract @ 20% foliar spray	1.99	1.69	0.87	0.85	2.41	2.18
T <sub>10</sub> - T <sub>2</sub> + Neemcake extract @ 20% foliar spray	2.30	1.98	0.89	0.87	2.39	2.14
T <sub>11</sub> - T <sub>3</sub> + Neemcake extract @ 20% foliar spray	2.36	2.00	0.87	0.85	2.31	2.17
T <sub>12</sub> - T <sub>4</sub> + Neemcake extract @ 20% foliar spray	2.46	2.16	0.91	0.87	2.46	2.39
T <sub>13</sub> - Recommended dose of inorganic fertilizer (120: 100: 100 kg ha <sup>-1</sup> )	2.56	2.22	0.92	0.88	2.50	2.43
T <sub>14</sub> - Control	1.81	1.61	0.74	0.72	2.20	2.08
S.E. ±	0.10	0.10	0.02	0.02	0.03	0.03
C.D. (P=0.05)	0.21	0.21	0.04	0.04	0.07	0.07

**Table 2 : Effect of organic nutrients on fresh weight of the herb in sweet basil (*Ocimum basilium* L.)**

Treatments	Fresh weight of the herb per plant (g)	
	Season - I	Season - II
T <sub>1</sub> - FYM @ 12.5 t ha <sup>-1</sup> + <i>Azospirillum</i> and Phosphobacteria @ 2 kg ha <sup>-1</sup>	222.13	202.20
T <sub>2</sub> - FYM @ 25 t ha <sup>-1</sup> + <i>Azospirillum</i> and Phosphobacteria @ 2 kg ha <sup>-1</sup>	239.06	218.80
T <sub>3</sub> - Vermicompost @ 2.5 t ha <sup>-1</sup> + <i>Azospirillum</i> and Phosphobacteria @ 2 kg ha <sup>-1</sup>	221.13	214.93
T <sub>4</sub> - Vermicompost @ 5 t ha <sup>-1</sup> + <i>Azospirillum</i> and Phosphobacteria @ 2 kg ha <sup>-1</sup>	237.13	210.11
T <sub>5</sub> - T <sub>1</sub> + Panchagavya @ 3% foliar spray	242.69	215.06
T <sub>6</sub> - T <sub>2</sub> + Panchagavya @ 3% foliar spray	256.99	239.66
T <sub>7</sub> - T <sub>3</sub> + Panchagavya @ 3% foliar spray	238.46	215.33
T <sub>8</sub> - T <sub>4</sub> + Panchagavya @ 3% foliar spray	239.19	219.13
T <sub>9</sub> - T <sub>1</sub> + Neemcake extract @ 20% foliar spray	229.06	221.93
T <sub>10</sub> - T <sub>2</sub> + Neemcake extract @ 20% foliar spray	246.13	217.40
T <sub>11</sub> - T <sub>3</sub> + Neemcake extract @ 20% foliar spray	220.66	209.60
T <sub>12</sub> - T <sub>4</sub> + Neemcake extract @ 20% foliar spray	210.00	200.84
T <sub>13</sub> - Recommended dose of inorganic fertilizer (120: 100: 100 kg ha <sup>-1</sup> )	249.84	228.84
T <sub>14</sub> - Control	191.00	187.40
S.E.±	3.02	4.15
C.D. (P=0.05)	6.04	8.30

besides in soil for making increased availability of nutrients, especially by solubilizing the phosphorus. Moreover, the Panchagavya applied as foliar might have been absorbed quickly by the plants. The favourable effect of bio fertilizers in enhancing the growth and yield attribute as observed in the present study have also been reported in a number of horticultural crops. Sujai Kumar (2001) in glory lily; Bharathi (2004) in ashwagandha and Manjunatha *et al.* (2002) have reported the beneficial effect of bio-fertilizers singly and in combinations with organic and inorganic nutrients. These results supported

the findings of the present study.

