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Effect of integrated nutrient management on growth, yield and quality of teasel gourd (*Momordica Subangulata SSP Renigera*) cv Arka Bharath

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ABSTRACT

Teasel gourd (*Momordica subangulata ssp. renigera*) is an underutilized perennial cucurbitaceous vegetable with considerable potential for nutritional security, crop diversification and sustainable vegetable production. However, standardized nutrient management practices for enhancing productivity and fruit quality in teasel gourd are limited. Hence, an experiment was conducted to evaluate the effect of integrated nutrient management involving inorganic fertilizers, farmyard manure (FYM), vermicompost and biofertilizers on growth, yield and fruit quality of teasel gourd. Fifteen nutrient management treatments comprising two levels of recommended dose of fertilizers (RDF), FYM, vermicompost and their combinations with reduced levels of inorganic fertilizers were evaluated in a randomized block design with two replications. Among the treatments, T_{10} (75% RDF_2 + 25% N through vermicompost) recorded superior performance for most of the growth, yield and quality parameters. T_{10} recorded the highest vine length (199.00 cm), vine girth (3.16 cm), branches vine-1 (5.70), leaves vine-1 (130.00) leaf area (198.90 cm²) and leaf area index (2.87). It also recorded the highest fruit weight (58.56 g), fruit length (6.98 cm), fruit diameter (37.87 mm), number of seeds per fruit (29.50), fruits vine-1 (50.50), fruit yield vine-1 (3.05 kg), fruit yield per plot (20.20 kg) and fruit yield per hectare (28.06 t ha⁻¹). Among quality parameters, T_{10} recorded the highest fruit firmness (39.40 N), Titratable acidity (0.86 %), TSS (5.99 °Brix), total sugars (4.84%), reducing sugars (3.16%), non-reducing sugars (1.69%), carotenoids (130.63 µg 100 g⁻¹), ascorbic acid (3.74 mg 100 g⁻¹), iron (5.70 mg 100 g⁻¹), fibre (2.42%) and fat (1.75%). Protein content was highest in T_3 (1.75%), while moisture content was highest in T_{14} (87.53%). The results indicated that integration of inorganic fertilizer with vermicompost was more effective than sole application of inorganic fertilizer or organic nutrient sources. Therefore, T_{10} may be considered a promising nutrient management practice for enhancing growth, yield and fruit quality of teasel gourd.

Keywords: Teasel gourd, *Momordica subangulata*, Integrated nutrient management, Vermicompost, Farmyard manure, Growth, Yield, Fruit quality

1. Introduction

Teasel gourd (*Momordica subangulata ssp. renigera*) is an underutilized cucurbitaceous vegetable with potential for diversification of vegetable production systems. The crop is perennial in nature and is traditionally cultivated in different regions of India. Because of its edible fruits and adaptation to tropical and subtropical conditions, teasel gourd has potential for wider cultivation and commercialization. The crop also exhibits considerable variability for important morphological and fruit characters, indicating opportunities for crop improvement and development of improved production technologies. (John *et al.*, 2007; Chattopadhyay *et al.*, 2016) [2, 1].

Nutritional and morphological variability in teasel gourd has been reported among available germplasm, demonstrating the importance of systematic evaluation of growth, yield and quality traits. The crop has received comparatively less research attention than major cucurbits such as cucumber, bottle gourd and bitter melon, and consequently, standardized production technologies, particularly nutrient management practices, are still limited.

Nutrient management is one of the most important factors determining vegetative growth, reproductive development, yield and quality of vegetable crops. Nitrogen promotes vegetative growth and chlorophyll formation, phosphorus contributes to energy transfer and reproductive development, while potassium plays an important role in enzyme activation, carbohydrate translocation, water relations and fruit development. Therefore, balanced nutrient availability throughout crop growth is essential for achieving higher productivity and quality. (Chattopadhyay *et al.*, 2016; Raniya *et al.*, 2026) [1, 3].

Integrated nutrient management combines inorganic fertilizers with organic manures and biofertilizers to achieve efficient nutrient supply and improve soil health. Organic nutrient sources such as FYM and vermi

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compost provide nutrients gradually, contribute organic matter and improve soil physical and biological properties, whereas inorganic fertilizers provide nutrients in readily available forms. The combined use of these sources can improve nutrient availability and nutrient-use efficiency compared with sole application of either source. Similar responses have been observed in several cucurbitaceous crops, including cucumber and bottle gourd. (Narayanamma *et al.*, 2010; Anjanappa *et al.*, 2012; Ahmad *et al.*, 2019) [5, 6, 4].

In cucumber, FYM or vermicompost combined with biofertilizers and reduced levels of inorganic fertilizer increased yield compared with recommended fertilizer alone. Integrated treatments also improved vitamin C, total carotene and β -carotene contents, demonstrating that INM can influence both productivity and nutritional quality. (Narayanamma *et al.*, 2010) [5].

Similarly, Anjanappa *et al.* (2012) [6] reported that integrated application of 75% RDF with FYM, Azotobacter, phosphobacteria and *Trichoderma* enhanced vine length, number of leaves, branches, fruit number, fruit weight, fruit yield, TSS and ascorbic acid in cucumber. (Anjanappa *et al.*, 2012) [6].

