International Journal of Organic agricultural Research & Development
Volume 20 (1) (2025)

GROWTH AND YIELD OF AMARANTH (*Amaranthus cruentus*) VARIETIES AS INFLUENCE BY DIFFERENT FORMS OF DEVIL'S CLAW APPLICATION IN OGBOMOSO

***1 Adetona, A. Florence; 1 Babajide, P. Akintoye; 1 Oyebisi K. Rauf; 1 Ibikunle O. Grace**
1 Department of Crop Production and S oil Science, Ladoke Akintola University of Technology, PMB 4000, Ogbomoso, Nigeria
Corresponding author: funmiflo2019@gmail.com

ABSTRACT

The study examined the performance of Amaranth (*Amaranthus cruentus*) as influenced by different forms of *Martynia annua* on the growth and yield of Amaranth. A pot experiment was conducted during the rainy season of (2024), Ladoke Akintola University of Technology, Ogbomoso in guinea savannah zone of Nigeria between May and October, (2024). Ogbomoso lies on latitude (8º N I0ºS) and longitude (4ºW, 10ºE) and annual rainfall was over 1000mm. Six (6) fertilizer treatments introduced were: NPK 15-15-15 at 300kgha^{-1} and four (4) forms of *Martynia annua* biomass (Shredded, Paste/suspension, Pelletized and Pulverized) applied at 4 tons ha^{-1} and the control. The trial was arranged in Complete Randomized Design (CRD), replicated thrice. Data were collected on growth (plant height, number of leaves and number of branches) and yield (shoot fresh weight, shoot dry weight, root fresh weight, and root dry weight) parameters. The data collected were subjected to analysis of variance (ANOVA). Means were separated using Duncan Multiple Range Test at 5% level of probability. Application of different forms of *Martynia annua* significantly ($P \leq 0.05$) enhanced the growth, yield and nutrient uptakes of the two amaranth varieties tested, compared to control. However, applications of pelletized and pulverized forms significantly improved the performances, irrespective of the variety concerned, compared to other forms of application and the control.

Keywords: *Martynia annua, Amaranth, Forms, Phytoresidue, Cat Claw*

INTRODUCTION

Amaranth belongs to the genus Amaranthus of the family Amaranthaceae. Amaranthus shows a wide range in yield diversity within certain species (Grubben, 2004). Current interest in amaranths resides in the fact that they have high nutritional value due to higher amount of protein with balanced essential amino acid contents, (Gamel *et al*., 2004; Mnkeni *et al*., 2007). Like many other vegetables, grain amaranth (*Amaranthus cruentus L.*), is a widely cultivated plant which produces grain as well as leaves for human and animal utilization. They are very good sources of vitamins, protein and dietary minerals including calcium, iron, magnesium, phosphorus, potassium, zinc, copper and manganese (Ofitserov, 2001). Amaranth seeds are characterized by an exceptionally rich chemical composition. The processed parts of the plants are a very valuable supplement to the diet. For proper nutrition people need to take with food at least 22 micronutrients (Broadley *et al.,* 2012).

Among the phytoresidues needed for soil fertility enhancement potential is *Martynia annua*, which has been underutilized or unaware by many farmers, for improved productivity. *Martynia annua* is an herbaceous annual plant, distributed throughout India but now extending to other parts of the world like Nigeria. It is commonly known as the Cat's claw or Devil's claw, the inner woody capsule splits open at one end into two curved horns or claws. They produce strange seed pods that attach to the feet and legs of large animals, and include some of the largest hitchhiker fruits in the world (Hosamani *et al*., 2002). Hence, researching into more underutilized plants, like *Martynia annua* which has relatively high fertilizer potentials and abundant biomass, may be beneficial to organic soil managements, for improve crop productivity.

Experimental site

Pot experiment was conducted at the experimental plot, behind Bee-Hall, Ladoke Akintola University of Technology, Ogbomoso in derived guinea savannah zone of Nigeria.

