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Influence of organic manures and inorganic fertilizers on quality attributes of capsicum cultivars under shade-net conditions

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Abstract

The present investigation entitled “Influence of Organic Manures and Inorganic Fertilizers on Quality Attributes of Capsicum Cultivars 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 quality parameters, treatment A₃B₂ (Rupali Yellow + 50% RDF + Neem cake 1 t/ha) recorded the highest ascorbic acid content (149.60 mg/100 g), while the highest oleoresin content (12.06%) was recorded in A₁B₂ (Rupali Red + 50% RDF + Neem cake 1 t/ha), whereas the maximum shelf life (8.67 days) was recorded in A₂B₂ (Rupali Green + 50% RDF + Neem cake 1 t/ha) compared to the other treatments.

Keywords: Capsicum, cultivars, organic manures, inorganic fertilizers, integrated nutrient management, quality attributes, vermicompost, neem cake, shade-net

Introduction

Capsicum (*Capsicum annuum* var. *grossum*, 2n = 2x = 24) is an important high-value vegetable crop belonging to the family Solanaceae and is cultivated under both open-field and protected conditions. It is native to Mexico, with Guatemala considered a secondary centre of origin (Bukasov, 1930) [2]. The crop was introduced into India during the nineteenth century, initially in the Shimla hills (Greenleaf, 1986). Capsicum grows well at a day temperature of 25-30 °C and a night temperature of 18-20 °C with relative humidity of 50-60 percent. Fruit set is adversely affected when the temperature exceeds 35 °C or falls below 12 °C. It is commonly known as bell pepper because of its characteristic bell-shaped fruits and is also referred to as sweet pepper.

Capsicum is extensively cultivated in the hill regions of Himachal Pradesh, Uttar Pradesh, the Nilgiri hills and Jammu and Kashmir during summer, while it is grown as an autumn and winter crop in Karnataka, Maharashtra, Tamil Nadu and Telangana. The crop has attained importance as a high-value commercial vegetable owing to its attractive fruits, pleasant flavour and nutritional composition. Capsicum fruits are rich in ascorbic acid, vitamins, minerals, carotenoids and other bioactive compounds (Chassy *et al.*, 2006; Sreedhara *et al.*, 2013) [4, 25]. They are consumed fresh and are widely used in salads, stuffing, baking, pizza, burgers and other food preparations. Fruit colour, cultivar and stage of maturity influence the concentration of vitamins and pigments, resulting in considerable variation in the nutritional and biochemical quality of capsicum fruits (Curl, 1962) [8].

Ascorbic acid is an important biochemical constituent of capsicum fruits owing to its nutritional and antioxidant properties. Coloured capsicums are particularly valued for their attractive appearance and nutritional quality and have considerable demand in the hotel and catering industry. Capsicum fruits also contain carotenoid pigments and other secondary metabolites that contribute to fruit colour and antioxidant activity. Oleoresin, which contains concentrated colour and flavour components, is another important quality constituent of

pepper with applications in the food industry. The accumulation of these biochemical constituents is influenced by cultivar, environmental conditions, maturity and nutrient availability.

Protected cultivation of capsicum, particularly coloured hybrids, is gaining importance as it provides favourable environmental conditions for crop growth and facilitates the production of quality fruits. Shade-net cultivation helps moderate solar radiation and temperature and can reduce the adverse effects of excessive radiation and heat stress. Such modification of the crop microclimate can influence plant growth, fruit development and biochemical composition. Shading has been reported to influence yield and nutritional attributes, including ascorbic acid and carotenoid content, in pepper (Caruso *et al.*, 2020) [3]. However, cultivars may differ in their response to modified environmental conditions. Therefore, identification of suitable cultivars for production under shade-net conditions is important for obtaining quality fruits.

Nutrient management plays an important role in determining crop productivity as well as fruit quality. Increasing fertilizer costs and concerns regarding the continuous use of chemical fertilizers have encouraged the adoption of integrated nutrient management practices. The combined application of organic and inorganic nutrient sources can provide nutrients in both readily available and gradually mineralizable forms and may improve nutrient-use efficiency and soil properties (Merentola *et al.*, 2012; Jaggi *et al.*, 2001) [18, 14]. Organic manures supply essential macro- and micronutrients and improve the physical, chemical and biological properties of soil (Nweke *et al.*, 2013; Chatterjee *et al.*, 2005) [19, 5].

