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# Yield and Economical Analysis of Chilli (*Capsicum annuum)* under Various Organic Nutrient Schedules

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**ABSTRACT**

The experiment was conducted at Instructional farm, College of Agriculture, Vellayani during 2012-13. The treatments consisted of three levels of FYM - $F_1$ (20 t $ha^{-1}$), $F_2$ (15 t $ha^{-1}$) and $F_3$ (10 t $ha^{-1}$) and three levels of substitution of the recommended dose of nitrogen. The levels of substitution are $N_1$ (100 % recommended dose of N- 75 kg $ha^{-1}$), $N_2$ (75% recommended dose of N - 56.25 kg $ha^{-1}$) and $N_3$ (50% recommended dose of N - 37.5 kg $ha^{-1}$). FYM along with neem cake in 1:1 ratio is used as organic manure for N substitution. Three controls were also tested in this study. Three controls were $C_1$- Kerala Agricultural University (KAU) package of practices recommendation (FYM @ 25 t $ha^{-1}$ along with75:40:25 kg N:$P_2O_5$:$K_20$ $ha^{-1}$ as inorganic fertilizer), $C_2$- KAU Ad hoc organic POP recommendation (FYM @ 25 t $ha^{-1}$ + Poultry manure at 5 t $ha^{-1}$ + Pseudomonas + Trichoderma and PGPR mix 1, each @2.5 kg $ha^{-1}$) and $C_3$- Farmers practice (Cow dung slurry @ 20 t $ha^{-1}$). Maximum yield (28.57 t/ha) was recorded at the highest level of FYM (20 t $ha^{-1}$). Yield contributing characters were also significantly higher at this level. Among the levels of substitution of nitrogen 100 per cent substitution recorded maximum productivity (28.32 t/ha). Application of FYM @ 20 t $ha^{-1}$ along with 100% recommended dose of N (75 kg $ha^{-1}$) as organic form gave maximum productivity which was on par with the yield realized from KAU Ad hoc organic POP and KAU POP. FYM @ 25 t $ha^{-1}$ along with poultry manure @ 5 t $ha^{-1}$ + Pseudomonas + Trichoderma and PGPR mix 1, each @ 2.5 kg was observed to be an economical nutrient schedule for chilli.

**Key words:** *Capsicum annuum*, Organic, Nutrient schedule, Recommended dose, Substitution, Yield

Excess chemical fertilizers and pesticides has lead to environmental as well as health hazards apart from deteriorating the soil ecosystem. To overcome these problems, organic farming, which aims at cooperating rather than confronting with the nature, is most appropriate. Chilli is considered as one of the most important commercial spice crops and is one of the important nutritious and highly remunerative vegetable crops grown mainly for its mature green fruits. Chilli is cultivated in tropical and sub-tropical climates, mostly as a rain-fed crop in India. Chilli are excellent source of vitamins A, B, C and E with minerals like molybdenum, manganese, foliate, potassium, thiamine and copper. Chilli is the largest spice item exported from India in terms of volume and occupies second position in terms of value. The mandatory quality testing of chilli and chilli products has made Indian chilli more acceptable in the international market and helped to achieve this higher level of exports. Therefore to increase the production according to the demand by adopting healthy practices of production is needed. Chavan *et al*. (1997) reported that combined application of nitrogen through FYM and urea was more beneficial to fertilizer alone in order to increase yield and quality of chilli. Anitha (1997) reported that in chilli various growth attributes like plant height, number of branches, dry matter production, yield, quality and yield attributes were better with poultry manure application as compared to FYM or vermicompost. So an integration of organic manure is essential for improving the production and to maintain the quality of produce as well as soil.

