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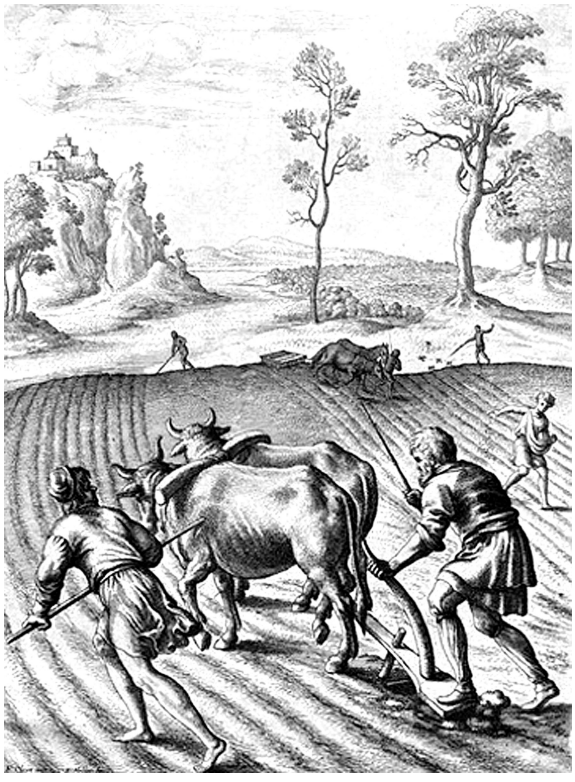

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Effect of Different Sources of Nitrogen on Growth and Yield of *Solanum macrocarpon* in Derived Savanna of Nigeria

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Abstract: Field experiments were conducted in 2002 and 2003 at the Teaching and Research Farm of the University of Ibadan and the Experimental field of the National Horticultural Research Institute, Ibadan, Nigeria, to assess the effects of different sources of nitrogen on the yield and nutritive value of *Solanun macrocarpon*. The experiment was a randomized complete block design, replicated three times. Results showed that nitrogen differed significantly in their ability to increase edible yield, stem and the economic yield at both years of study. Economic yield increase of 21.7, 46.8 and 53.3% were obtained using inorganic, organomineral and poultry manure respectively, in 2002 and the corresponding values for 2003 are 59.6, 50.2 and 43.2%. Results indicated no significant differences for most nutrient content at both years of study except for moisture content, protein and ash in 2003. The study highlighted the potential of poultry manure as well as organomineral fertilizers in vegetable production especially for *Solanum macrocarpon* in Nigeria.

Key words: Nitrogen sources, yield, nutritive value, *Solanum macrocarpon*, derived savanna, Nigeria

INTRODUCTION

Solanum macrocarpon belong to the *Solanaceae* family which includes potato, tomato and sweet pepper (Dupries and Deleener, 1989). This is now widely cultivated for its leaves in the warmer and non-arid parts of Africa (Schippers, 2000). *Solanum macrocarpon* in Nigeria is always intercropped with staple food crops like yam and cassava; however, some farmers plant it as a sole crop when the production is market oriented.

Solanum macrocarpon is inherently genetically endowed but in most cases, it is grown in soils that do not adequately give it enough nutrients to exhibit its inherent qualities such as re-growth and prolific characteristics. This low nutrient use by farmers could be associated with the rising cost of inorganic fertilizers.

Recently, there has been a global shift from chemical fertilizers to organic fertilizers that are renewable, quite easily accessible and cheap and less harmful (Ehiagiator, 1998). The use of organic manures such as poultry droppings, cow dung, compost, crop residue, had been an age old practice among the agricultural communities in Nigeria (Omueti *et al*., 2000). In cultivation of vegetables, farmers however, prefer the use of organic manure despite its bulkiness and low nutrient content especially nitrogen. In other to circumvent its low nutrient content, organomineral fertilizer that is a combination of organic manure fortified with inorganic fertilizers to enhance its nutrient value had been formulated (Omueti *et al*., 2000).

The extent of *Solanum macrocarpon* response to organic fertilizer application in Nigeria has not been properly investigated. This probably explained the reason for the scanty information about agronomic recommendation for the crop. This experiment was therefore, conducted to compare the use of the newly formulated organomineral fertilizer with those of other sources of nitrogen on the growth and nutrient content of *Solanum macrocarpon*.

