International Journal of Advanced Biochemistry Research

ISSN Print: 2617-4693
ISSN Online: 2617-4707
IJABR 2024; SP-8(5): 210-215
www.biochemjournal.com
Received: 24-03-2024
Accepted: 29-04-2024

Rizwana Khan
M.Sc. Students, Rama University, Mandhana, Kanpur, Uttar Pradesh, India

Jitendra Kumar
Assistant Professor, Rama University, Mandhana, Kanpur, Uttar Pradesh, India

Vinay Joseph Silas
Assistant Professor, Rama University, Mandhana, Kanpur, Uttar Pradesh, India

Aneeta Yadav
Associate Professor, (Rama University, Mandhana, Kanpur, Uttar Pradesh, India

Sarvesh Kumar
Assistant Professor, Rama University, Mandhana, Kanpur, Uttar Pradesh, India

Syed Mohd Quatadah
Assistant Professor, Rama University, Mandhana, Kanpur, Uttar Pradesh, India

Ashish Srivastava
Assistant Professor, Rama University, Mandhana, Kanpur, Uttar Pradesh, India

Corresponding Author:
Jitendra Kumar
Assistant Professor, Rama University, Mandhana, Kanpur, Uttar Pradesh, India

Impact of organic and inorganic fertilizers on capsicum (*Capsicum annuum* var. Grossum) growth, yield, and quality

Rizwana Khan, Jitendra Kumar, Vinay Joseph Silas, Aneeta Yadav, Sarvesh Kumar, Syed Mohd Quatadah and Ashish Srivastava

DOI: https://doi.org/10.33545/26174693.2024.v8.i5Sc.1163

Abstract
The current study is named "*Capsicum annuum* L. var. Grossum: Impact of Organic and Inorganic Nutrients on Growth and Yield." conducted during Rabi-2023–24 at the Rama University Agricultural Research Farm in Mandhna, Kanpur, Uttar Pradesh. Three replications and a randomized block design were used for the experiment. The plant growth and production metrics were greatly increased by the addition of inorganic fertilizers (100% RDF, 125% RDF, 20 kg $FeSO_4$, and 20 kg $ZnSO_4$), organic nutrients (2.5 t/ha vermicompost and 2.5 t/ha FYM), and their combinations. The maximum plant height (99.51 cm), the number of branches at the harvest stage (51.47), the number of fruits per plant (10.82), the length of the fruit (cm) (7.81 cm), the average fruit weight (g) (65.12), the fruit yield plant-1 (kg) (0.71), and the fruit yield per hectare (265.66 q) were all significantly recorded in T_6 100% RDF + 20 kg $FeSO_4$ + 20 kg $ZnSO_4$.

Keywords: Time series, ARIMA, modelling, forecasting

Introduction

The annual, day-neutral sweet pepper (*Capsicum annuum* L. var. Grossum) is a member of the Solanaceae family of plants. Due to its high nutritional content, flavor, and color, it is one of the most important vegetable crops farmed worldwide and in India (Tiwari *et al.* 2013) [16]. It is also regarded as one of the world's main commercial crops. It is the second most important vegetable crop in the world after tomatoes and has thick flesh that is either generally non-pungent or less pungent. Although sweet peppers are low in energy, they are high in nutrients, particularly in vitamins A and C (Roy *et al.* 2011) [11]. In India, capsicum is cultivated for its ripe fruits, which are then frequently baked, stuffed, and eaten in salad, noodle, and soup recipes (Kumari and Kaushal, 2014) [7].

Providing high-quality inputs can boost agricultural productivity in any given crop. Any crop, including capsicum, depends on nutrition for growth and development since fertilizers high in phosphorus, potassium, and nitrogen have been shown to positively affect the plant. One of the most important elements in crop productivity is fertilizer (Satyanarayana *et al.*, 2002) [13]. The application of both organic and inorganic fertilizers together has gained significant importance in the production of vegetables due to the high nutrient requirements for continuous production, the hectare-1 yield of vegetables, and the fact that fertilizer alone is insufficient to maintain soil productivity in highly intensive cropping systems. Additionally, certain nutrient deficits can be mitigated by using organic manures in integrated nutrition management. One of the main variables influencing yield is the condition of the soil (Singh and Jain, 2004) [15]. Large amounts of organic manures are applied as a basic source of vital nutrients for plants. Applying organic manures to soil enhances its physical characteristics and makes more nutrients available. It provides nutrients to the plants, particularly micronutrients, to boost crop yields (Saravaiya, 2010) [12].