Farmyard manure, vermicompost and neem cake are important organic sources used in vegetable production. Vermicompost contains macro- and micronutrients and contributes to improved plant growth and productivity (Hidalgo *et al.*, 1999) [13]. Neem cake supplies nutrients and organic matter and can also contribute to improved soil conditions, while possessing pesticidal and nematicidal properties (Singh *et al.*, 1980) [24]. The integration of organic manures with inorganic fertilizers may therefore provide a balanced nutrient supply and improve soil conditions favourable for crop growth, fruit development and quality.

Nutrient management can influence not only yield but also the biochemical composition and nutritional quality of capsicum fruits. Integrated nutrient management involving inorganic fertilizers, farmyard manure and biofertilizers has been reported to improve fruit quality and vitamin C content in capsicum under protected cultivation (Jaipaul *et al.*, 2011; Jat *et al.*, 2022) [15, 14]. Similarly, integrated nutrient management practices have been reported to improve ascorbic acid and other quality attributes in pepper (Chouhan *et al.*, 2018) [7].

Shelf life is an important component of fruit quality, particularly in a highly perishable crop such as capsicum. During storage, fruits undergo moisture loss, softening, shrivelling and deterioration in appearance and nutritional quality, which reduce marketability and increase post-harvest losses. Crop nutrition can influence fruit development, firmness and biochemical composition and may consequently affect the storage behaviour and keeping quality of harvested fruits. Hence, appropriate nutrient management is important for maintaining fruit quality and improving shelf life.

Organic manures and integrated nutrient management practices have been reported to improve growth, yield and quality of capsicum, although their response may vary with cultivar and growing environment. Therefore, the present study was undertaken to evaluate the effect of organic manures in combination with inorganic fertilizers on the quality and post-harvest behaviour of capsicum cultivars under shade-net conditions.

2. Materials 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 quality parameters like ascorbic acid content, shelf life and oleoresin content.

2.6 Statistical Analysis

The data collected were analyzed statistically by following the analysis of variance (ANOVA) technique (Panse and Sukhatme 1985) [21]. Statistical significance was tested with 'F' value at 5 percent level of significance and whenever the F value was found significant, critical difference was worked out at five percent level of significance.

3. Results and Discussion

3.1 Quality parameters

The data recorded on growth parameters viz., ascorbic acid content, oleoresin content and shelf life are presented in Table 1-3

Among the cultivars, the maximum ascorbic acid content (142.27 mg/100 g) was recorded in A₃ (Rupali Yellow). Among the nutrient management treatments, B₂ (50% RDF + Neem cake 1 t/ha) recorded the maximum ascorbic acid content (124.02 mg/100 g). The interaction effect between cultivars and nutrient management treatments was significant, with A₃B₂ (Rupali Yellow + 50% RDF + neem cake 1 t/ha) recording the maximum ascorbic acid content (149.60 mg/100 g). The higher ascorbic acid content in cv. Rupali Yellow may be attributed to its genetic potential and greater accumulation of metabolites during fruit ripening, resulting in enhanced vitamin C synthesis. The integrated application of 50% RDF along with neem cake might have promoted ascorbic acid accumulation through balanced nutrient supply, improved microbial activity and nutrient availability, thereby enhancing physiological and biochemical processes (Premsekhar and Rajashree, 2009)

[22]. Similar positive effects of neem-based amendments on crop quality and biochemical characteristics were reported by Gopalakrishnan *et al.* (2015) [12]. The present findings are also in agreement with Bhattarai *et al.* (2009) [1], Jaipaul *et al.* (2011) [15], Chetri *et al.* (2012) [6] and Olowoake *et al.* (2015) [20] in bell pepper.

In addition to quality attributes, significant differences were observed among the cultivars and nutrient management treatments with respect to oleoresin content. Among the cultivars, the maximum oleoresin content (11.08%) was recorded in A₁ (Rupali Red). Among the nutrient management treatments, B₂ (50% RDF + Neem cake 1 t/ha) recorded the maximum oleoresin content (8.80%). The interaction effect between cultivars and nutrient management treatments was significant, with A₁B₂ (Rupali Red + 50% RDF + Neem cake 1 t/ha) recording the maximum oleoresin content (12.06%). The higher oleoresin content in cv. Rupali Red may be associated with its inherent varietal characteristics and greater capacity to accumulate carotenoids and other pigment-related compounds during fruit maturation. The application of 50% RDF + Neem cake 1 t/ha may have favoured oleoresin accumulation by ensuring a steady nutrient supply and improving soil microbial activity, which enhanced the physiological and biochemical processes involved in pigment and secondary metabolite synthesis. Similar findings were reported in chilli by Dileep *et al.* (2009) [9], Sankar *et al.* (2013) [23] and Gangadhar and Devakumar (2020) [11].

