



International Journal of Research in Agronomy

E-ISSN: 2618-0618
P-ISSN: 2618-060X
© Agronomy
NAAS Rating (2026): 5.20
www.agronomyjournals.com
2026; 9(9): 835-842
Received: 02-06-2026
Accepted: 08-07-2026

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Growth and yield performance of capsicum cultivars as influenced by organic manures and inorganic fertilizers under shade net conditions

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DOI: <https://www.doi.org/10.33545/2618060X.2026.v9.i9l.6610>

Abstract

The present investigation entitled “Growth and Yield Performance of Capsicum Cultivars as Influenced by Organic Manures and Inorganic Fertilizers under Shade Net Conditions” was conducted during the *Rabi* seasons of 2024-25 and 2025-26 at the College of Horticulture, Rajendranagar, Sri Konda Laxman Telangana Horticultural University, Hyderabad. The experiment was conducted under shade net conditions in a Factorial Randomized Block Design (FRBD) with fifteen treatment combinations and two replications. The treatments comprised three cultivars, viz., A₁: Rupali Red, A₂: Rupali Green and A₃: Rupali Yellow, and five nutrient management treatments, viz., B₁: 50% RDF + Vermicompost 5 t/ha, B₂: 50% RDF + Neem cake 1 t/ha, B₃: 75% RDF + Vermicompost 2.5 t/ha, B₄: 75% RDF + Neem cake 0.5 t/ha and B₅: Control (100% RDF). Among the treatment combinations, A₁B₃ (Rupali Red + 75% RDF + Vermicompost 2.5 t/ha) recorded the maximum plant height (90.24 cm), number of branches per plant (16.88), number of flowers per plant (69.31), pedicel length (5.64 cm), polar diameter (6.15 cm), number of fruits per plant (57.68) and days to last harvest (146.83 days). In contrast, A₂B₃ (Rupali Green + 75% RDF + Vermicompost 2.5 t/ha) recorded the earliest flowering, with minimum days to first flower appearance (32.25 days) and 50 per cent flowering (34.41 days), and also exhibited superior performance for fruit size and yield. The treatment A₂B₃ recorded the maximum fruit length (6.69 cm), equatorial diameter (8.73 cm), fruit weight (124.15 g), fruit yield per plant (1.73 kg), fruit yield per plot (12.16 kg) and fruit yield per hectare (15.76 t), along with minimum days to first fruit set (36.31 days) and first fruit harvest (56.46 days). Overall, A₂B₃ was superior for earliness, fruit size and yield, whereas A₁B₃ performed better for vegetative growth, flower and fruit production, and extended harvesting duration. The findings indicate that integrated nutrient management using 75% RDF + Vermicompost 2.5 t/ha can be considered a promising nutrient management practice for capsicum production under shade net conditions.

Keywords: Capsicum, cultivars, organic manures, inorganic fertilizers, integrated nutrient management, growth, flowering, yield, vermicompost, shade net

1. Introduction

Capsicum (*Capsicum annuum* var. *grossum*, 2n = 2x = 24) is an important cool-season vegetable crop of the family Solanaceae, cultivated under both open and protected conditions. It is native to Mexico, with Guatemala considered a secondary centre of origin (Bukasov, 1930) [5]. The crop was introduced to India by the British during the nineteenth century in the Shimla hills (Greenleaf, 1986) [10]. Capsicum requires a day temperature of 25–30 °C and a night temperature of 18–20 °C, with a relative humidity of 50–60%. Fruit setting is adversely affected when the temperature exceeds 35 °C or falls below 12 °C.

Capsicum has attained the status of a high-value commercial vegetable crop owing to its attractive appearance, pleasant flavour and high nutritional value. It is rich in ascorbic acid, vitamins and minerals (Chassy *et al.*, 2006) [6]. Coloured capsicums, particularly red, yellow and green types, are in high demand in the hotel and catering industry and are consumed fresh or used in salads, stuffing, baking, pizzas, burgers and other food preparations. The increasing demand for coloured capsicums has created considerable opportunities for their commercial production under protected conditions.

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In India, capsicum is extensively cultivated in the hills of Himachal Pradesh, Uttar Pradesh, the Nilgiri hills and Jammu and Kashmir during the summer months, while it is grown as an autumn and winter crop in Karnataka, Maharashtra, Tamil Nadu and Telangana. In Telangana, capsicum is cultivated under both open and protected conditions, with increasing interest among farmers due to its higher market value and demand.

Protected cultivation of capsicum is gaining popularity, particularly for the production of coloured hybrids in peri-urban areas, owing to its proximity to urban markets and the potential for improved productivity and quality. Shade net cultivation provides a favourable microclimate by reducing excessive solar radiation and moderating temperature, thereby protecting plants from heat stress, scorching and wilting. It can consequently contribute to better crop growth, flowering, fruit development and quality. Rao *et al.* (2013) [20] reported that capsicum cultivated under shade net conditions recorded higher yield compared with open-field cultivation.

Nutrient management plays an important role in improving vegetative growth, flowering, yield and quality of capsicum. Excessive dependence on chemical fertilizers may adversely affect soil health and increase production costs. Therefore, the integrated use of organic manures with inorganic fertilizers is considered an important approach for maintaining soil fertility and improving nutrient availability in a sustainable manner. The combined application of organic and inorganic nutrient sources can provide nutrients in balanced quantities while improving soil physical, chemical and biological properties (Jaggi *et al.*, 2001) [13].