A crop cannot be supplied with all the nutrients it needs if only one type of fertilizer—chemical, organic, or biofertilizer—is used. According to Jaggi *et al*. (2001) [17], instead, nutrients must be provided through organic, inorganic, and biofertilizer sources in an integrated manner and in balanced amounts, using suitable management technology that is socially, economically, and environmentally acceptable. The current study was designed to assess the research on the effects of organic and inorganic nutrients on the growth and yield of capsicum (*Capsicum annuum* L. var. Grossum), taking into account the information provided above.

Materials and Methods

The current study was conducted from Rabi-2023–24 at Rama University's Agricultural Research Farm in Mandhna, Kanpur, Uttar Pradesh. Three replications and a randomized block design were used to set up the experiment. The course of treatment included T_1: Control, T_2: RDF = 100%; T_3: RDF = 125%; T_4: RDF = 100% + 20 kg $FeSO_4$ T_7: 100% RDF + 2.5 t/ha FYM, T_8: 100% RDF + 2.5 t/ha vermicompost, T_9: 100% RDF + 2.5 t/ha FYM + 2.5 t/ha vermicompost, and T_5: 100% RDF + 20 kg ZnSO4. N, P, and K were supplied via $FeSO_4$, $ZnSO_4$, and urea, respectively. The basal dose for potassium, phosphorus, and nitrogen was half of the recommended amounts. The remaining half of the nitrogen was sprayed as a top dressing during flowering. Twenty days prior to transplanting, vermicompost was added to the appropriate plot in accordance with the therapy. Before being transplanted, seedlings were infected with Azotobacter using the seedling dip method at a rate of 2.5 kg ha^{-1}. By using the 2, 6-dichlorophenol indophenols visual titration method, ascorbic acid (mg 100 g^{-1}) was ascertained. Using a hand refractrometer, the total soluble solid was calculated; the findings were given in °brix. Fruit Firmness (kg cm-2) was calculated using the "Agrosta 14" software. The gathered soil samples were combined, decreased to 500 g, dried in the shade, and then sieved using a 2 mm sieve. The available nitrogen content was determined using the alkaline potassium permagnate method (Subbiah and Asija, 1956) [18], the available phosphorus content was determined using the Olsen method (Olsen *et al*., 1954) [19], the available potassium content was estimated using the ammonium acetate method of Merwin and Peech (1951) [20], and the electrical conductivity and pH were measured using a digital pH meter (Jackson, 1973) [21]. The Walkey and Black (1934) [22] method was used to analyze organic carbon.

The statistical analysis was conducted in accordance with the guidelines provided by Panse and Sukhatme (1987) [23]. The amount of material required for one hectare was determined by economic research, and the annual cost of production was computed by taking into account the present market rate, depreciation, material life, and annual interest. By dividing net returns from the overall cost of cultivation, the benefit-cost ratio was calculated.

Result and Discussion

Growth attributes

Plant height (cm)

Plant height of capsicum plant as influence by different treatments is given in Table 1. Plant height was recorded at 30, 60, 90 days after sowing and at harvest stage.

The plant height at 30 days after sowing as affected by treatments varied from (31.20 cm) T_1 (control) to (37.50 cm) in T_9 during the experimentation. The results showed that maximum (38 cm) plant height was recorded with T_6 (100% RDF + 20 kg $FeSO_4$ + 20 kg $ZnSO_4$) which was statistically at par with T_9 (37.50 cm), T_5 (37.13 cm), respectively. However, minimum (31.20 cm) plant height was recorded with T_1 (control).

The plant height at 60 days after sowing as affected by treatments ranged from (57 cm) T_1 (Control) to (65.50 cm) T_9 during the experimentation. The maximum (66.66 cm) plant height was found in T_6 (100% RDF + 20 kg $FeSO_4$ + 20 kg $ZnSO_4$) which is at par with T_9 (65.50 cm), T_5 (64.33 cm), T_8 (64.10 cm), respectively. However, the minimum plant height (57 cm) was observed in T_1 (Control).

