



Effect of Different Organic and Inorganic Fertilizers on Growth, Yield and Quality of Amaranthus under Polyhouse Condition (*Amaranthus cruentus*) cv. NSC 999IUS

K. T. Anjali^{a*}, Samir E. Topno^a and Anita Kerketta^{a#}

^a *Department of Horticulture, Naini Agriculture Institute, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj-211007, Uttar Pradesh, India.*

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJECC/2022/v12i1131147

Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/91016>

Original Research Article

Received 03 July 2022
Accepted 14 August 2022
Published 18 August 2022

ABSTRACT

The present investigation was carried out in the polyhouse of Horticultural Research Field, Department of Horticulture, Naini Agriculture Institute, Sam Higginbottom University of Agricultural Technology and Sciences, Prayagraj during year 2021 on Amaranthus. The experiment was carried out in a Randomized Block Design consisting of 12 treatments with three replications using farm yard manure, vermicompost, poultry manure and goat manure for organic fertilizers and NPK for inorganic fertilizers to find out the best treatment combination. The application of treatment T₉ [R.D.F50%+25% Poultry manure+25% Goat manure] was shown highest in terms growth attributes Plant height (37.02), Number of branches (29), plant spread (25.89), Root length (7.83), Yield per plant (151.27g), Yield per plot (5.56 kg), Yield per 200m² (1112kg) and Anthocyanin content per 100g (158.8mg). T₉ [R.D.F 50%+50% Poultry manure] has given best results in terms of leaf length (7.36) and, Number of leaves (35.33). Therefore this treatment is best compared to other treatments and control.

^o PG Student;

[#] Assistant Professor;

*Corresponding author: E-mail: anjaliprakash9304@gmail.com;

Keywords: *Amaranthus*; farm yard manure; goat manure; poultry manure; vermicompost.

1. INTRODUCTION

Leafy vegetables play a vital role in crop rotation because of its short and large yield of edible matter per unit area. Amaranthus is one of the most important and popular one. Amaranthus is a cosmopolitan genus of annual or short lived perennial plants, cultivated as leaf vegetables pseudo cereals and ornamental plants. It is widely grown as a leafy vegetable in south east Asian countries especially Malaysia, Indonesia, southern china, and the hot and humid regions of Africa. It is often described as a poor man's leafy vegetable because of its low price and high nutritive value. The leaves and tender stems of Amaranth are rich in proteins minerals calcium vitamin A (carotene), Vitamin C, folic acid, thiamine, niacin and riboflavin. Amaranthus had antinutrient factors like oxalates and nitrates. The oxalate results in kidney stones and nitrates form methaemoglobin in the blood [1,2]. However normal consumptions do not have such problems.

Organic fertilizers release nutrients as they break down, improving the soil and its ability to hold water and nutrients. Given time they make your soil and plants healthier and hardier [3,4]. Organic fertilizers carry little risk of a toxic overdose of chemicals, but they require a breakdown of microorganisms to release nutrients limiting their seasonal effectiveness and potentially increasing the amount of time they take to feed your plants [5-7].

Inorganic fertilizers are fast releasing nutrients feeding your plant, show what you want and when you want. They are fully artificial and manufactured in exact doses. The use of inorganic fertilizer to sustain cropping was found to increase yield only for some few years but on long-term basic, it was not effective [8]. It often leads to decline in soil organic matter content, soil acidification and soil physical degradation, leading to increase soil erosion. On the other hand, inorganic fertilizers are beyond the reach of resource-poor farmers because of high cost and uncertain accessibility and organic inputs, which often proposed as alternative to inorganic fertilizer composition and high labour requirement (Remison et al. 2020).

It has long been known that plants containing colors are usually those that are of great benefit to human health [9,10]. One suggestion for this is the inclusion of colored plants, which contain

compounds having a number of beneficial effects to human health, such types of compounds include the Anthocyanin Getalado et al. [11].

This experiment is carried out to find suitable treatments of different organic and inorganic fertilizers on growth, yield and Quality of Amaranthus.