Organic manures serve as important sources of macro- and micronutrients and improve soil properties through the addition of organic matter. They also enhance nutrient availability and microbial activity, thereby promoting plant growth and development (Nweke *et al.*, 2013) [16]. Vermicompost is rich in readily available macro- and micronutrients and acts as a source of plant nutrients, thereby promoting vegetative growth and yield (Hidalgo *et al.*, 1999) [12]. Neem cake, a by-product obtained after extraction of oil from neem seeds, contributes to soil fertility by improving soil organic matter, aeration and water-holding capacity. It also possesses certain pesticidal and nematicidal properties and can contribute to improved crop growth.

The application of organic manures in combination with inorganic fertilizers ensures a balanced supply of nutrients, which promotes vegetative growth, timely flowering and flower development, ultimately contributing to improved fruit set, yield and quality in capsicum.

2. Material and Methods

The study was conducted during the *Rabi* seasons of 2024-25 and 2025-26 at the College of Horticulture, Sri Konda Laxman Telangana Horticultural University, Rajendranagar, Hyderabad. The experiment was conducted under shade net conditions in a Factorial Randomized Block Design (FRBD) with fifteen treatment combinations and two replications.

2.1 Experimental Material

The experimental material consisted of three capsicum cultivars, namely Rupali Red, Rupali Green and Rupali Yellow. The nutrient management treatments comprised vermicompost at 5 t/ha and 2.5 t/ha and neem cake at 1 t/ha and 0.5 t/ha, applied 15 days before transplanting. The recommended dose of NPK (100:60:80 kg/ha) was supplied through urea, single super phosphate and muriate of potash. Half of the nitrogen and the entire phosphorus and potassium were applied as basal doses,

while the remaining nitrogen was applied in two equal splits at 30 and 60 days after transplanting.

2.2 Raising of Seedlings

Protrays measuring 25 × 10 × 5 cm were cleaned and filled with cocopeat, perlite and vermiculite in a 3:1:1 ratio. Seeds were soaked overnight and sown individually in the protray cells. The seedlings were raised under shade net conditions and transplanted at the two-leaf stage.

2.3 Crop Management Practices

The experimental field was thoroughly ploughed and brought to a fine tilth. Raised beds measuring 4.00 × 1.00 m were prepared with 40 cm spacing between adjacent beds. Seedlings were transplanted at 45 days after sowing, followed by light irrigation. Drip irrigation was provided based on soil moisture conditions. Weeding and hoeing were carried out at 30 and 60 days after transplanting (DAT). Yellow and blue sticky traps were used for monitoring sucking pests, and standard crop management practices were followed throughout the crop period.

2.4 Details of experimental treatments

Factor A: Cultivars

A₁: Rupali Red

A₂: Rupali Green

A₃: Rupali Yellow

Factor B: Inorganic fertilizers and organic manures

B₁: 50% RDF + Vermicompost (5 t/ha)

B₂: 50% RDF + Neem cake (1 t/ha)

B₃: 75% RDF + Vermicompost (2.5 t/ha)

B₄: 75% RDF + Neem cake (0.5 t/ha)

B₅: Control (100% RDF)

Treatment combinations

A₁B₁: Rupali Red + 50% RDF + Vermicompost (5 t/ha)

A₁B₂: Rupali Red + 50% RDF + Neem cake (1 t/ha)

A₁B₃: Rupali Red + 75% RDF + Vermicompost (2.5 t/ha)

A₁B₄: Rupali Red + 75% RDF + Neem cake (0.5 t/ha)

A₁B₅: Rupali Red + Control (100% RDF)

A₂B₁: Rupali Green + 50% RDF + Vermicompost (5 t/ha)

A₂B₂: Rupali Green + 50% RDF + Neem cake (1 t/ha)

A₂B₃: Rupali Green + 75% RDF + Vermicompost (2.5 t/ha)

A₂B₄: Rupali Green + 75% RDF + Neem cake (0.5 t/ha)

A₂B₅: Rupali Green + Control (100% RDF)

A₃B₁: Rupali Yellow + 50% RDF + Vermicompost (5 t/ha)

A₃B₂: Rupali Yellow + 50% RDF + Neem cake (1 t/ha)

A₃B₃: Rupali Yellow + 75% RDF + Vermicompost (2.5 t/ha)

A₃B₄: Rupali Yellow + 75% RDF + Neem cake (0.5 t/ha)

A₃B₅: Rupali Yellow + Control (100% RDF)

2.5 Observations Recorded

The observations were recorded on growth, flowering and yield parameters like plant height, number of branches per plant, days taken to first flower appearance, days taken to 50% flowering, number of flowers per plant, fruit length, pedicel length, polar diameter, equatorial diameter, fruit weight, number of fruits per plant, days taken to first fruit set, days taken to first fruit harvest, days taken to last fruit harvest, fruit yield per plant, fruit yield per plot and fruit yield per hectare.

