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Influence of organic and inorganic sources of nitrogen on growth and yield of brinjal (*Solanum melongena* L.)

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Abstract
A field experiment was conducted at Adhiparasakthi Agricultural and Horticultural College, Kalavai during Rabi, 2014 to evaluate the influence of organic and inorganic sources of nitrogen on growth and yield of brinjal (*Solanum melongena* L.). The experimental design was in a Randomized Block Design (RBD), block of 11 treatment replicated thrice using CO 2 Brinjal (*Solanum melongena* L.) as test crop. The growth characters, *viz*., Plant height (cm), No. of leaves plant^{-1}, No. of branches plant^{-1}, No. of flowers plant^{-1} and Yield attributes like total no. of fruits plant^{-1}, Fruit weight (g), Fruit length (cm), Fruit diameter (cm), yield (kg ha^{-1}) were significantly increased by the application of 75% N through inorganic (163.04 kg urea) + 25% N through organic (2.5 t ha^{-1} vermicompost) which was on par with T_{11} (50.60 cm) that received 50% N through inorganic (108.7 kg urea) + 50% N through organic (5 t ha^{-1} vermicompost) and T_4 (48.73 cm) that received 75% N through inorganic (163.04 kg urea) + 25 % N through organic (5 t ha^{-1} FYM). Over all, from the experimental results, it could considered that application of 75% N through inorganic (163.04 kg urea) + 25% N through organic (2.5 t ha^{-1} vermicompost) as a better option for achieving higher productivity and profitability of Brinjal.

Keywords: Vermicompost, nitrogen, fym, brinjal, growth, yield

Introduction
Brinjal (*Solanum melongena* L.) belongs to family Solanaceae and is an important indigenous vegetable crop grown all over India. It is one of the common and popular Vegetable crops grown and is occupying a pride of place in every day food of all people. India ranks first both in area (4.20 lakh ha) and production (60 million tonnes) of brinjal (Anburani and Manivannan, 2002) [1]. In Vegetable production, the chemical fertilizers are being used increasingly because of the quick availability of the nutrients to the plants. The continuous application of chemical fertilizers may lead to substantial deterioration of soil health which is reflected in overall reduction in physical, chemical and biological properties of soil. Concentrated organic manures that are rich in plant nutrients could replace the inorganic fertilizers on equivalent nutrient basis. Integrated use of organic manures with optimum level of NPK fertilizers not only improves the nutrient status and soil health but also stabilizes the crop yield at higher level (Hiranmai Yadav and Vijayakumari, 2003) [5].

Materials and Methods
A field experiment was conducted at Adhiparasakthi Agricultural and Horticultural College, Kalavai during Rabi, 2014 to evaluate the effect of organic and inorganic sources of nitrogen on growth and yield of brinjal (*Solanum melongena* L.). Brinjal variety CO 2 was used as a test variety during the study. The experiment was conducted in a randomized block design with eleven treatments replicated thrice. The treatment details are as follows, T_1 - Control (No fertilizer), T_2 - 100:50:50 kg ha^{-1} NPK (RDF),T_3 - 100 % N through organic (20 t ha^{-1} FYM), T_4 - 75% N through inorganic (163.04 kg urea) + 25% N through organic (5 t ha^{-1} FYM), T_5 - 50% N through inorganic (108.7 kg urea) + 50% N through organic (10 t FYM), T_6 - 100% N through organic (2 t ha^{-1} neem cake), T_7 - 75% N through inorganic (163.04 kg urea) + 25% N through organic (0.5 t ha^{-1} neem cake), T_8 - 50% N through inorganic (108.7 kg urea) + 50 % N through organic (1 t ha^{-1} neem cake), T_9 - 100% N through organic 10 t ha^{-1} vermicompost, T_{10} - 75% N through inorganic (163.04 kg urea) + 25% N through organic (2.5 t ha^{-1} vermicompost), T_{11} - 50% N through inorganic (108.7 kg urea) + 50% N through organic (5 t ha^{-1} vermicompost). Recommended dose of phosphorus and potassium (50:50 kg ha^{-1}) were applied to all treatments except T_1 (Control). The data on various parameters were subjected to statistical analysis following the method of analysis of variance for the simple randomized block design (Panse and Sukhatme, 1978) [9].

Growth attributes

Plant height (cm)

The plant height in Brinjal was significantly affected by organic manures and inorganic nitrogenous fertilizers at different stages of crop growth (Fig. 1). The highest plant height (51.2 cm) was recorded in the treatment (T_{10}) that received 75% N through inorganic (163.04 kg urea) + 25% N through organic (2.5 t ha^{-1} vermicompost) which was on a par with the treatment T_{11} (50.6 cm) that received 50% N through inorganic (108.7 kg urea) + 50% N through organic (5 t ha^{-1} vermicompost) and T_4 (48.7 cm) that received 75% N through inorganic (163.04 kg urea) + 25% N through organic (5 t ha^{-1} FYM). The lowest plant height was recorded with control (29.3 cm). This might be due to the presence of readily available form of nitrogen which might have resulted in increase in vegetative growth of plants mainly by elongation of cells and partly by cell division (Maynord and David, 1987) [7].

