Complementary effect of organic and inorganic fertilizers on the growth of young cashew (*Anacardium occidentale* L.) in two agro-ecologies of Ghana

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Introduction

- **Erroneously, the cashew is considered to require low levels of plant available nutrients.**
- **Many plantations are found in soils of low natural fertility to which no fertilizers are applied.**
- **The cashew plant takes up nutrients from the soil for growth and yield.**
- **This depletes the soil of nutrients for sustainable crop production**.

Introduction

- **The nutrients so removed could be returned to the soil through inorganic or organic fertilizer application.**

- **The application of inorganic fertilizers significantly increased the growth and yield of cashew (Grundon, 1999)**

- **The use of inorganic fertilizers to supply the needed nutrients to cashew is presently expensive for farmers (Macit *et al.*, 2007).**

Introduction

- **The use of organic fertilizer such as poultry manure (PM) is cheap and environmentally friendly.**

- **Organic fertilizer supplies both major and minor plant nutrients and can substitute substantial amounts of inorganic fertilizer (Tollesa, 1999).**

- **Sole organic fertilizer or inorganic fertilizer applications are unable to give economic yield and do not sustain productivity under continuous intensive cropping.**

Introduction

- **The combined application of organic and inorganic fertilizers has received considerable attention in food crop production.**

- **This approach to crop nutrient management will be more suitable for cashew farmers.**

- **However, a study on combined nutrient management in cashew production has not yet been conducted in Ghana.**

Introduction

- **Since inorganic fertilizers are scarce and costly while the cost of organic fertilizers is low and has long lasting effects, it is pertinent to study the effects of complementary use of inorganic and organic fertilizers.**

- **Therefore, the objective of this study was to investigate the effects of organic and inorganic fertilizers either alone or in combinations on the growth of newly transplanted cashew seedlings.**

Materials and Methods

- ***Study sites:*** **The study was carried out at Bole in the Guinea Savannah and Nkonsia in the Forest Transitional agro-ecologies of Ghana from 2017 to 2019.**

- ***Experimental design:*** **The experiment was laid out in a randomized complete block design with three replicates and seven treatments**

- **T1 = NPK 20-10-10 @ 50g/seedling**
- **T2 = NPK 20-10-10 @ 100 g/seedling**
- **T3 = Poultry manure @ 400 g/seedling**
- **T4 = Poultry manure @ 800 g/seedling**
- **T5 = NPK 25 g + PM 200 g/seedling**
- **T6 = NPK 50 g + PM 400 g/seedling**
- **T7 = Control**

Materials and Methods

- ***Plot establishment and husbandry*: The plot was planted with six elite cashew materials in September 2017.**

- **Six-month-old cashew seedlings previously raised in a nursery were transplanted to the field at a spacing of 10 × 10 m (equivalent to 100 plants ha^{-1}).**

- **The interspaces were planted with maize and groundnut to ensure maximum utilization of the land.**

Materials and Methods

- ***Poultry manure and soil analyses***
- **Soil samples were collected at two distinct depths of 0-15 cm and 15-30 cm before establishing the plots.**
- **Soil parameters such as pH, organic carbon, nitrogen, phosphorus, potassium, calcium and magnesium were determined.**
- **Similarly chemical analyses such as pH, organic carbon, nitrogen, phosphorus, potassium, calcium and magnesium were carried out on the poultry manure.**

Materials and Methods

- ***Data collection***
- **The traits evaluated with respect to growth were plant height, stem diameter and plant vigour.**

- ***Statistical analysis***
- **Data collected on plant growth characteristics were subjected to analysis of variance (ANOVA).**

- **Treatment means that show significant differences were compared using standard error of difference (SED).**

Results

Table 1: Some chemical properties of the poultry manure

Property	OC (%)	N (%)	P (%)	K (%)	Ca (%)	Mg (%)	pH	C/N
Value	22.5	2.50	1.19	1.20	0.81	0.56	6.6	9.0

Table 2: Some chemical properties of the soils at the two locations

Location	pH	Org C (%)	Total N (%)	Avail. P (mg kg^{-1})	Exch. K	Exch. Mg	Exch. Ca
					cmol kg^{-1}		
Bole	6.37	1.12	0.05	2.76	0.19	1.13	1.61
Nkonsia	6.05	1.17	0.11	15.82	0.30	2.10	2.55

Table 3: Effects of different soil amendments on plant growth parameters

Treatments	Bole			Nkonsia		
	Height (cm)	Girth (mm)	Vigour	Height (cm)	Girth (mm)	Vigour
T1 NPK 50g	241.0^{ab}	76.7^{a}	3.1^{ab}	171.4^{a}	67.7^{a}	2.6^{a}
T2 NPK 100 g	263.3^{b}	86.6^{a}	3.1^{ab}	202.7^{ab}	70.1^{a}	2.9^{abc}
T3 PM 400 g	251.4^{ab}	80.9^{a}	3.1^{ab}	231.6^{b}	71.3^{a}	3.3^{c}
T4 PM 800 g	227.0^{ab}	84.4^{a}	2.7^{ab}	211.2^{ab}	76.6^{a}	2.7^{ab}
T5 NPK 25 g + PM 200 g	239.1^{ab}	84.3^{a}	2.9^{ab}	189.4^{ab}	67.3^{a}	2.8^{abc}
T6 NPK 50 g + PM 400 g	262.6^{b}	77.2^{a}	3.4^{b}	214.1^{ab}	69.6^{a}	3.1^{bc}
T7 Control	217.6^{a}	74.9^{a}	2.9^{ab}	176.9^{a}	65.7^{a}	2.7^{ab}
SED $(_{df)} = 12)$	17.4	6.6	0.3	20.8	7.3	0.2

Conclusion and recommendation

- **This study has demonstrated that the sole application of organic fertilizer or combined use of organic and inorganic fertilizers on less fertile soils will greatly benefit the nutrition of cashew plants.**

- **The best growth and vigour were recorded for T6 (NPK 50 g + PM 400 g) at Bole and T3 (PM 400 g) at Nkonsia.**

- **From their preeminence over the other treatments in promoting growth, T3 and T6 would ensure improved establishment success and more vigorous growth of cashew plants in less fertile soils.**

THANK YOU