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Effect of poultry manure and urea-n on flowering occurrence and leaf Productivity of *amaranthus cruentus*

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ABSTRACT: A field experiment was conducted during the dry season (December – March) in 2005 and 2006. To test the effect of poultry manure (PM) and urea - N on flower initiation and leaf yield of *Amaranthus cruentus*. Plants fertilized with sole poultry manure at 15 tonnes/ha were significantly (p = 0.05) tallest (90.6cm), while application of a mixture of 30 kg urea-N/ha and 15 tones/ha of poultry manure produced the higher number of leaves per plant (81.7), the largest leaf area (203.0 cm^2), highest number of branches per plant (16.0), longest vegetative life span (70 days after planting), highest fresh leaf mass (1.88 kg/plot), highest fresh stem mass (2.25 kg/plot) and highest fresh lead yield (12.20 tonnes/ha). This is an indication that combined application of 15 tonnes of poultry manure per hectare and 30 kg Urea-N/ha could prolong the vegetative phase thus, enhancing the leaf productivity of *Amaranthus cruentus*. @JASEM.

Amaranth (*Amaranthus cruentus L.)* belongs to the family *Amaranthaceae*. It is an erect annual with a short life cycle of two to three months and is widespread in hot, semi-arid and equatorial climate. Its cultivation and consumption is becoming increasingly popular and more than 60 varieties are cultivated in Asia, Australia, Indian, North and South America, Europe and Africa (Spetter and Thompson, 2007).

In Africa, *Amaranthus cruentus* features predominantly in the vegetable farming systems of the republic of Benin, Cote d'Ivoire, Tanzania, Zimbabwe, and Nigeria, where it is usually grown in family gardens or in small commercial holdings around the major urban and peri-urban areas under market gardening (De Lannoy, 2001).

Amaranthus cruentus is grown for its leaves and is among the highly prized leaf vegetables in Nigeria due to their high nutritional and commercial significance. The fresh leaves are an excellent source of plant protein, iron, calcium, fibre, beta-carotene and folate. Proximate analysis show that 100 g of fresh leaves contain 80-89% water, 3.6-4.6g protein, 1.3-8 g cellulose, 154-410 mg Calcium, 2.9 -8.9 mg iron, 5.7-6.5 mg beta-carotene, 23-64 mg vitamin C and an energy value of 108 kg or 26 kcal/100g (De Lannoy, 2000). Cooked leaves and young stems are highly cherished among the peasants and are utilized in different forms. They may be consumed as vegetables eaten with boiled, roasted or fried yam, cocoyam, sweet potato or Irish Potato. Raw or partially boiled leaves and shoots may be served in salad dishes and have been rated superior or equal in taste to spinach. It is considerably higher in calcium, iron and phosphorus than most other leave vegetables (Markus and Davis,1984; Igbokwe,1988; Markus,1990a).

High leaf production in *Amaranthus* is limited to the short vegetative phase of the cropland and reduces drastically during the flowering phase. In an attempt to increase the productivity of the crop, farmers have relied solely on inorganic fertilizer inputs over time which has not halted early occurrence of flowering. The hazardous environmental consequences and high cost of inorganic fertilizers make them not only undesirable but also uneconomical and out of reach of the resource-poor farmers who still dominate the Nigeria agricultural landscape (Ogungbile and Olukosi, 1990). At present, vegetable farmers mostly apply inorganic fertilizers, especially Urea, in combination with poultry manure which is easily got from the numerous poultry farms in the area. However, there is no empirically based recommendation on the optimum quantities of these materials that can be combined for enhanced crop productivity. The need for such authentic recommendations was the objective of this experiment.

MATERIALS AND METHODS

The study was carried out at the Crop Research Farm of the University of Calabar during the dry season (December – March from 2005 – 2006 cropping seasons. Calabar is situated at 04^0 57^1 N and 08^0 18^1 E, with altitude of 37 m above sea level. The rainfall patter of the area has a characteristic bimodal distribution with the highest peaks in July and the other in September. Annual rainfall amount is about 2000mm and spans from March/April to October/November with a short dry season of three months between November/December to February /March. The annual temperature range is from 23 ^{0}C to 33 ^{0}C, with relative humidity of about 80%.Three rates of Urea-N fertilizer (0, 20 and 30 kg/ha) and four levels of cured poultry manure (P M) at 0, 5, 10, and 15 tones/ha were combined in a 3x 4 factorial experiment, giving a total of twelve treatment combinations, each replicated three times in a randomized compete block design. Four week-old seedlings were transplanted into 2.5 m^2 plots at 50 cm inter-and 20cm intra- row spacings (100,000 plant/ha), two weeks after incorporation of poultry manure. Urea-N was applied by band placement, two weeks after transplanting (2WAT)

