The Pharma Innovation Journal 2021; 10(10): 311-314

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; 10(10): 311-314

www.thepharmajournal.com
Received: 22-08-2021
Accepted: 24-09-2021

Cheenuri Saikrishna
College of Horticulture, SKLTSHU, Rajendranagar, Hyderabad, Telangana, India

T Suresh Kumar
Horticulture Research Station, SKLTSHU, Konda Mallepally, Nalgonda, Telangana, India

A Krian Kumar
Administrative Office, SKLTSHU, Mulugu, Siddipet (District), Telangana, India

CH Raja Goud
College of Horticulture, SKLTSHU, Rajendranagar, Hyderabad, Telangana, India

S Mallesh
College of Horticulture, SKLTSHU, Rajendranagar, Hyderabad, Telangana, India

Corresponding Author:
Cheenuri Saikrishna
College of Horticulture, SKLTSHU, Rajendranagar, Hyderabad, Telangana, India

Study the effect of integrated nutrient management on growth of red Amaranthus (*Amaranthus cruentus* L.) Var. Arun

Cheenuri Saikrishna, T Suresh Kumar, A Krian Kumar, CH Raja Goud and S Mallesh

Abstract
The present investigation entitled "Study the effect of integrated nutrient management on growth of Red Amaranthus (*Amaranthus cruentus* L.) Var. Arun." was carried out during the *rabi* season of the year 2020-21 at the College of Horticulture, Rajendranagar, Sri Konda Laxman Telangana State Horticultural University.Telangana. The experiment was laid out in Randomized Block Design (RBD) with 16 treatments replicated thrice. The results revealed that application of 75% RDF + 25% RDN through Vermicompost + *Azotobacter* recorded significantly higher plant height (65.49 cm $plant^{-1}$), number of leaves (26.24 $plant^{-1}$), leaf area (37.81 cm^2 $plant^{-1}$), total dry matter (8.34 g $plant^{-1}$) and Growth indices like LAI (4.41), AGR (1.74 g $plant^{-1}$ day^{-1}) and NAR (0.0625 g m^{-2} day^{-1}), CGR (0.17 g m^{-2} day^{-1}).

Keywords: red amaranthus, growth indices, vermicompost, integrated nutrient management

Introduction
Red Amaranth (*Amaranthus cruentus* L.) a quick growing food crop, belongs to the family Amaranthaceae and genus Amaranthus. The genus consists of 60 species of annual herbs, which are native of America and 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. edulies* (L) (Pratap *et al*., 2010) [10]. This crop is cultivated as minor crop in America, Guatemala, Peru, India and Nepal. The crop is cultivated both in hilly areas as well as in plains, in the states of Himachal Pradesh, Gujarat, Maharashtra and Karnataka. (Patel *et al*., 2005) [9].
Amaranthus is highly adaptable, drought tolerant, pest and disease resistant, fast growing C_4 plant with high yielding potential. It grows well on different types of soil with neutral pH and thrives well under water stress condition (Miller *et al.*, 1984) [7]. Red Amaranthus leaves contain a unique source of antioxidant pigments, such as betalain, β-xanthin, and β-cyanin compared to other leafy vegetables and an excellent source of other antioxidant pigments, such as anthocyanins, carotenoids and chlorophylls, and natural antioxidant phytochemicals, such as vitamin C, phenolic acids, and flavonoids (Sarker *et al.*, 2018a [12] and 2018b) [13]. It is tolerant to abiotic stresses, such as drought and salinity. There are two colors in amaranth, one is red and another is green. Red amaranth has more pigments than green amaranth. Its nutritional value, taste, and attractive leaf color make them very popular in the Asian continent and the globe. Hence, experiment on "Study the effect of integrated nutrient management on growth of Red Amaranthus (*Amaranthus cruentus* L.) Var. Arun." was conducted at the field unit College of Horticulture, Rajendranagar, during 2020-21

Materials and Methods
The present investigation entitled "Study the effect of integrated nutrient management on growth of Red Amaranthus (*Amaranthus cruentus* L.)Var. Arun." was carried out during the *rabi* season of the year 2020-21 at the College of Horticulture, Rajendranagar, Sri Konda Laxman Telangana State Horticultural University. Telangana. The experiment was laid out in Randomized Block Design (RBD) with 16 treatments and three replications *viz*., T_1- control (no use of fertilizers), T_2 - 100% RDF NPK (75:40:25) Kg/ha, T_3- 100% RDN through FYM, T_4- 100% RDN through Vermicompost, T_5 - 75% RDF+25%RDN through FYM, T_6 - 75% RDF+25% RDN through Vermicompost, T_7 -50% RDF+25% RDN through FYM +25% RDN through Vermicompost, T_8- 75% RDF+25% RDN through FYM+PSB (5Kg/ha), T_9-75%