Bottle gourd studies have also demonstrated the effectiveness of combining organic and inorganic nutrient sources. Ahmad *et al.* (2019) [4] reported superior vine growth, fruit set and yield with integrated application of reduced chemical fertilizer, FYM, vermicompost, Azotobacter and PSB. Patle *et al.* (2019) [7] similarly reported higher fruit number, fruit yield and plant nutrient status under integrated nutrient management in bottle gourd.

Recent research further confirms the importance of INM in cucurbits. Wadiwa *et al.* (2025) [8] reported that 75% RDF combined with vermicompost, Azotobacter, PSB and KSB significantly improved vegetative growth and yield attributes of bottle gourd. Similarly, integrated nutrient management involving vermicompost and seaweed extract along with recommended fertilizers improved fruit number, fruit weight, yield and quality attributes in snake gourd.

Therefore, the present investigation was undertaken to evaluate different combinations of inorganic fertilizers, FYM, vermicompost and biofertilizers and to identify a suitable integrated nutrient management practice for improving growth, yield and fruit quality of teasel gourd.

2. Material and Methods

2.1 Experimental site and crop

The field experiment was conducted at the Vegetable Research Station, Rajendranagar, Hyderabad, Telangana, India, during summer and kharif season (March-October) 2025, to evaluate the influence of integrated nutrient management on growth and yield of teasel gourd (*Momordica subangulata* ssp. *renigera*). The experiment involved different combinations of inorganic fertilizers, farmyard manure, vermicompost and biofertilizers.

2.2 Experimental design

The experiment consisted of 15 treatments with two replications. The crop was planted at a spacing of 1.8 m $\times$ 0.50 m. The treatments comprised two recommended doses of fertilizers (RDF₁ @ 100:60:40 NPK kg ha⁻¹ and RDF₂ @ 120:80:80 NPK kg ha⁻¹), organic substitution of nitrogen through FYM or vermicompost, and an FYM-based treatment supplemented with biofertilizers.

2.3 Treatment details

Treatment	Nutrient management
T ₁	100% RDF ₁ @ 100:60:40 NPK kg ha ⁻¹
T ₂	100% RDF ₂ @ 120:80:80 NPK kg ha ⁻¹
T ₃	100% RDF ₁ , N through FYM
T ₄	100% RDF ₂ , N through FYM
T ₅	100% RDF ₁ , N through vermicompost
T ₆	100% RDF ₂ , N through vermicompost

Treatment	Nutrient management
T ₇	75% RDF ₁ + 25% N through FYM
T ₈	75% RDF ₂ + 25% N through FYM
T ₉	75% RDF ₁ + 25% N through vermicompost
T ₁₀	75% RDF ₂ + 25% N through vermicompost
T ₁₁	50% RDF ₁ + 50% N through FYM
T ₁₂	50% RDF ₂ + 50% N through FYM
T ₁₃	50% RDF ₁ + 50% N through vermicompost
T ₁₄	50% RDF ₂ + 50% N through vermicompost
T ₁₅	FYM 25 t ha ⁻¹ + Azotobacter 5 kg + PSB 5 kg + KSB 5 kg

2.4 Source of planting material

The planting material of teasel gourd cv. Arka Bharath was collected from Central Horticultural Experiment Station, Chettalli, Karnataka.

2.5 Observations recorded

Observations on vegetative growth parameters, including vine length, vine girth, number of branches per vine, number of leaves per vine, leaf area and leaf area index (LAI), were recorded during crop growth. Yield and yield-attributing parameters included fruit weight, fruit length, fruit girth, number of fruits per vine, fruit yield per vine, fruit yield per plot and fruit yield per hectare. Quality parameters included fruit firmness, TSS, total sugars, reducing sugars, non-reducing sugars, carotenoids, ascorbic acid, iron, fibre, fat, protein and moisture. Observations were recorded using standard procedures for the respective parameters.

2.5 Statistical analysis

The experimental data were subjected to statistical analysis appropriate for the experimental design. Treatment means were compared using the standard error of the mean (SEM) and critical difference (CD) at the 5% level of significance, wherever applicable. (Panse *et al.*, 1985) [9].

3. Results and Discussion

3.1 Growth parameters

Considerable variation was observed among the nutrient management treatments for growth parameters of teasel gourd. T₁₀, comprising 75% RDF₂ + 25% N through vermicompost, recorded the highest vine girth (3.16 cm), number of branches (5.70 vine⁻¹), number of leaves (130.00 vine⁻¹) leaf area (198.90 cm²) and leaf area index (2.87).

The superior vegetative growth under T₁₀ may be attributed to the balanced and continuous availability of nutrients resulting from the combined application of inorganic fertilizer and vermicompost. Inorganic fertilizers provide readily available nutrients during periods of high crop demand, while vermicompost contributes organic matter and nutrients and may improve nutrient availability and soil biological activity. The resulting improvement in root growth and nutrient uptake may have increased photosynthetic capacity and vegetative development. (Narayanamma *et al.*, 2010; Anjanappa *et al.*, 2012; Ahmad *et al.*, 2019) [5, 6, 4].

