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# Effect of organic fertigation on yield and quality of bell pepper (*Capsicum annuum* var. *Grossum* Sendt.)

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**ABSTRACT :** Investigation on effect of organic fertigation on growth and yield of bell pepper (*Capsicum annuum* var. *grossum* Sendt.) was carried out at vegetable unit, Department of Horticulture, Faculty of Agriculture, Annamalai University, Annamalai Nagar, Tamil Nadu, during 2016-2017. There were nine treatment combinations including organic manures *viz.*, farm yard manure, vermicompost, bio-stimulants (Humic acid and Sea weed extract) and organic fertigation with *Neem* cake (two levels *viz*., 1:20 and 1:40 dilution). Among the nine treatments, the treatment $T_7$ (Humic acid granules @ 5g plant$^{-1}$ + fertigation with *Neem* cake 1:20) exhibited the highest yield of 580.18 g plant$^{-1}$, and it was followed $T_1$ (RDF 250 :150:150 kg NPK ha$^{-1}$) with 561.5 g plant$^{-1}$. However, the lowest yield was recorded under $T_8$(FYM @125 g plant$^{-1}$ + fertigation with *Neem* cake 1:40) with 319.6 g plant$^{-1}$. Among the nine treatments, the *per se* effect of organic basal supplements derived from the treatment combinations revealed the superiority of humic acid over other organic supplements.

**KEY WORDS :** Bell pepper, Organic fertigation, FYM, Vermicompost, Sea weed extract, Humic acid

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Bell pepper has attained a status of high value crop in recent years and occupies a pride place among vegetables, not only because of its economic importance but also for the nutritional value of its fruits, mainly due to the fact that they are an excellent source of natural colors and antioxidant compounds (Howard *et al*., 2000). In the same respect, pepper fruit is considered an excellent source of bioactive nutrients such as carotenoids, vitamin C and phenolics compounds (Navarro *et al*., 2006), magnesium, calcium, potassium, phosphorus and iron (Jadczak *et al*., 2010). In India, capsicum is grown for its mature fruits and is widely used in stuffing and baking. It is also used in salad and soup preparation. As an autumn crop, it extends upto winter months in Andhra Pradesh, Karnataka, Maharashtra, Tamil Nadu, Bihar, West Bengal and Madhya Pradesh. The average annual production of capsicum in India is 0.182 million tonnes from an area of 0.32 million ha with the productivity of 5.68 tonnes per ha. Capsicum crop responds well to the application of both organic manures and inorganic fertilizers. Of late, organic manures are gaining importance because of their low cost, no residual toxicity and capacity to enrich soil fertility in addition to high returns under favourable conditions. There is a great demand in the international market for organically produced capsicum. Liquid organic manures are used either as soil drench or as foliar feeding for many crops as they provide nutrients in a readily

available form. Such dilute organic preparations provide a scope for fitting into fertigation with organic production system.In view of the above facts, an investigation was undertaken to study the influence of organic fertigation on yield and quality of bell pepper (C*apsicum annuum* var. *grossum* Sendt.).

## RESEARCH METHODS

The present study was carried out in the vegetable unit, Department of Horticulture, Faculty of Agriculture, Annamalai University during 2016-2017. Nine treatment combinations including organic manures *viz*., farm yard manure (FYM), vermicompost (VC), bio-stimulants [Humic acid (HA) and sea weed extract (SW) and organic fertigation with *Neem* cake (NC) were tried in the present investigation. Fermented neem cake solution was used in fertigation at two levels. All plants were given uniform quantity of water and fertigation was done on every alternate irrigation. The two levels of fertigation were worked out to supply approximately 200 and 400 ppm N at each fertigation. Treatments include: $T_1$- Recommended dose of fertilizer (RDF) 250:150:150 kg NPK $ha^{-1}$, $T_2$- VC (25 g per plant) + fertigation with NC 1:40 dilution, $T_3$- VC (25 g per plant) + fertigation with NC 1:20 dilution, $T_4$-SW (5 g per plant) + fertigation with NC -1:40 dilution, $T_5$- SW (5 g per plant) + fertigation with NC 1:20dilution, $T_6$- HA (5 g per plant) + fertigation with NC 1:40dilution, $T_7$- HA (5 g per plant) + fertigation with NC 1:20 dilution, $T_8$- FYM (125 g per plant) + fertigation with NC 1:40 dilution, $T_9$- FYM (125 g per plant) + fertigation with NC 1:20 dilution. The organic manures were applied at basal and the organic fertigation was given at alternate irrigation.The effect of nine treatments were tried on cv. "INDRA" grown in grow bags of 10 kg capacity. The treatments were replicated thrice and the experiment was studied under Completely Randomized Design.