2.6 Statistical Analysis

The data collected were analyzed statistically by following the analysis of variance (ANOVA) technique (Panse and Sukhatme

1985)^[18]. Statistical significance was tested with 'F' value at 5 per cent level of significance and whenever the F value was found significant, critical difference was worked out at five per cent level of significance.

3. Results and Discussion

3.1 Growth parameters

The data recorded on growth parameters viz., plant height and number of branches per plant are presented in Table 1

Among the cultivars, the highest plant height and number of branches per plant (77.36 cm and 13.65, respectively) were recorded in A₁ (Rupali Red). Among the nutrient management treatments, B₃ (75% RDF + Vermicompost 2.5 t/ha) recorded the highest plant height and number of branches per plant (77.81 cm and 13.28, respectively). The interaction effect between cultivars and nutrient management treatments was significant, with A₁B₃ (Rupali Red + 75% RDF + Vermicompost 2.5 t/ha) recording the

highest plant height (90.24 cm) and number of branches per plant (16.88). The superior vegetative growth of Rupali Red may be attributed to its inherent genetic potential and better adaptation to the growing conditions. The favourable response of 75% RDF and vermicompost (2.5 t/ha) may be attributed to improved soil conditions and enhanced root-zone environment resulting from vermicompost. The organic matter supplied through vermicompost may have improved soil structure, aeration and moisture retention, thereby creating favourable conditions for better root proliferation. A well-developed root system may have supported efficient water and nutrient absorption, which in turn promoted cell division, shoot elongation and branch initiation, resulting in greater plant height and number of branches per plant. Similar findings have been reported by Akanbi *et al.* (2007)^[2], Chatterjee *et al.* (2012)^[7], Gudadhe *et al.* (2013)^[11] and Gangadhar and Devakumar (2020)^[9].

Table 1: Effect of different organic manures with inorganic fertilizers on plant height (cm) and number of branches at the harvest of capsicum cultivars under shade net conditions

Treatments	Plant height			Number of branches per plant		
	2024-25	2025-26	Pooled	2024-25	2025-26	Pooled
Cultivars (A)						
A ₁	76.05	78.66	77.36	13.21	14.09	13.65
A ₂	49.22	51.87	50.54	6.88	7.74	7.31
A ₃	59.58	62.40	60.99	10.30	10.85	10.57
S.Em ±	0.53	0.39	0.40	0.16	0.15	0.14
CD (5%)	1.53	1.13	1.17	0.46	0.43	0.39
Modules (B)						
B ₁	62.62	64.83	63.73	10.29	10.83	10.56
B ₂	52.02	55.40	53.72	8.46	9.43	8.95
B ₃	76.82	78.80	77.81	13.00	13.57	13.28
B ₄	66.26	69.09	67.68	10.88	11.80	11.34
B ₅	50.37	53.40	51.89	8.02	8.82	8.42
S.Em ±	0.68	0.50	0.52	0.21	0.19	0.17
CD (5%)	1.98	1.45	1.51	0.59	0.56	0.50
Interaction (AXB)						
A ₁ B ₁	79.49	82.04	80.77	13.84	14.37	14.11
A ₁ B ₂	65.51	68.10	66.80	10.84	12.12	11.48
A ₁ B ₃	88.90	91.59	90.24	16.63	17.14	16.88
A ₁ B ₄	82.62	85.72	84.17	14.43	15.73	15.08
A ₁ B ₅	63.75	65.87	64.81	10.32	11.10	10.71
A ₂ B ₁	47.97	50.57	49.27	6.81	7.47	7.14
A ₂ B ₂	39.87	43.50	41.68	5.70	6.71	6.20
A ₂ B ₃	66.06	67.34	66.70	9.21	10.14	9.67
A ₂ B ₄	53.53	56.26	54.89	7.22	8.12	7.67
A ₂ B ₅	38.67	41.70	40.18	5.45	6.26	5.85
A ₃ B ₁	60.39	61.91	61.15	10.23	10.66	10.45
A ₃ B ₂	50.70	54.63	52.67	8.84	9.46	9.15
A ₃ B ₃	75.51	77.49	76.50	13.17	13.43	13.30
A ₃ B ₄	62.64	65.30	63.97	10.98	11.56	11.27
A ₃ B ₅	48.68	52.66	50.67	8.29	9.12	8.70
S.Em ±	1.18	0.87	0.90	0.36	0.33	0.30
CD (5%)	3.43	2.52	2.61	1.03	0.96	0.87

3.2 Flowering Parameters

The data recorded on flowering parameters viz., days taken to first flower appearance, days taken to 50% flowering and number of flowers per plant are presented in Table 2

Among the cultivars, the minimum number of days to first flowering and 50% flowering (35.67 and 38.56 days, respectively) were recorded in A₂ (Rupali Green). Among the nutrient management treatments, B₃ (75% RDF + Vermicompost 2.5 t/ha) recorded the minimum number of days to first flowering and 50% flowering (43.22 and 47.71 days, respectively). The interaction effect between cultivars and nutrient management

treatments was significant, with A₂B₃ (Rupali Green + 75% RDF + Vermicompost 2.5 t/ha) recording the minimum number of days to first flowering and 50% flowering (32.25 and 34.41 days, respectively). The earlier flowering observed in Rupali Green may be attributed to its genetic characteristics and early transition from vegetative to reproductive growth. The favourable response of 75% RDF and vermicompost (2.5 t/ha) may be attributed to the favourable nutritional and physiological status of the plants, which may have accelerated the transition from vegetative to reproductive growth. The continuous availability of nutrients from vermicompost along with inorganic fertilizers may have

supported the development of reproductive structures and promoted earlier flower initiation. Similar findings have been reported by Roy *et al.* (2011)^[22], Zahra *et al.* (2013)^[25], Ademola and Agele (2015)^[1] and Jamir *et al.* (2017)^[14] in bell pepper.