The plant height at 90 days after sowing as affected by treatments varied from (68.24 cm) T_1 (control) to (79.30 cm) in T_9 (100% RDF + 2.5 t/ha FYM + 2.5 t/ha vermicompost) during the experimentation. Among the treatments of organic and inorganic nutrients applied, the maximum (83.24 cm) plant height was found in T_6 (100% RDF + 20 kg $FeSO_4$ + 20 kg $ZnSO_4$) which is at par with T_9 (79.30 cm), T_5 (78.20 cm), T_8 (76.33 cm), respectively. However, minimum plant height (68.24 cm) was recorded with T_1 (control).

The plant height at harvest as affected by treatments varied from (85.71 cm) T_1 (control) to (98.29 cm) in T_9 (100% RDF + 2.5 t/haFYM + 2.5 t/ha vermicompost) during the experimentation. Among the treatments of organic and inorganic nutrients applied, the maximum (99.61) plant height was found in T_6 (100% RDF + 20 kg $FeSO_4$ + 20 kg $ZnSO_4$) which is at par with T_9 (98.21 cm), T_5 (96.58 cm), T_8 (94.28 cm), respectively. However, minimum plant height (85.71 cm) was recorded with T_1 (control).Similar findings were observed by Jamir *et al.* (2017) [3] carried on the effect of organic manures and chemical fertilizers on growth and yield of sweet pepper.

Table 1: To study the effect of Organic and Inorganic Fertilizers on growth of Capsicum.

Treatments	Plant height (cm)			
	30DAT	60DAT	90DAT	120DAT
T_1: Control	31.20	57.00	68.24	85.71
T_2: 100% (RDF)	34.87	61.15	72.09	89.05
T_3: 125% RDF	35.15	61.30	73.45	91.36
T_4: 100% RDF + 20 kg $FeSO_4$	36.10	63.12	75.43	93.29
T_5: 100% RDF + 20 kg $ZnSO_4$	37.13	64.33	78.20	96.58
T_6: 100% RDF + 20 kg $FeSO_4$ + 20 kg$ZnSO_4$	38.00	66.66	83.64	99.61
T_7: 100% RDF + 2.5 t/ha FYM	35.66	62.00	74.30	92.29
T_8: 100% RDF + 2.5 t/ha vermicompost	36.43	64.10	76.33	94.26
T_9: 100% RDF + 2.5 t/ha FYM + 2.5 t/ha vermicompost	37.50	65.50	79.30	98.29
CDaT_5%	1.06	0.03	0.67	0.58
C.V%	1.70	0.03	0.51	0.36