In contrast, A₂ (Rupali Green) exhibited better performance with respect to shelf life. Among the cultivars, the maximum shelf life (7.34 days) was recorded in A₂ (Rupali Green). Among the nutrient management treatments, B₂ (50% RDF + Neem cake 1 t/ha) recorded the maximum shelf life (8.03 days). The interaction effect between cultivars and nutrient management treatments was significant, with A₂B₂ (Rupali Green + 50% RDF + neem cake 1 t/ha) recording the maximum shelf life (8.67 days). The higher shelf life of cv. Rupali Green may be attributed to its firmer texture, thicker pericarp and lower respiration rate at the green mature stage, resulting in delayed ripening and reduced deterioration during storage. The application of inorganic fertilizers and neem cake may have improved fruit firmness, nutrient availability and membrane stability, thereby reduce moisture loss and extend shelf life (Gopalakrishnan *et al.*, 2015) [12]. Fruits with lower respiration rates and better firmness generally have longer storage life. Similar findings were reported in sweet pepper by Kurubetta and Patil (2009) [17], Yellava and Patil (2009) [26] and Fawzy *et al.* (2012) [10].

Table 1: Effect of different organic manures with inorganic fertilizers on ascorbic content (mg/100 g) of capsicum cultivars under shade net conditions

Treatments	2024-25						2025-26						Pooled data					
	B ₁	B ₂	B ₃	B ₄	B ₅	Mean	B ₁	B ₂	B ₃	B ₄	B ₅	Mean	B ₁	B ₂	B ₃	B ₄	B ₅	Mean
A ₁	101.80	121.44	100.15	112.92	92.93	105.85	103.99	124.08	101.94	117.63	94.46	108.42	102.89	122.76	101.04	115.27	93.69	107.13
A ₂	82.25	98.71	80.67	90.92	73.39	85.19	84.77	100.69	84.16	93.04	76.74	87.88	83.510	99.69	82.414	91.978	75.06	86.53
A ₃	140.09	147.67	138.58	145.69	130.25	140.45	142.91	151.53	141.17	152.65	132.24	144.10	141.49	149.60	139.87	149.17	131.24	142.27
Mean	108.05	122.60	106.47	116.51	98.86		110.55	125.44	109.09	121.11	101.14		109.30	124.02	107.77	118.80	100.00	
	S.Em±			CD (5%)			S.Em±			CD (5%)			S.Em±			CD (5%)		
Cultivars (A)	0.61			1.76			0.75			2.17			0.46			1.33		
RDF & OM (B)	0.78			2.27			0.97			2.81			0.59			1.72		
A x B	1.36			3.93			1.68			4.86			1.03			2.98		

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)
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Table 2: Effect of different organic manures with inorganic fertilizers on oleoresin content (%) of capsicum cultivars under shade net conditions

Treatments	2024-25						2025-26						Pooled data					
	B ₁	B ₂	B ₃	B ₄	B ₅	Mean	B ₁	B ₂	B ₃	B ₄	B ₅	Mean	B ₁	B ₂	B ₃	B ₄	B ₅	Mean
A ₁	10.70	11.83	10.56	11.66	9.95	10.94	11.05	12.29	10.96	11.83	10.00	11.23	10.88	12.06	10.76	11.75	9.97	11.08
A ₂	4.63	5.45	4.35	5.43	3.68	4.71	4.81	5.67	4.67	5.59	3.93	4.93	4.72	5.56	4.51	5.51	3.80	4.82
A ₃	7.71	8.58	7.67	8.49	7.12	7.91	7.94	8.96	7.68	8.75	7.23	8.11	7.83	8.77	7.68	8.62	7.17	8.01
Mean	7.68	8.62	7.53	8.52	6.91		7.94	8.97	7.77	8.73	7.05		7.81	8.80	7.65	8.63	6.98	
	S.Em±		CD (5%)				S.Em±		CD (5%)				S.Em±		CD (5%)			
Cultivars (A)	0.03		0.08				0.04		0.11				0.03		0.08			
RDF & OM (B)	0.03		0.10				0.05		0.14				0.03		0.10			
A x B	0.06		0.17				0.09		0.25				0.06		0.17			