RDF+25% RDN through FYM+VAM (5Kg/ha), T_{10}-75% RDF + 25% RDN through FYM + Azotobacter (5Kg/ha), T_{11}-75% RDF +25% RDN through Vermicompost + PSB, T_{12}-75% RDF + 25% RDN through Vermicompost + VAM, T_{13}-75% RDF + 25% RDN through Vermicompost + Azotobacter, T_{14}- 50% RDF + 25% RDN through FYM + 25% RDN through Vermicompost + PSB (5Kg/ha), T_{15}-50% RDF + 25% RDN through FYM + 25% RDN through Vermicompost + VAM (5Kg/ha), T_{16}- 50% RDF + 25% RDN through FYM + 25% RDN through Vermicompost + Azotobactor (5Kg/ha). Plant height in cm was recorded from the base of the plant to the tip of the main shoot up to panicle initiation and from the base of the plant to the tip of the primary panicle after panicle initiation and mean of five was presented as plant height. Numbers of fully opened leaves from five randomly selected plants were counted and mean values were computed. The leaves from the selected plants were fed to the leaf area meter and expressed as cm2 per plant. Dry matter accumulation was determined for leaves, stem and root portion of plant. Randomly selected five plants from each treatment were up rooted carefully without damaging the roots up to 15 cm depth and partitioned into different parts like leaf, stem and root and dried at 65 – 70 °C in hot air oven. The completely dried samples were weighed and recorded as gram (g) plant-1. These primary data were used to estimate the total dry weight plant-1.

Leaf Area Index (LAI)

Leaf area index (LAI) is defined as an assimilatory surface per unit area of land (Williams *et al*., 1946) [15]. Leaf area index was worked out at 30, 45 and 60 days after sowing by dividing the leaf area per plant by land area occupied by the plant.

$$LAI = \frac{\text{Total leaf area of a plant } (cm^2)}{\text{Ground area occupied by the plant} (cm^2)}$$

Absolute Growth Rate (AGR)

Absolute growth rate (AGR) refers to the total growth of a plant per unit time. For various growth periods it was worked out from the below mentioned formula of Watson (1952) [14] and expressed in g per day.

$$AGR = \frac{w_2 - w_1}{t_2 - t_1} \text{ g day}^{-1}$$

Where,
W2 = Dry matter production per plant (g) at t2
W1 = Dry matter production per plant (g) at t1
t1and t2 = time intervals

Net Assimilation Rate (NAR)

It is the rate of increase in the dry matter per unit leaf area per unit time and expressed as grams per day. It was calculated by the formula as suggested by Gregory (1917) [3].

$$NAR = \frac{(W_2 - W_1)}{(t_2 - t_1)} \times \frac{(\log_e L_2 - \log_e L_1)}{(L_2 - L_1)}$$

Where
W2 = Dry matter production per plant (g) at t2
W1 = Dry matter production per plant (g) at t1
t1and t2 = time intervals
L1 = Leaf area index (LAI) at time t1
L2 = LAI at time t2

Crop Growth Rate (CGR)

Crop growth rate (CGR) for various growth periods was worked out from the below given formula of Watson (1952) [14] and expressed in g per m2 per day.

$$CGR = \frac{(W_2 - W_1)}{\rho (t_2 - t_1)}$$

Where
W2 = Dry matter production per plant (g) at t2
W1 = Dry matter production per plant (g) at t1
t1and t2 = time intervals
P = land area (cm^2)

The data collected from the experimental field was analyzed statistically following the procedure as described by Gomez and Gomez (1984) [4]. The level of significance used in ‘F’ and ‘t’ test was P=0.05. Critical differences were calculated wherever ‘F’ test was significant.

Results and Discussion

Growth attributes

The result revealed that application of 75% RDF + 25% RDN through Vermicompost + *Azotobacter* (T13) recorded significantly higher growth attributes like higher plant height (65.49 cm), number of leaves (26.24), leaf area (37.81 cm^2), total dry matter (8.34 g $plant^{-1}$) at 60 days after sowing and which were found on par with application of 50% RDF + 25% RDN through FYM + 25% RDN through Vermicompost+Azotobacter (T16) and 75% RDF + 25% RDN through FYM + *Azotobacter* (T10). The lower plant height (37.78 cm), number of leaves (13.83), leaf area (23.70 cm^2) and total dry matter (3.75 g plant-1) were noted with T_1 treatment control (no use of fertilizers) (Table 1). The higher growth attributes like higher plant height and number of leaves with application 75% RDF + 25% RDN through Vermicompost + *Azotobacter* were might be due to the nutrient applied through inorganic fertilizers gets mineralized rapidly and released to the crop uptake with the activity of bio-fertilizers and also increased availability of nitrogen in soil by the activity of bio-fertilizers. Better growth and development observed under high nitrogen rate suggest that increasing plant nitrogen to an optimum rate enables the plants to produce their potential number of leaves (Bhaskar *et al*., (1996) [2] and Khoja *et al.*, (2004) [5]. Higher leaf area and total dry matter were might be due to the higher availability of inorganic nutrients to the plants which have accelerated the synthesis of chlorophyll and amino acids associated with major photosynthetic processes of plant. The availability of more photosynthates resulted in higher leaf area and ultimately higher dry matter accumulation. Results are in accordance with (Law-Ogbomo *et al.*) (2009) [6].