2. MATERIALS AND METHODS

The experiment was carried out during 2021 July –September at the Experimental Research field, department of horticulture, Sam Higginbottom University of Agriculture technology and sciences, Prayagraj (UP). The experiment was laid out in a randomized block design with three replications consisting of 12 treatments having Organic and Inorganic fertilizers in varied combinations. The organic fertilizers used are Farm yard manure, Vermicompost, Poultry manure and Goat manure and inorganic fertilizers NPK of Recommended dose 75:25:25 kg ha⁻¹. Normal cultural and plant protection measures were followed during cultivation process. Plants were randomly selected from each plot as a representative sample for recording data. Statistical. The observation were recorded for Plant height (cm), Leaf length (cm), Number of leaves, Number of branches, Plant spread (cm²), Root length (cm), Herbage yield per plant (g), Herbage yield per plot (kg), Herbage yield per 200m² (kg), Anthocyanin content per 100g (mg).

3. RESULTS AND DISCUSSION

The present investigation concluded that treatment T₁₂ (R.D.F 50% + 25% Poultry manure + 25% Goat manure) found the best results in terms of Growth parameters, Yield parameters and Quality parameter and is highly recommended for farmers for profitable cultivation.

3.1 Growth Parameters

The treatments significantly increased the growth of Amaranthus that gave a higher yield and improved its quality. The data were recorded in 15DAS and 30DAS. The treatment combination T₁₂ (R.D.F 50% + 25% Poultry manure + 25% Goat manure) observed maximum in terms of Plant height (cm) (8.91,37.02), Number of branches (29.0,5.78), Plant spread (cm²) (8.16,25.89), Root length (cm) (7.83).

Table 1. Effect of different organic and Inorganic fertilizers on growth attributes of amaranthus 15 DAS (*Amaranthus cruentus*) cv.NSC 999 IUS

| Treatments | Treatment combinations | Plant height(cm) | Leaf length (cm) | Number of leaves | Number of branches | Plant spread (cm ²) |
|-----------------|---|------------------|------------------|------------------|--------------------|---------------------------------|
| T ₁ | CONTROL | 6.81 | 1.88 | 5.33 | 4.11 | 6.04 |
| T ₂ | R.D.F (75:25:25) | 7.44 | 2.33 | 5.89 | 4.89 | 6.11 |
| T ₃ | R.D.F 25% + 75% FYM | 8.91 | 2.44 | 6 | 4.89 | 8.16 |
| T ₄ | R.D.F 25% + 75 % VERMICOMPOST | 8.06 | 2.71 | 6.44 | 5.33 | 5.78 |
| T ₅ | R.D.F 25% + 75% POULTRY MANURE | 8.34 | 2.01 | 5.78 | 4.44 | 6.36 |
| T ₆ | R.D.F 25% + 75% GOAT MANURE | 7.78 | 2.42 | 5.56 | 4.22 | 7.07 |
| T ₇ | R.D.F 50% + 50% FYM | 7.07 | 2.51 | 5.89 | 4.89 | 7.03 |
| T ₈ | R.D.F 50% + 50% VERMICOMPOST | 7.5 | 2.67 | 6.22 | 4.85 | 5.81 |
| T ₉ | R.D.F 50% + 50% POULTRY MANURE | 7.54 | 2.86 | 6.67 | 4.44 | 6.18 |
| T ₁₀ | R.D.F 50% + 50% GOAT MANURE | 7.4 | 2.61 | 6.44 | 5.22 | 7.44 |
| T ₁₁ | R.D.F 50% +25%FYM +25% VERMICOMPOST | 8.87 | 2.62 | 6.22 | 5 | 7.92 |
| T ₁₂ | R.D.F 50%+ 25%POULTRY MANURE+ 25%GOAT MANURE | 9.1 | 2.56 | 6.56 | 5.78 | 8.16 |
| | F-TEST | S | S | S | S | S |
| | S.Ed(±) | 0.52 | 0.14 | 0.26 | 0.32 | 0.29 |
| | C.V | 11.55 | 9.92 | 7.43 | 11.36 | 7.28 |
| | CD | 1.54 | 0.41 | 0.77 | 0.93 | 0.84 |