Material and Methods

Soil sampling and analysis

After land preparation of each site, pre planting collection of soil sample was carried out using auger at a depth of 0-30cm. The samples were bulked into a composite sample according to (Weil, 2014).

Experimental Materials

Seeds of Amaranth varieties (Ogbomoso Local, and NHAM 0587-1), *Martynia annua Biomass*

Treatments

The six (6) fertilizer treatments introduced were: NPK 15-15-15 at 300kgha^{-1} and four (4) forms of *Martynia annua* biomass (Shredded, Paste/suspension, Pelletized and Pulverized) applied at 4 tons ha^{-1} and the control. All the treatment was applied at recommended rate. Two pots per treatment was used and replicated three times.

Data collection and Analysis

Data were collected on the following parameters; Plant height (cm), Number of leaves, Number of Branches and Yield parameters. All the data collected were subjected to analysis of variance (ANOVA). Means were separated using Duncan Multiple Range Test at 5% level of probability (SAS, 2009).

Results

Soil physical and chemical properties of sample used.

The soil is slightly acidic with a pH value of 6.00 and grossly low in essential nutrients particularly N, P and K. However, the textural class is sandy loam.

Table 4.1: physical and chemical Analysis of the soil sample uses

Soilcharacteristics	Values
pH (H_20)	6.00
Organic Carbon (gkg^{-1})	2.76
Total N (gkg^{-1})	0.08
Available P (mgkg^{-1})	3.86
Fe (mgkg^{-1})	10.60
Cu (mgkg^{-})	3.22
Zn (mgkg^{-1})	3.25
Exchangeable K (cmolkg^{-1})	0.20
Exchangeable Na (cmolkg^{-1})	0.18
Exchangeable Ca (cmolkg^{-1})	3.16
Exchangeable Mg (cmolkg^{-1})	2.66
Sand (gkg^{-1})	750.20
Silt (gkg^{-1})	149.12
Clay (gkg^{-1})	100.68
Textural class	sandy loam

Effect of different forms of *Martynia annua* on Plant Height of Amaranth

Table 4.2 shows the effect of different forms of *Martynia annua* on plant height of amaranth. At 6 weeks, V2 that receive NPK has the highest value of (74.6cm) and is not significantly different from other treatment but significantly different from the control and the least value of (26.8cm) from the control. At 8 weeks, V2 that received NPK and pulverized *Martynia annua* has the highest value of (84.0cm) and is not significantly different from other treatment except the control and the least value of (33.1cm) was obtained from the control. At 10 weeks, V1 that received pulverized *Martynia annua* has the highest value of (112.5cm) and is not significantly different from other treatment except the control and the least value of (37.8cm) was obtained from the control. At 12 weeks, V1 that received pulverized *Martynia annua* has the highest value of (136.5cm) and is not significantly different from other treatment but significantly different from V1 and V2 that received NPK and control with the least value of (40.3cm) obtained from the control.

Effect of different forms of *Martynia annua* on Number of Branches of Amaranth

Table 4.3 shows the effect of different forms of *Martynia annua* on number of branches of amaranth. At 6 weeks, V1 that receive pulverized *Martynia annua* has the highest value of (15.4) and is not significantly different from Variety 1 and Variety 2 that received pelletized *Martynia annua* and pulverized *Martynia annua* but significantly different from other treatment

and the control has the least value of (4.0). At 8 weeks, Variety 1 pulverized *Martynia annua* has the highest value of (22.6) which is not significantly different from other treatment except the control and the least value of (8.2) was obtained from the control. At 10 weeks, Variety 2 that receive pulverized *Martynia annua* has the highest value of (33.6) and is not significantly different from Variety 1 and Variety 2 that received pelletized *Martynia annua* and pulverized *Martynia annua* but significantly different from other treatment with the least value of (11.0) from the control. At 12 weeks, Variety 1 and Variety 2 that receive pelletized *Martynia annua* has the highest value of (35.5) and is not significantly different from Variety 1 and Variety 2 that received pulverized *Martynia annua* but significantly different from other treatment with the least value (11.0) from the control