Significant variation was also observed in the number of flowers per plant. Among the cultivars, the maximum number of flowers per plant (58.58) was recorded in A₁ (Rupali Red), while B₃ (75% RDF + Vermicompost 2.5 t/ha) recorded the maximum number of flowers per plant (46.39) among the nutrient management treatments. The interaction effect was significant, with A₁B₃ (Rupali Red + 75% RDF + Vermicompost 2.5 t/ha) recording the maximum number of flowers per plant (69.31). The higher number of flowers in Rupali Red may be attributed to its vigorous growth and greater branching habit, which provided more sites for flower initiation. The superior performance of 75% RDF and vermicompost (2.5 t/ha) may be associated with improved nutrient availability and nutrient uptake, which supported vegetative growth and reproductive development. Similar findings have been reported by Bhattarai *et al.* (2011)^[4], Chetri *et al.* (2012)^[8], Olowoake *et al.* (2015)^[17] and Shiva *et al.* (2015)^[23] in bell pepper.

3.3 Yield parameters

The data recorded on yield parameters viz., fruit length, pedicel length, polar diameter, equatorial diameter, fruit weight, number of fruits per plant, days taken to first fruit set, days taken to first fruit harvest, days taken to last fruit harvest, fruit yield per plant, fruit yield per plot and fruit yield per hectare are presented in Table 3-7

Among the cultivars, the maximum fruit length (6.23 cm), equatorial diameter (7.45 cm), fruit weight (100.64 g), fruit yield per plant (1.46 kg), fruit yield per plot (10.26 kg), and fruit yield per hectare (13.37 t) were recorded in A₂ (Rupali Green). Similarly, among the nutrient management treatments, B₃ (75% RDF + Vermicompost 2.5 t/ha) recorded the maximum fruit length (6.31 cm), equatorial diameter (5.71 cm), fruit weight (62.26 g), fruit yield per plant (1.33 kg), fruit yield per plot (9.32 kg), and fruit yield per hectare (12.13 t). The interaction effect between cultivars and nutrient management treatments was significant, with A₂B₃ (Rupali Green + 75% RDF + Vermicompost 2.5 t/ha) recording the maximum fruit length (6.69 cm), equatorial diameter (8.73 cm), fruit weight (124.15 g), fruit yield per plant (1.73 kg), fruit yield per plot (12.16 kg), and fruit yield per hectare (15.76 t). The superior performance of Rupali Green may be related to its inherent genetic potential for fruit development and yield formation. The favourable response to 75% RDF and vermicompost (2.5 t/ha) may be associated with improved soil condition and nutrient release pattern, which could have supported better root activity and sustained supply of nutrients during fruit development. This may have enhanced photosynthetic activity and translocation of assimilates towards the developing fruits, resulting in better fruit enlargement, fruit

weight and overall yield. Similar improvements in fruit growth and yield attributes under integrated nutrient management have been reported by Lal and Kanaujia (2013)^[15], Ramesh *et al.* (2016)^[19].

In addition to yield attributes, significant differences were observed among the cultivars and nutrient management treatments with respect to earliness. Among the cultivars, the minimum number of days to first fruit set (42.25 days) and first fruit harvest (59.91 days) was recorded in A₂ (Rupali Green). Among the nutrient management treatments, B₃ (75% RDF + Vermicompost 2.5 t/ha) recorded the minimum number of days to first fruit set (49.59 days) and first fruit harvest (68.75 days). The interaction effect between cultivars and nutrient management treatments was significant, with A₂B₃ (Rupali Green + 75% RDF + Vermicompost 2.5 t/ha) recording the minimum number of days to first fruit set (36.31 days) and first fruit harvest (56.46 days). The earlier fruit set and harvest under A₂B₃ may be associated with improved nutrient availability and plant vigour resulting from integrated nutrient management. The balanced supply of nutrients may have favoured early reproductive development and fruit growth. Similar effects of nutrient management on earliness in vegetable crops have been reported by Aliyu (2000)^[3] and Chatterjee *et al.* (2012)^[7].