The present findings are in accordance with Anjanappa *et al.* (2012) [6], who reported maximum vine length, leaves and branches in cucumber under integrated nutrient management involving inorganic fertilizer, FYM and biofertilizers. Similarly, Wadiwa *et al.* (2025) [8] reported significant improvement in vine length and primary branches of bottle gourd through an integrated treatment involving 75% RDF and vermicompost along with biofertilizers. (Anjanappa *et al.*, 2012; Wadiwa *et al.*, 2025) [6, 8].

The improvement in leaf area index under T₁₀ could have contributed to greater light interception and photosynthetic activity. A larger photosynthetic surface provides greater assimilate production for subsequent fruit development. Thus, improved vegetative growth under T₁₀ may have contributed directly to its superior yield performance.

3.2 Yield attributing and yield characters

Nutrient management significantly influenced fruit characteristics. T₁₀ recorded the highest fruit length (6.98 cm) fruit girth (37.87 mm), number of seeds per fruit (29.50) and fruit weight (58.56 g). Improved fruit development under integrated nutrient management may be attributed to adequate availability of macro- and micronutrients during fruit initiation and enlargement.

The combined availability of nitrogen, phosphorus and potassium under T₁₀ may have enhanced cell division, cell expansion and translocation of assimilates to developing fruits. Potassium in particular plays an important role in carbohydrate translocation and regulation of water relations, which are important processes during fruit development. (Narayanamma *et al.*, 2010; Anjanappa *et al.*, 2012) [5, 6].

Similar improvement in fruit weight and fruit dimensions through INM has been reported in bottle gourd. Wadiwa *et al.* (2025) [8] observed the highest fruit length, fruit diameter and average fruit weight under 75% RDF combined with vermicompost and biofertilizers.

The highest number of fruits per vine (50.50), fruit yield per vine (3.05 kg), fruit yield per plot (20.20 kg) and fruit yield per hectare (28.06 t ha⁻¹) were recorded in T₁₀ (75% RDF₂ + 25% N through vermicompost). The superior yield under T₁₀ may be attributed to the cumulative effect of improved yield-attributing characters, particularly higher fruit number and fruit weight, along with vigorous vegetative growth and greater leaf area index. The combined application of inorganic fertilizer and vermicompost might have ensured better nutrient availability and uptake during different stages of crop growth, thereby enhancing assimilate production and its translocation towards reproductive sinks. Similar increases in fruit yield through integrated nutrient management have been reported in cucumber, bottle gourd and ridge gourd, where combinations of inorganic fertilizers with FYM, vermicompost and biofertilizers improved crop productivity compared with individual nutrient sources. (Patle *et al.*, 2019; Rathod *et al.*, 2019; Singh *et al.*, 2020) [7, 10, 11]

3.3 Quality parameters

3.3.1 Fruit firmness

Fruit firmness is an important quality characteristic because it affects fruit handling, transportation and postharvest storage. T₁₀ recorded the highest fruit firmness of 39.40 N.

The higher firmness under T₁₀ may be associated with balanced nutrient availability and adequate potassium nutrition. Balanced nutrition can improve structural development of fruit tissues and reduce excessive water accumulation, thereby contributing to better firmness.

3.3.2 Titratable acidity

The highest titratable acidity of 0.86 per cent was recorded in T₁₀ (75% RDF₂ + 25% N through vermicompost). The higher acidity under T₁₀ may be attributed to the balanced supply of nutrients through inorganic fertilizers and vermicompost, which might have influenced organic acid synthesis and accumulation in developing fruits. Similar improvements in fruit quality attributes in response to integrated nutrient management have been reported in cucurbitaceous vegetables such as cucumber and bitter melon (Anjanappa *et al.*, 2012; Narayanamma *et al.*, 2010; Patel *et al.*, 2020) [6, 5].

3.3.3 Total soluble solids

T₁₀ recorded the highest TSS of 5.99 °Brix. Increased TSS under integrated nutrient management may be attributed to improved photosynthetic activity and enhanced translocation and accumulation of soluble solids in fruits.

Anjanappa *et al.* (2012) [6] also observed improvement in TSS in cucumber under integrated nutrient management involving FYM, inorganic fertilizers and biofertilizers. In another cucumber study, the combined application of 75% RDF, FYM and vermicompost improved TSS compared with the control. (Anjanappa *et al.*, 2012; Singh *et al.*, 2020) [6, 11].

3.3.4 Total, reducing and non-reducing sugars

The highest total sugars (4.84 %), reducing sugars (3.16%) and non-reducing sugars (1.69%) were recorded in T₁₀. Higher sugar accumulation may be associated with enhanced photosynthetic activity, improved nutrient uptake and efficient translocation of assimilates from source leaves to developing fruits.

Potassium is particularly important in carbohydrate metabolism and assimilate translocation, while adequate nitrogen promotes development of a healthy photosynthetic canopy. The balanced supply of these nutrients under T₁₀ may therefore have contributed to greater sugar accumulation in fruits.

