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Effect of Transplanting Age and Poultry Manure on Growth and Yield of Vegetable Amaranth

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Abstract
A field experiment was conducted during the 2014 cropping season at the Institute for Agricultural Research farm, Samaru, (11^0, 11' N, 07^0 38'E and 686 above sea level) in the northern Guinea savanna ecological zone of Nigeria to study the effect of poultry manure and seedling age at transplanting on growth and yield of vegetable amaranth (*Amaranthus caudatus* L.). The treatments consisted of factorial combinations of four levels of poultry manure (0, 4, 8 and 12 t ha^{-1}) and three transplant ages (2, 3 and 4 weeks after sowing). The experimental design was randomized complete block replicated three times. Growth characters such as plant height, shoot fresh weight and number of leaves and branches per plant were significantly (P=0.05) higher with the application of 8 t ha^{-1} of poultry manure compared with no–manure control. However, in most cases, the difference in growth characters using poultry manure rates varying from 4 to 12 t ha^{-1} were not significant. Seedlings transplanted at 4 weeks of age were. Significant taller with shoot fresh weight than 2-weeks old seedlings at the initial growth stage. Transplant age had no effect on these parameters at later stage. All the other growth parameters were not affected by transplant age. Marketable yield increased significantly with increasing poultry manure rate up to 4 t ha^{-1} only.

Keywords: Amaranth, Poultry Manure, Transplanting age, Factorial combination.

Introduction

Vegetable amaranth is a fast growing plant with an extremely high yield potential of about 30 t $ha^{-1.}$fresh leaf or 4.5 t $ha^{-1.}$dry leaf in four weeks. Its succulent tender stem and young leaves are used in soup and stew; young shoots are sometimes dried for future use as a forage crop for feeding livestock (Grubben and Van Slotten, 1981). Leaf protein concentrate can be extracted from amaranth and used for feeding young children and person's requiring high protein, vitamin A and Iron, (Anon, 1984). Amaranth has also been found to contain high levels of nutritionally critical amino acids, lysine, and methionine (Koch *et al.*, 1985).

Vegetable amaranth is grown primarily for its tender stems and succulent leaves which are used in soups and stew. It has a high nutritional value due to its high protein, vitamins and essential amino acid content (Grubben and Van Slotten, 1981; Schippers, 2000). The leaves contain high amount of vitamins, minerals, sugar and water needed for healthy body growth and maintenance (Bailey, 1992). The dry matter content of the leaves is about 13% and fresh amaranth often provides two or three times the amount of nutrients in other vegetables (Anon, 1984 b). Amaranth contains vitamins such as carotene, riboflavin, niacin, ascorbic acid and folic acid and its nutritional value is excellent (Oyenuga and Fetuga, 1975). Vegetable amaranth is also a source of minerals such as calcium, potassium, sodium and phosphorous. The antioxidant properties of vegetable amaranth has been implicated in the prevention of aging related diseases such as cancer, arteriosclerosis, diabetes and in the management of HIV/AIDS. Increase vegetable consumption helps to preserve bones and fight bone thinning diseases called osteoporosis (Hertog *et al.*, 1992). In some African societies, protein from amaranth leaves provides as much as 25% of the daily protein intake during harvest season (Anon, 1984 b). As most farmers cannot afford the use of chemical fertilizers, there has been a renewed interest in the use of organic wastes as cheap sources of fertilizer for crops. Apart from being cheap and readily available, organic wastes are environmental friendly. Many farmers do not apply fertilizer (organic or inorganic) to amaranth but rely on native soil fertility for its production. To increase the availability of high quality amaranth throughout the year and at affordable price, there is need to use organic manure such as poultry manure which is available in large quantity particularly in urban and peri urban areas (Akparobi, 2009). Moreover, the effect of transplant age on yield is an issue that is of major interest to growers of horticultural crops because when transplants are too old, growth and yield are adversely affected(Vavrina, 1990).Transplanting age depends on the crop, environment and cultural conditions. In general, older transplants mature early while younger ones may produce comparable or even higher yields but take longer time to do so (Vavrina,1991). Mulundana *et al.(*2009) who transplanted vegetable amaranth at one, two, three and four weeks after emergence found that the best transplanting age was between two and three weeks after emergence. The conflicting results on literatures on transplant age may likely be due to the different environmental and cultural conditions that the plants were subjected to during the studies.