Table 2. Effect of different organic and inorganic fertilizers on growth attributes of amaranthus 30 DAS (*Amaranthus cruentus*) cv.NSC 999 IUS

| Treatments | Treatment combinations | Plant height (cm) | Leaf length (cm) | Number of leaves | Number of branches | Plant spread (cm ²) | Root length (cm) |
|-----------------|---|-------------------|------------------|------------------|--------------------|---------------------------------|------------------|
| T ₁ | CONTROL | 27.43 | 4.72 | 18.22 | 17.67 | 8.53 | 4.17 |
| T ₂ | R.D.F (75:25:25) | 28.05 | 4.86 | 19.11 | 21.89 | 9.69 | 3.97 |
| T ₃ | R.D.F 25% + 75% FYM | 28.94 | 5.32 | 20.89 | 19.67 | 10.86 | 4.3 |
| T ₄ | R.D.F 25% + 75 % VERMICOMPOST | 30.82 | 6.34 | 22.56 | 25 | 14.61 | 5.07 |
| T ₅ | R.D.F 25% + 75% POULTRY MANURE | 30.62 | 6.62 | 25.33 | 23.11 | 19.67 | 4.07 |
| T ₆ | R.D.F 25% + 75% GOAT MANURE | 32.44 | 6.82 | 26.22 | 24.56 | 15.11 | 5.57 |
| T ₇ | R.D.F 50% + 50% FYM | 33.5 | 6.78 | 28.89 | 22.67 | 19.2 | 6.5 |
| T ₈ | R.D.F 50% + 50% VERMICOMPOST | 32.63 | 6.97 | 28.11 | 26.89 | 19.17 | 5.13 |
| T ₉ | R.D.F 50% + 50% POULTRY MANURE | 33.43 | 7.36 | 35.33 | 28.22 | 19.99 | 5.77 |
| T ₁₀ | R.D.F 50% + 50% GOAT MANURE | 34.43 | 7.12 | 31.67 | 29 | 19.34 | 6.2 |
| T ₁₁ | R.D.F 50% +25%FYM +25% VERMICOMPOST | 36.21 | 6.98 | 27.11 | 26.78 | 18.41 | 6.33 |
| T ₁₂ | R.D.F 50%+ 25%POULTRY MANURE+ 25%GOAT MANURE | 37.02 | 7.16 | 30.89 | 29 | 25.89 | 7.83 |
| | F-TEST | S | S | S | S | S | S |
| | S.Ed(±) | 0.73 | 0.38 | 0.98 | 2.35 | 2.49 | 0.4 |
| | C.V | 3.94 | 10.33 | 6.45 | 16.61 | 25.81 | 12.74 |
| | CD | 2.14 | 1.12 | 2.86 | 6.90 | 7.30 | 1.17 |

Table 3. Effect of different organic and Inorganic fertilizers on yield and quality attributes on amaranthus (*Amaranthus cruentus*) cv.NSC 999 IUS