3.3.5 Carotenoids

The highest carotenoid content (130.63 µg 100 g⁻¹) was recorded in T₁₀. Increased carotenoid accumulation may be related to improved nutritional status and physiological activity of the crop under balanced nutrient supply.

Narayanamma *et al.* (2010) [5] reported higher total carotene and β-carotene contents in cucumber fruits produced under integrated nutrient management than under RDF alone or organic manures alone. This supports the present observation that appropriate integration of organic and inorganic nutrients can improve not only yield but also nutritional quality. (Narayanamma *et al.*, 2010) [5].

3.3.6 Ascorbic acid

The highest ascorbic acid content (3.74 mg 100 g⁻¹) was recorded under T₁₀. The increase in ascorbic acid may be associated with improved nutrient availability and physiological activity under balanced nutrition.

Anjanappa *et al.* (2012) [6] reported higher ascorbic acid content in cucumber under integrated nutrient management involving 75% RDF, FYM and biofertilizers. Similarly, Narayanamma *et al.* (2010) [5] observed improved vitamin C content under integrated nutrient management compared with individual application of organic manure or RDF. (Anjanappa *et al.*, 2012; Narayanamma *et al.*, 2010) [6, 5].

3.3.7 Protein content

The highest protein content (1.75%) was recorded in T₃. Nitrogen is a major component of amino acids and proteins, and its adequate availability can therefore influence protein synthesis in plant tissues.

The variation in protein content among treatments indicates that the source and level of nitrogen supply can influence nutritional composition independently of total fruit yield. Similar treatment-dependent variation in nutrient composition has been observed in vegetable crops subjected to different integrated nutrient management practices. (Narayanamma *et al.*, 2010; Patle *et al.*, 2019) [5, 7].

3.3.8 Iron content

T₁₀ recorded the highest iron content of 5.70 mg 100 g⁻¹. Improved micronutrient accumulation under integrated nutrient management may be associated with improved soil conditions, nutrient cycling and root activity.

Rathod *et al.* (2019) [10] reported that integrated nutrient management improved micronutrient content and uptake, including iron, manganese, copper and zinc, in ridge gourd. The treatment also enhanced soil microbial populations and fruit yield, demonstrating the relationship between integrated nutrient supply, soil biological activity and nutrient uptake. (Rathod *et al.*, 2019) [10].

3.3.9 Fibre and fat

T₁₀ recorded the highest fibre content (2.42%) and fat content (1.75%). Variation in proximate composition among nutrient management treatments may be attributed to differences in nutrient availability and plant physiological activity.

The influence of nutrient management on quality characteristics has been documented in cucurbitaceous crops. Integrated nutrient management can modify fruit biochemical composition through its influence on nutrient uptake, photosynthesis and assimilate partitioning. (Narayanamma *et al.*, 2010; Anjanappa *et al.*, 2012) [5, 6].

3.3.10 Moisture content

The highest moisture content (87.53%) was recorded in T₁₄. Moisture content is influenced by genotype, fruit maturity, environmental conditions and nutrient availability. Differences among treatments may therefore reflect variations in fruit development and water accumulation.

Anjanappa *et al.* (2012) [6] also observed treatment differences in moisture content of cucumber fruits under integrated nutrient management, demonstrating that nutrient management can influence several physical and biochemical characteristics of cucurbit fruits. (Anjanappa *et al.*, 2012) [6].

4. Conclusion

The present investigation demonstrated that integrated nutrient management had a marked influence on growth, yield and fruit quality of teasel gourd. Among the 15 nutrient management treatments, T₁₀ (75% RDF₂ + 25% N through vermicompost) was superior for most growth, yield and quality parameters. It recorded the highest vine length, vine girth, branches, leaves, leaf area index, fruit weight, fruit dimensions, number of fruits per vine, fruit yield per vine and fruit yield per hectare.

T₁₀ also recorded superior fruit quality, including firmness, TSS, total sugars, reducing sugars, non-reducing sugars, carotenoids, ascorbic acid, iron, fibre and fat. Protein content was highest under T₃, while moisture content was highest under T₁₄. The superior performance of T₁₀ can be attributed to the complementary effects of inorganic fertilizer and vermicompost, which may have ensured balanced nutrient availability and improved nutrient-use efficiency.

The results are consistent with findings from cucumber, bottle gourd, snake gourd and ridge gourd, where integrated nutrient management involving inorganic fertilizers, FYM, vermicompost and biofertilizers improved growth, yield and/or quality compared with individual nutrient sources. (Narayanamma *et al.*, 2010 [5]; Anjanappa *et al.*, 2012 [6]; Ahmad *et al.*, 2019 [4]; Patle *et al.*, 2019 [7]; Wadiwa *et al.*, 2025) [8].

Therefore, T₁₀ (75% RDF₂ + 25% N through vermicompost) may be considered a promising integrated nutrient management practice for obtaining higher productivity and superior-quality fruits in teasel gourd under the conditions of the present investigation. Further multi-location and multi-season validation is recommended before making a generalized production recommendation.

Table 1. Effect of integrated nutrient management on growth parameters of teasel gourd (*Momordica subangulata* ssp. *renigera*) cv. Arka Bharath.