Materials and Methods

A field experiment was conducted during the wet season of 2014 at the research farm of the Institute for Agricultural Research, Ahmadu Bello University, Samaru, Zaria ($11^0$11' N, 0.7^0 38'E, and 686m above sea level) in the northern Guinea savanna zone of Nigeria. The treatments consisted of factorial combinations of four levels of poultry manure (0, 4, 8 and 12 t ha$^{-1.}$and three transplant ages (2, 3, and 4 weeks after sowing). The experimental design was randomized complete block design with three replicates. The gross plot size was 3.0m x1.8m and the net plot size was 1.8m^2 consisting of the two middle rows.

Seed of local amaranth cultivar was obtained at Samaru market and sown in a nursery within the orchard of Agronomy Department on 16 July, 23 July and 30 July, 2014 for the two, three and four weeks old seedlings respectively. Physical and chemical properties of the soil samples were determined using standard procedures as described by Black, (1965). The experimental site was ploughed, harrowed and ridged, thereafter; the plots were demarcated and flattened into sunken beds. The plots were marked out and there was 1.5m border between the plots. Prior to application, samples of the poultry manure were taken and subjected to laboratory analysis. The two, three and four weeks old seedlings were transplanted into moist seed beds in the evening of 13 August, 2014 at an inter row spacing of 30cm and intra row spacing of 10cm giving a population of 40 plants/plot. The field was weeded manually with hoe in the morning before transplanting the seedlings in the evening on the 13 August, 2014. Another hoe weeding was done at three weeks after transplanting (WAT). The established seedlings in each plot were counted and recorded on 18 August, 2014.The parameters measured were plant height, shoot fresh weight, usable yield and marketable yield. The data collected were subjected to analysis of variance (ANNOVA) using SAS system (SAS,1991). Significant means were separated using Duncan's Multiple Range Test (DMRT) (Duncan, 1955).

Results and Discussion

The physico-chemical properties of soil taken from experimental site is shown in table 1.The soil is loam with 0.56g organic carbon,0.23mg/100 available potassium,1.07mg calcium. The analysis of poultry manure on the other hand gave 3.3% nitrogen and phosphate, potassium 0.4%.This confirms the findings of Mario *et al* (1989) and Ayeni *et al* (2009) that poultry manure is valuable kind of organic manure that improves soil fertility and structure, thus making nutrient available for crop nutrition. At 10 DAT, application of poultry manure at the rate of 8 t ha^{-1} resulted in the production of taller plants than 0 and 4 t ha^{-1} but was statistically at par with 12 t ha^{-1}. However, at 20 DAT, 12 t ha$^{-1.}$produced the tallest plants which was only similar to 8 t ha^{-1}. The control produced the shortest plants. At 10 DAT, the application of up to 12 t ha^{-1} of poultry manure produced more number of leaves than 4 t ha^{-1} but was statistically comparable to 8 t ha$^{-1,}$Further increase in poultry manure rate to 12 t ha^{-1} resulted in a significant increase in leaf number per plant compared with 0 and 4 t ha$^{-1.}$.The number of leaves per plant was significantly higher at 8 and 12 t ha^{-1} compared with the control at 20 DAT. Shoot fresh weight was significantly affected by poultry manure at each of the sampling periods. At 10, 30 and 40 DAT, all the sampled plants produced heavier shoot fresh weight except the no control and 4 t ha^{-1} at 10 DAT. Shoot fresh weights was significantly higher using 8 t ha^{-1} of poultry manure compared with 4 t ha-^{1} at 10 DAT. At 20 DAT the no-manure control produced significantly lower shoot fresh weight compared with all other poultry manure rates that were statistically similar., At each of the sampling period, 8 and 12 t ha^{-1} of poultry manure gave similar but significantly higher usable yield per plant than the control. Moreover, 4 t ha^{-1} of poultry manure was similar to the control and also 4 and 8 t ha^{-1} of poultry manure gave similar usable yield/plant on each sampling date. The application of 4 t ha^{-1} poultry manure resulted in 119% increase in marketable yield of amaranth compared with 0 t ha^{-1} of poultry manure. Further increase in the rate of applied poultry manure resulted in no significant increase in marketable yield. The interaction between poultry manure and seedling age throughout the sampling period was not significant.