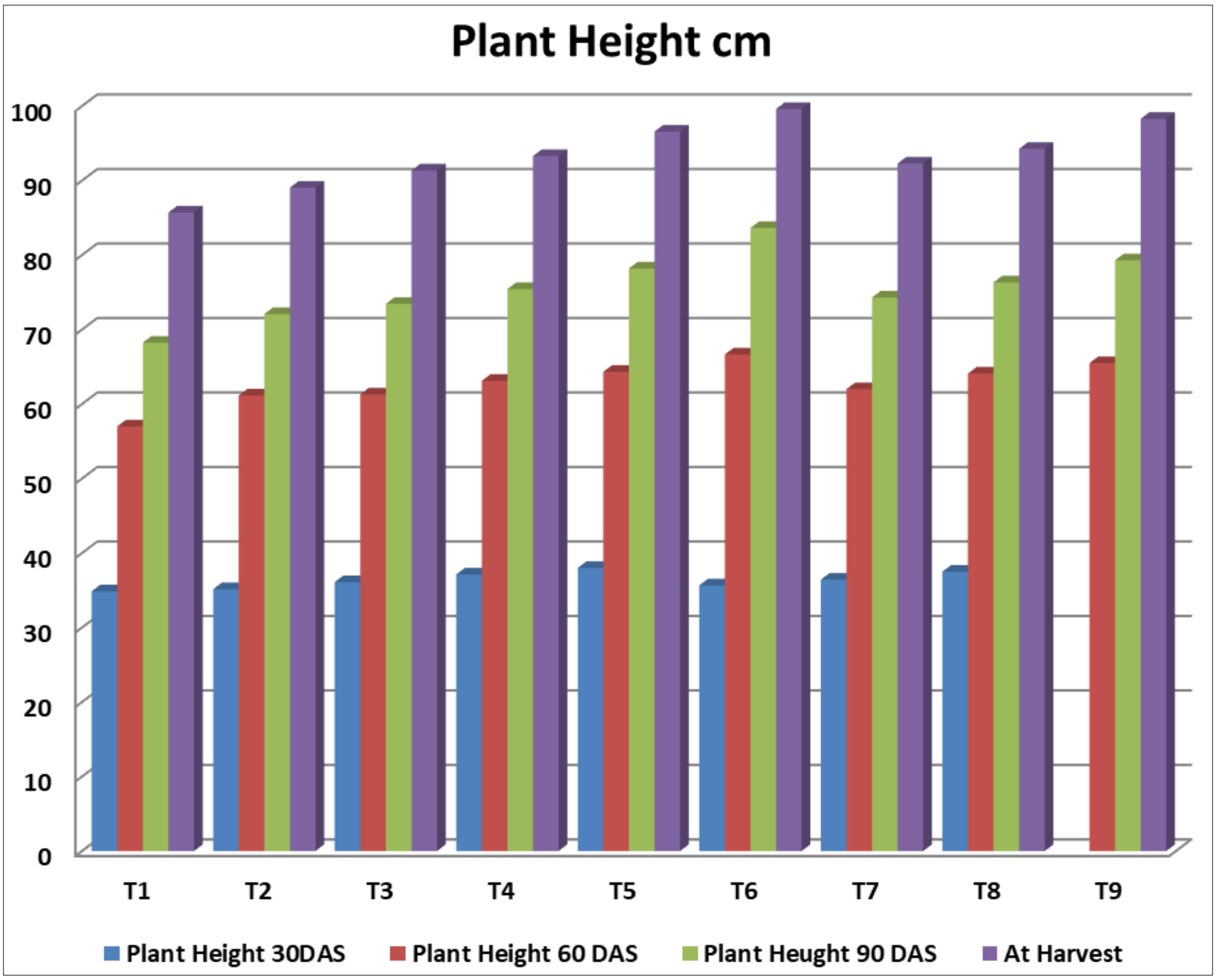

Fig 1: Effect of organic and Inorganic nutrients on plant height (cm) of capsicum.

Number of Branches

Data recorded on number of branches at harvest stage has been portrayed in Table 2 and graphically presented in Figure 2. The perusal of data indicates the significant response of organic and inorganic nutrients on number of branches at harvest stage. The leaf area at harvest stage as influenced by different treatments varied from (36.50) T_1 (control) to (53.42) T_9 (100% RDF + 2.5 t/ha FYM + 2.5 t/ha vermicompost) during the investigation. The maximum (54.47) number of branches was found in T_6 (100% RDF + 20 kg $FeSO_4$ + 20 kg $ZnSO_4$) which is at par with (53.42) T_9 (100% RDF + 2.5 t/ha FYM + 2.5 t/ha vermicompost), T_8 (154), T_4 (148), T_7 (135.3), and (129) T_3 respectively. While statistically minimum (36.50) number of branches was recorded under the treatment T_1 (control). These results are also supported by findings of and Kashyap *et al.* (2014) [5]

Table 2: Effect of organic and inorganic nutrients on number of branches of capsicum.

Treatments	Number of branches at Harvest Stage
T_1: Control	36.50
T_2: 100% (RDF)	42.54
T_3: 125% RDF	44.03
T_4: 100% RDF + 20 kg $FeSO_4$	47.50
T_5: 100% RDF + 20 kg $ZnSO_4$	51.01
T_6: 100% RDF + 20 kg $FeSO_4$ + 20 kg$ZnSO_4$	54.47
T_7: 100% RDF + 2.5 t/ha FYM	44.45
T_8: 100% RDF + 2.5 t/ha vermicompost	49.67
T_9: 100% RDF + 2.5 t/ha FYM + 2.5 t/ha vermicompost	53.42
CDaT$_5$%	0.75
C.V%	0.91