Treatment details	Vine length (cm) at 90 DAP	Vine girth (cm) at harvest	Number of branches at 90 DAP	Number of leaves at 90 DAP	Leaf area (cm ²) at 90 DAP	LAI at 90 DAP
T ₁ : 100 % RDF ₁ @ 100:60:40 NPK kg/ha	177.00	2.56 ^c	4.50 ^b	104.00 ^b	155.50 ^h	1.80 ^d
T ₂ : 100 % RDF ₂ @ 120:80:80 NPK kg/ha	165.60	2.60 ^c	4.40 ^b	100.35 ^c	168.10 ^f	1.88 ^d
T ₃ : 100 % RDF ₁ @ 100:60:40 kg/ha N through FYM	160.20	2.68 ^c	4.80 ^b	98.30 ^c	163.50 ^g	1.78 ^d
T ₄ : 100 % RDF ₂ @ 120:80:80 kg/ha N through FYM	184.70	2.92 ^b	4.90 ^b	104.20 ^b	180.50 ^d	2.09 ^c
T ₅ : 100 % RDF ₁ @ 100:60:40 kg/ha N through Vermicompost	177.50	2.59 ^c	4.50 ^b	105.70 ^b	174.70 ^e	2.06 ^c
T ₆ : 100 % RDF ₂ @ 120:80:80 kg/ha N through Vermicompost	175.80	2.84 ^b	4.50 ^b	99.60 ^c	187.80 ^c	2.09 ^c
T ₇ : 75% RDF ₁ @ 100:60:40 kg/ha + 25% N through FYM	167.10	2.55 ^c	4.80 ^b	104.40 ^b	160.50 ^g	1.86 ^d
T ₈ : 75% RDF ₂ @ 120:80:80 kg/ha + 25% N through FYM	186.20	2.72 ^c	5.10 ^a	102.00 ^b	194.30 ^b	2.20 ^c
T ₉ : 75% RDF ₁ @ 100:60:40 kg/ha + 25% N through Vermicompost	194.40	3.02 ^a	5.60 ^a	118.20 ^a	182.50 ^d	2.40 ^b
T ₁₀ : 75% RDF ₂ @ 120:80:80 kg/ha + 25% N through Vermicompost	199.00	3.16 ^{a*}	5.70 ^{a*}	130.00 ^a	198.90 ^{a*}	2.87 ^a
T ₁₁ : 50% RDF ₁ @ 100:60:40 kg/ha + 50% N through FYM	165.10	2.90 ^b	4.80 ^b	105.00 ^b	171.10 ^e	1.99 ^d
T ₁₂ : 50% RDF ₂ @ 120:80:80 kg/ha + 50% N through FYM	183.40	2.66 ^c	4.80 ^b	109.10 ^b	191.00 ^c	2.32 ^b
T ₁₃ : 50% RDF ₁ @ 100:60:40 kg/ha + 50% N through Vermicompost	189.40	2.59 ^c	4.90 ^b	110.80 ^b	177.40 ^d	2.19 ^c
T ₁₄ : 50% RDF ₂ @ 120:80:80 kg/ha + 50% N through Vermicompost	185.80	2.82 ^b	5.00 ^b	107.80 ^b	197.20 ^a	2.36 ^b
T ₁₅ : FYM 25 t/ha + Azotobacter (5 kg), PSB (5 kg), KSB (5 kg)	192.80	2.78 ^b	4.50 ^b	105.80 ^b	164.90 ^f	1.94 ^d
SE(m) ±	8.65	0.06	0.22	5.01	0.60	0.10
CD at 5%	NS	0.20	0.67	15.19	1.83	0.29
CV %	6.79	3.39	6.49	6.62	0.48	6.45

Table 2. Effect of integrated nutrient management on yield attributing characters of teasel gourd (*Momordica subangulata* ssp. *renigera*) cv. Arka Bharath

Treatment details	Length of fruit (cm)	Fruit diameter (mm)	Number of seeds per fruit	Fruit weight (g)
T ₁ : 100 % RDF ₁ @ 100:60:40 NPK kg/ha	6.10 ^d	30.78 ^c	26.50 ^b	42.69 ^d
T ₂ : 100 % RDF ₂ @ 120:80:80 NPK kg/ha	6.65 ^b	33.11 ^b	27.50 ^b	51.91 ^b
T ₃ : 100 % RDF ₁ @ 100:60:40 kg/ha N through FYM	6.70 ^b	29.93 ^c	25.50 ^c	42.07 ^d
T ₄ : 100 % RDF ₂ @ 120:80:80 kg/ha N through FYM	6.54 ^b	32.14 ^c	28.50 ^a	51.82 ^b

(continued on next page)