Conclusion

This study has shown that the growth and yield parameters of amaranth were significantly increased in response to the application of poultry manure. This may be due to the beneficial effects of poultry manure on soil fertility and structure. Mario *et al*., 1989;,Ayeni *et al.*,2009). Poultry manure is a valuable kind of organic manure that improves soil fertility and structure, thus making nutrient available for crop nutrition (Mario *et al. (*1989) and it also increases soil carbon content (Beckman, 1973). Plant height, shoot fresh weight, and marketable yield of amaranth were significantly influenced by poultry manure. This observation is in line with Ainika (2010) who also reported that poultry manure significantly increased growth characters such as plant height, number of leaves, shoot fresh weight and marketable yield of amaranth. Bawa (2010) also observed taller plants, more leaf number and height, as well as enhanced vegetative growth and yield of amaranth with poultry manure application. Mulandana *et al*. (2009) showed that the best transplanting age was between two and three weeks after emergence, which roughly corresponded with three to four weeks old seedlings used in the present study.

Table 1: Physico – chemical properties of soil (0-30cm in depth) of experimental field during 2014 rainy season at samaru

Soil characteristics	Value
Physical composition (%)	
Sand	51.1
Silt	38.3
Clay	10.6
Textural class	Loam

Table 2: Chemical properties of Poultry Manure

Nitrogen	3.3
Phosphates	3.3
Potassium	0.41
Sodium	1.10
calcium	1.60
Organic Carbon	69.40
Magnesium	0.33

Table 3: Effect of poultry manure and seedling age on plant height (cm) o amaranth at Samaru during the 2014 wet season

Days after transplanting				
Treatment	10	20	30	40
Poultry manure (t ha-^{1})				
0	7.88b	8.74c	12.04b	16.74b
4	8.70b	12.32b	14.75ab	22.85ab
8	12.05a	13.79ab	16.79a	25.69a
12	10.16ab	15.48a	17.91a	28.83a
SE±	0.84	0.96	1.37	2.53
Seedling age (weeks)				
2	8.59b	10.98b	15.72	24.96
3	9.07a	11.74ab	14.31	23.06
4	11.39a	15.11a	16.09	22.55
SE±	0.73	0.83	1.18	2.19
PXS	NS	NS	NS	NS

Means followed by the same letter(s) in the vertical column are not statistically different using DMRT at 5% level of probability.

Table 4: Effect of poultry manure and seeding age on shoot dry weigh (g/plant) of amaranth at Samaru during the 2014 wet season

Days after transplanting				
Treatment	10	20	30	40
Poultry manure (t ha-^{1})				
0	1.29c	1.49b	2.87b	6.86c
4	2.28bc	4.35ab	5.49ab	12.24bc
8	3.99ab	5.95a	9.14a	20.57ab
12	4.82a	7.54a	9.26a	26.06a
SE±	0.75	1.12	1.32	4.25
Seedling age (weeks)				
2	3.47	4.11	7.33	13.93
3	2.72	3.97	6.84	15.43
4	3.10	6.42	5.89	19.43
SE±	0.65	0.97	1.14	3.96
PXS	NS	NS	NS	NS

Means followed by the same letter(s) in the vertical column are not statistically different using DMRT at 5% level of probability.

Table 5: Effect of poultry manure and seedling age on number of branches per plant of amaranth at Samaru in 2014 wet season.

Days after transplanting				
Treatment	10	20	30	40
Poultry manure (t ha^{-1})				
0	-	0.48b	0.41b	2.15b
4	-	1.56ab	1.56ab	2.74A
8	-	1.99a	1.04ab	2.70a
12	-	2.59a	1.78a	4.07a
SE±	-	0.4	0.35	0.46
Seedling age (weeks)				
2	-	1.68	1.36	2.47
3	-	1.42	1.04	3.33
4	-	1.91	1.08	2.94
SE±	-	0.36	0.30	0.39
PXS	NS	NS	NS	NS

Means followed by the same letter(s) in the vertical column are not statistically different using DMRT at 5% level of probability.

Table 6: Effect of poultry manure and seedling age on the usable yield (g/plant) of amaranth at Samaru during the 2014 wet season.

Days after transplanting				
Treatment	10	20	30	40
Poultry manure (t ha^{-1})				
0	-	1.39c	4.04c	6.56b
4	-	5.37bc	7.29bc	17.12ab
8	-	8.74ab	13.14ab	21.60a
12	-	10.68a	14.96a	23.66a
SE±	-	1.69	2.13	3.93
Seedling age (week)				
2	-	5.90	10.38	16.65
3	-	5.28	10.87	15.09
4	-	8.45	8.01	19.97
SE±	-	1.47	1.84	3.40
PXS	-	NS	NS	NS

Means followed by the same letter(s) in the vertical column are not statistically different using DMRT at 5% level of probability.