4.4 Effect of different forms of *Martynia annua* on Number of leaves of Amaranth

Table 4.5 shows the effect of different forms of *martynia annua* on number of leaves of amaranth At 6 weeks, Variety 2 that receive NPK has the highest value of (62.0) and is not significantly different from other treatment irrespective of the variety except the control with the least value of (19.5) from the control. At 8 weeks, Variety 2 that receive pelletized *Martynia annua* has the highest value of (90.0) and is not significantly different from Variety 1 and Variety 2 that received paste *Martynia annua* and pulverized *Martynia annua* but significantly different from other treatment irrespective of the variety with the least value of (24.0) from the control. At 10 weeks, V2 that receive pelletized *Martynia annua* has the highest value of (99.5) and is not significantly different from other treatment except the control and NPK with the least value of (30.2) from the control. At 12 weeks, V2 that receive pulverized *Martynia annua* has the highest value of (106.3) and is not significantly different from other treatment except the control and NPK with the least value of (22.6) from the control.

Table 4.2 Effect of different forms of *Martynia annua* on Plant Height of Amaranth

Treatment	PH6	PH8	PH10	PH12
V1T0	26.8	34.8b	39.4c	40.3c
V1T1	67.2a	83.5a	101.2ab	102.1b
V1T2	67.0a	80.6a	110.5a	120.1a
V1T3	64.5a	78.9a	109.2a	123.0a
V1T4	68.2a	76.8a	107.8a	132.4a
V1T5	67.6a	80.5a	112.5a	136.5a
V2T0	24.5b	33.1b	37.8c	38.0c
V2T1	74.6a	84.0a	98.8ab	100.2b
V2T2	71.5a	81.6a	109.2a	119.6a
V2T3	69.2a	80.4a	108.5a	121.2a
V2T4	72.3a	83.8a	110.6a	130.1a
V2T5	70.5a	84.0a	108.2a	130.2a

Means within the column with the same letter are not significantly different by DMRT(P≤0.05) T0 (Zero Application), T1 (NPK 15-15-15), T2 (Shredded Martynia annua), T3 (Paste Martynia annua), T4 (Pelletized Martynia annua) , T5 (Pulverized Martynia annua). PH: Plant Height

Table 4.3 Effect of different forms of *Martynia annua* on Number of Branches of Amaranth

Treatment	NB6	NB8	NB10	NB12
V1T0	4.0c	8.2c	11.0c	11.0c
V1T1	8.0b	16.0ab	19.0b	20.3b
V1T2	6.0bc	16.0ab	22.5b	24.0b
V1T3	6.0bc	17.0a	23.1b	24.0b
V1T4	14.4a	22.2a	29.2a	35.5a
V1T5	15.4a	22.6a	32.5a	36.0a
V2T0	4.3c	8.4c	12.2c	13.5c
V2T1	8.0b	15.7ab	18.0b	21.0b
V2T2	8.0b	14.6ab	22.0b	24.6b
V2T3	8.0b	16.2ab	22.0b	25.0b
V2T4	14.0a	21.8a	33.0a	35.5a
V2T5	14.0a	22.0a	33.6a	35.3a

Means within the column with the same letter are not significantly different by DMRT(P≤0.05) T0 (Zero Application), T1 (NPK 15-15-15), T2 (Shredded Martynia annua), T3 (Paste Martynia annua), T4 (Pelletized Martynia annua), T5 (Pulverized Martynia annua).NB: Number of branches

Table 4.4 Effect of different forms of *Martynia annua* on Number of leaves of Amaranth