In contrast, A₁ (Rupali Red) exhibited better performance with respect to fruiting potential and harvest duration. Among the cultivars, the maximum pedicel length (5.05 cm), polar diameter (5.25 cm), number of fruits per plant (47.17), and days to last fruit harvest (137.30 days) were recorded in A₁ (Rupali Red). Among the nutrient management treatments, B₃ (75% RDF + Vermicompost 2.5 t/ha) recorded the maximum pedicel length (4.12 cm), polar diameter (5.66 cm), number of fruits per plant (39.10), and days to last fruit harvest (143.74 days). The interaction effect between cultivars and nutrient management treatments was significant, with A₁B₃ (Rupali Red + 75% RDF + Vermicompost 2.5 t/ha) recording the maximum pedicel length (5.64 cm), polar diameter (6.15 cm), number of fruits per plant (57.68), and days to last fruit harvest (146.83 days). The higher number of fruits per plant and extended harvest duration under A₁B₃ (Rupali Red + 75% RDF + Vermicompost 2.5 t/ha) may be due to the inherent fruiting behaviour of Rupali Red and its ability to maintain fruit production over a longer period. The gradual decomposition and nutrient release from vermicompost may have helped maintain plant vigour during the later stages of crop growth, supporting the development of successive flowering and fruiting sites. This sustained reproductive activity may have resulted in a greater number of fruits per plant and prolonged the harvesting period. Similar beneficial effects of vermicompost and integrated nutrient management on fruit production have been reported by Rekha *et al.* (2018)^[21] and Singh *et al.* (2015)^[24]. Overall, A₂B₃ was superior for fruit size, earliness and fruit yield, whereas A₁B₃ was more favourable for number of fruits per plant and extended harvest duration.

Table 2: Effect of different organic manures with inorganic fertilizers on days taken to first flowering, days taken to 50% flowering and number of flowers per plant of capsicum cultivars under shade net conditions

Treatments	Days taken to first flowering			Days taken to 50% flowering			Number of flowers per plant		
	2024-25	2025-26	Pooled	2024-25	2025-26	Pooled	2024-25	2025-26	Pooled
Cultivars(A)									
A ₁	59.93	56.65	58.29	64.14	61.65	62.90	58.35	58.80	58.58
A ₂	36.45	34.90	35.67	39.77	37.35	38.56	13.90	18.59	16.24
A ₃	53.27	50.09	51.68	59.75	56.31	58.03	35.11	39.75	37.43
S.Em ±	0.33	0.29	0.19	0.22	0.37	0.18	0.70	0.94	0.61
CD (5%)	0.96	0.83	0.54	0.65	1.08	0.53	2.03	2.72	1.78

Modules (B)									
B ₁	50.31	47.44	48.88	54.32	51.66	52.99	34.84	40.50	37.67
B ₂	52.29	50.00	51.14	58.13	55.70	56.91	30.87	32.30	31.58
B ₃	44.57	41.87	43.22	49.48	45.93	47.71	44.13	48.66	46.39
B ₄	47.73	45.12	46.42	51.20	47.97	49.58	39.52	43.44	41.48
B ₅	54.52	51.61	53.07	59.63	57.58	58.60	29.58	30.33	29.95
S.Em ±	0.43	0.37	0.24	0.29	0.48	0.24	0.91	1.22	0.79
CD (5%)	1.24	1.07	0.70	0.84	1.39	0.69	2.62	3.52	2.30
Interaction (AXB)									
A ₁ B ₁	60.94	58.65	59.79	64.96	62.16	63.56	58.62	64.21	61.41
A ₁ B ₂	64.46	60.38	62.42	69.34	66.64	67.99	52.47	45.91	49.19
A ₁ B ₃	51.21	48.32	49.76	56.62	53.68	55.15	66.55	72.07	69.31
A ₁ B ₄	55.65	53.25	54.45	58.88	56.51	57.69	62.73	67.72	65.22
A ₁ B ₅	67.37	62.64	65.00	70.90	69.29	70.09	51.39	44.11	47.75
A ₂ B ₁	36.07	34.11	35.09	38.29	36.47	37.38	12.14	18.18	15.16
A ₂ B ₂	37.71	36.71	37.21	43.24	41.09	42.17	11.38	15.78	13.58
A ₂ B ₃	33.07	31.42	32.25	35.82	33.00	34.41	19.40	24.28	21.84
A ₂ B ₄	35.49	33.70	34.60	36.97	34.11	35.54	15.82	20.25	18.03
A ₂ B ₅	39.89	38.55	39.22	44.51	42.06	43.28	10.74	14.45	12.60
A ₃ B ₁	53.93	49.56	51.75	59.72	56.36	58.04	33.77	39.11	36.44
A ₃ B ₂	54.68	52.91	53.80	61.79	59.36	60.58	28.76	35.21	31.98
A ₃ B ₃	49.41	45.88	47.65	56.00	51.13	53.57	46.43	49.63	48.03
A ₃ B ₄	52.03	48.42	50.23	57.74	53.30	55.52	40.01	42.37	41.19
A ₃ B ₅	56.32	53.65	54.98	63.48	61.39	62.43	26.60	32.43	29.51
S.Em ±	0.75	0.64	0.42	0.50	0.83	0.41	1.57	2.11	1.37
CD (5%)	2.16	1.85	1.21	1.45	2.41	1.19	4.54	6.09	3.98

Table 3: Effect of different organic manures with inorganic fertilizers on fruit length and pedicel length of capsicum cultivars under shade net conditions

