

Assessment of biofortified cassava genotypes for total carotenoid content, yield and yield components at advanced breeding stage

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Introduction

- Hunger and vitamin A deficiency are major challenges in many countries in sub-Saharan Africa.
- Vitamin A deficiency causes several health disorders including night blindness, xerophthalmia, total blindness and it is a leading cause of maternal and child mortality in developing countries (WHO, 2009).
- Cassava is an important staple crop with great potential to rectify these challenges in the sub-region.
- The development of superior cassava genotypes with high provitamin A levels is a realizable way of combatting these problems.
- Improvement of cassava for yield and provitamin A requires information on the extent of genetic variability that exists among available cassava clones. Hence, the study aimed to assess genetic variability that exists among 12 biofortified cassava genotypes and identify outstanding genotypes.

Materials and Methods

- The advanced yield trial, which comprised of 12 genotypes including 3 checks, was evaluated at the International Institute of Tropical Agriculture (IITA), Ibadan and the IITA experimental stations at Ikenne, Ubiaja and Mokwa during the 2017/2018 cropping season.
- The trial was laid out in a randomized complete block design with three replications. Each plot consisted of six rows of seven plants, giving a plot size of 42 plants.
- The trial was harvested at 12 months after planting and data were recorded on traits such as fresh yield (FYLD), harvest index (HI), total yield (TYLD) dry yield (DYLD), dry matter contents (DM) and total carotenoid content (TCC).
- Data were subjected to analysis of variance using the R statistical software while pertinent means were separated.

Results and Discussion

- Results revealed significant variation ($P < 0.01$) among the genotypes for all measured traits (Table 1) while variation among environments was also significant for all traits except TYLD. Genotype x environment interaction effect was significant ($P < 0.01$) for all traits except FYLD and TI.
- The mean performance of the genotypes across locations showed that FYLD ranged from 11.78 for IITA-TMS-IKN150091 to 30.97 t/ha for IITA-TMS-IBA070337. Similarly, the highest DYLD (10.23 t/ha) and TYLD (30.80) values were recorded for IITA-TMS-IBA070337 while IITA-TMS-IKN150091 had the lowest values for both traits.
- Furthermore, IITA-TMS-IBA070337 and IITA-TMS-IKN140026 recorded the highest (31.20) and lowest DM values (22.48), respectively. IITA-TMS-IKN140026 which had the lowest DM recorded the highest TCC while IITA-TMS-IBA070337 which recorded the highest DM had the lowest TCC.
- The highest and lowest HI were obtained for IITA-TMS-IKN140026 and IITA-TMS-IKN150091, respectively.

Table 1: Mean squares from ANOVA of FYLD and other traits of 12 biofortified cassava evaluated in 4 environments in 2017/18

Sources of variations	Df	FYLD	HI	DM	DYLD	TYLD	TC
Envt (E)	3	6534**	0.54**	15.01**	669.5**	8.51	27.76*
Rep x E	6	15.83	0.01	0.76	1.40	10.81	6.43
Gen (G)	11	402.8**	0.04**	86.16**	38.97**	241.2**	25.6**
G x E	33	86.51	0.03	43.95**	11.22**	200.1**	14.17**
Error	94	7.98	0.10	17.42	6.39	49.36	1.92

Table 2: Means for FYLD and other traits of 12 biofortified cassava evaluated in 4 environments in 2017/18

Genotype	FYLD	DYLD	TYLD	HI	DM	TC
IITA-TMS-IBA070337	30.97	10.23	30.80	0.45	31.20	7.50
IITA-TMS-IKN140026	26.44	5.88	30.28	0.48	22.48	13.83
IITA-TMS-IKN150089	22.40	6.07	24.61	0.46	25.81	12.46
IITA-TMS-IBA070539	21.61	5.27	23.65	0.41	22.94	9.89
IITA-TMS-IKN160315	21.41	6.49	25.08	0.44	25.71	12.16
IITA-TMS-IKN160020	20.36	5.73	18.38	0.47	25.62	13.75
IITA-TMS-IBA121709	18.18	5.97	19.71	0.45	29.47	11.73
IITA-TMS-IKN130010	17.65	5.30	26.36	0.39	27.40	13.79
IITA-TMS-IBA0700593	13.79	3.86	21.13	0.35	24.28	12.38
IITA-TMS-IKN140044	13.75	4.40	21.46	0.34	28.64	11.49
IITA-TMS-IBA110841	12.99	3.55	20.36	0.36	25.85	11.41
IITA-TMS-IKN150091	11.78	3.55	16.36	0.32	29.07	11.58
LSD _{0.05}	6.47	2.05	5.70	0.08	3.39	1.39

Conclusions

Superior genotypes such as IITA-TMS-IBA070337 and IITA-TMS-IKN150089 which combine high yield with high DM along with moderate to high levels of TCC should be advanced to Uniform Yield Trial for release and commercialization.

The identified genotypes could also serve as sources of favorable alleles for introgression into tropical cassava populations.

Reference

WHO. 2009. "Global prevalence of vitamin A deficiency in populations at risk 1995-2005" in WHO Global Database on Vitamin A Deficiency (Geneva: World Health Organization), 1–55.