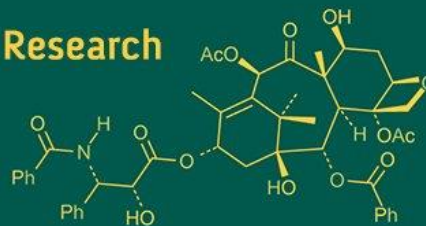
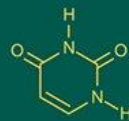
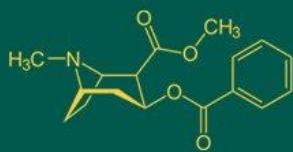


International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2025): 5.29
IJABR 2025; SP-9(10): 1557-1560
www.biochemjournal.com
Received: 26-07-2025
Accepted: 29-08-2025

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Effect of integrated nutrient management on growth of Red Amaranthus

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DOI: <https://www.doi.org/10.33545/26174693.2025.v9.i10Ss.6058>

Abstract

The present study entitled “Effect of integrated nutrient management on growth of Red Amaranthus” was conducted during summer season 2024-25 in the research and instructional farm at Bharregaon under Pt. KLS College of Horticulture and Research Station, Rajnandgaon (C.G.). The field experiment was conducted in randomized block design with three replications and ten treatments consisting a control. The aim of the experiment was to find out to the effect of integrated nutrient management on growth Red Amaranthus. Integrated nutrient management 60% RDF + 40% RDN through Vermicompost + PSB gave significantly better performance at vegetative character like maximum plant height (62.41cm), number of leaves per plant (16.23), leaf area per plant (33.95 cm²), Stem girth (2.82 cm), fresh weight of plant (37.78 g), dry weight of plant (1.08 g) and minimum days to harvest (49 days).

Keywords: Red Amaranthus, FYM, RDN, vermicompost, PSB

1. Introduction

The Red Amaranthus (*Amaranthus cruentus* L.) is annual short-lived perennial plants belongs to the family Amaranthaceae and diploidy (2n = 16) in nature. Amaranthus despite its potential, amaranth remains an underexploited crop, commonly known as chaulai or lal bhaji and colloquially referred to as the poor man's vegetable. In English it has several common names, including blood amaranth, purple amaranth, prince's feather and Mexican grain amaranth. In Maharashtra, it is called shravani math. The genus consists of 60 species of annual herbs, which are native of America and they are distributed in the tropics, of which 25 species occur in India. Mostly four cultivated species of amaranthus has been reported and they are *A. hypochondriacus* (L.), *A. cruentus* (L.), *A. caudatus* (L.) and *A. edulis* (L.). The primary leafy type, *Amaranthus tricolor* L., originates from South East Asia, specifically India (Pratap *et al.*, 2010). *Amaranthus cruentus* is a tall annual herb topped with clusters of dark pink flowers. The plant can grow up to 2 m (6 ft) in height and blooms from summer to fall. It is believed to have originated from *Amaranthus hybridus*, with which it shares many morphological features. While *A. cruentus* is no longer a staple food in North and Central America, it is still grown and sold as a health food. (Pratap *et al.*, 2010) [5].

Amaranth leaves are nutritionally similar to beets, swiss chard and spinach, but are genetically closer to their wild ancestors and offer a far superior source of carotene, iron, calcium, protein, vitamin C, A and trace elements. Tender stems and leaves contain moisture (85.70%), protein (4.0 g), fat (0.5 g), carbohydrates (6.3 g), calcium (397.0 mg), iron (25.5 mg), phosphorus (83.0 mg), vitamin A (9200 IU) and vitamin C (99 mg), (Rai and Yadav, 2005) [6].

Organic fertilizers had a positive effect on soil microbial population resultant in enhanced soil biomass, carbon, nitrogen content and dehydrogenase activity. To compensate we should use indigenous sources like farmyard manure, vermicompost etc. Use of organic manures helps in increasing crop yields and also improves the physical, chemical and biological properties of soil and increases the efficiency of applied fertilizers.

Among the sources of organic manures, vermicompost has a special place because of the presence of readily available plant nutrients, growth enhancing substances and number of beneficial microorganisms like N₂ fixing, P solubilizing and cellulose decomposing

organisms. FYM alone or in combination with Bio-fertilizer helps in proper supply of nutrition and maintains the soil health. FYM is beneficial for its residual value. (Sultan, 1997) ^[9].