| Treatments | Treatment combinations | Herbage yield per plant(g) | Herbage yield per plot(kg) | Herbage yield per 200m ² (kg) | Anthocyanin content per 100g(mg) |
|-----------------|---|----------------------------|----------------------------|--|----------------------------------|
| T ₁ | CONTROL | 57.93 | 1.90 | 380.66 | 74.03 |
| T ₂ | R.D.F (75:25:25) | 66.50 | 2.30 | 461.33 | 80.21 |
| T ₃ | R.D.F 25% + 75% FYM | 63.67 | 3.07 | 614.66 | 77.54 |
| T ₄ | R.D.F 25% + 75 % VERMICOMPOST | 74.63 | 5.03 | 1006 | 84.50 |
| T ₅ | R.D.F 25% + 75% POULTRY MANURE | 87.00 | 5.22 | 1045.33 | 90.43 |
| T ₆ | R.D.F 25% + 75% GOAT MANURE | 91.90 | 3.12 | 624.66 | 92.08 |
| T ₇ | R.D.F 50% + 50% FYM | 93.33 | 3 | 600 | 93.71 |
| T ₈ | R.D.F 50% + 50% VERMICOMPOST | 103.33 | 3.59 | 718.66 | 98.71 |
| T ₉ | R.D.F 50% + 50% POULTRY MANURE | 96.97 | 3.81 | 762.66 | 103.73 |
| T ₁₀ | R.D.F 50% + 50% GOAT MANURE | 124.13 | 3.67 | 735.33 | 116.10 |
| T ₁₁ | R.D.F 50% +25%FYM +25% VERMICOMPOST | 145.97 | 5.40 | 1081.33 | 131.1 |
| T ₁₂ | R.D.F 50%+ 25%POULTRY MANURE+ 25%GOAT MANURE | 151.27 | 5.56 | 1112 | 158.8 |
| | F Test | S | S | S | S |
| | S.Ed(±) | 4.57 | 0.12 | 23.19 | 3.15 |
| | C.V | 8.21 | 3.73 | 3.73 | 3.85 |
| | C.D | 13.39 | 0.24 | 48.10 | 6.53 |

The application of Poultry manure and Goat manure along with NPK fertilizer increase the plant height significantly due to maintenance of soil fertility and plant nutrient supply at an optimum level. High nitrogen percentage in Poultry manure and Goat manure increases the protein production and thus result in an increase in plant height. These similar findings was given by Hamma et al. (2019) and Oyedeji et al. [12].

The treatment combination T₉ (R.D.F 50% + 50% Poultry manure) observed maximum in terms of Leaf length (cm) (2.86,7.36) and Number of leaves (6.67,35.33). More rapid growth of Amaranth was realized with use of organic and along with inorganic. this could be due to increased availability of soil nitrogen with application of inorganic fertilizer culminating into enhanced N uptake and hence faster growth. Release of nitrogen by manure however occurs slowly after mineralization. Similar findings was recorded by Bruce et al. [13]. Organic manures help in maintaining soil fertility, efficient use of nutrients and enhance water holding capacity of the soil. It was found that the treated treatments gave better plant height over the control. These similar findings was given by Akinbile et al. [14].

3.2 Yield Parameters

The Application of organic along with inorganic fertilizers significantly increased the yield characters of Amaranthus. The treatment combination T₁₂ (R.D.F 50% + 25 % Poultry manure + 25% Goat manure) gave maximum Herbage yield per plant(g) (151.27), Herbage yield per plot (kg) (5.56), Total herbage yield per 200M² (kg) (1112). The control plot gave minimum values in terms of all paramerets. The application of organic and inorganic fertilizers together increased the vegetative growth of plant thus increased the yield .this could be due to the substantial growth rate obtained due to quick mineralization of organic component and slow release of inorganic constituents must have sustained the continuous better performance of Amaranthus than separate application. Similar findings was given by Akinbile et al. [14].

3.3 Quality Parameters

The treatment T₁₂ (R.D.F 50% +25% Poultry manure + 25% Goat manure) (mg) (158.8) has the highest Anthocyanin as compared to other treatments and the lowest Anthocyanin content was recorded by control. Application of organic and inorganic fertilizers significantly influenced

the Anthocyanin content .The leaves have higher Anthocyanin content than stem. Applying fertilizers with high nitrogen content is a promising way to improve Anthocyanin content in vegetative parts especially young leaves. Similar findings was given by Patil et al. [15] in cotton.