Number of leaves plant^{-1}

It is evident from data that the number of leaves plant^{-1} was increased by the application of organic manures and inorganic nitrogenous fertilizers at different stages of crop growth (Fig 1). The highest number of leaves plant^{-1} (82.5) was recorded in the treatment (T_{10}) that received 75% N through inorganic (163.04 kg urea) + 25% N through organic (2.5 t ha^{-1} vermicompost) which was on a par with the treatment T_{11} (76.4) that received 50% N through inorganic (108.7 kg urea) + 50% N through organic (5 t ha^{-1} vermicompost) and T_4 (74.3) that received 75% N through inorganic (163.04 kg urea) + 25% N through organic (5 t ha^{-1} FYM). The lowest number of leaves plant^{-1} was recorded with control (35.6). This might be due to integrated use of organic manures, bio-fertilizers and chemical fertilizers could be due to production of growth regulators besides nitrogen fixation through biofertilizers (Govindan and Purushothaman, 1984b) [4].

Table 1: Effect of organic and inorganic sources of nitrogen on growth of brinjal

Treatments	Plant height (cm)	No. of leaves plant^{-1}	No. of branches plant^{-1}	No. of flowers plant^{-1}
T_1 - Control (No fertilizer)	29.3	35.6	8.2	48.4
T_2 - 100:50:50 kg ha^{-1} NPK (recommended dose of fertilizer	43.3	53.0	10.6	53.2
T_3 - 100% N through organic (20 t ha^{-1} FYM)	37.2	36.5	9.5	51.5
T_4 - 75% N through inorganic (163.04 kg urea) + 25% N through organic (5 t ha^{-1} FYM)	48.7	74.3	11.6	56.2
T_5 - 50% N through inorganic (108.7 kg urea) + 50% N through organic (10 t ha^{-1} FYM)	44.2	58.4	9.7	52.1
T_6 - 100% N through organic (2 t ha^{-1} neem cake)	37.2	41.8	8.3	48.4
T_7 - 75% N through inorganic (163.04 kg urea) + 25% N through organic (0.5 t ha^{-1} neem cake)	45.1	64.2	9.2	53.9
T_8 - 50% N through inorganic (108.7 kg urea) + 50% N through organic (1 t ha^{-1} neem cake)	45.3	65.6	10.5	50.9
T_9 - 100% N through organic (10 t ha^{-1} vermicompost)	35.8	53.2	9.8	51.8
T_{10} - 75% N through inorganic (163.04 kg urea) + 25% N through organic (2.5 t ha^{-1} vermicompost)	51.2	82.5	13	57.8
T_{11} - 50% N through inorganic (108.7 kg urea) + 50% N through organic (5 t ha^{-1} vermicompost)	50.6	76.4	12.2	56.4
SEd	2.5	3.7	0.46	0.80
CD	5.4	7.9	0.98	1.81

Number of branches plant^{-1}

The highest number of branches 13.0 was recorded in the treatment (T_{10}) that received 75% N through inorganic (163.04 kg urea) + 25% N through organic (2.5 t ha^{-1} vermicompost) which was significantly superior to rest of treatments (Table 1). This is followed by the treatment (T_{11}) that treatment that received 50% N through inorganic (108.7 kg urea) + 50% N through organic (5 t ha^{-1} vermicompost) and T_4 (11.6) that received 75% N through inorganic (163.04 kg urea) + 25% N through organic (5 t ha^{-1} FYM). The lowest number of branches plant^{-1} was recorded with control (8.2). It might be due to supply of higher quantities of nutrients and presence of plant growth promoters like cytokinins and auxins in worm casts (Krishnamurthy and Vajranabhaiah, 1986) [4].