There is a sample scope to increase amaranth foliage yield per unit area with appropriate use of inorganic, organic fertilizers with biofertilizers. The approach toward integrated nutrient management (INM) improves soil health as the use of organic manure and chemicals will not only sustain crop yield but also increase the efficiency of applied fertilizers in a judicious way (Singh and Biswas, 2000) ^[8].

Vermicompost is implemented as organic manure produced by use of earth worms. It contains about 1.60% N₂, 2.20% P₂O₅ and 0.67% K₂O. Among the sources of organic manures, vermicompost has a special place because of the presence of readily available plant nutrients, growth enhancing substances and number of beneficial microorganisms like N₂ fixing, P solubilising and cellulose decomposing organisms (Sultan, 1997) ^[9].

2. Materials and Methods

The present study entitled "Effect of integrated nutrient management on growth of Red Amaranthus" was conducted during summer season 2024-25 in the research and instructional farm at Bharregaon under Pt. KLS College of Horticulture and Research Station, Rajnandgaon (C.G.). The field experiment was conducted in randomized block design with three replications and ten treatments consisting a control i.e., Control (T₀), 100% RDF N:P: K (75: 40:25) Kg/ha (T₁), 100% RDN through FYM (T₂), 100% RDN through Vermicompost (T₃), 60% RDF + 40% RDN through FYM(T₄), 60% RDF + 40% RDN through Vermicompost (T₅), 60% RDF + 20% RDN through FYM + 20% RDN through Vermicompost (T₆) 60% RDF + 40% RDN through FYM + VAM (T₇), 60% RDF + 40% RDN through Vermicompost + PSB (T₈) and 50% RDF + 25% RDN through FYM + 25% RDN Vermicompost (T₉).

2.1 Preparation of experimental site

The soil was made to fine tilth by continuous cultivator and harrowing after the area had been carefully ploughed and weeds, stubbles, stones etc., were completely removed. Following complete field levelling the required area for experiment was marked and plots were prepared in thrice counter act block according to the plan of layout with the help of tape and rope after leveling.

2.2 Details of the treatments used

Randomised Block Design (RBD) was used for conducting the desired experiment which consisted of nine numbers of treatments with three replications. The variety used for the investigation was Arun Red.

2.2.1. Inorganic fertilizers

Inorganic fertilizers viz., nitrogen, phosphorus and potassium were supplied through urea (46% N), single super phosphate (16% P₂O₅) and muriate of potash (60% K₂O).

2.2.2. Organic fertilizers

Organic fertilizers are the fertilizers or manures derived from animal products and plant residues containing adequate amounts of nutrients. Organic manures used in this experiment are farm yard manure (FYM) and vermicompost.

i. Farm yard manure (FYM)

The decomposed mixture of dung, litter, urine and leftover materials from roughages and fodder is called farmyard manure (FYM). It is the most basic fertilizer which is used in almost all the crops to supply organic matter and it enhances the physical, chemical and biological characteristics of the soil.

ii. Vermicompost

It is the compost produced by degradation of organic matter by the action of microbes and earthworms. The NPK content of vermicompost used are 1.87-2.50, 0.7-1.50 and 1.50-2.00 percent, respectively. Vermicompost also contains some beneficial microorganisms, plant growth hormones, enzymes and humic acids.

2.2.3. Biofertilizers

A biological preparation from the efficient microorganism which is used to promote the plant growth and development is called bio-fertilizers. As the sources of bio-fertilizers, phosphate solubilizing bacteria (PSB) and VAM were utilized in the present investigation.

3. Results and Discussion

3.1 Growth parameter

3.1.1 Plant height (cm)

T₈ (60% RDF + 40% RDN through Vermicompost + PSB) recorded significantly the maximum plant height (24.78 cm), (44.33 cm) & (62.41 cm). However, T₀ (Control) recorded the minimum plant height (17.20 cm), (25.44 cm) & (33.47 cm) among the others at 20 days, 40 days and at harvest, respectively.

