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Effect of organic manure and inorganic fertilizer on growth and yield of chilli (*Capsicum annum* L.)

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Abstract

The present experiment was carried out during November to May 2021-22 in Research field, Department of Horticulture, SHUATS, Prayagraj. The experiment was conducted in Randomized Block Design (RBD), with 08 treatments, replicated thrice with organic (FYM, Vermicompost, Poultry Manure) & Inorganic (NPK) on chilli. T₀ control [RND(RDF(150:60:80 Kg NPK)], T₁-100% RND through chemical fertilizer, T₂-100% RDF + 10t vermicompost, T₃-100% RDF + 5t poultry manure, T₄- 75% RDF + 25% through FYM, T₅-75% RDF + 25% through FYM, T₆-75% RDF + 25% through vermicompost, T₇-75% RDF + 25% through poultry manure, from the present experiment, it is found that Treatment 2 combination of 100% RDF + 10t vermicompost, was found best in terms of growth, yield and quality parameters of chilli, followed by T₆-75% RDF + 25% through vermicompost. In terms of benefit cost ratio T₂ (1:2.76) was found maximum Whereas minimum B:C ratio was recorded in T₀ (1:1.14) control [RND (RDF (150:60:80kg NPK)].

Keywords: Chilli, organic (FYM, vermicompost, poultry manure) inorganic (NPK)

Introduction

Vegetables play a major role in Indian agriculture and responsible in solving problems of malnutrition among human population. Growing vegetable crops generate greater employment potential in rural areas bringing national security. India is the second largest producer of vegetables after China and contributes about 12 per cent of the world vegetable production (Nayak *et al.*, 2016) [28].

Vegetables are protective supplementary foods and rich sources of minerals and vitamins. Chilli (*Capsicum annum* L.) is an essential vegetable cum commercial spice crop around the world, not only because of its economic importance but also for the nutritional value of the fruit, primarily to the fact it is an excellent source of antioxidant compounds the term "Chilli" is derivative of the Mexican word, chilli. Chilli forms an essential ingredient of Indian curry. There is no spice probably as popular as chilli and no other spice has become such an indispensable ingredient of the daily food of majority people of the world Chilli (*Capsicum annum* L.) belongs to the family Solanaceae and originated in Southern and Central America. The genus *Capsicum* consists of about 20 species and only four species are under cultivation, out of which *C. Pendulum* and *C. Pubescens* are restricted to some species such as *C. annum* and *C. frutescens* are commonly cultivated throughout the world. *C. annum* is the most commonly cultivated species.

Chilli (*Capsicum annum* L.) belongs to the family Solanaceae having chromosome number 2n = 24 is an important vegetable cum spice crop grown in almost all parts of tropical and sub-tropical regions of the world. It is originated from South and Central America where it was domesticated around 7000 BC. *Capsicum* includes 30 species, 5 of which are cultivated *Capsicum annum* L., *C. Frutescence* L., *C. Chinense* J., *C. Pubescence* R. and *C. Baccatan* L. (Patel *et al.*, 2016).

The largest producer of chillies in the world is India accounting for 13.76 million tonnes of production annually followed by China with a production of around 3 million tonnes. Out of the total (37.62 million tonnes) world chilli production, 36.57 percent is contributed by India. The chilli fruits are available in the market throughout the year as chillies are grown in all seasons in all parts of the country. Chilli is one of the popular vegetables cultivated in tropical states of the country. The major chilli growing states are Maharashtra, Andhra Pradesh, Karnataka, Orissa, Tamil Nadu, Madhya Pradesh, West Bengal and Rajasthan. (Anonymous *et al.*, 2016).

Chilli is famous for its pleasant aromatic flavour, pungency and high colouring substance. It is vegetable as well as spice and one of the most important cash crops of India. It is used for industrial purpose due to extraction of oleoresin. Green fruit of chilli and sweet peppers are one of the richest sources of anti-oxidants, vitamins such as Vitamin-A, C and E, these anti-oxidants in food protect occurrence of cancer and instant pain relief. It is one of the most valuable commercial annual spice crops grown in India. The substance that responsible for pungency in chilli is capsaicin. Even though chilli is a high valued commodity. The nutritive value of chilli is excellent. Chilli has also acquired a Great importance in food and beverage industries In the Form of oleoresins, which permits better distribution of colour and flavour in food as compare to chilli powder. Chilli is not only used as a food additive but also used for various medicinal purposes. The daily uses of chilli stimulate saliva and enable proper digestion and good blood circulation. The capsaicin extracted from ripe dried fruits is used in pharmaceutical preparations and medicines related to heart diseases.