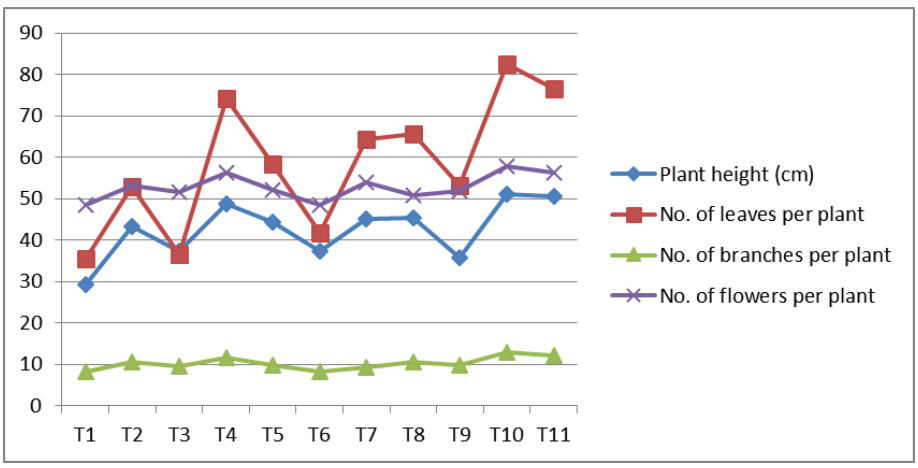

Fig 1: Effect of organic and inorganic sources of nitrogen on growth of brinjal

Number of flowers plant^{-1}

The data pertaining to number of flowers plant^{-1} revealed that the number of flowers plant^{-1} was significantly affected by organic source of manures and inorganic nitrogenous fertilizers. The maximum number of flowers plant^{-1} 57.8 was recorded in the treatment (T_{10}) that received 75% N through inorganic (163.04 kg urea) + 25% N through organic (2.5 t ha^{-1} vermicompost) which was on a par with T_{11} (56.4) that received 50% N through inorganic (108.7 kg urea) + 50% N through organic (5 t ha^{-1} vermicompost) and T_4 (35.2) that received 75% N through inorganic (163.04 kg urea) + 25% N through organic (5 t ha^{-1} FYM). The lowest number of branches plant^{-1} was recorded with control (48.4). This might be due to the combined application of inorganic and organic source of fertilizer (Darley Jose, 1984) [3].

Yield attributes

Fruit length (cm)

Fruit length in Brinjal was significantly affected by organic manures and inorganic nitrogenous fertilizers (Fig. 2). The maximum fruit length of 10 cm was recorded in the treatment (T_{10}) that received 75% N through inorganic (163.04 kg urea) + 25% N through organic (2.5 t ha^{-1} vermicompost) which was on a par with T_{11} (9.8 cm) that received 50% N through inorganic (108.7 kg urea) + 50% N through organic (5 t ha^{-1} vermicompost) and T_4 (9.1 cm) that received 75% N through inorganic (163.04 kg urea) + 25% N through organic (5 t ha^{-1} FYM). The lowest number of branches plant^{-1} of was recorded with control (8.3 cm). This might be due to combined application of vermicompost and inorganic nitrogenous fertilizers because of gradual and steady nutrient release during the growth period and enhanced biological activity and provided balanced nutrition to the crop (Nair and Peter, 1990) [8].

Fruit diameter (cm)

Fruit diameter in brinjal was significantly affected by organic manures and inorganic nitrogenous fertilizers (Table 2). The maximum fruit diameter of 10.8 cm was recorded in the T_{10} that received 75% N through inorganic (163.04 kg urea) + 25% N through organic (2.5 t ha^{-1} vermicompost) which was on a par with T_{11} (10.6 cm) that received 50% N through inorganic (108.7 kg urea) + 50% N through organic (5 t ha^{-1} vermicompost) and T_4 (48.73 cm) that received 75% N through inorganic (163.04 kg urea) + 25% N through organic (5 t ha^{-1} FYM). The minimum fruit diameter was recorded with control (9.0 cm). It might be due to application of organic manure and inorganic nitrogenous fertilizers it can provide to better mobilization of plant nutrients particularly N and P during later stage of plant growth. Similar findings are reported by Subbaiah *et al.* (1982) [11].

Total number of fruits plant^{-1}

The total number of fruits plant^{-1} was significantly affected by organic manure and inorganic fertilizer. The maximum number of fruits plant^{-1} of 40.4 was recorded in the treatment (T_{10}) that received 75% N through inorganic (163.04 kg urea) + 25% N through organic (2.5 t ha^{-1} vermicompost) which was on a par with T_{11} (40.0) that received 50% N through inorganic (108.7 kg urea) + 50% N through organic (5 t ha^{-1} vermicompost) and T_4 (35.2) that received 75% N through inorganic (163.04 kg urea) + 25% N through organic (5 t ha^{-1} FYM).. The lowest number of fruits plant^{-1} was recorded with control (18.5). This might be due to more accumulation of carbohydrate and higher rate of metabolic activity by the elements which would have lead to increased number of fruits per plant (Som *et al.*, 1986) [10].