Treatments	Fruit length			Pedicel length		
	2024-25	2025-26	Pooled	2024-25	2025-26	Pooled
Cultivars (A)						
A ₁	5.21	5.45	5.33	4.90	5.20	5.05
A ₂	6.19	6.27	6.23	2.03	2.37	2.20
A ₃	4.65	4.75	4.70	3.32	3.57	3.44
S.Em ±	0.07	0.08	0.07	0.06	0.05	0.05
CD (5%)	0.21	0.24	0.20	0.18	0.15	0.14
Modules (B)						
B ₁	5.35	5.46	5.41	3.47	3.82	3.64
B ₂	4.79	5.03	4.91	3.12	3.29	3.20
B ₃	6.27	6.35	6.31	3.96	4.29	4.12
B ₄	5.71	5.86	5.78	3.59	4.10	3.84
B ₅	4.61	4.77	4.69	2.94	3.06	3.00
S.Em ±	0.09	0.11	0.09	0.08	0.07	0.06
CD (5%)	0.27	0.30	0.26	0.23	0.20	0.18
Interaction (AXB)						
A ₁ B ₁	5.57	5.65	5.61	5.17	5.54	5.36
A ₁ B ₂	4.43	4.88	4.65	4.38	4.69	4.53
A ₁ B ₃	6.18	6.34	6.26	5.55	5.74	5.64
A ₁ B ₄	5.66	5.85	5.75	5.22	5.56	5.39
A ₁ B ₅	4.19	4.56	4.38	4.21	4.45	4.33
A ₂ B ₁	6.11	6.30	6.20	2.06	2.16	2.11
A ₂ B ₂	5.91	6.00	5.95	1.84	1.99	1.91
A ₂ B ₃	6.66	6.72	6.69	2.36	3.08	2.72
A ₂ B ₄	6.50	6.54	6.52	2.13	2.81	2.47
A ₂ B ₅	5.77	5.82	5.80	1.74	1.80	1.77
A ₃ B ₁	4.38	4.44	4.41	3.17	3.78	3.47
A ₃ B ₂	4.03	4.22	4.13	3.15	3.19	3.17
A ₃ B ₃	5.96	5.99	5.97	3.99	4.04	4.01
A ₃ B ₄	4.99	5.18	5.08	3.42	3.92	3.67
A ₃ B ₅	3.87	3.93	3.90	2.87	2.92	2.90
S.Em ±	0.16	0.18	0.16	0.14	0.12	0.11
CD (5%)	0.47	0.53	0.45	0.40	0.34	0.31

Table 4: Effect of different organic manures with inorganic fertilizers on polar diameter and equatorial diameter of capsicum cultivars under shade net conditions

Treatments	Polar diameter			Equatorial diameter		
	2024-25	2025-26	Pooled	2024-25	2025-26	Pooled
Cultivars (A)						
A ₁	5.18	5.31	5.25	3.11	3.34	3.23
A ₂	3.57	3.79	3.68	7.30	7.60	7.45
A ₃	4.83	4.99	4.91	3.63	3.85	3.74
S.Em ±	0.03	0.03	0.02	0.08	0.07	0.05
CD (5%)	0.09	0.08	0.07	0.23	0.19	0.13
Modules (B)						
B ₁	4.52	4.62	4.57	4.86	5.09	4.97
B ₂	3.85	4.03	3.94	4.07	4.23	4.15
B ₃	5.59	5.72	5.66	5.55	5.87	5.71
B ₄	5.00	5.26	5.13	5.22	5.47	5.34
B ₅	3.69	3.85	3.77	3.70	4.00	3.85
S.Em ±	0.04	0.04	0.03	0.10	0.08	0.06
CD (5%)	0.11	0.10	0.08	0.30	0.24	0.17
Interaction (AXB)						
A ₁ B ₁	5.34	5.47	5.40	3.30	3.54	3.42
A ₁ B ₂	4.43	4.56	4.49	2.51	2.74	2.62
A ₁ B ₃	6.05	6.25	6.15	3.87	4.18	4.02
A ₁ B ₄	5.85	5.91	5.88	3.55	3.79	3.67
A ₁ B ₅	4.24	4.39	4.31	2.35	2.48	2.41
A ₂ B ₁	3.24	3.35	3.30	7.53	7.79	7.66
A ₂ B ₂	2.91	3.11	3.01	6.49	6.59	6.54
A ₂ B ₃	4.98	5.06	5.02	8.51	8.96	8.73
A ₂ B ₄	3.90	4.50	4.20	8.15	8.33	8.24
A ₂ B ₅	2.80	2.92	2.86	5.82	6.33	6.08
A ₃ B ₁	4.98	5.03	5.01	3.75	3.93	3.84
A ₃ B ₂	4.20	4.43	4.32	3.22	3.36	3.29
A ₃ B ₃	5.72	5.87	5.79	4.28	4.47	4.38
A ₃ B ₄	5.25	5.39	5.32	3.96	4.30	4.13
A ₃ B ₅	4.02	4.25	4.14	2.94	3.20	3.07
S.Em ±	0.07	0.06	0.05	0.18	0.15	0.10
CD (5%)	0.19	0.18	0.15	0.51	0.42	0.30

Table 5: Effect of different organic manures with inorganic fertilizers on fruit weight and number of fruits per plant of capsicum cultivars under shade net conditions