MATERIALS AND METHODS

Field experiments were conducted during 2002 growing season at the Teaching and Research Farm, of the Department of Agronomy, University of Ibadan (7°20' N, 3°45' E). In 2003, the trial was repeated at the National Horticultural Research Institute (NIHORT), Ibadan (7°24' N, 3°54' E). The sites lies within derived savanna zone (transition forest ecosystem of Nigeria). The soil is dominated by Alfisols (Harpstead, 1973) and belonged to the Egbeda soil series, which is derived from fine grained biotite gnesis (Smyth and Montgomery, 1962) (Table I).

Three sources of nitrogen were used for the study namely: cured poultry manure with nitrogen value of 2.93% in 2002 and 3.12% in 2003, organomineral fertilizer

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Table 1: Physico-chemical properties of the experimental soil used during both years of study

Soil properties	2002	2003
Ph (H_2O) 1:2	6.50	6.30
Organic carbon (g kg^{-1})	8.50	7.90
Total N (g kg^{-1})	0.17	0.14
Available P (mg kg^{-1})	14.48	7.63
Ca (cmol kg^{-1})	62.00	75.00
Mg (cmol kg^{-1})	6.00	9.00
K (mol kg^{-1})	2.00	6.00
Na (cmol kg^{-1})	1.00	5.00
Exchangeable acidity (cmol kg^{-1})	14.00	17.00
Effective Cation Exchange Capacity (ECEC)	85.00	112.00
Sand (%)	65.20	79.30
Silt (%)	23.40	12.90
Clay (%)	11.40	7.80

obtained from decomposed refuse waste fortified with inorganic fertilizer to enhance its nitrogen value to 4.42% and chemical fertilizer (NPK 15-15-15). The treatment thus consisted of poultry manure, organomineral fertilizer, inorganic fertilizer and control (no fertilizer).

Nitrogen was applied from each source at the rate of 80 kg N ha^{-1}. Poultry manure and organomineral fertilizer were applied to the main field one week before transplanting while inorganic fertilizer was applied one week after transplanting. The experiment was a randomized complete block design with three replications. Each treatment occupied land area of 5×3 m with a distance of 1 m separating the treatment.

Solanum macrocarpon seeds (NH 94/42) were sown thinly in rows in well-prepared nursery bed. The seeds were covered with a thin layer of soil that was slightly pressed. Seedlings were transplanted at age of 5 weeks and planted at 100 cm between rows and 15 cm within rows to give a plant population of 66, 666 plants ha^{-1}.

Four harvesting were carried out, when the plant was at a height of 6 cm above ground level leaving 2-3 buds to aid re-growth. Numbers of harvested leaves were also counted. At final harvest total dry weight (stem, leaves and roots) of the plant was determined and plant tissue analyses were carried out. Analysis of variance (ANOVA) was performed on all data using SAS-GLM procedures (SAS Institute, 1996). The means were separated by the Least Significant Difference (LSD $p<0.05$).

RESULTS

Results of Table 1 showed that total nitrogen and organic carbon were low in the soil, which in essence would allow response to nitrogen treatments.

The number of leaves per plant in each nitrogen source increased with time till 12 and 15 weeks after planting in 2002 and 2003, respectively, except for inorganic fertilizer source which produced the highest number of leaves at 18 weeks after planting in 2003

Table 2: Effects of different sources of nitrogen on number of leaves of *Solanum macrocarpon* in derived savanna of Nigeria

	Weeks after planting (No. of leaves per plant)				
Nitrogen source	8	12	15	18	Total
2002 UI experimental site					
Inorganic fertilizer	20.5	23.0	20.4	16.0	79.9
Organomineral	20.4	23.1	16.0	17.1	76.6
Poultry manure	23.4	25.5	22.1	17.2	88.2
Control	17.5	18.8	17.0	17.5	70.8
LSD (5%)	ns	ns	ns	ns	ns
2003 NIHORT experimental site					
Inorganic fertilizer	17.8	24.2	28.2	39.9	110.1
Organomineral	23.0	22.2	29.3	22.7	97.1
Poultry	17.6	17.7	25.8	22.9	84.0
Control	22.7	16.1	24.9	21.9	85.6
LSD (5%)	4.84	3.36	2.88	5.88	7.23