India is the largest producer, consumer and exporter of chilli and contributes 25% of total world's area and production (world area 1.5 Mha and production 7 MT). Andhra Pradesh is the largest producer of chilli in India, which contributes about 30% to the total area under chilli, followed by Karnataka (20%), Maharashtra (15%), Madhya Pradesh (10%), Orissa (9%), Tamil Nadu (8%) and other states contributing 18%. In India, Chilli occupies an area, production and productivity 7.52 lakh hectare, 21.40 lakh ton and 2.86 tha-1. Respectively during (NHB 2018-19). In India, major chilli growing states are Andhra Pradesh, Karnataka, Maharashtra, West Bengal, Rajasthan and Madhya Pradesh.

In present condition it is not possible to completely eliminate the use of chemical fertilizer but the dose of fertilizer need to be gradually reduced and be balanced by increasing the use of optimum quantity of organic manures particularly integrated nutrient management with FYM, vermicompost, poultry manures and oil cakes showed a significant positive response on chillies. Organic manures, as well as inorganic fertilizers, are both effective in growing chilli plants. Besides providing major nutrients and minerals, organic manures also improve many soil properties and soil health that contribute to crop production. It is therefore imperative to use organic manure and inorganic fertilizers in chilli cultivation.

Materials and Methods

The experiment was conducted during the year 2021-22 in Departmental research field of Department of Horticulture and Sciences, Prayagraj. The area is situated on the south of Prayagraj on the right bank of Yamuna at Rewa Road at a distance of about 6 km from Prayagraj city. It is situated at 25.08°N latitude and 81.50°E longitudes on elevation of 98 meters from the sea level. This region has sub-tropical climate with extreme of summer and winter the temperature falls down to as low as 1 °C-2 °C during winter season especially in the month of December and January. The mercury rises up to 46°C-48 °C during summer the average rain fall in this area is around 1013.4mm annually with maximum concentration during July to September with few showers and drizzles in winter also the soil type was sandy loam in nature with pH varies from 7.0-8.0 and low in organic carbon, nitrogen and phosphorus.

Results and Discussion

The morphological, growth, yield and quality characteristics of the chilli, namely plant height (cm), number of branches, number of flower, fruit length(cm), average fruit weight(g), no of fruit/plant(kg), fruit yield/plant(kg), fruit-1 FYM, Vermicompost, Poultry manure. They not yield/ha (t/ha), fruit girth (mm), TSS and survival only increase the yield but also improve physical, chemical and biological properties of soils that improve productivity of crop. Use of organic manures alone cannot fulfil the crop nutrients requirement. Mixture of organic manures and inorganic fertilizers gave better results than organic manure alone. There is a proper ratio between the organic and chemical sources and it should be worked out to derive the best combination of the inputs for attaining quantity and quality in chilli. The integrated supply and use of plant nutrients from chemical fertilizers and organic manures has shown to produce higher crop yields than when they are applied alone. Keeping these things under consideration use of organics and their combination in chilli cultivation as target dose of application and to study its effect on growth, yield. Inclusion of organic manures with inorganic sources of nutrient is essential. It is found that percentage were affected by the combined application of FYM, NPK, Vermicompost and Poultry manure.

Application of these individual fertilizers without combination did not have significant increase of yield and related traits but with the great combination of fertilizers and organic manures had significantly increased yield in chilli.

The data related to various growth, yield and quality traits in chilli are presented in Table 2 and that regarding benefit cost ratio were presented in Table 3. Application of recommended dose of fertilizers had showed the least growth, yield and quality of the chilli compared to all other treatment combinations, namely plant height 30DAT (11.89cm), namely plant height 60DAT (35.56 cm), namely plant height 90 DAT (53.44 cm), number of branches (5.22), number of flower (14.56), fruit length(10.56 cm), average fruit weight (5g), no of fruit/plant (41.78), fruit yield/plant(0.50g),fruit yield/ha (18.52t/ha-1), fruit girth (2.33mm), TSS (4.33bricks) and survival percentage(96%) Whereas, highest vine length observed in case of T2 followed by T6 and T3 but lowest was observed in T0 (control).

Impact of different nutrient treatment on growth characters of chilli.