Treatment details	Length of fruit (cm)	Fruit diameter (mm)	Number of seeds per fruit	Fruit weight (g)
T ₅ : 100 % RDF ₁ @ 100:60:40 kg/ha N through Vermicompost	6.39 ^c	34.87 ^b	26.50 ^b	54.57 ^a
T ₆ : 100 % RDF ₂ @ 120:80:80 kg/ha N through Vermicompost	6.96 ^a	30.48 ^c	29.50 ^a	50.23 ^b
T ₇ : 75% RDF ₁ @ 100:60:40 kg/ha + 25% N through FYM	6.41 ^c	30.48 ^c	26.00 ^c	52.29 ^b
T ₈ : 75% RDF ₂ @ 120:80:80 kg/ha + 25% N through FYM	6.55 ^b	32.21 ^c	28.50 ^a	51.72 ^b
T ₉ : 75% RDF ₁ @ 100:60:40 kg/ha + 25% N through Vermicompost	6.85 ^a	37.51 ^a	28.50 ^a	55.34 ^a
T ₁₀ : 75% RDF ₂ @ 120:80:80 kg/ha + 25% N through Vermicompost	6.98 ^{a*}	37.87 ^{a*}	29.50 ^a	58.56 ^{a*}
T ₁₁ : 50% RDF ₁ @ 100:60:40 kg/ha + 50% N through FYM	6.55 ^b	30.30 ^c	25.50 ^c	57.34 ^a
T ₁₂ : 50% RDF ₂ @ 120:80:80 kg/ha + 50% N through FYM	6.36 ^c	32.59 ^b	27.50 ^b	56.23 ^a
T ₁₃ : 50% RDF ₁ @ 100:60:40 kg/ha + 50% N through Vermicompost	6.71 ^b	31.42 ^c	27.50 ^b	43.44 ^d
T ₁₄ : 50% RDF ₂ @ 120:80:80 kg/ha + 50% N through Vermicompost	6.33 ^c	34.81 ^b	29.50 ^a	58.45 ^a
T ₁₅ : FYM 25 t /ha + Azotobacter (5 kg), PSB (5 kg), KSB (5 kg)	6.50 ^c	32.06 ^c	26.50 ^b	52.33 ^b
SE(m) ±	0.07	0.93	0.528	1.44
CD at 5%	0.23	2.82	1.601	4.37
CV %	1.68	4.02	2.711	3.93

Table 3. Effect of integrated nutrient management on yield parameters of teasel gourd (*Momordica subangulata* ssp. *renigera*) cv. Arka Bharath

Treatment details	Number of fruits per vine	Fruit yield per vine (kg)	Fruit yield per plot (kg)	Fruit yield per hectare (t)
T ₁ : 100 % RDF ₁ @ 100:60:40 NPK kg/ha	43.00 ^e	2.06 ^b	16.70 ^d	22.93 ^d
T ₂ : 100 % RDF ₂ @ 120:80:80 NPK kg/ha	45.50 ^d	2.48 ^a	17.70 ^c	24.07 ^c
T ₃ : 100 % RDF ₁ @ 100:60:40 kg/ha N through FYM	42.00 ^f	2.28 ^b	16.80 ^d	22.48 ^d
T ₄ : 100 % RDF ₂ @ 120:80:80 kg/ha N through FYM	47.50 ^b	2.38 ^b	19.00 ^b	26.39 ^b
T ₅ : 100 % RDF ₁ @ 100:60:40 kg/ha N through Vermicompost	44.50 ^d	2.01 ^b	17.80 ^c	24.72 ^c
T ₆ : 100 % RDF ₂ @ 120:80:80 kg/ha N through Vermicompost	48.50 ^b	2.43 ^b	18.45 ^b	26.94 ^a
T ₇ : 75% RDF ₁ @ 100:60:40 kg/ha + 25% N through FYM	41.00 ^g	2.05 ^b	15.80 ^e	22.78 ^d
T ₈ : 75% RDF ₂ @ 120:80:80 kg/ha + 25% N through FYM	49.00 ^a	2.48 ^a	18.80 ^b	26.29 ^b
T ₉ : 75% RDF ₁ @ 100:60:40 kg/ha + 25% N through Vermicompost	47.00 ^c	3.00 ^a	19.20 ^b	26.11 ^b
T ₁₀ : 75% RDF ₂ @ 120:80:80 kg/ha + 25% N through Vermicompost	50.50 ^a	3.05 ^{a*}	20.20 ^{a*}	28.06 ^a
T ₁₁ : 50% RDF ₁ @ 100:60:40 kg/ha + 50% N through FYM	43.50 ^e	2.18 ^f	17.40 ^d	24.17 ^c
T ₁₂ : 50% RDF ₂ @ 120:80:80 kg/ha + 50% N through FYM	48.00 ^b	2.40 ^b	19.20 ^b	25.88 ^b
T ₁₃ : 50% RDF ₁ @ 100:60:40 kg/ha + 50% N through Vermicompost	46.00 ^c	2.30 ^b	18.40 ^b	24.38 ^c
T ₁₄ : 50% RDF ₂ @ 120:80:80 kg/ha + 50% N through Vermicompost	49.00 ^a	2.45 ^a	19.80 ^a	27.22 ^a
T ₁₅ : FYM 25 t /ha + Azotobacter (5 kg), PSB (5 kg), KSB (5 kg)	45.00 ^d	1.93 ^b	18.00 ^c	25.00 ^b
SE(m) ±	0.50	0.20	0.30	0.54
CD at 5%	1.52	0.61	0.93	1.63
CV %	1.54	12.21	2.40	3.02

