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Response of Root Dry Matter Content of Four Improved Cassava Genotypes to Fertilizer Application in Two Agro-ecologies in Nigeria

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Introduction

Low soil fertility remains the key factor limiting the yield of cassava (*Manihot esculenta* Crantz) in African agricultural systems (Dakora and Keya, 1997). Cassava responds to soil nutrient amendments through fertilizer combinations (N, P and K) to give higher root yield (Sughai, 2010). Nutrient element interactions, however, played a significant role in nutrient uptake and plant response.

Objective

This study seeks to determine (i) the effect of fertilizer rates of (NPK) with N, P and K omission on cassava root dry matter content (DM) and (ii) the influence of environment on root dry matter of four improved cassava genotypes.

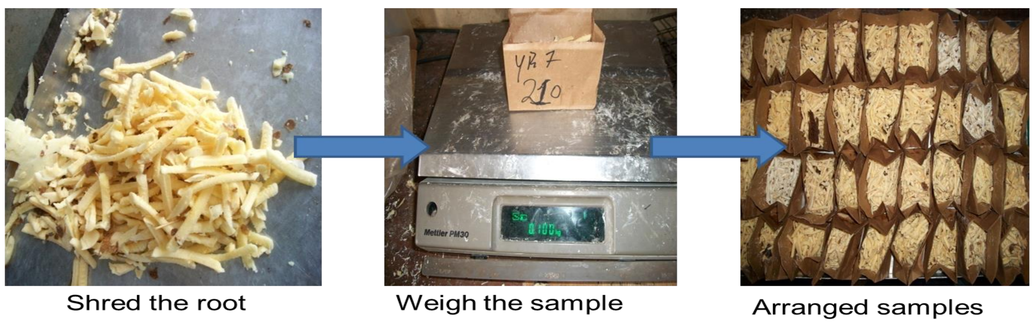
Materials and Methods

Field trials were conducted in 3 locations in Nigeria (Ibadan, Ikenne and Tsonga) in two planting seasons (2014 and 2015) to evaluate 2 yellow root (IITA-TMS-IBA011412, IITA-TMS-IBA070593) and 2 white root cassava genotypes (IITA-TMS-IBA010040 and TMEB419). The experiment was arranged as a split-split plot in a RCBD with three replicates with genotype, fertilizer type and rate respectively as main plot, subplot and sub-subplot treatments. DM was estimated using the oven dry method (70^{0}C for 72 hrs). Data collected were analyzed using SAS ver 9.4 and means separated using the Duncan's multiple range test.

- Fertilizer type: N= NPK 15-15-15 and urea, K = KCl, P = TSP
- Rate = 45 and 75 kg of N, P_2O_5 and K_2O ha^{-1}.

TSP fertilizer (46% P_2O_5) | Urea fertilizer (46% N) | MOP fertilizer (60% K_2O) | NPK fertilizer (15 % N, P_2O_5, K_2O)

plate 1. Fertilizer types used in this study



Shred the root | Weigh the sample | Arranged samples

Plate 2. Determination of dry matter content(dm) of cassava root by oven dry method

Results

Genotype effects were highly significant ($p \leq 0.001$), fertilizer types and rates were also significant ($p \leq 0.05$). Treatment urea+TSP+KCl at 45 kg ha^{-1} to TMEB419 gave the highest DM (32.7 %), with 10.3 % higher than the unfertilized plots (control). Omission of nitrogen, phosphorus and potassium fertilizers to genotype TMEB419 at 45 kg ha^{-1} gave 12.1 %, 11.4 % and 16.3 % reduction in DM respectively. TMEB419 and IBA010040 (white root) had the highest dry matter content while IBA011412 had the lowest (Table 1). Ikenne had the highest DM and Tsonga the lowest (Figure 1).