Table 3: Fresh and dry matter yields of *Solanum macrocarpon* grown with different sources of nitrogen fertilizer in derived savanna of Nigeria

	Fresh weights (g $plant^{-1}$)			
Nitrogen source	Edible yield	Stem		Economic yield
2002 UI experimental site				
Inorganic fertilizer	70.4	36.9		107.3
Organomineral	106.0	51.9		157.9
Poultry manure	109.8	70.2		180.0
Control	55.1	29.3		84.0
LSD (5%)	10.9	14.5		21.3
Dry matter weights (g $plant^{-1}$)				
	Leaves	Stem	Root	Total dry weight
Inorganic fertilizer	10.0	3.5	1.2	14.7
Organomineral	13.5	5.1	1.9	20.5
Poultry manure	12.9	7.2	2.3	22.4
Control	6.3	2.5	0.6	9.4
LSD (5%)	4.5	3.9	0.8	11.7
2003 NIHORT experimental site				
Fresh weights (g $plant^{-1}$)				
	Edible yield	Stem		Economic yield
Inorganic fertilizer	124.2	51.5		175.7
Organomineral	96.8	45.6		142.4
Poultry manure	83.5	41.3		124.8
Control	51.5	19.4		70.9
LSD (5%)	12.8	4.0		15.9
Dry matter weights (g $plant^{-1}$)				
	Leaves	Stem	Root	Total dry weight
Inorganic fertilizer	11.07	7.00	2.80	21.2
Organomineral	9.73	6.57	1.73	18.03
Poultry manure	11.57	6.83	1.97	20.37
Control	5.87	3.17	1.07	10.10
LSD (5%)	1.2	1.4	0.2	0.9

(Table 2). At every sampling, highest numbers of leaves were obtained from poultry manure treatment in 2002, while inorganic fertilizer treatment produced the highest number of leaves in 2003. However, the control treatment gave the lowest number of leaves at both years of study.

Poultry manure produced the highest fresh weight (economic yield) in 2002, while inorganic fertilizer treatment produced the highest value of economic yield in 2003. Economic yield increase of poultry manure over inorganic, organomineral and control are 40.4, 12.8 and 53.3%, respectively, in 2002 while the yield increase of

Table 4: Nutritive value of *Solanum macrocarpon* grown with different sources of nitrogen (100 g of edible portion), in derived savanna of Nigeria

	Nutrient			
Nitrogen source	Water (%)	Protein (%)	Fat (%)	Ash (%)
2002 UI experimental site				
Inorganic fertilizer	86.3	3.9	1.1	4.4
Organomineral	87.0	4.4	1.5	4.0
Poultry manure	87.6	3.8	1.1	4.5
Control	88.9	3.5	1.2	3.7
LSD (5%)	NS	NS	NS	NS
2003 NIHORT experimental site				
Inorganic fertilizer	82.6	2.9	0.1	3.2
Organomineral	84.4	2.9	0.1	3.2
Poultry manure	84.5	3.1	0.1	3.4
Control	82.6	2.6	0.1	3.3
LSD (5%)	0.57	0.22	0.01	0.16

NS =Non-significant

inorganic fertilizer treated crops over the organomineral, poultry manure and control are 19.0, 29.0 and 40.0% in 2003, respectively. The dry matter production at final harvest was significantly different between the fertilizer source and control (Table 3). Highest dry matter yield was among plants treated with poultry manure in 2002, while inorganic fertilizer treatment gave the highest dry matter yield in 2003.

Nutrient content of the leaves did not follow the trend of fresh weight in 2002 and no significant differences were observed. However, in 2003 significant differences was observed for all the nutritive parameters except fat%. Generally, all the nitrogen sources had higher significant values, for the nutritive parameters than the control (Table 4).

DISCUSSION

Among the mineral nutrients, N is perhaps the most important because of its biological roles and because it is required in large quantities by the plants. In Nigeria and other West Africa countries where *Solanum macrocarpon* is grown as vegetable, most farmers do not apply fertilizer, as a result of high prices that is associated with its usage (Ehiagiator, 1998). Under continuous cropping, the maintenance of organic matter content of soil through the use of manure is of primary importance to any soil management programme.