Maximum plant height might be due combining the application of organic and inorganic sources certain growth promoting substances secreted by the vermicompost, bio-fertilizers (phosphate solubilizing bacteria) which, in turn, might have led to better root development, better transportation of water, uptake and deposition of nutrients. This might be due to application of integrated nutrients which increased photosynthetic activity, chlorophyll formation, nitrogen metabolism and auxin contents in the plants which ultimately improved the plant height. These findings were in agreement with the findings of Canellas *et al.*, (2000) ^[2].

3.1.2 Number of leaves per plant

T₈ (60% RDF + 40% RDN through Vermicompost + PSB) recorded significantly the maximum number of leaves (9.49), (12.80) & (16.74). However, T₀ (Control) recorded the minimum number of leaves (5.01), (8.54) & (9.89) among the others at 20 days, 40 days and at harvest, respectively.

The increased number of leaves might be due to promotive effects of nitrogen from both inorganic and organic sources on vegetative growth which ultimately lead to more photosynthetic activity. Reported that adequate supply of plant nutrients through inorganic and bio-fertilizers influenced the plant growth. Vermicompost increased the fertility of the soil, loosen the soil, stimulate root, stem and leaf growth. Similar results were also reported by Tindall (1975) ^[10].

3.1.3. Leaf area per plant (cm²)

T₈ (60% RDF + 40% RDN through Vermicompost + PSB) recorded significantly the maximum leaf area (19.24 cm²),

(23.46 cm²) & (33.95 cm²). However, T₀ (Control) recorded the minimum leaf area (10.22 cm²), (15.44 cm²) & (22.40 cm²) among the others at 20 days, 40 days and at harvest, respectively.

Maximum leaf area per plant (cm²) was recorded T₈ might be due to higher availability of nutrients which has accelerated the synthesis of chlorophyll and amino acids which are associated with photosynthetic process of plants resulted in higher leaf area. Similar results were also reported by Babajide (2014) ^[1].

3.1.4. Stem girth (cm)

T₈ (60% RDF + 40% RDN through Vermicompost + PSB) recorded significantly the maximum stem girth (1.88 cm), (2.20 cm) & (2.82 cm). However, T₀ (Control) recorded the minimum stem girth (0.65 cm), (0.92 cm) & (1.30 cm) among the others at 20 days, 40 days and at harvest, respectively.

Maximum stem girth due to the plants used NPK more effectively which led to higher growth as well as stem girth. Moreover, it might be due to vermicompost which is rich in nitrogen, phosphorus, potassium, calcium, magnesium and micronutrients like zinc, iron and copper. These nutrients supported for healthy cell division and growth, leading to an increased in stem girth. More amount of nitrogen was readily available in vermicompost, which is important for the synthesis of structural proteins. Similar results were also reported by Kushare *et al.* (2010) ^[4] in amaranthus.

3.1.5. Fresh weight of plant (g)

The results revealed that the maximum fresh weight of plant was recorded in the treatment T₈ (60% RDF + 40% RDN through Vermicompost + PSB) (37.78 g), while the lowest fresh weight of plant (22.96 g) in T₀ (Control).

Maximum fresh weights was recorded T₈ might be due to application of vermicompost, bio-fertilizer and chemical increase the plant height no. of leaves leaf area and stem girth. Organic nutrients such as vermicompost contributed to

the production of phytohormones, which might have boosted plant growth and nutrient uptake. Similar results were also reported by Zarei *et al.* (2012) ^[11] in soybean and Shedeed *et al.* (2014) ^[7] in onion.

3.1.6. Dry weight of plant (g)

The results revealed that the maximum dry weight of plant was recorded in the treatment T₈ (60% RDF + 40% RDN through Vermicompost + PSB) (1.08 g) which was statistically at par with treatments T₇ (60% RDF + 40% RDN through FYM + VAM) (1.01 g) and T₆ (60% RDF + 20% RDN through FYM + 20% RDN through Vermicompost) (0.92 g) respectively, while, it was the lowest dry weight of plant (0.50 g) in T₀ (Control).

Maximum dry weight was recorded T₈ might be caused by the balanced nutrients which enhanced the rate of photosynthetic activity and transfer of photosynthates from source to sink thereby increased the dry weight of the leaves. Similar results were also reported by Khadse *et al.*, (2021) ^[3] in amaranthus.

3.1.7 Days to harvest

Application of T₈ (60% RDF + 40% RDN through Vermicompost + PSB) resulted in earliness of days to harvest (49 days) which was statically at par with the treatment T₇ (60% RDF + 40% RDN through FYM + VAM) (50 days) respectively. However, the maximum number of days to harvest (55 days) was recorded in T₀ (Control).