Table 7: Effect of poultry manure and seedling age on the marketable yield of amaranth (t ha^{-1}) at 45 days after transplanting at Samaru during the 2014 wet seaso n.

Treatment	Marketable yield (t ha^{-1})
Poultry manure (t ha^{-1})	
0	1.52b
4	3.33a
8	3.52a
12	4.32a
SE±	0.406
Seedling age (weeks)	
2	2.94
3	3.15
4	3.43
SE±	0.35

Means followed by the same letter(s) in the vertical column are not statistically different using DMRT at 5% level of probability.

Reference

1. Ainika, J.I. (2010). Response of grain amaranth (Amaranthus cruentus L) to nitrogen and FYM rates in northern guinea and sudan savanna ecological zones of Nigeria.Unpublished Msc thesis. Bayero University Kano.

2. Anonymous (1984 a). Amaranth Modern prospects for an ancient crop. National Academic Press. Washington D.C.
3. Akparobi, S.O. (2009). Effect of poultry manure on growth and yield of (Amaranthus cruentus L.) Agricultura Tropica ET subtropica 42 (1).
4. Ayeni, L.S., Omole,T.O., Adeleye, E.O. and Ojeniyi, S.O. (2009). Comparative effect of poultry manure and N.P.K on the performance of Tomato in derived Savanna transition zone of southwest Nigeria. American Eurasian Journal of Sustainable Agriculture 3(4):850-853.
5. Bailey, J.M. (1992). The leaves we eat. South Pacific commission hand book. No.31.
6. Beckman, E.O. (1973). Organic fertilizer in vegetable farming: luxury or necessity. Technical communication of International Society of Horticultural Science. 29: 247
7. Black,C.A. (1965).Methods of Soil Analysis II. Chemi cal and Microbiological properties American Society o f Agronomy, Madison, Wisconsin.
8. Bawa, A.A. (2010). Performances of vegetable amaranth (Amaranthus cruentus L.) as influence by poultry manure rate and inter row spacing at Samaru, Unpublished under graduate project. Agronomy department, A.B.U.Zaria.
9. Duncan, D.B. (1955). Multiple range and multiple f-test biometrics 11: 1-42
10. Grubben, G.H. and Van Slotten, D.A. (1981). Genetic resources of amaranth. IBPGR Secretariat, Rome, Italy. 58.
11. Hertog, M.G.L., Hallman, P.C.H. and Katan, M.B. (1992). Content of potentially anti carcinogenic flavonoids of 28 vegetable and fruits commonly consumed in the Netherlands. Journal of Agricultural Food Chemistry. 40:2379-2383.
12. Koch, B., Kota. I. and Horvath, M. (1985). Fodder crops as leaf protein,Agrobotanica 1: 19-28.
13. Mario, A., Erict, D. and Tuen, B.(1989). How to grow tomato and pepper.Agromisa Wageningen.The Netherlands. Agrodok-serie.17: 25-26.
14. Mulandana, N.S., Mamadi, N.E., Du ploy, C.P. and Beletse, Y.G. (2009). Effect of spacing and transplanting time on amaranths yield. African Crop Science Conference Proceedings. 9 : 243-246
15. Oyenuga, U.A. and Fetuga, B.L. (1975). Dietry importance of fruits and vegetables. First National Seminar on fruits and vegetables. University of Ibadan. pp.122-131.
16. SAS Institute, inc. (1991). SAS User guide statistic version 8.SAS Institute, N.C., and U.S.A.
17. Schippers, R.R. (2000). African indigenous vegetables and overview of the cultivated species. National Resources Institute /Technical centre for Agricultural and rural cooperation, University of Greenwich, London. U.K. pp 56-62.
18. Snedecor, G.W. and Cochran, W.O. (1967). Statistical methods. Sixth Edition. Iowa State
19. Vavrina, C.S., Ambrester, K and Cole, T. (1990). Watermelon production as influence by transplant age. Proc. Fla.State Horticultural Science 103: 94-96
20. Vavrina, C.S. (1991). Effect of transplant age on tomato production. Proc. Fla.State Horticultural Science 104: 225-226