Treatment	NL6	NL8	NL10	NL12
V1T0	19.5b	24.0c	30.2c	22.6d
V1T1	56.5a	65.7b	71.4b	66.5c
V1T2	56.0a	67.0b	81.6ab	83.0ab
V1T3	55.0a	73.3ab	84.2ab	86.0ab
V1T4	58.0a	88.2a	96.6a	99.3a
V1T5	57.0a	85.6a	92.7a	98.0a
V2T0	17.0b	26.0b	32.4c	26.0d
V2T1	62.0a	65.3c	70.5b	73.0c
V2T2	58.2a	72.0ab	79.5ab	83.0ab
V2T3	55.0a	73.6ab	80.3ab	84.0ab
V2T4	61.0a	90.0a	99.5a	102.5a
V2T5	58.0a	87.3a	98.0a	106.3a

Means within the column with the same letter are not significantly different by DMRT(P≤0.05) T0 (Zero Application), T1 (NPK 15-15-15), T2 (Shredded Martynia annua), T3 (Paste Martynia annua), T4 (Pelletized Martynia annua) , T5 (Pulverized Martynia annua). NL: Number of leaves

Effect of different forms of *Martynia annua* on yield parameters of Amaranth

Root Fresh Weight

Variety 2 that receive NPK has the highest value of (27.5g/plant) and is not significantly different from other treatment tested at Variety 2 except the control but significantly different from other treatment tested with the least value (5.0g/plant) obtained from V1 that received shredded *Martynia annua.*

Shoot Fresh Weight

Variety 2 that receive paste *Martynia annua* has the highest value of (36.9g/plant) and is not significantly different from Variety 2 that receive (NPK, pelletized *Martynia annua* and pulverized *Martynia annua*) but significantly different from other treatment tested with the least value (15.1g/plant) obtained from Variety 1 that received NPK.

Root Dry Weight

Variety 2 that receive pelletized *Martynia annua* has the highest value of (10.6g/plant) and is not significantly different from other treatment tested at Variety 2 including the control but significantly different from other treatment tested with the least value (2.9g/plant) obtained from Variety 1 that received shredded *Martynia annua.*

Shoot Dry Weight

Variety 2 that receive pulverized *Martynia annua* has the highest value of (23.0g/plant) and is not significantly different from other treatment tested at Variety 2 except the control and shredded *Martynia annua* but significantly different from other treatment tested with the least value (5.2g/plant) obtained from Variety 1 that received NPK and shredded *Martynia annua.*

Effect of different forms of *Martynia annua* on nutrient uptake of Amaranth

Among all the treatment tested, Variety 2 that received paste *Martynia annua* significantly enhanced Nitrogen (N) uptake with a value of (49.7g/kg) and is not significantly different from Variety 2 that received pelletized *Martynia annua* but significantly different from other treatment irrespective of the variety and the least value (15.5g/kg) from the control. In terms of phosphorus (P), Variety 2 that receive paste *Martynia annua* has the highest value of (8.7g/kg) and is not significantly different Variety 1 that receive (paste *Martynia annua* and pelletized *Martynia annua*) and Variety 2 that received (pelletized *Martynia annua*) with the least value (0.9g/kg) obtained from the control. In terms of potassium (K), Variety 1 that received shredded *Martynia annua* has the highest value (39.6g/kg) and is not significantly different from Variety 1 that received paste *Martynia annua* and Variety 2 that received shredded *Martynia annua* and paste *Martynia annua* but significantly different from other treatment irrespective of the variety with the least value (1.8g/kg) obtained from the control.