## MATERIALS AND METHODS

A field experiment was conducted on chilli (*Capsicum annuum*) to determine the effect of various organic nutrient schedules on growth character was taken up at the Instructional Farm, College of Agriculture, Vellayani, Thiruvananthapuram, Kerala, during June-November, 2012. The chilli variety Vellayani Athulya selected for the experiment had attractive light green colour, long fruit with medium pungency. The investigation was laid out in randomised block design as factorial experiment with 2

factors and three controls and 3 replications. The experiment consisted of 12 treatments. The treatments consisted of three levels of FYM - $F_1$ (20 t $ha^{-1}$), $F_2$ (15 t $ha^{-1}$) and $F_3$ (10 t $ha^{-1}$) and three levels of substitution of the recommended dose of nitrogen. The levels of substitution are $N_1$ (100% recommended dose of N- 75 kg $ha^{-1}$), $N_2$ (75% recommended dose of N -56.25 kg $ha^{-1}$) and $N_3$ (50% recommended dose of N - 37.5 kg $ha^{-1}$). FYM along with neem cake in 1: 1 ratio is used as organic manure for N substitution. Three controls were also tested in this study. These controls were $C_1$ -Kerala Agricultural University (KAU) POP recommendation (FYM @ 25 t $ha^{-1}$ along with 75:40:25 kg N:$P_2O_5$:$K_20$ $ha^{-1}$ as inorganic fertilizer), $C_2$ - KAU Ad hoc organic POP recommendation (FYM @25 t $ha^{-1}$ + Poultry manure at 5 t $ha^{-1}$ + Pseudomonas + Trichoderma and PGPR mix 1, each @ 2.5 kg $ha^{-1}$) and $C_3$ - Farmers practice (Cow dung slurry @ 20 t $ha^{-1}$). Farm yard manure (0.50% N, 0.2% $P_2O_5$, 0.5% $K_2O$) and neem cake (3.0% N, 0.60% $P_2O_5$, 0.5% $K_2O$) and poultry manure (2% N, 1.6% $P_2O_5$, 0.9% $K_2O$) were used as the organic sources. Urea (46% N), rajphos (20% $P_2O_5$) and muriate of potash (60% $K_2O$) were used as the inorganic sources for the experiment. The deficiency of phosphorus and potassium computed while substituting the chemical fertilizers on nitrogen equivalent basis was compensated with rajphos and ash (20% $P_2O_5$ and 4.2% $K_2O$) respectively. One healthy seedling of 30 days old was transplanted at 45 cm × 45 cm spacing in main field. Number of fruits $plant^{-1}$, length of fruit (cm), weight of fruits $lant^{-1}$ (g) and mature fruit yield (kg $ha^{-1}$) were recorded and economical analysis including net return and B:C ratio were also analysed.

## RESULTS AND DISCUSSION

*Yield and yield attributes*

Highest number of fruits $plant^{-1}$ (43), fruit length (13.69 cm), fruits yield $plant^{-1}$ (574.46 g) and total fruit yield (28.57 t $ha^{-1}$) (Table 1) were realized in the present investigation with the application of highest dose of FYM @ 20 t $ha^{-1}$ and these yield attributing characters were significantly superior to 10 t FYM $ha^{-1}$ (Fig 1).

Table 1 Yield and yield attributing characters as influenced by different levels of FYM, levels of substitution and their interaction

| FYM levels | No. of fruits $plant^{-1}$ | Fruit yield $plant^{-1}$ | Length of fruit (cm) | Total fruit yield (t $ha^{-1}$) |
|---|---|---|---|---|
| $F_1$ | 43.00 | 574.46 | 13.69 | 28.57 |
| $F_2$ | 42.33 | 560.52 | 13.29 | 27.67 |
| $F_3$ | 40.86 | 539.74 | 12.62 | 26.65 |
| SEm | 0.29 | 1.76 | 0.033 | S |
| CD (0.05) | 0.869 | 5.280 | 0.100 | 0.374 |
| Levels of substitution | | | | |
| $N_1$ | 42.83 | 569.42 | 13.37 | 28.32 |
| $N_2$ | 42.08 | 559.52 | 13.25 | 27.60 |
| $N_3$ | 41.28 | 545.78 | 12.98 | 26.96 |
| SEm | 0.29 | 1.76 | 0.033 | 0.12 |
| CD (0.05) | 0.869 | 5.280 | 0.100 | 0.374 |
| Interaction effects | | | | |
| $F_1N_1$ | 43.50 | 588.32 | 13.84 | 29.69 |
| $F_1N_2$ | 43.17 | 575.68 | 13.80 | 28.40 |
| $F_1N_3$ | 42.33 | 559.37 | 13.44 | 27.61 |
| $F_2N_1$ | 44.00 | 567.58 | 13.37 | 28.02 |
| $F_2N_2$ | 42.17 | 565.03 | 13.39 | 27.85 |
| $F_2N_3$ | 40.83 | 548.93 | 13.11 | 27.14 |
| $F_3N_1$ | 41.00 | 552.37 | 12.89 | 27.27 |
| $F_3N_2$ | 40.92 | 537.83 | 12.57 | 26.55 |
| $F_3N_3$ | 40.67 | 529.03 | 12.39 | 26.12 |
| Treatment mean | 42.06 | 558.24 | 12.20 | 27.63 |
| SEm | 0.50 | 3.05 | 0.058 | 0.22 |
| CD (0.05) | NS | NS | 0.174 | NS |
| Control | | | | |
| Control 1 | 44.17 | 586.92 | 13.73 | 29.18 |
| Control 2 | 43.50 | 585.00 | 13.55 | 29.11 |
| Control 3 | 36.83 | 487.08 | 11.80 | 23.56 |
| Control mean | 41.50 | 553.00 | 13.03 | 27.28 |
| Treatments Vs Controls | S | S | S | S |
| Between controls | S | S | S | S |
| Between treatments (Including controls) | 1.504 | 9.146 | 0.174 | 0.647 |