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)
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Table 3: Effect of different organic manures with inorganic fertilizers on shelf life (days) of capsicum cultivars under shade net conditions

Treatments	2024-25						2025-26						Pooled data					
	B ₁	B ₂	B ₃	B ₄	B ₅	Mean	B ₁	B ₂	B ₃	B ₄	B ₅	Mean	B ₁	B ₂	B ₃	B ₄	B ₅	Mean
A ₁	6.37	7.54	6.25	7.36	5.23	6.55	6.89	8.16	6.72	8.04	5.86	7.13	6.63	7.85	6.48	7.70	5.55	6.84
A ₂	6.85	8.31	6.35	7.94	5.29	6.95	7.64	9.03	7.20	8.85	5.97	7.74	7.24	8.67	6.77	8.40	5.63	7.34
A ₃	5.34	7.13	5.24	7.06	5.19	5.99	6.13	7.98	6.02	7.83	5.79	6.75	5.73	7.56	5.63	7.45	5.49	6.37
Mean	6.19	7.66	5.94	7.45	5.24		6.88	8.39	6.64	8.24	5.87		6.54	8.03	6.29	7.85	5.56	
	S.Em±		CD (5%)				S.Em±		CD (5%)				S.Em±		CD (5%)			
Cultivars (A)	0.03		0.09				0.03		0.10				0.03		0.07			
RDF & OM (B)	0.04		0.12				0.04		0.13				0.03		0.10			
A x B	0.07		0.21				0.08		0.22				0.06		0.17			

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)
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4. Conclusion

Based on the study, it was concluded that different combinations of inorganic fertilizers and organic manures significantly influenced the quality attributes of capsicum under shade net conditions. Among the treatment combinations, treatment A₃B₂ (Rupali Yellow + 50% RDF + Neem cake 1 t/ha) recorded the highest ascorbic acid content (149.60 mg/100 g), while the highest oleoresin content (12.06%) was recorded in A₁B₂ (Rupali Red + 50% RDF + Neem cake 1 t/ha), whereas the maximum shelf life (8.67 days) was recorded in A₂B₂ (Rupali Green + 50% RDF + Neem cake 1 t/ha).

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References

- Bhattarai DR, Sharma MD, Shakya SM, Gautam DM, KC RB. Effect of different sources of nutrients on growth, yield and quality of sweet pepper (*Capsicum annuum* L.) under protected conditions. Journal of Agriculture and Environment. 2011;12:114-120.
- Bukasov SM. The cultivated plants of Mexico, Guatemala and Colombia. Bulletin of Applied Botanical Genetics and Plant Breeding Supplement. 1930:553.
- Caruso G, Cozzolino E, Cuciniello A, Maiello R, Cenvinzo V, Giordano M, et al. Yield and quality of greenhouse organic pepper as affected by shading net in Mediterranean area. Acta Horticulturae. 2020;1268:335-340.