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Table 4. Effect of integrated nutrient management on fruit quality parameters of teasel gourd (*Momordica subangulata* ssp. *renigera*) cv. Arka Bharath

Treatment details	Fruit firmness (N)	Titrateable acidity (%)	TSS (°Brix)	Carotenoids (µg/100 g)	Ascorbic acid (mg/100g)
T ₁ : 100 % RDF ₁ @ 100:60:40 NPK kg/ha	32.20 ^c	0.74 ^c	5.15 ^m	95.69 ^c	1.20 ^d
T ₂ : 100 % RDF ₂ @ 120:80:80 NPK kg/ha	34.22 ^c	0.51 ^h	5.31 ^k	88.98 ^d	1.65 ^d
T ₃ : 100 % RDF ₁ @ 100:60:40 kg/ha N through FYM	32.69 ^c	0.39 ⁱ	5.07 ^o	89.12 ^d	2.29 ^c
T ₄ : 100 % RDF ₂ @ 120:80:80 kg/ha N through FYM	34.15 ^c	0.80 ^b	5.41 ^j	90.93 ^c	2.85 ^b
T ₅ : 100 % RDF ₁ @ 100:60:40 kg/ha N through Vermicompost	36.80 ^b	0.77 ^b	5.51 ⁱ	108.70 ^b	1.71 ^d
T ₆ : 100 % RDF ₂ @ 120:80:80 kg/ha N through Vermicompost	31.20 ^d	0.65 ^f	5.67 ^f	89.43 ^d	1.75 ^d
T ₇ : 75% RDF ₁ @ 100:60:40 kg/ha + 25% N through FYM	35.50 ^b	0.57 ^g	5.45 ^j	99.48 ^c	1.91 ^c
T ₈ : 75% RDF ₂ @ 120:80:80 kg/ha + 25% N through FYM	36.00 ^b	0.69 ^e	5.73 ^e	106.97 ^b	1.65 ^d
T ₉ : 75% RDF ₁ @ 100:60:40 kg/ha + 25% N through Vermicompost	38.80 ^a	0.76 ^b	5.85 ^b	111.22 ^b	3.39 ^a
T ₁₀ : 75% RDF ₂ @ 120:80:80 kg/ha + 25% N through Vermicompost	39.40 ^a	0.86 ^a	5.99 ^a	130.63 ^a	3.74 ^a
T ₁₁ : 50% RDF ₁ @ 100:60:40 kg/ha + 50% N through FYM	31.23 ^d	0.75 ^c	5.37 ^k	96.12 ^c	2.30 ^c
T ₁₂ : 50% RDF ₂ @ 120:80:80 kg/ha + 50% N through FYM	33.40 ^c	0.63 ^f	5.53 ^h	127.34 ^a	2.18 ^c
T ₁₃ : 50% RDF ₁ @ 100:60:40 kg/ha + 50% N through Vermicompost	36.10 ^b	0.71 ^d	5.71 ^f	109.67 ^b	2.30 ^c
T ₁₄ : 50% RDF ₂ @ 120:80:80 kg/ha + 50% N through Vermicompost	36.10 ^b	0.75 ^c	5.81 ^c	95.46 ^c	3.45 ^a
T ₁₅ : FYM 25 t/ha + Azotobacter (5 kg), PSB (5 kg), KSB (5 kg)	32.25 ^c	0.67 ^e	5.23 ^l	100.56 ^c	1.62 ^d
SE(m) ±	0.84	0.01	0.01	4.50	0.15
CD at 5%	2.56	0.02	0.04	13.63	0.47
CV %	3.43	1.07	0.30	6.19	9.76

Table 5. Effect of integrated nutrient management on total sugars (%), reducing sugars (%) and non-reducing sugars (%) of teasel gourd (*Momordica subangulata* ssp. *renigera*) cv. Arka Bharath