Table 2 Net returns (₹) and benefit-cost ratio as influenced by different levels of FYM, Levels of substitution and their interaction

| FYM levels | Net returns (₹) | B: C ratio |
|---|---|---|
| $F_1$ | 224866.78 | 1.65 |
| $F_2$ | 208929.00 | 1.61 |
| $F_3$ | 190502.33 | 1.56 |
| SEm | 2489.52 | 0.007 |
| CD (0.05) | 7476.03 | 0.021 |
| Levels of substitution | | |
| $N_1$ | 215096.11 | 1.61 |
| $N_2$ | 207363.67 | 1.60 |
| $N_3$ | 201838.33 | 1.60 |
| SEm | 2489.52 | 0.007 |
| CD (0.05) | 7476.03 | NS |
| Interaction effects | | |
| $F_1N_1$ | 240358.33 | 1.68 |
| $F_1N_2$ | 221337.00 | 1.64 |
| $F_1N_3$ | 212905.00 | 1.63 |
| $F_2N_1$ | 208985.00 | 1.59 |
| $F_2N_2$ | 212297.00 | 1.62 |
| $F_2N_3$ | 205505.00 | 1.61 |
| $F_3N_1$ | 195945.00 | 1.56 |
| $F_3N_2$ | 188457.00 | 1.55 |
| $F_3N_3$ | 187105.00 | 1.56 |
| Treatment mean | 208099.37 | 1.60 |
| SEm | 4311.97 | 0.012 |
| CD (0.05) | 12948.87 | 0.037 |
| Control | | |
| Control 1 | 283644.00 | 1.95 |
| Control 2 | 244838.33 | 1.73 |
| Control 3 | 145785.00 | 1.45 |
| Control mean | 224755.78 | 1.71 |
| Treatments *Vs* Controls | S | S |
| Between controls | S | S |
| Between treatments (including controls) | 12948.87 | 0.037 |

FYM seems to act directly by increasing the crop yield either by accelerating the respiratory process through cell permeability or by hormone growth action. It supplies nitrogen, phosphorus and sulphur in available forms to the plants through biological decomposition. Senthilkumar and Sekar (1998) in bhindi and Joseph (1998) in snake gourd were also found significant increase in yield and yield attributing characters with FYM application. Application of 100% RFD ( $N_1$) in the form of nitrogen substitution with FYM and neem cake (1:1 ratio) recorded higher number of fruits plant$^{-1}$ (42.83), fruit length (13.37 cm) and it was on par with 75% RFD. The weight of fruits plant$^{-1}$ and mature fruit yield were significantly higher from the plot treated with 100% RFD. The lowest number of fruits plant$^{-1}$ (41.28), fruit length (12.98 cm) and weight of fruits plant$^{-1}$ (545.78 g), mature fruit yield (26.96 t ha$^{-1}$) were recorded by $N_3$ (50% N substitution with FYM and neem cake). Interaction effect of different doses of FYM and levels of substitution also proved to be significant (Table 1). The highest dose of FYM (20 t ha$^{-1}$) along with 100% RFD in the form of FYM and neem cake recorded maximum number of fruits plant$^{-1}$, fruit length, weight of fruits plant$^{-1}$ and mature fruit yield.