## RESEARCH FINDINGS AND DISCUSSION

The results of the experiment are given in Tables 1 and 2 and are discussed hereunder. A causal appraisal of the data on yield and yield parameters indicated significant effect of organic fertigation. Application of vermicompost @ 25 g per plant + fertigation with *Neem* cake 1:20 ($T_3$) flowered early (42.3 days) and had the maximum number of fruits per plant (12.3). This was followed by the treatment $T_7$ which received humic acid @ 5 g per plant + fertigation with neem cake 1:20, which took 43.9 days for fifty per cent flowering and the treatment $T_1$which received recommended dose of fertilizer (RDF) 250:150:150 kg NPK $ha^{-1}$ in case of number of fruits per plant (11.5). However, the treatment ($T_8$) FYM @ 125 g per plant + fertigation with *Neem* cake 1:40 took the maximum of 58.8 days to attain fifty per cent flowering and possessed the minimum number of fruits (7.6). It might be attributed to the fact that application of vermicompost enhanced the micro-flora and enzymatic activity which might have augmented the plant growth and flowering. Maximum number of flowers enhanced more number of fruits per plant and increased the number of pickings (Chaitra and Patil, 2007 and Chamani, 2008).The increase in number of fruits observed in this treatment may be attributed to the increase in number of cells as well as elongation of individual cells, which might have been rendered possible through stimulated auxin, gibbrellins and cytokinin (Phuong and Tichy, 1976).

**Table 1 : Effect of organic fertigation on days to 50 per cent flowering, number of fruits per plant, fruit length and fruit girth in bell pepper**

| Treatments | Days to fifty per cent flowering | Number of fruits per plant | Fruit length (cm) | Fruit girth (cm) |
|---|---|---|---|---|
| $T_1$- Recommended dose of fertilizer (RDF) 250:150:150 kg NPK $ha^{-1}$ | 44.6 | 11.5 | 7.26 | 18.12 |
| $T_2$- Vermicompost (25 g per plant) + Fertigation with *Neem* cake 1:40 | 47.1 | 9.5 | 6.09 | 16.19 |
| $T_3$- Vermicompost (25 g per plant) + Fertigation with *Neem* cake 1:20 | 42.3 | 12.3 | 7.28 | 18.76 |
| $T_4$- Sea weed extract (5 g per plant) + Fertigation with *Neem* cake -1:40 | 52.9 | 8.2 | 6.01 | 15.54 |
| $T_5$- Sea weed extract (5 g per plant) + Fertigation with *Neem* cake -1:20 | 48.2 | 10.2 | 7.14 | 17.95 |
| $T_6$- Humic acid (5 g per plant) + Fertigation with *Neem* cake 1:40 | 55.8 | 9.2 | 6.12 | 16.84 |
| $T_7$- Humic acid (5 g per plant) + Fertigation with *Neem* cake 1:20 | 43.9 | 10.7 | 7.33 | 19.38 |
| $T_8$- FYM (125 g per plant) + Fertigation with *Neem* cake 1:40 | 58.8 | 7.6 | 5.93 | 14.72 |
| $T_9$- FYM (125 g per plant) + Fertigation with *Neem* cake 1:20 | 56.9 | 9.3 | 6.97 | 17.19 |
| S.E.± | 0.44 | 0.18 | 0.11 | 0.31 |
| C.D. (P= 0.05) | 0.93 | 0.36 | 0.22 | 0.62 |

Yield is the ultimate goal of any crop management practice and it is in general is a highly complex parameter influenced by many yield components. The treatments differed significantly for fruit length, fruit girth, single fruit weight and fruit yield. Among the treatments, ($T_7$) humic acid (5 g per plant) + fertigation with *Neem* cake 1:20 recorded the maximum fruit length (7.33 cm) and fruit girth (19.38 cm)and it was at par with ($T_3$) vermicompost (25 g per plant) + fertigation with *Neem* cake 1:20 (18.76 cm). Application of humic acid @ 5 g per plant + fertigation with neem cake 1:20 recorded the maximum single fruit weight (53.82 g). This was followed by ($T_9$) FYM (125 g per plant) + fertigation with *Neem* cake 1:20 with (49.20 g). The superior yield attributes observed in HA application might be due the fact that humic acids are major components (65-70 %) of soil organic matter. They increase plant growth enormously due to increased cell membrane permeability, respiration, photosynthesis oxygen and phosphorus uptake and supplying root cell growth (Cacco *et al.*, 1984 and Russo and Berlyn, 1996).