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The first harvest was done at four weeks after transplanting (4 WAT) and thereafter fortnightly until the experiment was terminated. Experimental plots were weeded regularly throughout the duration of the experiment by hand hoeing, while watering was done twice daily in the morning and evening using a watering can. No insecticide was used as there was no serious occurrence of pests and diseases. Data on plant height at first harvest, fresh stem weight (kg/plot), number of leaves/plant, fresh leaf weight (g/plot), leaf area (cm^2), number of branches/plant, duration to 50% flowering and cumulative fresh leaf yield (tonnes/ha), were taken on nine plants in the center of each plot. Data collected were analyzed statistically using analysis of variance technique and means were tested using the least significant difference (LSD) at P = 0.05.

RESULTS AND DISCUSSION

Result obtained (Table 1) showed that poultry manure significantly (P = 0.05) increased *Amaranthus* plant height. Tallest plants were in plots incorporated with 15 tones of poultry manure per hectare followed by plants in plots incorporated with 10 tonnes of the manure per hectare, while shortest plants were in plots fertilized with sole Urea-N at 20 kg/ha.

Joint application of 15 tonnes of poultry manure and 30 kg of Urea -N per hectare produced vigorously growing plants that had the highest number of leaves and branches per plant, the largest leaf surface area, longest vegetative life span, highest fresh stem masses and highest fresh leaf yield. The least number of leaves and branches per plant and smallest size leaves were produced by plants in zero poultry manure plots fertilized with Urea-N at 20 kg/ha.

On-set of flowering significantly (P = 0.05) varied among the treatment combinations. Early flowering occurred in plants treated with zero poultry manure and sole Urea- N at 20 or 30 kg/ha and those in control plots. However, incorporation of 10 tonnes of poultry manure per hectare without applying Urea-N suppressed flower initiation and significantly (P = 0.05) extended the vegetative phase and hence, the harvest period more than any other treatment.

Table1. Influence of Urea-N and poultry manure on some vegetative parameters and leaf yield of *Amaranthus cruentus* in Calabar.

Treatment		Plant height (cm)	Leaves Per plant	Leaf area $(cm)^2$	Branches Per plant	Duration to 50% flowering (DAT)	Fresh leaf weight (kg/plot)	Fresh stem weight (Kg/plot)	Fresh leaf yield (kg/ha)
Urea-N (kg/ha)	Poultry manure (tonnes/ha)								
0	0	33.2	27.3	53.8	10.0	39	0.18	0.02	840
	5	60.6	50.3	167.5	13.0	55	0.87	0.69	5200
	10	71.0	72.3	197.1	13.3	65	1.30	1.48	8400
	15	90.6	73.3	180.7	15.0	61	0.82	1.98	5280
20	0	25.2	17.3	37.4	2.7	41	9.15	0.14	920
	5	58.2	46.3	165.7	13.3	63	0.42	0.62	3400
	10	80.8	70.0	199.2	13.0	32	1.09	1.74	7400
	15	65.0	70.7	194.6	12.7	64	1.05	1.13	7000
30	0	38.3	33.0	70.3	9.3	40	0.36	0.37	1640
	5	69.1	49.0	160.8	12.7	64	0.76	1.01	5640
	10	82.2	72.0	198.0	13.3	60	1.13	1.27	6680
	15	85.3	81.7	203.0	16.0	70	1.88	2.25	12200
	$LSD_{0.05}$								
	A(Urea-N)	-	-	-	1.19	-	-	-	1080
	B(Poultry manure)	13.5	15.98	31.57	2.20	22	0 .38	0.47	1928
	AB(interaction)	-	-	-	-	-		-	-

Fresh leaf and stem weight per plot and fresh leaf yield per hectare were least in the control but significantly (P = 0.05) highest in plots that were fertilized with combined Urea-N and poultry manure at 30 kg/ha and 15 tonnes/ha, repectively.

Poultry manure applied in combination with Urea-N had more favourable influence on growth of *Amaranthus cruentus* than either sole Urea-N or poultry manure. Sole poultry manure however had more positive influence on vegetative growth more than any sole rate of Urea-N. Good growth of vegetables due to the effect of poultry manure has been reported in bush okra (*Corchorus olitoris*) and the common bean by Massoma and Rweyemany (1989). Enhanced seedling growth and leaf proliferation and expansion in leaf vegetables, attributed to organic soil amendments, has similarly

been demonstrated in pervious field experiments (Kogbe, 1976; Sanchez and Miller, 1986; Obatolu, 1995; Richert and Salomon, 1998).
Applying Urea-N without organic manure produced scanty foliage irrespective of the rate applied, whereas poultry mare alone had superior effect over any rate of Urea-N on development of foliage. Poultry manure contains about 16 kg N, 20 kg P (P_2O_5), and 12 kg K (K_2O)/tonne including micronutrients (Cooperband, 2002). The positive influence of poultry manure on the growth of the crop in poultry manure plots might be due to the release of the balanced nutrients contained in the organic nutrient.