Table 4.5 Effect of different forms of *Martynia annua* on yield parameters of Amaranth

Treatment	FSW	FSW	DRW	DSW
V1T0	8.1b	18.7d	4.1c	7.2c
V1T1	7.8b	15.1d	4.3c	5.2c
V1T2	5.0b	16.2d	2.9c	5.2c
V1T3	6.2b	16.9d	4.7c	6.0c
V1T4	9.3b	18.0d	5.5bc	8.2c
V1T5	7.1b	20.8d	4.2c	9.3c
V2T0	15.9b	19.3d	9.4a	11.5bc
V2T1	27.5ab	36.6abc	9.7a	19.5ab
V2T2	23.0ab	26.6bd	8.9a	12.5bc
V2T3	25.2ab	36.9ab	9.3a	17.7ab
V2T4	44.1a	41.4a	10.6a	23.8a
V2T5	21.6ab	43.3a	8.4ab	23.0a

Means followed by the same letter are not significantly different using analysis of variance (Anova). T0 (control), T1 (NPK 15-15-15), T2 (shredded Martynia annua), T3 (paste Martynia annua), T4 (pelletized Martynia annua), T5 (pulverized Martynia annua). SFW (Shoot fresh weight), RFW (Root fresh weight), RDW (Root dry weight), SDW (Shoot dry weight)

Table 4.6 Effect of different forms of *Martynia annua* on nutrient uptake of Amaranth

Treatment	N	P	K	Ca	Mg	Fe	Cu	Mn	Zn
V1T0	15.9e	0.9c	1.8g	3.8g	0.7d	380.a	1.8e	90.4b	31.6ab
V1T1	38.4d	5.9b	28.8f	7.9ef	2.9c	253.1b	6.5ab	90.8b	36.6a
V1T2	38.7d	5.7b	39.6ab	7.5f	2.8c	252.4b	5.9b	44.9c	23.2cd
V1T3	48.8ab	8.6a	39.1ab	9.6abc	4.9b	234.6c	3.5d	40.7d	20.1cd
V1T4	47.5b	8.4a	37.7cd	9.9a	5.8a	234.7c	4.6c	36.8de	16.5d
V1T5	41.6c	6.2b	36.4e	8.9bcd	4.8b	245.6bc	4.5c	35.3e	18d
V2T0	15.5e	0.9c	2.1g	3.9g	0.8d	383.7a	1.8e	95.7a	31.3ab
V2T1	39.1d	6.2b	29.5f	8.5de	2.7c	256.7a	6.8ab	91.6b	37.3a
V2T2	39.1d	5.7b	39.7a	7.7f	2.9c	249.4bc	6.1b	45.8c	25.9bc
V2T3	49.7a	8.7a	38.7abc	9.7ab	5.0b	236.9c	3.6d	35.2e	20.3cd
V2T4	48.5ab	8.4a	38.4bc	9.7ab	5.7a	236.9c	4.8c	37.1de	16.6d
V2T5	42.4c	6.3b	36.8de	8.9cd	4.7b	246.6bc	4.6c	35.9e	17.7d

Means followed by the same letter are not significantly different using analysis of variance (Anova). T0 (control), T1 (NPK 15-15-15), T2 (shredded Martynia annua), T3 (paste Martynia annua), T4 (pelletized Martynia annua), T5 (pulverized Martynia annua).

DISCUSSION

Amaranth in Nigeria, as in most other tropical countries of Africa where the daily diet is dominated by starchy staple foods, vegetables are the cheapest and most readily available sources of important proteins, vitamins minerals, and essential amino acids. Amaranth is also used in the treatment of intestinal bleeding, diarrhea and excessive menstruation. In this current study, the two varieties of amaranth exhibited better response to all forms of *Martynia annua* than NPK compound fertilizer; this implies that the mineralization sustained longer in soil than NPK compound fertilizer. Similar report was given by Ogedegbe *et al*. (2013).

In the pre-cropping soil analyses, it showed that the soil sample used were slightly acidic and low in nutrient (especially Nitrogen), at the experimental location. It showed that the experimental plot was inadequate in nutrient and therefore there will be need to apply fertilizer to meet the nutrient needed for optimum growth and yield of Amaranth. These results are in agreement with the other earlier researchers (Babajide *et al*., 2008; Akanbi2002).