Treatment details	Total sugars (%)	Reducing sugars (%)	Non reducing sugars (%)
T ₁ : 100 % RDF ₁ @ 100:60:40 NPK kg/ha	3.79 ⁿ	2.53 ⁿ	1.26 ⁿ
T ₂ : 100 % RDF ₂ @ 120:80:80 NPK kg/ha	3.98 ^l	2.61 ^l	1.37 ^l
T ₃ : 100 % RDF ₁ @ 100:60:40 kg/ha N through FYM	3.72 ^o	2.46 ^o	1.26 ⁿ
T ₄ : 100 % RDF ₂ @ 120:80:80 kg/ha N through FYM	4.10 ^j	2.69 ^j	1.41 ^j
T ₅ : 100 % RDF ₁ @ 100:60:40 kg/ha N through Vermicompost	4.22 ^g	2.77 ^g	1.45 ^g
T ₆ : 100 % RDF ₂ @ 120:80:80 kg/ha N through Vermicompost	4.36 ^f	2.86 ^f	1.51 ^f
T ₇ : 75% RDF ₁ @ 100:60:40 kg/ha + 25% N through FYM	4.12 ⁱ	2.71 ⁱ	1.41 ⁱ
T ₈ : 75% RDF ₂ @ 120:80:80 kg/ha + 25% N through FYM	4.44 ^d	2.92 ^d	1.53 ^d
T ₉ : 75% RDF ₁ @ 100:60:40 kg/ha + 25% N through Vermicompost	4.58 ^b	3.00 ^b	1.59 ^b
T ₁₀ : 75% RDF ₂ @ 120:80:80 kg/ha + 25% N through Vermicompost	4.84 ^a	3.16 ^a	1.69 ^a
T ₁₁ : 50% RDF ₁ @ 100:60:40 kg/ha + 50% N through FYM	4.02 ^k	2.65 ^k	1.37 ^k
T ₁₂ : 50% RDF ₂ @ 120:80:80 kg/ha + 50% N through FYM	4.20 ^h	2.76 ^h	1.45 ^h
T ₁₃ : 50% RDF ₁ @ 100:60:40 kg/ha + 50% N through Vermicompost	4.38 ^e	2.88 ^e	1.51 ^e
T ₁₄ : 50% RDF ₂ @ 120:80:80 kg/ha + 50% N through Vermicompost	4.50 ^c	2.96 ^c	1.55 ^c
T ₁₅ : FYM 25 t/ha + Azotobacter (5 kg), PSB (5 kg), KSB (5 kg)	3.92 ^m	2.58 ^m	1.35 ^m
SE(m) ±	0.013	0.003	0.014
CD at 5%	0.039	0.008	0.042
CV %	0.434	0.132	1.358

Table 6. Effect of integrated nutrient management on fruit quality parameters of teasel gourd (*Momordica subangulata* ssp. *renigera*) cv. Arka Bharath

Treatment details	Protein (%)	Iron (mg/100g)	Fibre (%)	Fat (%)	Moisture (%)
T ₁ : 100 % RDF ₁ @ 100:60:40 NPK kg/ha	1.68 ^a	4.50 ^h	0.65 ^d	0.41 ^f	85.13 ^a
T ₂ : 100 % RDF ₂ @ 120:80:80 NPK kg/ha	1.04 ^e	4.40 ^l	1.20 ^c	0.53 ^e	80.73 ^b
T ₃ : 100 % RDF ₁ @ 100:60:40 kg/ha N through FYM	1.75 ^a	4.80 ^f	1.65 ^b	0.44 ^f	79.67 ^c
T ₄ : 100 % RDF ₂ @ 120:80:80 kg/ha N through FYM	1.57 ^b	4.90 ^e	1.87 ^b	0.62 ^d	83.44 ^b

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Treatment details	Protein (%)	Iron (mg/100g)	Fibre (%)	Fat (%)	Moisture (%)
T₅ : 100 % RDF ₁ @ 100:60:40 kg/ha N through Vermicompost	1.62 ^b	4.50 ^h	1.09 ^c	0.38 ^f	83.25 ^b
T₆ : 100 % RDF ₂ @ 120:80:80 kg/ha N through Vermicompost	1.20 ^d	4.50 ^h	1.98 ^a	0.91 ^c	81.66 ^b
T₇ : 75% RDF ₁ @ 100:60:40 kg/ha + 25% N through FYM	1.64 ^b	4.80 ^f	1.45 ^b	0.98 ^c	85.08 ^a
T₈ : 75% RDF ₂ @ 120:80:80 kg/ha + 25% N through FYM	1.61 ^b	5.10 ^d	1.19 ^c	1.02 ^d	79.70 ^c
T₉ : 75% RDF ₁ @ 100:60:40 kg/ha + 25% N through Vermicompost	1.36 ^c	5.60 ^a	2.14 ^a	1.48 ^b	79.27 ^c
T₁₀ : 75% RDF ₂ @ 120:80:80 kg/ha + 25% N through Vermicompost	1.59 ^b	5.70 ^a	2.42 ^a	1.75 ^a	80.79 ^b
T₁₁ : 50% RDF ₁ @ 100:60:40 kg/ha + 50% N through FYM	1.61 ^b	4.80 ^f	1.57 ^b	1.06 ^d	84.46 ^a
T₁₂ : 50% RDF ₂ @ 120:80:80 kg/ha + 50% N through FYM	1.08 ^e	4.80 ^f	1.35 ^c	1.69 ^a	84.89 ^a
T₁₃ : 50% RDF ₁ @ 100:60:40 kg/ha + 50% N through Vermicompost	1.22 ^d	4.90 ^e	1.25 ^c	0.60 ^d	85.80 ^a
T₁₄ : 50% RDF ₂ @ 120:80:80 kg/ha + 50% N through Vermicompost	1.27 ^d	5.00 ^e	1.08 ^c	1.28 ^c	87.53 ^a
T₁₅ : FYM 25 t/ha + Azotobacter (5 kg), PSB (5 kg), KSB (5 kg)	1.12 ^e	4.50 ^h	1.69 ^b	1.15 ^d	84.30 ^a
SE(m) ±	0.03	0.051	0.15	0.05	1.26
CD at 5%	0.10	0.156	0.45	0.15	3.84
CV %	3.40	1.504	14.08	7.76	2.15

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