Leaf productivity in *Amaranthus cruentus* often declines sharply after the on-set of flowering. Early occurrence of flowering in the control and in zero poultry manure plots in about 40 days after transplanting was probably due to nutrient stress and/or imbalance which resulted in poor crop growth in such plots. Early occurrence of flowering implies a short period of copious leaf production as was observed in zero poultry manure plots. Using poultry manure alone delayed flowering longer and up to 55-60 days after transplanting. This is an indication that the organic manure has a more favourable influence on the growth of *Amaranthus* than sole inorganic nutrients. However, combined application of poultry manure and Urea-N produced the best crop growth and further extended the leaf production phase. Availability of micronutrients and major plant nutrients (NPK) in poultry manure and the possible good soil conditions created by the organic manure could account for the extended vegetative growth and hence delayed flowering of plants in plots that were fertilized with both organic and inorganic nutrients.

The longest leaf production period of 70 days was however obtained by jointly applying 15 tonnes of poultry manure and 30 kg of Urea-N/ha. Extended duration of leaf harvest gives more yield and higher income to the farmers. The leaf yield variation in different treatments underscores the nutrient efficiency of combining organic and inorganic nutrient sources in crop production. Highest fresh leaf output obtained in plots fertilized with 30 kg Urea-N and 15 kg poultry manure per hectare might be an indication of adequacy or optimal level of fertilization for the crop, or that higher leaf yield might still be possible by applying higher doses of the nutrients.

Conclusion: Integrated nutrient management in *Amaranthus* production is critical for enhanced leaf yield. Joint application of 15 tonnes of poultry manure per hectare and 30 kg of Urea-N per hectare suppressed/delayed flower initiation and hence, extended the duration of leaf yield, thereby enhancing fresh leaf productivity of the crop. Managing the crop at this level of fertilization could be strategic for its increased productivity.

REFERENCES

Cooperband, L. 2002. Building soil organic matter with organic amendments. Center for Integrated Agricultural Sysytems, University of Winsconsin, Madison, September,2002. 13pp

De lannoy, G . (2000). Vegetables. Pp.403-459. In: Raemaekers. R.B (ed). Crop production in tropical Africa.

Igbokwe, P.E. (1988). *Amaranth:* a potential crop for South Western Mississippi. Research Report 13 No. Iv. Mississippi State University.

Kogbe, S. O. (1976). Studies of manorial requirements of Nigerian leafy vegetables: effect of poultry manure on component yield of bush okra. Nigerian Journal of Agriculture 19(20):145-152.

Makus, D. J. (1990a). Composition and nutritional value of vegetable *Amaranth* as affected by stage of growth, environment and method of preparation. Proceedings of the Fourth *Amaranth* Symposium. Minnesota Extension Services, Minnesota Agriculture University St. Paul

Markus, D. J; Davis, D. R. (1984). A mid-summer crop for fresh green of canings: vegetable *Amaranth*. Ark Farm Research, 33:10.

Massomo, S.M.S; Rweyemany, I.C.I. (1989). Evaluation of the effects of cattle and poultry manure in combination with inorganic fertilizer on seed yield components and seed quality of common bean *(P. vulgaris)* (L) grown in different plant stands per hill. Bean Research 4:88-98.

Obatolu, C.R. (1995). Nutrient balance sheet after coffee and maize cropping on an Ultisol supplied with organic fertilizer in Ibadan, Nigeria. Proceedings of 3rd African Soil Science Conference, University of Ibadan, 21-26 August, 1995.

Ogungbile, A.O; Olukosi, J. (1990). An overview of the problems of the resource - poor farmers in Nigeria. Proceedings of the Nigerian National Farming Systems Research Network, Calabar, 14-August,1990

Richert, A.S; Salomon, E. (1998). Application of broiler chicken manure to lettuce and cabbage crops: effect on yield, plant nutrient utilization and mineral nitrogen in the soil. Acta Horticulture, 571; 10-12.

Sanchez, P.A; Miller, R.H. (1986). Organic matter and soil fertility management in acid soils of the tropics. Transactions of the 13th Congress of the International Soil Science Society Vol. V.

Spetter, J; Thompson, L. (2007). The revival of an ancient crop. Low External Inputs and Sustainable Agriculture. September, 23 (3):12-13.