Panchagavya has significantly increased the yield due to the presence of useful microorganisms and also due to the presence of nitrogen, calcium, cytokinin, glucose, minerals etc. These nutrients might have triggered rapid cell division, proliferation and speedy growth. More over foliar application of Panchagavya might have resulted in speedy absorption and assimilation of varied nutrients resulting in higher vegetative growth. The favourable effect of Panchagavya as enhancer of yield in combination with other organic amendments have been reported by

**Table 3 : Effect of organic nutrients on fresh weight of the inflorescence in sweet basil (*Ocimum basilium* L.)**

Treatments	Fresh weight of the inflorescence per plant (g)	
	Season - I	Season - II
T <sub>1</sub> - FYM @ 12.5 t ha <sup>-1</sup> + <i>Azospirillum</i> and Phosphobacteria @ 2 kg ha <sup>-1</sup>	45.15	44.26
T <sub>2</sub> - FYM @ 25 t ha <sup>-1</sup> + <i>Azospirillum</i> and Phosphobacteria @ 2 kg ha <sup>-1</sup>	46.40	43.13
T <sub>3</sub> - Vermicompost @ 2.5 t ha <sup>-1</sup> + <i>Azospirillum</i> and Phosphobacteria @ 2 kg ha <sup>-1</sup>	40.73	40.30
T <sub>4</sub> - Vermicompost @ 5 t ha <sup>-1</sup> + <i>Azospirillum</i> and Phosphobacteria @ 2 kg ha <sup>-1</sup>	49.86	41.83
T <sub>5</sub> - T <sub>1</sub> + Panchagavya @ 3% foliar spray	54.66	50.13
T <sub>6</sub> - T <sub>2</sub> + Panchagavya @ 3% foliar spray	58.00	57.60
T <sub>7</sub> - T <sub>3</sub> + Panchagavya @ 3% foliar spray	55.86	52.66
T <sub>8</sub> - T <sub>4</sub> + Panchagavya @ 3% foliar spray	54.66	51.93
T <sub>9</sub> - T <sub>1</sub> + Neemcake extract @ 20% foliar spray	53.12	49.80
T <sub>10</sub> - T <sub>2</sub> + Neemcake extract @ 20% foliar spray	53.36	52.19
T <sub>11</sub> - T <sub>3</sub> + Neemcake extract @ 20% foliar spray	52.81	49.84
T <sub>12</sub> - T <sub>4</sub> + Neemcake extract @ 20% foliar spray	56.19	54.19
T <sub>13</sub> - Recommended dose of inorganic fertilizer (120:100:100 kg ha <sup>-1</sup> )	57.03	55.96
T <sub>14</sub> - Control	38.93	35.00
S.E.	0.30	1.59
C.D. (P=0.05)	0.15	0.78

Sivakumar (2004) in kalmegh; Ponni and Shakila (2007) in *Phyllanthus niruri* and Mohanalaxmi and Vadivel (2008) in ashwagandha and these reports are in agreement with the results of the present study.

The fresh weight of the inflorescence was found to vary significantly among the various treatments in both season-I and season-II (Table 3). In season-I, T<sub>6</sub> recorded the maximum fresh weight of the inflorescence per plant (58.00 g), which was followed by treatment T<sub>13</sub> (57.03) and T<sub>12</sub> (56.19 g) while least weight of the inflorescence was obtained in T<sub>14</sub> (Absolute control) (38.93 g). In season-II, among the various treatments, T<sub>6</sub> registered the maximum weight of the inflorescence (57.60 g) followed by T<sub>13</sub> (55.96 g) and T<sub>12</sub> (54.19 g). T<sub>14</sub> (Absolute control) recorded minimum weight of the inflorescence (35.00 g). While comparing the two seasons, the plants in season-I were found to record the maximum inflorescence yield than season-II.

Based on the consistent result obtained as above and taking into consideration of the favourable effects on NPK uptake, herbage yield and inflorescence yield, application of FYM @ 25 t ha<sup>-1</sup> + *Azospirillum*+ phosphobacteria + Panchagavya @ 3 per cent foliar spray given thrice at 30, 45 and 60 DAP can be adjudged as the best treatment combination.

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