Growth indices

The application of 75% RDF + 25% RDN through Vermicompost + *Azotobacter* (T13) recorded significantly higher growth indices like leaf are index (LAI) during 45 DAS and 60 DAS (3.41, 4.41 respectively), absolute growth rate (AGR) between 30 DAS to 45 DAS and 45 DAS to 60

DAS (1.03, 1.74 g plant $^{-1}$day^{-1} respectively), net assimilation rate (NAR) between 30 DAS to 45 DAS and 45 DAS to 60 DAS (0.055, 0.0625 g m^{-2}day^{-1}respectively) and crop growth rate (CGR) between 30 DAS to 45 DAS and 45 DAS to 60 DAS (0.162, 0.17 g m^{-2}day^{-1}respectively). The lower LAI during 45 DAS and 60 DAS (1.37, 1.81 respectively) and lower AGR, NAR, CGR, between 30 DAS to 45 DAS and 45 DAS to 60 DAS (0.51, 0.69 g plant-1day-1, 0.019, 0.028 g m-2 day-1, 0.056, 0.088 g m-2 day-1 respectively) were recorded with T_1 treatment control (no use of fertilizers) (Table 2). The higher growth indices with application of 75% RDF + 25% RDN through Vermicompost + *Azotobacter* might be due to higher nutrient uptake leading to increased leaf area and availability of more photosynthetically active leaf area for longer period resulted in higher dry matter production and availability of active leaves over a period of time and active sites of photosynthesis. The results are in conformity with the findings of Tabitha *et al.* (2018) [13], Ngoroyemoto *et al.* (2019) [8] and Arya *et al.* (2017) [1] who have also reported similar results.

Table 1: Plant height, number of leaves, leaf area and total dry matter of Red Amaranthus as influenced by different Integrated Nutrient Management

Treatments	Plant height (cm) at 60 DAS	Number of leaves at 60 DAS	Leaf area per plant (cm^2)	Dry matter accumulation (g/plant)
T1	37.78	13.83	23.70	3.75
T2	52.02	20.43	30.84	6.34
T3	39.71	15.43	25.35	4.53
T4	43.09	15.57	27.74	4.68
T5	45.92	17.92	28.01	5.90
T6	47.61	20.04	28.65	6.18
T7	50.52	20.38	28.75	6.34
T8	58.69	22.13	32.58	7.05
T9	54.82	21.38	31.09	6.74
T10	62.09	24.23	35.44	7.78
T11	58.72	22.60	32.68	7.32
T12	56.73	21.85	32.19	6.74
T13	65.49	26.24	37.81	8.34
T14	59.72	22.79	33.50	7.60
T15	57.96	22.11	32.44	6.87
T16	63.50	25.21	36.59	8.12
S.Em±	1.91	0.86	1.22	0.62
CD at 5%	5.54	2.49	3.53	1.81

Table 2: Leaf area index (LAI), absolute growth rate (AGR), Crop growth rate(CGR), net assimilation rate(NAR) per plant of Grain Amaranth as influenced by different Integrated Nutrient Management practice