Table 1: Mean root dry matter content (%) of each cassava genotype as influenced by fertilizer application in 2014/2015 and 2015/2016 planting seasons across three locations in Nigeria

Fertilizer type	Fertilizer rate (kg ha^{-1})	TMS-IBA010040	TMS-IBA011412	TMS-IBA070593	TMEB 419	Mean	SE(±)	CV (%)
Control	0	26.35	20.21	23.09	29.36	24.75^{c}	1.98	6.24
NPK 15:15:15	45	26.07	22.85	24.35	29.15	25.61^{a}	1.35	9.47
NPK 15:15:15	75	26.94	21.15	24.24	29.36	25.42^{ab}	1.77	7.19
Urea+TSP+KCl	45	26.56	20.50	23.59	32.73	25.85^{a}	2.61	4.96
Urea+TSP+KCl	75	24.93	21.07	24.64	29.64	25.07^{bc}	1.76	7.13
Urea+TSP (-K)	45	25.44	21.94	23.91	27.40	24.67^{c}	1.16	10.66
Urea+TSP (-K)	75	24.70	20.06	23.31	29.30	24.34^{cd}	1.92	6.35
Urea+KCl (-P)	45	26.24	21.65	24.35	29.01	25.31^{b}	1.55	8.16
Urea+KCl (-P)	75	25.62	20.44	22.60	30.86	24.88^{c}	2.26	5.51
TSP+KCl (-N)	45	26.76	20.53	24.75	28.78	25.21^{b}	1.76	7.15
TSP+KCl (-N)	75	26.63	21.16	24.39	30.15	25.58^{ab}	1.89	6.76
Mean		26.02^{b}	21.05^{d}	23.93^{c}	29.61^{a}			
SE(±)		0.23	0.25	0.21	0.40			
CV (%)		2.89	3.99	2.90	4.52			
Fertiliser type *; Fertiliser rate *; Cassava genotype ***								

TSP: Triple superphosphate, KCl: Potassium chloride, SE: Standard error, CV: Coefficient of variation, *: significant at P≤0.001, *: significant at P≤0.05. Means with the same alphabet are not significantly different.**

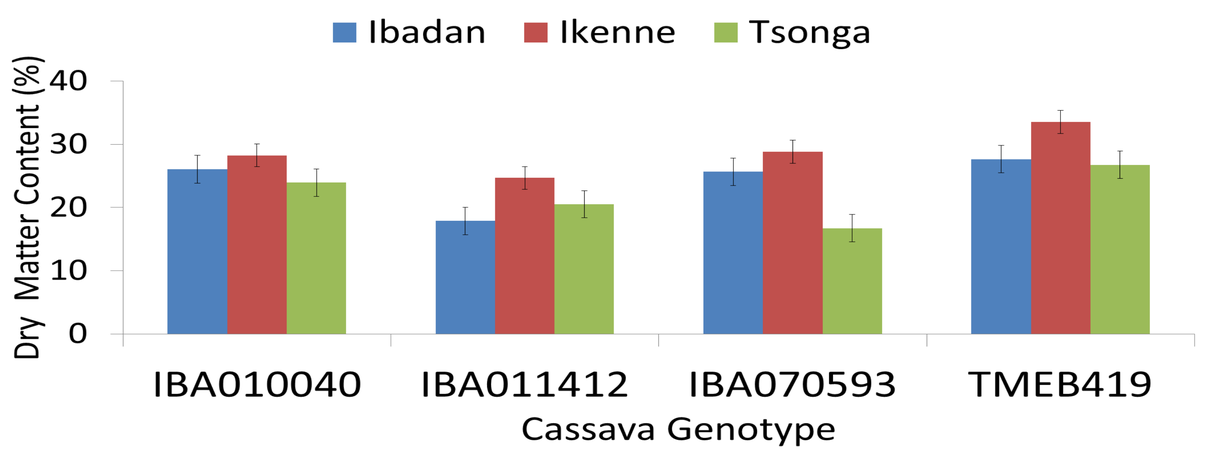


Figure 1: Influence of Environment on Root Dry Matter Content of four cassava genotypes.

Conclusion

Application of single element fertilizers (urea+KCl+TSP) at 45 kg ha^{-1} to TMEB419 gave the highest DM, hence, cassava genotypes respond differently to fertilizer treatments with positive response on root dry matter content.

Acknowledgment

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