4. CONCLUSION

From the present Investigation on Amaranthus under polyhouse conditions it is concluded that application organic fertilizers along with inorganic fertilizers improved the growth, yield and quality. The treatment T₁₂ [R.D.F 50% + 25% Poultry manure + 25% Goat manure] has Given the best results in terms of Plant Height, Number of branches, Plant Spread, Root length, Yield per plant, Yield per plot, Yield per 200m² and Anthocyanin content per 100g and the treatment T₉ [R.D.F 50% + 50% Poultry manure] has given best results in terms of leaf Length and Number of Leaves.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Law Ogbomo KE, Remison SU, Jombo EO. Effect of organic and inorganic fertilizer on the productivity of Amaranthus cruentus in an ultisol environment. International Journal of Plant Physiology and Biochemistry. 2011;3(14):247- 252.
2. Modisane PCY, Beletse, Du Plooy CP. Yield response of Amaranthus and Cleome to fertilizer application. Africa Crop Science Conference Proceedings,2009;9:213-216.
3. Maerere G, Kimbi GG, Nonga DLM. Comparative effectiveness of animal manures on soil chemical properties, yield and root length of Amaranthus (*Amaranthus cruentus* L.).African Journal of Science and Technology. 2001;1(4): 14-21.
4. Preetha D, Sushama PK, Marykutty KC. Vermicompost+ inorganic fertilizers promote yield and nutrient uptake of Amaranth (*Amaranthus tricolor* L.).Journal of Tropical Agriculture. 2006;43:87-89.
5. Ahmad A T, Bello IU, Jibril SM, Kolawole OS, Ogah JJ and Daniel S.Comparative evaluation of the effects of organic and inorganic fertilizers on the vegetative growth of spleen Amaranth (*Amaranthus*

- dubius* L.).Journal of Applied Sciences and Environmental Management. 2019;23(2): 359-363.
6. Ambar Pratiwi. Effect of nitrogen fertilizer to the flavonoid content of red Amaranth (*Amaranthus gangeticus* L.).Pharmaciana; University of Ahmad Dahlan. 2017;7(1): 87-94.
 7. Kunene EN, Masarirambi MT, Gadaga TH, Dlamini PS , Ngwenya MP and Vilane VS..Effect of organic and inorganic fertilizers on the growth and yield of Amaranth (*Amaranthus hybridus*).African Vegetables Forum. 2017;1238.4:31-38.
 8. Ojeniyi S, Makinde E, dedina SO, Odedina J. Effect of organic and organomineral and NPK fertilizer on nutritional quality of Amaranthus in Lagos, Nigeria. Nigerian Journal of Soil Science. 2009;19(2):1-6.
 9. Richard O Nyankanga,Richard O Onwonga, Francis S Wekesa, Dororthy Masinde. Effect of inorganic and organic fertilizers on performance of profitability of grain Amaranth (*Amaranthus caudatus* L.) in western Kenya. Journal of Agricultural Science. 1012;4(1):223-232.
 10. Uma B, Malathi M. Vermicompost as a soil supplement to improve growth and yield of Amaranthus species.Research Journal of Agriculture and Biological Sciences. 2009; 5(6):1054-1060.
 11. Chaneen Meg C,Busa and Melinda C, Getalado. Evaluation of Anthocyanin in *Amaranthus gangeticus* L. (Nurawsuraw) Leaf extract as hair colorant. International Journal of Trend in Scientific Research and Development, ISSN:2456-6470. 2019; 3(4):1441-1445.
 12. Stephen Oyedeji, David Adedayo Animasaun, Abdullahi Ajibola Bello and Oludare Oladipo Agboola. Effect of NPK and Poultry manure on Growth, Yield and proximate composition of three Amaranthus. Journal of Botany; 2014;. Article ID 828750.
 13. Bruce G and Philippe S.Evaluation of management practices of grain Amaranth production in eastern Canada. Agronomy Journal. 2008;100:344-351.
 14. Christopher O, Akinbile, Samuel Adefolaju, Fidelis O, Ajibade. Effect of organic and inorganic fertilizers on the growth and yield of Amaranthus cruentus in Akure, Ondo state, Nigeria.37th Annual conference and Annual meeting–Minna, Minna-Niger, Nigeria.2016:337-312.
 15. Byale NA, Patil VD and Nandede BM. Influence of fertilizers on chlorophyll and anthocyanin pigments in Btcotton. Quarterly Journal of Life Sciences. 2014; 11(4a):1082-1084.

© 2022 Anjali et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:

The peer review history for this paper can be accessed here:
<https://www.sdiarticle5.com/review-history/91016>