Among the treatments, ($T_7$) humic acid (5 g per plant) + fertigation with *Neem* cake 1:20 recorded the maximum fruit yield per plant (580.18 g). It was followed by ($T_1$) recommended dose of fertilizer (RDF) 250 : 150 : 150 kg NPK $ha^{-1}$ (561.5 g). The minimum values for fruit length, fruit girth, single fruit yield and fruit yield per plant were observed in ($T_8$) FYM (125 g per plant) + fertigation with *Neem* cake 1:40.The higher yield at humic acid and *Neem* cake dilution might be attributed to the high level of growth stimulating substances (Atiyeh *et al.*, 2002).The higher response of yield parameters to application of humic acid can be correlated with its intrinsic ability of undistinguished direct and indirect positive effect on plant growth. Humic acid improves aggregation, aeration and permeability of soil as well as increases its water holding capacity (Kaya *et al.*, 2005). Apart from that HA enhances the availability of macro and micronutrients in soil to meet the demand of rapid growing crops (Kaya *et al.*, 2005). HA enhances vitamins, amino acids and also auxin, cytokinin and abscisic acid contents of the plants (Vanitha and Mohandass, 2014).

Higher yield due to the application of vermicompost may be attributed to enhanced microbial activity, which may have improved the availability of macro and micro nutrients to the plants. It also act as an chelating agent and regulates availability of metabolic micro nutrients to the plants and thus, increased plant growth and yield attributing traits by providing nutrients in their available form (Bhavalkar, 1991) in capsicum.

Organic production could benefit from activation of microbial activity in the growing media with the use of manure extract (or) compost tea, leaf tea could be a good option for yield maximization (Gravel *et al.*, 2010). The economics of organic production may be a factor in the extension of its practice to large areas. The rates of organic fertilizer required to supply N requirements might be economically challenging for farmers (Evanylo *et al.*, 2008). Therefore, organic liquid fertigation can help in reducing the need for high rates of organic fertilizer to maintain proper amount of nutrients and hence in reducing the expenses. The favorable effect of fertigation on fruit yield may be due to the fact that continuous supply of required quantity of nutrients in the root zone of the crop by way of increasing metabolic activities in the plant

**Table 2 : Effect of organic fertigation on fruit yield per plant and ascorbic acid content in bell pepper**

| Treatments | Single fruit weight (g) | Fruit yield per plant (g) | Ascorbic acid content (mg 100 $g^{-1}$) |
|---|---|---|---|
| $T_1$- Recommended dose of fertilizer (RDF) 250:150:150 kg NPK $ha^{-1}$ | 48.57 | 561.51 | 158.01 |
| $T_2$- Vermicompost (25 g per plant) + Fertigation with *Neem* cake 1:40 | 43.15 | 409.92 | 144.21 |
| $T_3$- Vermicompost (25 g per plant) + Fertigation with *Neem* cake 1:20 | 44.57 | 548.62 | 162.99 |
| $T_4$- Sea weed extract (5 g per plant) + Fertigation with *Neem* cake -1:40 | 44.62 | 369.04 | 138.67 |
| $T_5$- Sea weed extract (5 g per plant) + Fertigation with *Neem* cake -1:20 | 48.57 | 497.84 | 153.36 |
| $T_6$- Humic acid (5 g per plant) + Fertigation with *Neem* cake 1:40 | 48.75 | 450.94 | 145.69 |
| $T_7$- Humic acid (5 g per plant) + Fertigation with *Neem* cake 1:20 | 53.82 | 580.18 | 168.31 |
| $T_8$- FYM (125 g per plant) + Fertigation with *Neem* cake 1:40 | 41.84 | 319.60 | 132.84 |
| $T_9$- FYM (125 g per plant) + Fertigation with *Neem* cake 1:20 | 49.20 | 459.56 | 152.01 |
| S.E.± | 0.41 | 4.07 | 0.99 |
| C.D. (P= 0.05) | 0.87 | 8.64 | 1.98 |

system and resulted in maximum yield.

In any vegetable, the quality of the produce is very important, as it determines the market price. In the present study, the highest ascorbic acid content was observed in the treatment ($T_7$) humic acid (5 g per plant) + fertigation with neem cake 1:20.The improvement in biochemical content by the addition of HA could be related with the improvement of soil properties like aggregation, aeration, water holding capacity and increased capacity of immune plant system as reported by Ahmed *et al*. (2010). The humic acid can stimulate the uptake of macro and micronutrients and also promote growth, increased yield and quality in a number of plant species, at least partially through increasing nutrient uptake of chelation and complexation reaction of HA with macro and micro nutrients in soil (Trevisan *et al.*, 2010).

## Conclusion :

From the findings of the present study, it can be concluded that application of humic acid (5 g per plant) + fertigation with neem cake 1:20 dilution was beneficial in increasing the yield and quality of bell pepper.

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