Treatments	Fruit weight			Number of fruits per plant		
	2024-25	2025-26	Pooled	2024-25	2025-26	Pooled
Cultivars (A)						
A ₁	22.32	24.78	23.55	45.99	48.35	47.17
A ₂	98.38	102.89	100.64	13.17	15.41	14.29
A ₃	25.46	28.10	26.78	33.29	35.30	34.29
S.Em ±	0.63	0.87	0.70	0.63	0.78	0.65
CD (5%)	1.83	2.51	2.03	1.82	2.27	1.88
Modules (B)						
B ₁	48.28	51.79	50.03	30.57	32.77	31.67
B ₂	40.85	43.45	42.15	26.57	28.63	27.60
B ₃	60.43	64.09	62.26	37.79	40.42	39.10
B ₄	54.88	58.53	56.71	34.00	36.34	35.17
B ₅	39.16	41.77	40.46	25.16	26.94	26.05
S.Em ±	0.82	1.12	0.90	0.81	1.01	0.84
CD (5%)	2.37	3.24	2.62	2.35	2.93	2.42
Interaction (AXB)						
A ₁ B ₁	22.60	25.26	23.93	45.37	48.54	46.95
A ₁ B ₂	18.18	20.11	19.14	39.63	41.71	40.67
A ₁ B ₃	28.02	30.99	29.50	56.39	58.97	57.68
A ₁ B ₄	25.86	28.27	27.06	50.45	52.72	51.58
A ₁ B ₅	16.95	19.27	18.11	38.13	39.81	38.97
A ₂ B ₁	96.52	101.22	98.87	12.09	14.01	13.05
A ₂ B ₂	82.83	86.32	84.57	11.78	13.76	12.77
A ₂ B ₃	121.80	126.50	124.15	16.85	19.21	18.03
A ₂ B ₄	110.33	117.00	113.66	14.51	17.68	16.10
A ₂ B ₅	80.44	83.43	81.93	10.65	12.40	11.53
A ₃ B ₁	25.73	28.88	27.30	34.25	35.77	35.01
A ₃ B ₂	21.55	23.92	22.73	28.30	30.43	29.36
A ₃ B ₃	31.49	34.79	33.14	40.13	43.07	41.60
A ₃ B ₄	28.46	30.32	29.39	37.04	38.62	37.83
A ₃ B ₅	20.08	22.61	21.34	26.70	28.60	27.65
S.Em ±	1.42	1.94	1.57	1.41	1.75	1.43
CD (5%)	4.10	5.61	4.53	4.07	5.07	4.19

Table 6: Effect of different organic manures with inorganic fertilizers on days taken to first fruit set, days taken to first fruit harvest and days taken to last fruit harvest of capsicum cultivars under shade net conditions

Treatments	Days taken to first fruit set			Days taken to first fruit harvest			Days taken to last fruit harvest		
	2024-25	2025-26	Pooled	2024-25	2025-26	Pooled	2024-25	2025-26	Pooled
Cultivars(A)									
A ₁	69.92	68.57	69.24	83.48	81.43	82.45	135.95	138.64	137.30
A ₂	43.06	41.44	42.25	60.63	59.18	59.91	126.32	129.58	127.95
A ₃	62.40	60.49	61.44	79.94	77.49	78.71	130.41	133.77	132.09
S.Em ±	0.16	0.23	0.17	0.25	0.23	0.20	0.40	0.22	0.23
CD (5%)	0.48	0.67	0.48	0.71	0.66	0.57	1.16	0.62	0.66
Modules (B)									
B ₁	58.85	56.50	57.68	74.60	72.10	73.35	132.47	135.36	133.91
B ₂	63.58	61.84	62.71	77.50	75.57	76.53	122.45	125.50	123.97
B ₃	50.31	48.86	49.59	69.79	67.71	68.75	141.83	145.65	143.74
B ₄	54.20	52.71	53.45	72.36	70.99	71.67	137.75	141.02	139.38
B ₅	65.35	64.25	64.80	79.17	77.14	78.16	119.97	122.48	121.22
S.Em ±	0.21	0.30	0.21	0.32	0.29	0.26	0.52	0.28	0.30
CD (5%)	0.61	0.86	0.62	0.92	0.85	0.74	1.50	0.81	0.86
Interaction (AXB)									
A ₁ B ₁	70.27	68.47	69.37	84.02	82.25	83.13	139.28	141.57	140.42
A ₁ B ₂	76.33	75.14	75.73	87.04	84.64	85.84	128.85	131.73	130.29
A ₁ B ₃	59.48	57.62	58.55	76.35	73.99	75.17	145.11	148.55	146.83
A ₁ B ₄	64.93	63.56	64.25	80.14	78.92	79.53	141.45	144.28	142.86
A ₁ B ₅	78.59	78.06	78.32	89.86	87.35	88.60	125.06	127.11	126.08
A ₂ B ₁	43.37	41.46	42.41	60.57	58.08	59.32	126.48	130.08	128.28
A ₂ B ₂	46.59	44.48	45.53	62.72	61.70	62.21	116.85	120.34	118.60
A ₂ B ₃	36.97	35.66	36.31	57.00	55.93	56.46	137.26	141.68	139.47
A ₂ B ₄	40.00	38.73	39.36	58.74	57.61	58.17	134.55	137.39	135.97
A ₂ B ₅	48.37	46.87	47.62	64.15	62.62	63.38	116.45	118.44	117.44