Solanum macrocarpon being a widely grown and consumed leafy vegetable crop in Nigeria, with nutrient requirement for its effective growth and productivity, requires that a sustainable and easily available source of nitrogen be sought to ease the twin problem of scarcity and cost associated with mineral fertilizer. The results from this study showed that nitrogen had significant role to play in *Solanum macrocarpon* production. The results from the experiment showed that the control had less leaves than the various nitrogen sources. The difference in the number of leaves affected other parameters such as dry matter production, edible and economic yields in which nitrogen sources excelled. This direct effect of number of leaves on the parameters as observed in this study had been reported for vegetable crops such as Amaranthus (Olufolaji and Tayo, 1980) and Lucas and Lawani (1985).

The study indicated that poultry manure produced higher values for edible and economic yield in 2002, as against inorganic fertilizer in 2003 and this could be adduced to the fact that the nutrients in the fertilizers were leached out of the soil because of the intensity of rainfall during the period of study. This is in contrast with the organic nitrogen source which usually release nutrient slowly and which are not easily leached.

Nutrient content especially% protein did not follow the trend with fresh weight. Plants under organomineral had the highest values of these parameters. The values obtained for some of the nutrients were within the range earlier reported for Solanum macrocarpon and its related species (Edmonds and Chiveya, 1997).

This study highlighted the possibility of the use of poultry manure and organomineral fertilizer in the production of leafy vegetables. Hitherto, the use of poultry manure in the production of leafy vegetable had been highlighted by Kogbe (1976) and Lucas and Lawani (1985), in *Amaranthus caudatus* and *Corchorus olitorius*, respectively.

The promising yield obtained with organomineral fertilizer is a pointer to its potential use in vegetable production in Nigeria. With the use of organomineral the benefits of organic manure such as nutrient supply, soil structure improvement and inorganic fertilizer (high and fast nutrient release) will therefore enhance vegetable production.

REFERENCES

Dupries, H. and P. Deleener, 1989. Vegetable and condiments fruits: In African Gardens and Orchards

Edmonds, J.M. and J.A. Chweya, 1997. Black nightshades, Solanum nigrum L. and related species. In: Traditional African Vegetable. Proceeding of the IPGRI International Workshop on Genetic Resource of Traditional Vegetables in Africa, Nairobi, Kenya, August 1995.

Ehiagiator, J.O., 1998. Farmyard (FYM). Need for its adoption as an alternative to chemical fertilizer use in Nigeria. Nig. J. Hortic. Sci., 3: 1-5.

Harpstead, M.T., 1973. The classification of some Nig. soils. Soil Sci., 116: 437-443.

Kogbe, J.O.S., 1976. Studies on the manorial requirement of Nigeria local leafy vegetables I. Effect of poultry manure on yield and component of yield of Amaranth (*Amaranth caudatus*). Nig. Agric. J., 13: 84-87.

Lucas, E.O. and C. Lawani, 1985. The effect of poultry manure and inorganic fertilizers on the growth of *Corchorus olitorius* in Nigeria. African J. Agric. Sci., 12: 141-158.

Olufolaji, A.O. and T.O. Tayo, 1980. Growth, development and mineral content of three cultivars of Amaranth. Sci. Hortic., 13: 181-189.

Omueti, J.A.I., M.K.C. Sridhar, G.O. Adeoye, O. Bamiro and D.A. Fadare, 2000. Organic Fertilizer Use in Nigeria. In: Agronomy in Nigeria. Polygraphics Press Ibadan, Nigeria, pp: 208-215.

SAS Institute, 1996. SAS/STAT user's Guide: Vers. 7, 4th Edn., SAS Inst. Cary, N.C.

Schippers, R.R., 2000. African Indigenous Vegetables. An Overview of the cultivated species. Charham, UK: Natural Resources Institute/ACP-EU Technical Centre for the Agricultural and Rural Cooperation.

Smyth, A.J. and R.F. Montgometry, 1962. Soils and land use in Central Western Nigeria Government Printers, Ibadan, Western Nigeria.