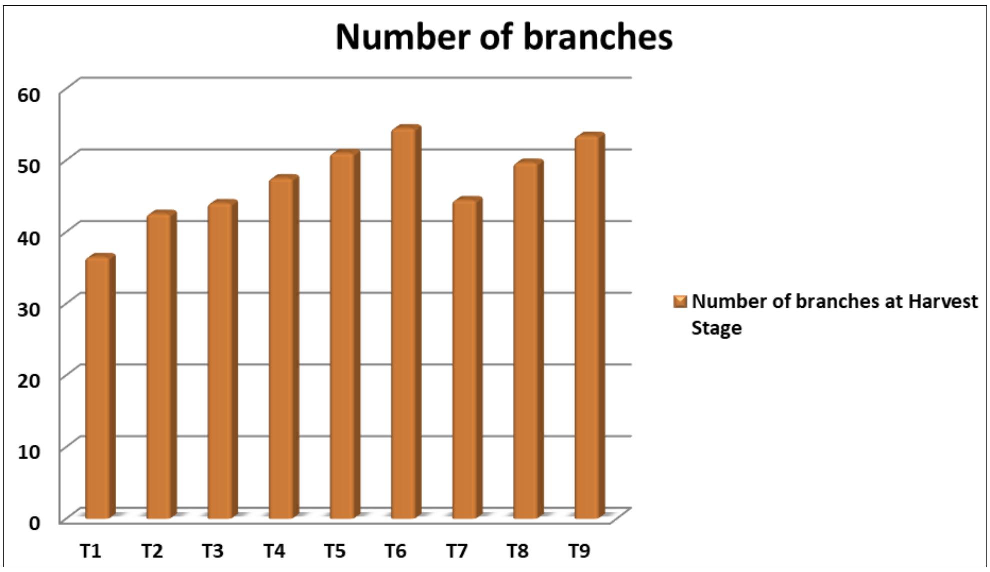

Fig 2: Effect of organic and inorganic nutrients on number of branches of capsicum.

Yield parameters

Number of fruits/plants

The data with regard to number of fruits plant $^{-1}$ as influenced by effect of organic and inorganic nutrients on capsicum cv. "Arka Gaurav" with mean has been tabulated and illustrated graphically in Table 3 and Fig. 3.during the year of investigation T_1 (control) reported the lowest number of fruits per plant (6.18) and was significantly lower than all the other treatments. The maximum number of fruits per plant (10.82) was recorded in the treatment T_6 (100% RDF + 20 kg $FeSO_4$ + 20 kg $ZnSO_4$) followed by (10.64) in the Treatment T_9 (100% RDF + 2.5 t/ha FYM + 2.5 t/ha vermicompost), (10.18) in T_5 (100% RDF + 20 kg $ZnSO_4$) and (9.87) in the Treatment T_8. These findings are in accordance with Nitesh *et al.*, (2005) [8] and Chandini *et al.*, (2016) [2].

Table 3: Effect of organic and inorganic nutrients on number of fruits per plant of capsicum.

Treatments	Number of fruits per plant
T_1: Control	6.18
T_2: 100% (RDF)	7.61
T_3: 125% RDF	8.24
T_4: 100% RDF + 20 kg $FeSO_4$	9.48
T_5: 100% RDF + 20 kg $ZnSO_4$	10.18
T_6: 100% RDF + 20 kg $FeSO_4$ + 20 kg$ZnSO_4$	10.82
T_7: 100% RDF + 2.5 t/ha FYM	8.80
T_8: 100% RDF + 2.5 t/ha vermicompost	9.87
T_9: 100% RDF + 2.5 t/ha FYM + 2.5 t/ha vermicompost	10.64
CD at 5%	0.17
C.V %	1.08