A ₃ B ₁	62.93	59.59	61.26	79.21	75.96	77.59	131.65	134.43	133.04
A ₃ B ₂	67.82	65.89	66.86	82.74	80.38	81.56	121.64	124.43	123.04
A ₃ B ₃	54.49	53.32	53.90	76.01	73.21	74.61	143.13	146.73	144.93
A ₃ B ₄	57.66	55.85	56.75	78.21	76.44	77.32	137.24	141.39	139.31
A ₃ B ₅	69.10	67.81	68.45	83.52	81.46	82.49	118.41	121.89	120.15
S.Em ±	0.37	0.52	0.37	0.55	0.51	0.44	0.90	0.48	0.51
CD (5%)	1.06	1.49	1.07	1.59	1.47	1.28	2.60	1.40	1.49

Table 7: Effect of different organic manures with inorganic fertilizers on fruit yield per plant, fruit yield per plot and fruit yield per hectare of capsicum cultivars under shade net conditions

Treatments	Fruit yield per plant			Fruit yield per plot			Fruit yield per hectare		
	2024-25	2025-26	Pooled	2024-25	2025-26	Pooled	2024-25	2025-26	Pooled
Cultivars(A)									
A ₁	1.08	1.10	1.09	7.50	7.65	7.57	9.77	9.95	9.86
A ₂	1.41	1.51	1.46	9.92	10.61	10.26	12.89	13.84	13.37
A ₃	0.78	0.82	0.80	5.47	5.77	5.62	7.08	7.54	7.31
S.Em ±	0.04	0.01	0.01	0.08	0.10	0.08	0.08	0.13	0.05
CD (5%)	0.12	0.03	0.02	0.24	0.28	0.24	0.22	0.37	0.13
Modules (B)									
B ₁	1.08	1.11	1.09	7.45	7.71	7.58	9.67	10.04	9.86
B ₂	0.95	1.02	0.99	6.70	7.12	6.91	8.70	9.28	8.99
B ₃	1.30	1.36	1.33	9.13	9.51	9.32	11.83	12.43	12.13
B ₄	1.19	1.26	1.23	8.36	8.82	8.59	10.86	11.48	11.17
B ₅	0.93	0.99	0.96	6.50	6.88	6.69	8.51	9.00	8.75
S.Em ±	0.05	0.01	0.01	0.11	0.13	0.11	0.10	0.16	0.06
CD (5%)	0.16	0.04	0.03	0.31	0.36	0.30	0.29	0.48	0.17
Interaction (AXB)									
A ₁ B ₁	1.01	1.05	1.05	7.10	7.34	7.22	9.24	9.59	9.41
A ₁ B ₂	0.95	0.97	0.96	6.64	6.76	6.70	8.66	8.87	8.76
A ₁ B ₃	1.30	1.31	1.30	9.08	9.20	9.14	11.80	11.97	11.88
A ₁ B ₄	1.18	1.20	1.19	8.28	8.39	8.34	10.77	10.86	10.82
A ₁ B ₅	0.91	0.95	0.93	6.39	6.55	6.47	8.36	8.46	8.41
A ₂ B ₁	1.41	1.46	1.43	9.87	10.22	10.05	12.78	13.29	13.03
A ₂ B ₂	1.23	1.34	1.28	8.68	9.38	9.03	11.27	12.19	11.73
A ₂ B ₃	1.65	1.80	1.73	11.72	12.60	12.16	15.15	16.38	15.76
A ₂ B ₄	1.55	1.68	1.62	10.83	11.75	11.29	14.12	15.32	14.72
A ₂ B ₅	1.22	1.29	1.26	8.51	9.08	8.79	11.16	12.03	11.60
A ₃ B ₁	0.77	0.80	0.78	5.37	5.57	5.47	7.01	7.24	7.13
A ₃ B ₂	0.69	0.74	0.72	4.79	5.21	5.00	6.17	6.77	6.47
A ₃ B ₃	0.95	0.96	0.95	6.60	6.73	6.66	8.55	8.94	8.74
A ₃ B ₄	0.84	0.90	0.87	5.98	6.31	6.14	7.70	8.27	7.98
A ₃ B ₅	0.66	0.71	0.69	4.62	5.01	4.81	6.00	6.50	6.25
S.Em ±	0.09	0.03	0.02	0.19	0.22	0.18	0.17	0.28	0.10
CD (5%)	0.27	0.07	0.05	0.54	0.63	0.53	0.50	0.82	0.30

4. Conclusion

Based on the study, it was concluded that different combinations of inorganic fertilizers and organic manures significantly influenced the growth and yield attributes of capsicum under shade net conditions. Among the treatment combinations, A₂B₃ (Rupali Green + 75% RDF + Vermicompost 2.5 t/ha) was superior for earliness, fruit size and yield, whereas A₁B₃ (Rupali Red + 75% RDF + Vermicompost 2.5 t/ha) performed better for vegetative growth, flower and fruit production, and extended harvesting duration. Overall, the application of 75% RDF + Vermicompost 2.5 t/ha was found to be a promising integrated nutrient management practice for improving capsicum productivity under shade net conditions.

Acknowledgments

At the very outset, I submit the commodious and indefinite thanks to COH, Rajendranagar, Hyderabad for giving me a platform to conduct research work and to ICAR for giving me timely scholarship.

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