4. Chassy AW, Bui L, Renaud EN, Van Horn M, Mitchell AE. Three-year comparison of the content of antioxidant microconstituents and several quality characteristics in organic and conventionally managed tomatoes and bell peppers. *Journal of Agricultural and Food Chemistry*. 2006;54(21):8244-8252.
5. Chatterjee B, Ghanti P, Thapa U, Tripathy P. Effect of organic nutrition in sprouting broccoli. *Vegetable Science*. 2005;33(1):51-54.
6. Chetri DA, Singh AK, Singh VB. Effect of integrated nutrient management on yield, quality and nutrient uptake by capsicum (*Capsicum annuum*) cv. California Wonder. *Journal of Soils and Crops*. 2012;22:44-48.
7. Chouhan KS, Baghel SS, Mishra K, Singh AK, Singh V. Effect of integrated nutrient management on yield, quality and economics of chilli (*Capsicum annuum* L.). *Current Horticulture*. 2018;6(1):37-40.
8. Curl AL. Red pepper carotenoids: The carotenoids of red bell peppers. *Journal of Agricultural and Food Chemistry*. 1962;10(6):504-509.
9. Dileep KG, Reddy MG, Rao AS. Effect of organic and inorganic fertilizers on growth, yield and quality of chilli (*Capsicum annuum* L.). *Journal of Maharashtra Agricultural Universities*. 2009;34(3):296-298.
10. Fawzy ZF, El-Bassiony AM, Li-Yunsheng OZ, Ghoname AA. Effect of mineral, organic and bio-N fertilizers on growth, yield and fruit quality of sweet pepper. *Journal of Applied Sciences Research*. 2012;8(8):3921-3933.
11. Gangadhar K, Devakumar N. Growth, yield and quality parameters of chilli (*Capsicum annuum* L.) as influenced by different organic manures and decomposers. *International Journal of Current Microbiology and Applied Sciences*. 2020;9(5):1234-1242.
12. Gopalakrishnan S, Humayun P, Kiran BK, Kannan IGK, Vidya MS, Deepthi K, et al. Evaluation of neem-based organic amendments for improving soil health, crop productivity and quality. *Current Science*. 2015;109(9):1601-1607.
13. Hidalgo P, Sindoni M, Matta F, Nagel DH. Earthworm castings increase germination rate and seedling development of cucumber. *Mississippi Agricultural and Forestry Experiment Station Research Report*. 1999;22:135-142.
14. Jaggi RC, Mahajan A, Choudhary AK, Baghla K. Integrated plant nutrient management (IPNM) in agriculture: The need of the day. *Indian Farmers' Digest*. 2001;34(1):10-12.
15. Jaipaul J, Sharma S, Dixit A, Sharma AK. Growth and yield of capsicum (*Capsicum annuum*) and garden pea (*Pisum sativum*) as influenced by organic manures and biofertilizers. *Indian Journal of Agricultural Sciences*. 2011;81(7):637-642.
16. Jat SL, Rajawat KS, Rana P, Kanaujia SP. Effect of integrated nutrient management on fruit quality, soil nutrient status and economics of capsicum under low-cost polyhouse condition. *Journal of Experimental Agriculture International*. 2022;44(1):13-17.
17. Kurubetta MS, Patil AA. Performance of capsicum hybrids under different protected structures. *Karnataka Journal of Agricultural Sciences*. 2009;22(5):1058-1061.
18. Merentola M, Kanaujia SP, Singh VB. Effect of integrated nutrient management on growth, yield and quality of cabbage. *Journal of Soils and Crops*. 2012;22(2):233-239.
19. Nweke IA, Ijearu SI, Igili DN. Effect of different sources of animal manure on the growth and yield of okra in Ustoxic Dystropept at Enugu South Eastern, Nigeria. *Journal of Scientific and Technology Research*. 2013;2(3):135-137.
20. Olowoake AA, Ojo JA, Osunlola OS. Growth and quality of pepper as influenced by integrated nutrient management. *African Journal of Agricultural Research*. 2015;10(30):2931-2937.
21. Panse VG, Sukhatme PV. *Statistical Methods for Agricultural Workers*. 4th ed. New Delhi: Indian Council of Agricultural Research; 1985.
22. Premsekhar M, Rajashree V. Influence of organic manures on growth, yield and quality of chilli (*Capsicum annuum* L.). *American-Eurasian Journal of Sustainable Agriculture*. 2009;3(4):630-635.
23. Sankar V, Kumar S, Thamburaj S. Influence of organic and inorganic fertilizers on yield and quality of chilli (*Capsicum annuum* L.). *Journal of Spices and Aromatic Crops*. 2013;22(2):156-160.
24. Singh UP, Singh HB, Singh RB. The fungicidal effect of neem (*Azadirachta indica*) extracts on some soil-borne pathogens of gram (*Cicer arietinum*). *Mycologia*. 1980;72(6):1077-1093.
25. Sreedhara DS, Kerutagi MG, Basavaraja H, Kunnal LB, Dodamani MT. Economics of capsicum production under protected conditions in Northern Karnataka. *Karnataka Journal of Agricultural Sciences*. 2013;26(2):217-219.
26. Yellava SK, Patil AA. Varietal performance of capsicum under protected structures. *Karnataka Journal of Agricultural Sciences*. 2009;22(4):854-857.