Fruit weight (g)

Fruit weight in brinjal was significantly affected by organic manures and inorganic nitrogenous fertilizers (Table.2). There was significant difference among the treatments for weight of fruit. The highest weight of fruit of 34.6 g was recorded the treatment (T_{10}) that received 75% N through inorganic (163.04 kg urea) + 25% N through organic (2.5 t ha^{-1} vermicompost), which was on a par with T_{11} (32.2 g) that received 50% N through inorganic (108.7 kg urea) + 50% N through organic (5 t ha^{-1} vermicompost) and T_4 (28.6 g) that received 75% N through inorganic (163.04 kg urea) + 25 % N through organic (5 t ha^{-1} FYM). The lowest fruit weight of was recorded with control (26.4 g). This might be due to accelerated mobility of photosynthates from the source to the sink as influenced by the growth hormone, released or synthesized due to the organic sources of fertilizers (Susan, 1995) [12].

Table 2: Effect of organic and inorganic sources of nitrogen on yield attributes of brinjal

Treatments	Fruit length (cm)	Fruit diameter (cm)	Total no. of fruits plant^{-1}	Fruit weight (g)	Yield (kg ha^{-1})
T_1 - Control (No fertilizer)	8.3	9.0	18.5	26.4	14699
T_2 - 100:50:50 kg ha^{-1} NPK (recommended dose of fertilizer)	9.5	9.5	35.9	28.9	31999
T_3 - 100% N through organic (20 t ha^{-1} FYM)	9.6	9.4	32.3	27.5	20000
T_4 - 75% N through inorganic (163.04 kg urea) + 25% N through organic (5 t ha^{-1} FYM)	9.1	9.6	35.2	28.6	32599
T_5 - 50% N through inorganic (108.7 kg urea) + 50% N through organic (10 t ha^{-1} FYM)	9.3	9.8	38.0	29.1	29999
T_6 - 100% N through organic (2 t ha^{-1} neem cake)	9.5	10.2	26.57	28.0	15000
T_7 - 75% N through inorganic (163.04 kg urea) + 25% N through organic (0.5 t ha^{-1} neem cake)	9.4	9.9	36.6	28.5	30933
T_8 - 50% N through inorganic (108.7 kg urea) + 50% N through organic (1 t ha^{-1} neem cake)	9.2	9.8	35.4	28.2	30933
T_9 - 100% N through organic (10 t ha^{-1} vermicompost)	9.6	9.4	33.14	33.8	21899
T_{10} - 75% N through inorganic (163.04 kg urea) + 25% N through organic (2.5 t ha^{-1} vermicompost)	10	10.8	40.4	34.6	38499
T_{11} - 50% N through inorganic (108.7 kg urea) + 50% N through organic (5 t ha^{-1} vermicompost)	9.8	10.6	40.0	32.23	36466
SEd	0.18	0.27	1.77	2.15	861.2
CD at 5%	0.39	0.57	3.74	4.5	1800

Yield (t ha^{-1})

The fruit yield in Brinjal was significantly affected by organic manure and inorganic nitrogenous fertilizers (Fig. 2). The highest yield (38.4 t ha^{-1}) was recorded in the treatment (T_{10}) that received 75% N through inorganic (163.04 kg urea) + 25% N through organic (2.5 t ha^{-1} vermicompost) which was on a par with T_{11} (36.4 t ha^{-1}) that received 50% N through inorganic (108.7 kg urea) + 50% N through organic (5 t ha^{-1} vermicompost) and T_4 (32.5 t ha^{-1}) that received 75% N through inorganic (163.04 kg urea) + 25% N through organic (5 t ha^{-1} FYM). The lowest yield of was recorded with control (14.6 t ha^{-1}). This might be due to increase in the fruit number (Buwalda and Freeman, 1986) [2].

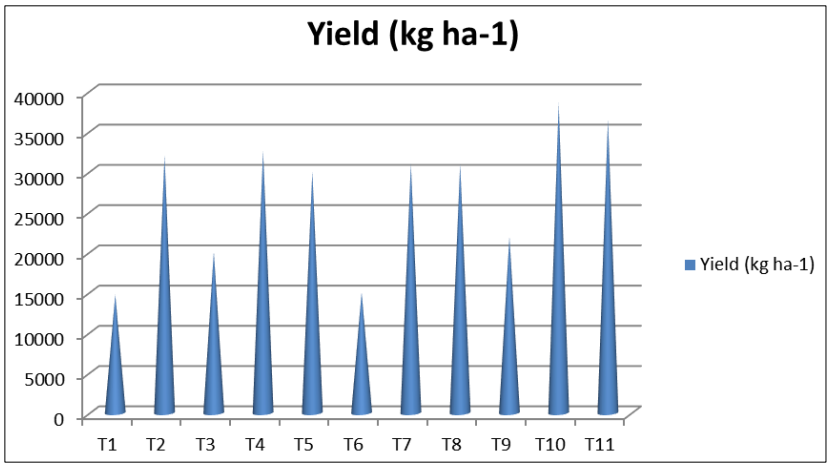

Fig 2: Effect of organic and inorganic sources of nitrogen on yield of brinjal

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