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Organic/inorganic leaf amaranth production: the case of poultry manure, fish effluent and npk fertiliser

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Abstract

The work evaluated the responses of two Amaranthus cultivars to poultry manure, fish effluent, NPK fertiliser and control in randomised complete block design. A. hybridus was taller, had thicker stem and more leaves per plant than A. viridis. For each Amaranthus variety, poultry manure produced highest number of leaves and tallest plants with thickest stem followed by fish effluent and NPK fertiliser. A. hybridus had higher leaf and marketable yields/ha than A. viridis. Leaf and marketable yields/ha were highest with poultry manure followed by fish effluent and NPK fertilizer. Leaf yield/ha increased by 105, 34 and 34% for poultry manure, fish effluent and NPK fertilizer, respectively compared with the control in A. hybridus and by 284, 132 and 146% in A. viridis. Similarly, marketable yield/ha increased by 116, 45 and 45% for poultry manure, fish effluent and NPK, respectively in A. hybridus and by 176, 16 and 43% in A. viridis over the control.

Introduction

The need for vegetables in urban nutrition in Nigeria is increasing due to high urban population. Equally urban dwellers are beginning to show greater interest in fish farming and poultry production to improve household nutrition. But these enterprises generate wastes, which pollute the environment. The fish water wastes from fish culture is usually termed fish 'effluent' Poultry manure is readily available in Nigeria and could be put to agricultural use.

There is need to employ these animal wastes as fertilisers for vegetable crop production, especially in peri-urban areas. Research information is scanty on the comparative effects of fish water effluent, poultry manure or inorganic fertiliser on vegetable production. The aim of the study was to evaluate the effect of fish water effluent, poultry manure or NPK fertiliser on the growth and yield of vegetables with leaf amaranth as a test crop.

Material and methods

A field experiment was conducted at Michael Okpara University of Agriculture, Umudike, Nigeria (latitude 05° 29´ N, longitude 07° 33´ E, 122 m above sea level) research farm in 2013 to determine the effect of organic and inorganic fertilisers on two leaf amaranth species. Umudike is within the tropical rainforest agro-ecological zone of Nigeria with average rainfall of 2200 mm per annum, mean maximum and minimum temperatures of 31.7° C and 21° C, respectively. The soil of the experiment site is a sandy loam ultisol with 69% sand, 14% silt and 17% clay. It had 0.14%, 0.62% and 0.45% nitrogen (N), available phosphorus (P) and exchangeable potassium (K), respectively.

A 2 x 4 factorial experiment in randomised complete block design with three replications was carried out. The treatment comprised two leaf amaranth species (*Amaranthus hybridus* and *A. viridis*) treated with three fertiliser sources (Poultry manure, fish water effluent, NPK 20:10:10) and no fertiliser as control. The poultry manure was collected from the University deep litter poultry pens and composted whereas the fish water effluent was from fibre glass tanks of 1 m^3 volume stocked with 250 *Heterobranchus longifilis* fingerlings.

Chemical analyses showed that the poultry manure had 7.06 pH, 3.38% (N), 1.27% (P) and 0.67% K; the values for fish water effluent were 6.14 pH, 0.021% N, 0.11% P and 0.24% K. Poultry manure (10 t/ha) was applied and worked in at seed bed (1.2 m x 1.2 m) preparation and 300 kg/ha NPK 20:10:10 fertiliser was applied 2 weeks after transplanting (WAT) where as fish water effluent was used as irrigation water

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depending on the treatment schedule. The no fertiliser, NPK and poultry manure plots were irrigated with water from borehole. Three weeks old seedlings of *A. hybridus* and *A. viridis* were transplanted into the various treated sunken beds at a spacing of 0.3 m x 0.3 m.

At 6 WAT, four plants were randomly used to collect data on plant height, number of leaves per plant and stem girth. Fresh leaves and marketable leaves were harvested weekly from four plants from middle rows and the harvests were later cumulated to obtain total leaf (edible) and marketable (leaf + shoot) yields per hectare.

The data collected were subjected to analysis of variance for factorial experiment in randomised complete block design and Fisher's protected least significant difference (F-LSD) test at 0.05 probability level was used to compare the treatment means.

Results

Growth: *Amaranthus hybridus* plants were taller, produced more leaves and had thicker stem than *A. viridis* (Table 1). The differences in the growth of the crop might be due to genetic make up of the cultivars. Poultry manure had the highest growth parameters but there was no significant ($P > 0.05$) difference between NPK and fish water effluent for the number of leaves per plant and stem girth (Table 1). Interaction of the fertilizer type x amaranth cultivar indicated that for each fertilizer type, *A. hybridus* performed better than *A. viridis* for plant height but for the number of leaves per plant in the control plots, *A. hybridus* produced more leaves than *A. viridis*. There was no significant ($P > 0.05$) for stem girth. Khan et al. (2010) had reported taller plants, thicker stems and larger leaf areas for sorghum and maize with fish water effluents compared with ordinary fresh water.