Treatments	Leaf area index		Absolute growth rate (g/plant/day)		Net assimilation rate (g/dm^2 /day)		Crop growth rate (g/m^2 /day)	
	45 DAS	60DAS	30-45 DAS	45-60 DAS	30-45 DAS	45-60 DAS	30-45 DAS	45-60 DAS
T1	1.37	1.81	0.51	0.69	0.0199	0.0281	0.054	0.088
T2	2.22	2.84	0.64	1.37	0.0400	0.0431	0.119	0.124
T3	1.80	2.30	0.55	0.73	0.0260	0.0305	0.060	0.093
T4	1.91	2.35	0.57	0.90	0.0295	0.0363	0.068	0.098
T5	2.00	2.36	0.61	1.16	0.0318	0.0376	0.094	0.100
T6	2.05	2.78	0.62	1.23	0.0355	0.0394	0.098	0.105
T7	2.13	2.78	0.63	1.28	0.0398	0.0411	0.103	0.118
T8	2.89	3.07	0.74	1.65	0.0442	0.0514	0.135	0.152
T9	2.25	2.85	0.66	1.39	0.0408	0.0436	0.127	0.138
T10	3.10	3.27	0.86	1.69	0.0460	0.0546	0.147	0.165
T11	3.02	3.19	0.77	1.67	0.0442	0.0522	0.136	0.154
T12	2.48	3.01	0.68	1.42	0.0415	0.0460	0.131	0.139
T13	3.41	4.11	1.03	1.74	0.0553	0.0625	0.162	0.170
T14	3.04	3.20	0.82	1.68	0.0444	0.0523	0.136	0.156
T15	2.85	3.05	0.69	1.63	0.0432	0.0489	0.132	0.147
T16	3.23	3.70	0.86	1.72	0.0550	0.0584	0.156	0.167
S.Em±	0.28	0.24	0.05	0.13	0.006	0.005	0.006	0.007
CD at 5%	0.82	0.72	0.15	0.47	0.018	0.015	0.019	0.020

Conclusion
From this study, it can be concluded that application of 75% RDF + 25% RDN through Vermicompost + *Azotobacter* has realised higher growth parameter (plant height, number of leaves, leaf area, total dry matter) and growth indices like LAI, AGR, NAR and CGR in Red Amaranthus as compare to other treatments. Thus proper management of nutrient increased the growth and development of Red Amaranthus.

Acknowledgement
The corresponding author is thankful to Sri Konda Laxman Telangana State Horticultural University (SKLTSHU) for financial support

References
1. Arya S, Kumar TR, Santhosh Kumar R. Comparative study on the effect of fertilizers on agronomic and

biochemical characters in *Amaranthus* sp. Indian Journal of Tropical Biodiversity 2017;25(1):93-97.
2. Bhaskar J, Bharad GM, Patil SN. Effect of plant population, nitrogen and phosphorus on grain amaranth. Indian Journal of Agronomy 1996;41(1):181-182.
3. Gregory FG. The effect of climatic conditions on growth of barley. Ann. Bot 1926;46:1-26.
4. Gomez KA, Gomez AA. Statistical Procedures for Agric. Res. 2nd Ed. John Wiley & Sons, New York 1984.
5. Khoja JR. Effect of sowing time and sources of nitrogen on growth, thermal requirement, yield and quality of coriander (*Coriandrum sativum* L.). (Doctoral dissertation, Ph. D. Thesis, Rajasthan Agricultural University, Bikaner. 2004, 127-130.
6. Law-Ogbomo KE, Ajayi SO. Growth and yield performance of *Amaranthus cruentus* influenced by planting density and poultry manure application. Notulae Botanicae Horti Agrobotanici Cluj-Napoca 2009;37(2):195-199.
7. Miller TE, Wing JS, Huete AR. The agricultural potential of C_4-plants in arid environments. Journal of arid environments. 1984;7:275-286.
8. Ngoroyemoto N, Gupta S, Kulkarni MG, Finnie JF, Van Staden J. Effect of organic biostimulants on the growth and biochemical composition of *Amaranthus hybridus* L. South African Journal of Botany 2019;124:87-93.
9. Patel BM, Ravindrababu Y, Patel PG, Patel MM. Effect of integrated nutrient management in light textured soil on grain amaranth (*amaranthus hypochondriacus* L.). Journal of Soils and Crops 2005;15(2):260-263.
10. Pratap T, Dutta M. Integrated nutrient management studies in grain amaranth (*Amaranthus hypochondriacus* L.). Journal of Hill Agriculture 2010;1(2):187-189.
11. Sarker U, Islam MT, Rabbani MG, Oba S. Variability in total antioxidant capacity, antioxidant leaf pigments and foliage yield of vegetable amaranth. Journal of Integrative Agriculture 2018a;17:1145-1153.
12. Sarker U, Islam MT, Rabbani MG, Oba S. Antioxidant leaf pigments and variability in vegetable amaranth. Genetika 2018b;50:209-220.
13. Tabitha K, Wilson T, Joseph PGO. Morphological Characteristics of *Amaranthus cruentus* and *Amaranthus tricolor* as Influenced by Integration of Organic and Inorganic Fertilizers in Kiambu County, Kenya. Asian Research Journal of Agriculture 2018, 1-18.
14. Watson DJ. The physiological basis for variation in yield. Adv. Agron 1952;4:101-145
15. Williams RF. The physiology of plant growth with special reference to the concept of net assimilation rate. Annals of Botany 1946;10(37):41-72.