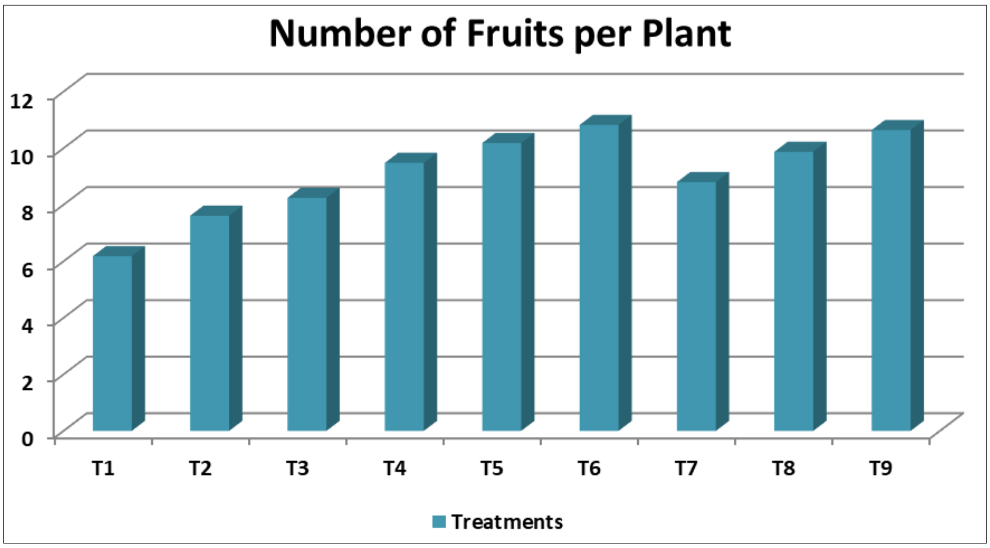

Fig 3: Effect of organic and inorganic nutrients on number of fruits per plant of capsicum.

Average Fruit Weight (g)

The data with regard to average fruit weight plant $^{-1}$ as influenced by effect of organic and inorganic nutrients on capsicum cv. "ArkaGaurav" with mean has been tabulated and illustrated graphically in Table 4. And Fig. 4. during the year of investigation T_1 (control) reported the lowest average fruit weight per plant (56.14) and was significantly lower than all the other treatments. The maximum average fruit weight per plant (65.12) was recorded in the treatment T_6 (100% RDF + 20 kg $FeSO_4$ + 20 kg $ZnSO_4$) followed by (64.82) in the Treatment T_9 (100% RDF + 2.5 t/ha FYM + 2.5 t/ha vermicompost), (63.84) in T_5 (100% RDF + 20 kg $ZnSO_4$) and (63.20) in the Treatment T_8. These findings led support to the observations of Vimala and Natrajan (2000) [24] in capcicum. Accordance to Reddy *et al.* (2017) [9] carried on different organic manure combination on growth and yield of chilli (*Capsicum annum* L.) Rehaman *et al.* (2015) [10].

Fruit yield plant^{-1} (kg)

Data with regard to fruit yield per plant influenced by effect of organic and inorganic nutrients on capsicum with mean has been tabulated and illustrated graphically in Table 4. and Figure 4.during the year of investigation. The fruit yield per plant in the kilogram significantly affected by different treatments varied from (0.35) T_1 (control) to (0.68 kg) in T_9 (100% RDF + 2.5 t/ha FYM + 2.5 t/ha vermicompost). Among the treatments of organic and inorganic nutrients applied, the maximum fruit yield in gram (0.71 g) was observed in T_6 (100% RDF + 20 kg $FeSO_4$ + 20 kg $ZnSO_4$) followed by (0.68 g) in T_9 (100% RDF + 2.5 t/ha FYM + 2.5 t/ha vermicompost), (0.65 g) in T_5 (100% RDF + 20 kg $ZnSO_4$) and (0.61 g) in T_8 (100% RDF + 2.5 t/ha vermicompost). While, statistically minimum number of fruit yield per plant (0.35) was recorded under the treatment T_1 (control). Similar finding was also reported by Kumar *et al.* (2016) [6].

Fruit yield (q/ha)

Data with regard to fruit yield q/ha influenced by effect of organic and inorganic nutrients on capsicum with mean has been tabulated and illustrated graphically in Table 4. and Figure 4. during the year of investigation. The fruit yield q/ha in significantly affected by different treatments varied from (129 q/ha) T_1 (control) to (253.33) in found T_9 (100% RDF + 2.5 t/ha FYM + 2.5 t/ha vermicompost) which was statistically at par with (241 q/ha) T_5 (100% RDF + 20 kg $ZnSO_4$) followed by (224.67 q/ha) T_8 (100% RDF + 2.5 t/ha vermicompost). fruit yield per hectare. While, statistically minimum fruit yield q/ha (129 q/ha) was recorded under the treatment T_1 (control). These findings are in agreement with (Adhikari *et al.*, 2016) [1] This observation was determined by Kadam *et al.* (2016) [4], These results are in accordance with the finding *of* Shabir *et al.* (2017) [14].