Table 1: Effect of fertilizer type on the growth of two leaf amaranth cultivars 6 weeks after planting

	Fertiliser type				
	Control	NPK	Fish water effluent	Poultry manure	Mean
Cultivar	**Plant height (cm)**				
A. hybridus	78.11	78.89	88.77	99.90	86.41
A. viridis	31.10	36.43	35.84	74.00	44.34
Means	54.60	57.66	62.30	86.95	
	Number of leaves/plant				
A. hybridus	13.44	13.22	13.95	16.78	14.35
A. viridis	9.11	10.89	11.77	19.11	12.72
Means	11.28	12.05	12.84	17.94	
	Stem girth (cm)				
A. hybridus	2.04	2.06	2.02	2.65	2.19
A. viridis	1.08	1.42	1.32	1.62	1.36
Means	1.56	1.74	1.67	2.14	
	Plant height	No. of leaves/plant	Stem girth		
$LSD_{0.05}$ for 2 cultivar means (C)	4.29	1.59	0.21		
$LSD_{0.05}$ for 2 fertiliser means (F)	6.03	2.24	0.30		
$LSD_{0.05}$ for 2 C x F means	8.53	3.17	NS		

Yield: For each fertilizer type, fresh leaf yield/ha and marketable yield/ha were always higher for *A. hybridus* than *A. viridis* and for each amaranth cultivar, poultry manure had the highest leaf and marketable yields/ha (Table 2). There was no significant difference
($P > 0.05$) between the fish water effluent and the inorganic fertilizer for leaf and marketable yields/ha but fish water effluent treatment produced higher leaf and marketable yields/ha than the control. Leaf yield/ha increased by 105, 34 and 34% for poultry manure, fish effluent and NPK fertilizer, respectively compared with the control in *A. hybridus* and by 284, 132 and 146% in *A. viridis*. Similarly, marketable yield/ha

increased by 116, 45 and 45% for poultry manure, fish effluent and NPK, respectively in *A. hybridus* and by 176, 16 and 43% in *A. viridis* over the control.

Table 2: Fresh leaf and marketable yields of two leaf amaranth cultivar influenced by fertilizer type

	Fertiliser type					
	Control	NPK	Fish water effluent	Poultry manure		Mean
Cultivar	**Leaf yield (t/ha)**					
A. hybridus	9.58	12.60	12.86	19.63		13.67
A. viridis	1.38	3.21	3.40	5.30		3.32
Means	5.48	7.91	8.13	12.47		
	Marketable yield (t/ha)					
A. hybridus	10.66	15.50	15.47	23.05		16.17
A. viridis	3.60	4.19	5.16	9.94		5.72
Means	7.13	9.84	10.31	16.50		
		Leaf yield	Marketable yield			
$LSD_{0.05}$ for 2 cultivar means (C)		1.40	2.24			
$LSD_{0.05}$ for 2 fertiliser means (F)		1.97	3.17			
$LSD_{0.05}$ for 2 C x F means		2.79	NS			

Discussion

The higher yields from organic fertilizers (fish water effluent and poultry manure) compared to inorganic fertiliser (NPK) could be due to higher nutrients and improvement of the soil physico-chemical properties such as increased infiltration rate, water retention, soil aggregate and nutrient stabilizers (Carsky *et* al., 2001 and Osaigbovo *et al*., 2010).

In conclusion,fish water effluent and poultry manure increased the growth, leaf and marketable yields of *Amaranthus* species. They as biowastes could be put to agricultural use and reduce environmental pollution.

References

Carsky RJ Becker M & Hauser S (2001). Mucuna cover crops fallow systems: Potential and limitation. In: Sapporo TG, Ishida F & Keating D (eds.) Sustaining Soil fertility in West Africa. SSSA Special Publication Madison W1, Soil Science Society of America and America Society of Agronomy 58, 111-135,

Khan MA Shaukat SS Hauny O & Jabeen S (2010). Irrigation of sorghum crop with waste stabilization pond effluents: Growth and yield responses. *Pakistan* Journal of Botan*y* 42 (3), 1665-1674.

Osaigbovo AU. Orhue ER. & Nwaagula CN (2010). Effect of fish pond effluent on some soil chemical properties and vegetable growth of maize (*Zea mays* L.). Journal of Sustainable Agriculture and Environment 12 (2), 123-131.