Integrated management for nutritional balance had an important impact on all growth characteristics (Table 2). Significantly the highest plant height 30 DAT (16.33cm), namely plant height 60 DAT (45.33 cm), namely plant height 90 DAT (63.00 cm), number of branches (8.11), number of flower (20.67). The maximum plant height was observed in the combination of both organic and inorganic fertilizers, might be due to the quick availability of nutrients especially nitrogen, the chief nutrient of protein for the formation of protoplasm which leads to cell division and cell enlargement. Similar results were found by Mart Handan and Sundar lingam, (2016) ^[17] and Jamir *et al.*, (2017) ^[29] that the interaction effect of organic and inorganic fertilizers could be attributed the growth of the plant.

Impact of different nutrient treatment on yield and yield attributing characters of chilli

Table 2 presents the yield attributing characters such as fruit

length (14.22 cm), average fruitweight (7.33g), no. of. fruit/plant (54.22), fruit yield d/plant (0.99 kg), fruit yield/ha-1 (36.74t/ha-1), fruit girth (3.89 mm), TSS (5.67 bricks) and survival percentage (99.78%) There was a significant difference observed with the application of organic manures and inorganic fertilizers on fruit length. The mean performance of fruit length ranged from 10.56 cm to 14.22 cm with the mean value of 11.75 cm. The maximum fruit length was recorded for treatment T2- 100%RDF + 10t vermicompost (14.22cm) followed by T6-75% RDF+25% through vermicompost (12.11 cm) and T3-100% RDF + 5t poultry manure (12.00 cm) while the minimum fruit length was recorded under treatment T0 - control (10.56 cm). The reason of maximum fruit length might be due to increase in the production of leaves, ultimately in photosynthesis, higher amount of carbohydrates production and translocation from source (leaves) to sink (reproductive parts) resulted increase in fruit length observed by Shabir *et al.*, (2017) [30].

Impact of different nutrient treatment on economic analysis (B:c ratio) of chilli.

Table 2: Effect of organic manures and inorganic fertilizers on various growth, yield and quality related traits in chilli

Sr. No	Treatment	Plant Height 30 Days	Plant Height 60 Days	Plant Height 90 Days	Number Of Branches	Number Of Flower	Fruit Length (cm)	Average Fruit Weight(g)	Number Of Fruits Per Plant(kg)	Fruit Yield Per Plant(kg)	Yield/ha (t/ha-1)	Fruit Diameter	Tss (bricx)	Survival %
01	T ₀	11.89	35.56	53.44	5.22	14.56	10.56	5.00	41.78	0.50	18.52	2.33	4.33	96.00
02	T ₁	15.00	40.22	60.44	6.56	17.00	11.44	6.33	46.22	0.34	12.72	2.56	5.22	96.22
03	T ₂	16.33	45.33	63.00	8.11	20.67	14.22	7.33	54.22	0.99	36.74	3.89	5.67	99.78
04	T ₃	15.33	43.00	61.11	7.11	19.11	12.00	6.78	48.78	0.68	25.10	2.78	5.44	97.89
05	T ₄	12.00	36.56	55.00	5.89	15.44	10.67	5.89	44.56	0.59	21.81	2.22	4.89	95.89
06	T ₅	14.78	39.33	60.22	6.22	15.56	11.33	6.00	45.22	0.60	22.22	2.33	5.00	96.11
07	T ₆	14.89	43.11	61.22	7.44	19.67	12.11	7.00	50.22	0.63	23.35	3.44	5.56	98.00
08	T ₇	15.11	42.67	61.00	6.89	17.78	11.67	6.56	47.78	0.61	22.62	6.56	5.33	97.56
	F-Test	S	S	S	S	S	S	S	S	S	S	S	S	S
	S. Ed. (±)	0.32	0.65	0.41	0.38	0.80	0.49	0.40	2.23	0.04	1.34	0.40	0.22	0.63
	CD at @ 5%	0.97	1.96	1.26	1.16	2.44	1.47	1.23	6.76	0.11	4.06	1.23	0.66	1.91
	CV	3.85	2.75	1.21	9.91	7.97	7.15	11.02	8.15	7.15	10.12	11.02	7.31	1.12

Table 3: Benefit cost ratio of various treatment combinations in chilli cultivation

Treatment	Selling Price (Sp) In Kg	Yield/ha-1	Gross Profit (Sp X Y)	Net Profit (Gp - Vc)	B:C Ratio (G P/Vc)
T ₀	15	18519	277778	127778	1.14
T ₁	15	12716	190741	181855	1.87
T ₂	15	37222	558333	449447	2.76
T ₃	15	25103	376543	292657	2.13
T ₄	15	21811	327160	230774	1.73
T ₅	15	22222	333333	289168	2.43
T ₆	15	22012	330185	298520	2.64
T ₇	15	21239	318580	286915	2.55

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