Table 4: Effect of organic and inorganic nutrients on fruit yield of capsicum.

Treatments	Average fruit weight (g)	Fruityieldplant^{-1}(kg)	Fruit yield (q/ha)
T_1: Control	56.14	0.35	129.00
T_2: 100% (RDF)	59.16	0.45	166.00
T_3: 125% RDF	60.72	0.49	181.00
T_4: 100% RDF + 20 kg $FeSO_4$	62.82	0.58	217.67
T_5: 100% RDF + 20 kg $ZnSO_4$	63.84	0.65	241.00
T_6: 100% RDF + 20 kg $FeSO_4$ + 20 kg$ZnSO_4$	65.12	0.71	265.66
T_7: 100% RDF + 2.5 t/ha FYM	61.46	0.54	198.33
T_8: 100% RDF + 2.5 t/ha vermicompost	63.20	0.61	224.67
T_9: 100% RDF + 2.5 t/ha FYM + 2.5 t/ha vermicompost	64.82	0.68	253.33
CDaT$_5$%	0.10	0.00	2.17
C.V%	0.10	0.71	0.59

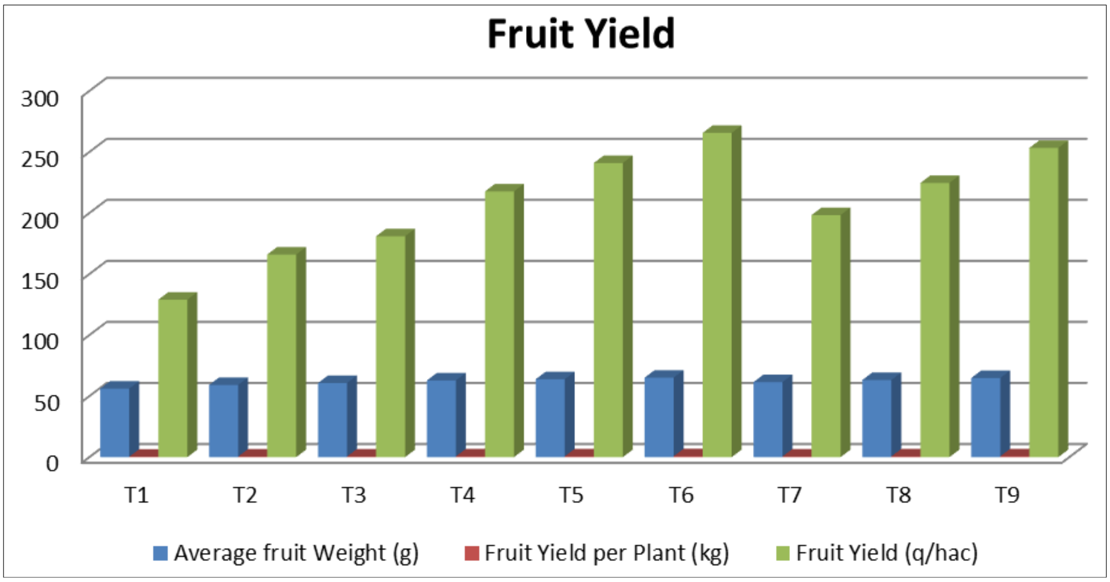

Fig 4: Effect of organic and inorganic nutrients on fruit yield per plant of capsicum.