Earliness of days to harvest was recorded T₈ (60% RDF + 40% RDN through Vermicompost + PSB) might be caused the application of vermicompost, bio-fertilizer and chemical fertilizer influenced the fresh weights of the amaranth's plants. Organic nutrients such as vermicompost contributed to the production of phytohormones, which might have boosted plant growth and nutrient uptake. Similar results were also reported by Zarei *et al.* (2012) ^[11] in soybean and Shedeed *et al.* (2014) ^[7] in onion.

Table 1: Effect of integrated nutrient management on plant height, number of leaves, leaf area, stem girth, fresh weight of plant, dry weight of plant and days to harvest.

Treatment	Treatment combination	Plant height (cm)			Number of leaves per plant			Leaf area per plant (cm ²)			Stem girth (cm)			Fresh weight of plant (g)	Dry weight of plant (g)	Days to harvest
		20 days	40 days	At harvest	20 days	40 days	At harvest	20 days	40 days	At harvest	20 days	40 days	At harvest			
T ₀	Control	17.20	25.44	33.47	5.01	8.54	9.89	10.22	15.44	22.40	0.65	0.92	1.30	22.96	0.50	55
T ₁	100% RDF N:P: K (75: 40: 25) Kg/ha	20.56	29.95	49.55	6.88	10.55	12.58	13.76	18.95	29.69	0.93	1.86	2.05	29.45	0.78	53
T ₂	100% RDN through FYM	18.20	27.22	44.54	5.22	9.55	11.22	12.95	17.33	25.55	0.82	1.22	1.78	26.27	0.65	54
T ₃	100% RDN through Vermicompost	20.22	28.33	45.22	6.33	9.97	11.47	13.22	17.54	27.33	0.84	1.55	1.82	27.88	0.72	54
T ₄	60% RDF + 40% RDN through FYM	20.44	28.76	45.76	6.47	10.11	12.33	13.55	18.3	29.54	0.85	1.66	1.84	28.66	0.75	53
T ₅	60% RDF + 40% RDN through Vermicompost	21.47	33.74	53.46	7.54	11.43	13.23	14.74	20.47	31.32	1.33	1.82	2.34	30.21	0.85	52
T ₆	60% RDF + 20% RDN through FYM + 20% RDN through Vermicompost	22.98	35.95	57.88	7.89	11.74	15.44	16.23	21.22	32.45	1.54	2.10	2.55	33.46	0.92	51
T ₇	60% RDF + 40% RDN through FYM + VAM	23.21	38.44	60.33	8.23	12.22	15.67	17.21	22.43	32.55	1.67	2.14	2.61	36.24	1.01	50
T ₈	60% RDF + 40% RDN through Vermicompost + PSB	24.78	44.33	62.41	9.49	12.80	16.74	19.24	23.46	33.95	1.88	2.20	2.82	37.78	1.08	49
T ₉	50% RDF + 25% RDN through FYM + 25% RDN Vermicompost	21.23	32.66	50.22	7.21	10.97	13.05	14.22	20.05	30.84	1.20	1.95	2.21	30.21	0.86	52
SE(m ±)		0.78	1.54	2.07	0.28	0.44	0.46	0.58	0.82	1.11	0.06	0.07	0.08	1.10	0.03	1.94
C.D. at 5%		2.32	4.56	6.15	0.83	1.31	1.38	1.73	2.42	3.28	0.16	0.21	0.25	3.28	0.10	5.75
CV		6.44	8.12	7.13	6.88	7.10	6.13	6.91	7.24	6.46	8.13	7.09	6.86	6.33	7.15	6.42

4. Conclusion

In light of the present experimental findings summarized above, it may be concluded that the use of inorganic nutrients along with vermicompost and bio-fertilizers enhanced the growth of Red Amaranthus. The study of comparison of various treatments revealed that the application of 60% RDF + 40% RDN through Vermicompost + PSB showed the better response with respect to the plant height (cm), number of leaves per plant, leaf area per plant (cm²), Stem girth (cm), fresh weight of plant (g), dry weight of plant (g) and days to harvest than all the treatments. Among the ten treatments the T₈ was considered the best treatment.

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