The highest plant height for the two varieties of amaranth at maturity was observed in plants treated with Variety 1 that received pulverized *Martynia annua* which was not significantly different from other treatment but significantly different from Variety 1 and Variety 2 that received NPK and control. This is in line with Abayomi and Adebayo (2014) and Islam *et al.* (2011). Amaranth responded best to all forms of *Martynia annua*. Also the values of the number of leaves obtained from most of element were not significantly different from one another.

RECOMMENDATION AND CONCLUSION

All forms of *Martynia annua* biomass significantly improved the growth and yield parameters of Amaranth varieties but green (local) variety responded better to different forms of *Martynia annua* treatments compared to red (hybrid) Amaranth variety (NHAM 0587-1). Therefore, the study recommended application of all forms of *Martynia annua* to improve performance of local.

Amaranth variety particularly in the study area.

REFERENCES

Abayomi, O.A. and Adebayo, O.J. (2014). Effect of fertilizer types on the growth and yield of Amaranthus caudatus in Ilorin, Sothern Guinea, Savanna Zone of Nigeria. Advances in Agriculture. 14:5

Akanbi, W. B. (2002). Growth, Nutrient uptake and yield of maize and okra as influenced by compost and nitrogen fertilizer under different cropping systems. Ph. D. Thesis, Department of Crop Protection and Environmental Biology, University of Ibadan, Ibadan, Nigeria pp. 232.

Babajide, P.A.; Olabode, O.S.; Akanbi, W.B.; Olatunji, O.O and Ewetola E.A (2008). Infuence of Composted Tithonia-biomass and N Mineral Fertilizer on Soil Physico-Chemical Properties and Performance of Tomato (Lycopersicon lycopersicum). Research Journal of Agronomy Vol. 2 (4): 101-106

Broadley LG, Milton JD, Fernig DG, Rhodes JM (2012). Opposite effects on human colon cancer cell proliferation of two dietary Thomsen-Friedenreich antigen-binding lectins.J Cell Physiol. ; 186:282-7.

Gamel T.H., Linssen J.P., Alink G.M., Massallem A.S. and Shekib L.A. (2004). Nutritional study of raw andpopped seed proteins of Amaranth Caudatus L. adb. Amaranth Cruentus L. Journal of the Science of Food & Agriculture, 84, 1153-1158

Grubben G.J.H. (2004). Amaranthus cruentus L. In: Grubben G.J.H. and Denton O.A. (eds), Plant Resources of Tropical Africa 2: Vegetables. PROTA Foundation, Wageningen. Buckkuys Publishers, Leiden/CTA, Wageningen, The Netherlands p. 667

Hosamani KM, Sattigeri RM and Patil KB . Studies on chemical compounds of Martynia annua syn. M. diandra seed oil. Journal of Medicinal and Aromatic Plant Sciences. 2002; 24(1): 12.

Islam, M.M., Karim, A.J.M., Jahiruddin, M., Majid, N.M., Miah, M.G., Ahmed, M.M. and Hakim M.A. (2011). Effects of organic manure and chemical fertilizers on crops in the radish-stem amaranth-indian spinach cropping pattern in homestead area. Australian journal of crop science. 5(11):1370-1378

Mnkeni A.P., Mosika P. and Maphaha M. (2007). Nutritional quality of vegetables and seeds from different accessions of Amaranthus in South Africa. South

Africa Journal of Biotechnology, 33, 369-376

Ofitserov, N.E. (2001). Amaranth: Perspective raw material for Food-processing and Pharmaceutical Industry. Chemistry and computational simulation, Tatarstan. Pp 1-4.

Ogedegbe, S.A., Ajala, B.A. and Ogah, J.J. (2013) Effect of organic fertilizers on leaf and seed yields of amaranth (Amaranthus specie L.) varieties in Vom, Nigeria. Nigerian journal of agriculture, food and environment. 9(4):13-18