References

1. Adhikari P, Khanal A, Subedi R. Effect of different sources of organic manure on growth and yield of sweet pepper. Adv Plants Agric Res. 2016;3(5):00111.
2. Chandini AR, Holebasappa K, Hore JK, Chattopadyay N. Growth and yield of chilli (*Capsicum annuum*) as influenced by different growth regulators. J Agric Res. 2016;11(1):385-388.
3. Jamir T, Rajwade VB, Prasad VM, Lyngdoh C. Effect of organic manures and chemical fertilizers on growth and yield of sweet pepper (*Capsicum annuum* L.) hybrid Indam Bharath in shade net condition. Int J Curr Microbiol Appl Sci. 2017;6(8):1010-1019.
4. Kadam PD, Vaidya PH, Dhawan AS, Aundhakar AV. Effect of tank silt and organic manures on growth, quality, yield and yield attributes of okra (*Abelmoschus esculentus* L.). Int J Curr Microbiol Appl Sci. 2016;11:4219-4221.
5. Kashyap S, Kumar S, Maji S, Kumar D. Effect of organic manures and inorganic fertilizers on growth, yield and quality of brinjal (*Solanum melongena* L.) cv. Pant Rituraj. Int J Agric Sci. 2014;10:305-308.
6. Kumar V, Sachan CP, Senjam J, Singh A, Sinha AK. Effect of INM practice on plant growth, fruit yield and yield attributes in chilli (*Capsicum annuum* L.). Int J Plant Anim Environ Sci. 2016;6(1):170-173.
7. Kumari R, Kaushal A. Drip fertigation in sweet pepper: a review. Int J Eng Res Appl. 2014;8(4):144-9.
8. Nitesh N, Vyakaranhal BS, Gouda MS, Deshpande VK. Influence of growth regulators on growth, seed yield and quality of chilli cv. Byadgi Kaddi. Karnataka J Agric Sci. 2005;18(1):36-38.
9. Reddy GC, Venkatachalapathi V, Reddy GPD, Hebbar SS. Study of different organic manure combinations on growth and yield of chilli (*Capsicum annuum* L.). Int J Curr Microbiol Appl Sci. 2017;17(1):472-474.
10. Rehman A, Shahid M, Malik A, Khan S. Effect of organic and inorganic fertilizers on brinjal cultivars under the agro-climatic conditions of Mansehra. J Biol. 2015;5(1-5):45-65.
11. Roy SS, Khan MSI, Pall KK. Nitrogen and phosphorus efficiency on the fruit size and yield of capsicum. J Exp Sci. 2011;2(1):32-37.
12. Saravaiya SN, Patel NB, Ahir MP, Patel NM, Desai KD, Patel JB. Integrated nutrient management (INM) approach for brinjal (*Solanum melongena* L.) and other solanaceous vegetables: a review. Agric Res Commun Centre. 2010;31(2):79-92.
13. Satyanarayana V, Prasad PV, Murthy VR, Boote KJ. Influence of integrated use of farmyard manure and inorganic fertilizers on yield and yield components of irrigated lowland rice. J Plant Nutr. 2002;25(10):2081-2090.
14. Shabir A, Khan SH, Wani SH. Evaluation of integrated nutrient management practices on yield and economics of chilli (*Capsicum annuum* L.). Int J Curr Microbiol Appl Sci. 2017;6(24):2195-2201.
15. Singh DK, Jain SK. Interaction effect of nitrogen and phosphorous on yield and economics of chilli (*Capsicum annuum* L.). Sci Hortic. 2004;9:97-100.
16. Tiwari SP, Panigrahi HK, Sharma D. Effect of different fertigation levels on morpho-physiological characters and yield of capsicum under greenhouse condition. Int J Agric Sci. 2013;1(9):111-113.
17. Jaggi S, Sood C, Kumar V, Ravindranath SD, Shanker A. Leaching of pesticides in tea brew. Journal of Agricultural and Food Chemistry. 2001 Nov 19;49(11):5479-5483.
18. Subbaiah BV, Asija GL. A rapid procedure for the estimation of available nitrogen in soil Current Science. 1956;25258-260.
19. Olsen SR. Estimation of available phosphorus in soils by extraction with sodium bicarbonate. US Department of Agriculture; c1954.
20. Merwin HD, Peech M. Exchangeability of soil potassium in the sand, silt, and clay fractions as influenced by the nature of the complementary exchangeable cation; c1951. p. 125-128.
21. Jackson WA, Flesher D, Hageman RH. Nitrate uptake by dark-grown corn seedlings: some characteristics of apparent induction. Plant Physiology. 1973 Jan 1;51(1):120-127.
22. Walkley A, Black IA. An examination of the Degtjareff method for determining soil organic matter, and a proposed modification of the chromic acid titration method. Soil science. 1934 Jan 1;37(1):29-38.
23. Joshi BH. Panse VG, Sukhatme, PV" Statistical Methods for Agricultural Workers"(Book Review). Indian Journal of Agricultural Economics. 1956 Oct 1;11(4):81.
24. Vimala B, Natarajan S. Effect of nitrogen, phosphorus and biofertilizers on pod characters, yield and quality in pea (*Pisum sativum* L. spp. hortense). South Indian Horticulture. 2000;48(1/6):60-63.