Transcriptome analysis of sucrose phosphate synthase genes in high and low starch cassava (*Manihot esculenta* Crantz) genotypes.

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Abstract

The exploration and understanding of sucrose phosphate synthase (SPS) genes have been extensively documented across various plant species. However, research on the characterization and analysis of SPS genes in cassava remains relatively limited. Our study endeavours to fill this gap by investigating four SPS genes; namely, sucrose phosphate synthase 3F, sucrose phosphate synthase 1F, sucrose phosphate synthase family protein, and sucrose phosphate synthase 2F, identified through transcriptome analysis (NCBI Bio project ID: PRJNA998707). These genes were isolated from the total RNA extracted from the storage roots of TME-419 and H-165 cassava varieties. Upon sequence analysis, we observed that the expression of SPS genes predominantly occurred during the third to sixth months of storage root development in both cassava varieties. Notably, the TME-419 variety exhibited a 3.4-fold higher expression of SPS genes compared to the H-165 variety. To validate the reliability of our findings, the selected differentially expressed genes (DEGs) were confirmed through reverse transcription-polymerase chain reaction (RT-qPCR). Further investigation revealed the chromosomal locations of the SPS genes: Chr 18 for sucrose phosphate synthase family protein, Chr 15 for Sucrose phosphate synthase 3F, Chr 14 for Sucrose phosphate synthase 1F, and Chr 16 for Sucrose phosphate synthase 2F. Correlation analysis unveiled a positive relationship between the expression of SPS genes and the levels of sucrose and starch contents in the cassava storage roots. This correlation suggests that high expression of SPS genes in cassava storage roots can accelerate the accumulation of starch, an important selection factor for the cassava industry, food security, and the breeding of elite cassava and related starch-producing crops. This research underscores the significance of understanding the molecular mechanisms underlying starch accumulation in cassava, paving the way for potential advancements in crop improvement and agricultural sustainability.

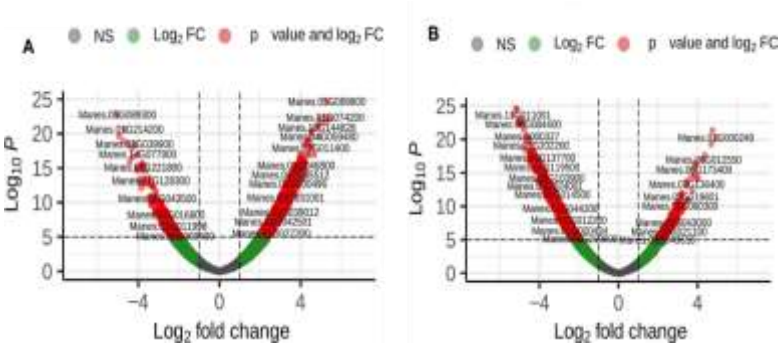


Figure 1 (A-B): Volcano plots showing the comparison of DEGs between the H-165 and TME-419 transcript group.
(A): H-165/3_vs_TME-419 at 3 months after planting.
(B): H-165/6_vs_TME-419 at 6 months after planting.

Recent Publications

1. Reuben-Kalu JI, Eswaran, K, Muthurajan R, Doraiswamy, U, Venkatasamy B, and Shanmugam KP (2023). Precise isolation of high-quality RNA from leaves and storage roots of cassava (*Manihot esculenta* Crantz) for gene expression studies. Bulletin of the National Research Centre 47 (1):84
2. Reuben-Kalu JI. Kokiladevi, E, Raveendran M, Uma D, Balasubramani V, Kavitha, PS, Kingsley TL, Mbe, JO, Nsofor GC (2024). Comparison of Granule Size Distribution of Starches and Biochemical Profile of Flour from Selected Cassava (*Manihot esculenta* Crantz) Genotypes. RRJ Biol. 11:001
3. Reuben-Kalu JI, Renuka R. (2021). Anti-hyperglycemic Efficiency of the Aqueous Seed Extract of *Mucuna pruriens* in Nicotinamide Streptozotocin-induced Diabetic Wistar Rats. Int. J. Plant & Soil Science. 33 (24): 59-67.
4. Reuben-kalu JI, Renuka R, Uma D, Gnanam, R, Santhanakrishnan, VP, Alum, EA. (2021). Phytochemical and *In-Silico* Evaluation of the Pharmaceutically Important Biomolecules Present in Leaf and Seed Extracts of *Mucuna pruriens*. Madras Agric. J. 107,10-12.
5. Reuben-Kalu JI, Renuka R, Uma, D. and Gnanam, R. (2021). Cell suspension culture of *Mucuna pruriens* for production and improvement of L-3, 4-Dihydroxy Phenylalanine Concentration. Nigerian Agricultural Journal. 52, (2) 12RN0-129.



Biography

Jane Ijeoma Reuben-Kalu is a Senior Research Scientist working with the National Root Crops Research Institute (NRCRI) Umudike, Nigeria.
She is on the verge of completing her doctoral research program at Tamil Nadu Agricultural University Coimbatore, India. Her current research is focused on the genetic enhancement of starch in cassava, a crop with significant socioeconomic importance in Nigeria and beyond. Through her work, she aims to elucidate the underlying genetic mechanisms governing starch accumulation patterns in different cassava genotypes, by employing cutting-edge biotechnology techniques. Jane strives to unravel key genetic markers and pathways associated with starch biosynthesis, with the ultimate goal of enhancing the starch content and other biochemical properties in cassava.

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