The higher availability and uptake of nutrients might have enabled the plant to produce more number of flower buds which in turn increased the number of fruits. The positive direct effect of growth and yield attributing character's due to increased dose of organic manure have resulted in significantly higher number of fruits plant$^{-1}$, fruit length, weight of fruits plant$^{-1}$ and mature fruit yield. Similar results of increased fruit yield due to increased nutrient levels have been reported by Gaur *et al.* (1984), Raj (1999). The lowest yield attributing characters were obtained from the treatment combination consisting of 10 t ha$^{-1}$ FYM along with 50% RFD in the form of FYM and neem cake ($f_3n_3$). The lower availability of nutrients due to the application of lower quantity of nutrients might have led to the lower growth and yield attributing characters and yield.

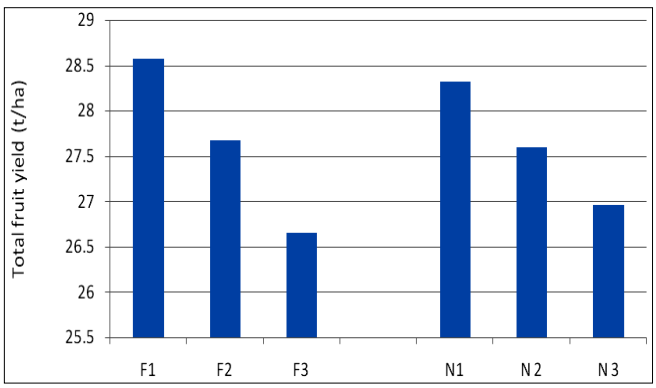


Fig 1 Effect levels of FYM and levels of substitution on total fruit yield (t/ha)

POP recommendation of KAU as well as Ad hoc organic recommendation consisting of FYM and poultry manure recorded higher number of fruits plant$^{-1}$, fruit length and weight of fruits plant$^{-1}$ and mature fruit yield. The increased yield and yield attributes obtained in this study might be due to the interaction of organic and inorganic nutrients resulting in better translocation of nutrients under optimum moisture condition of the soil leading to ready availability of nutrients, increased photosynthetic activity and increased leaf area of the crop inducing better growth. Positive response of increase in 100 fruit weight of chilli, fruit length and number of fruits plant$^{-1}$ due to application of FYM + RFD and organics in combination were reported by Malawadi (2003), Kattimani (2004) in chilli. The higher availability of nutrients might also have contributed to the higher growth parameters and in turn yield and yield attributing characters. Similar better growth attributes, yield and yield attributing characters with poultry manure application in chilli were reported by Anitha (1997).

*Economic analysis*

The highest level of organic nutrition (20 t ha$^{-1}$) and levels of substitution of nitrogen (100% recommended dose of N- 75 kg ha$^{-1}$) resulted in higher net income (Fig 2) and

B:C ratio (Fig 3) of chilli. The continuous supply of nutrients for a prolonged period due to organic manures might have resulted in higher yield, and the higher yield along with higher price for the organically produced vegetables have resulted in high net income and B:C ratio. A similar result of increased profit with FYM and neem cake was reported by Raj (1999), Shekhar and Rajasree (2009) in bhindi.

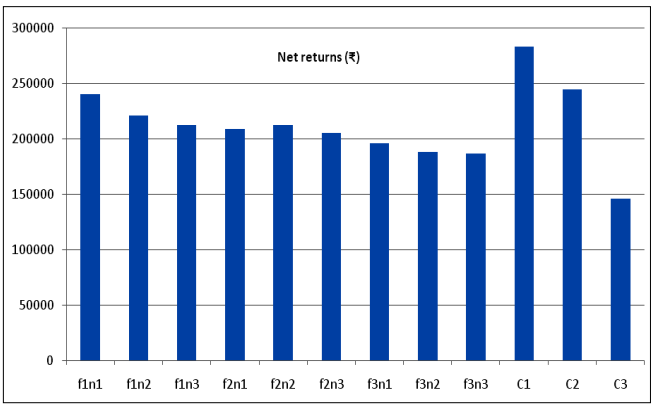


Fig 2 Interaction effect of FYM and levels of substitution on net returns

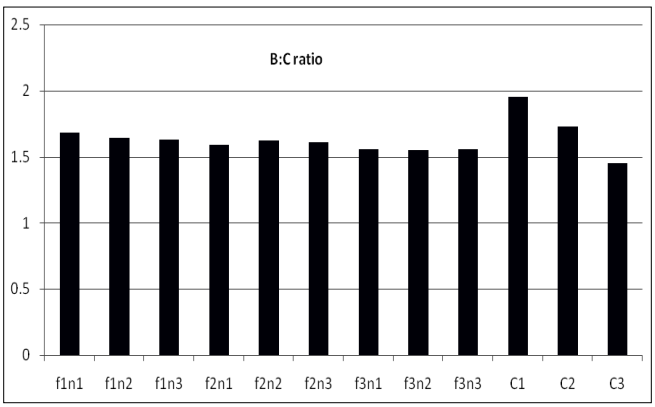


Fig 3 Interaction effect of FYM and levels of substitution on B:C ratio

Package of practices (POP) recommendation of Kerala Agriculture University (FYM @ 25 t $ha^{-1}$ along with 75:40:25 kg N: $P_2O_5$: $K_2O$ $ha^{-1}$ as inorganic fertilizer) registered maximum net returns and B:C ratio. This increase in net returns and B:C ratio may be due to higher yield along with reduced cost of cultivation due to the low cost incurred for nutrition with inorganic nutrients. Raut *et al*. (2003) reported the maximum net return with benefit: cost ratio of 2.30 with the application of inorganic fertilizers and farmyard manure (FYM) in tomato.

## LITERATURE CITED

Anitha V. 1997. Nitrogen management in vegetable chilli grown in pots with modified drip irrigation system. *M. Sc. (Agriculture) Thesis*, Kerala Agricultural University, Thrissur. pp 121.

Chavan P J, Syedimaiz, Rudraksha G B, Malewar G and Baig M I. 1997. Effect of various nitrogen levels through FYM and urea on yield, uptake of nutrients and ascorbic acid content in chilli (*Capsicum annuum* L.). *Journal of the Indian Society of Soil Science* **45**(4): 833-835.

Gaur A C, Neelakantan S and Dargan K S. 1984. *Organic manures.* Indian Council of Agricultural Research, New Delhi. pp 159.

Joseph P. 1998. Evaluation of organic and inorganic sources of nutrients on yield and quality of snake gourd (*Trichosanthes anguina* L.). *M. Sc. (Agriculture) Thesis*, Kerala Agricultural University, Thrissur. pp 95.

Kattimani S. 2004. Response of chilli (*Capsicum annuum* L.) genotypes to integrated nutrient management. *M. Sc. (Agriculture) Thesis*, University of Agricultural Sciences, Dharwad, Karnataka. pp 128.

Malawadi M N. 2003. Effect of secondary and micronutrients on yield and quality of chilli (*Capsicum annuum* L.). *M. Sc. (Agriculture) Thesis*, University of Agricultural Sciences, Dharwad, Karnataka. pp 129.

Raj A K. 1999. Organic nutrition in okra (*Abelmoschus esculentus*). *M. Sc. (Agriculture) Thesis*, Kerala Agricultural University, Thrissur, Kerala. pp 166.

Raut R L, Naidu A K, Jain P K and Rajwade V B. 2003. Influence of organic and chemical sources of nutrients on the yield, fruit quality and storage of tomato in Madhya Pradesh, India. *JNKVV Reserch Journal* **37**(1): 30-33.

Sekhar P and Rajasree V. 2009. Influence of organic manure on growth yield and quality of okra. *American - Eurasian Journal of Sustainable Agric*ulture **3**(1): 6-8.

Senthilkumar R and Sekar K. 1998. Effect of organic and inorganic amendments on bhindi in lignite mine soils. *The Madras Agricultural Journal* **5**(1): 38-40.