

Cassava varieties with high dry matter and starch content

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Summary

The amount of dry matter and starch held by cassava roots are greatly influencing their value for farmers because these quality characteristics determine its uses in manufacturing of flour, chips or industrial materials. Cassava crops in Sub-Saharan Africa are renowned for a low degree of root filling with dry matter and starches, which is for a large part ascribed to the limited range of varieties that are accessible to farmers. Improvements of root quality are representing a major growth market for African cassava in the medium term future, immediately benefiting food security of subsistence communities and growth of agri-food industries. Breeding cassava for high dry matter and starch content is important to improve the supply for local and regional markets, and a number of varieties have been developed for African farming systems. The better quality of roots makes that farmers get a higher economic yield from a cassava crop on the same area of land, and thus more food or income.

Technical Description

Bulking of dry matter in cassava roots takes place by accumulation of starch cells at specific stages in crop's growth cycle, and the degree of root bulking differs largely among varieties, and environment. The total amount of carbohydrates in roots of common African cassava varieties ranges from 20% to 31% of fresh yields, and starch makes up 64% to 72% of the total carbohydrates. Breeders can substantially improve the quality of roots by conventional crossing of cassava varieties known for superior root filling with lines that are high-yielding and resistant to major pests and diseases. In this way, a number of cassava varieties have been developed with root dry matter contents of 40% to 45%, and starch contents of 80% to 95% (on total carbohydrates), which achieve similar or higher yields than natural land races and hybrid lines of cassava grown in Sub-Saharan Africa. Gene marker assisted and transgenic methods are also used for breeding cassava with high dry matter and starch content. Roots with improved quality are suited for fresh consumption or processing into flour or starch that can be used as thickener for foods, as well as filler, binder or stabilizer for pharmaceutical products, packaging material and industrial goods.

Uses

Cassava varieties with high dry matter and starch content offer a viable tool to enhance the root yields and qualities in all major growing areas of Sub-Saharan Africa because common varieties that are cultivated by millions of farmers achieve medium to poor root bulking. Varieties with improved root quality are available that possess a high degree of resistance to drought and pests, and adaptations to other adverse growing conditions or production objectives; and combinations of traits can be tailored to suit the needs in a specific area. Cassava root with high dry matter and starch content are useful in subsistence farming systems for enhancing food security and incomes, and commercial agri-businesses as source of low-cost flour and starch for various manufacturing processes.

Composition

A set of cassava varieties with improved root quality have been released in Sub-Saharan Africa that also possess other favorable agronomic and nutritional traits, such as TMS-961632 (Farmers’ Pride), TME419 and CR36-5 (Ayaya). There is a medium to high level of heritability for root dry matter content when crossing varieties, enabling breeders to improve the root quality of a broad selection of varieties. Nearly all high dry matter and starch cassava varieties that are available to farmers in Africa were developed using regular crossing techniques, while genetically modified varieties are very few to date.

Application

The multiplication and cultivation of cassava varieties with high dry matter and starch happens in the same way like any other cassava crop, in which cuttings taken from one stand are reused to plant another field. Caution has to be exercised by farmers that planting materials are free of diseases symptom when transfers are made between fields. Different modes for planting have to be employed depending on rainfall conditions, cuttings are best placed horizontally and covered entirely with soil in areas with a dry climate, and can be planted vertical or angular in humid areas with high precipitation. Recommended soil and fertilizer management for particular growing areas and conditions have to be adhered to achieve high root yields. Limitations in the availability of nutrients and water, soil compaction and weed encroachment have to be addressed for making sure that the use of disease resistant cassava varieties increases production levels.

Agroecologies	All Agroecologies.
Regions	Africa South of Sahara.
Developed in Countries	Nigeria, Ivory Coast, Benin.
Available in	Nigeria, Ivory Coast, Benin.

Solution Forms	Genetics.
Solution Applications	Improved variety.
Agricultural Commodities	Cassava.
Beneficiaries	Small-scale farmers, Commercial farmers.

Commercialization

Commercialization Category

Commercially available

Startup Requirements

1) Identify or develop cassava varieties with high dry matter and starch content that align with conditions and contexts in the value chain, 2) Production and marketing of cassava with high root quality by multipliers and seed companies in the region, 3) Setting up linkages between seed suppliers, cassava growers, food processors and consumer groups to create demand for cassava-based food products, and 4) Provide financial support for local suppliers and smallholder farmers that catalyzes investments and purchases of cassava with improved root quality.

Production Cost

Cassava breeding for high dry matter and starch content in roots through conventional crossing is a lengthy process that starts in the lab and screen house, and is following by extensive testing of in the field. The costs associated with developing lines of cassava with improved root quality are not substantially different from a common hybrid variety, making that prices for planting materials are similar. When cultivating cassava crops for high dry matter and starch content farmers are needing to invest in fertilizer inputs, and crop and soil management practices, for achieving the desired root quality and making profit from it.

Customer Segmentation

Suppliers of cassava planting materials, Subsistence and commercial cassava producers, Agri-food processors

Potential Profitability

Cultivating varieties with improved root quality offers various financial benefits for farmers and food processors. The high dry matter contents of cassava roots increases the amount of dried roots that are harvested from an area of land, which reduces the land under cultivation and labour requirements for a similar yield. The high starch content in root dry matter translates into a better nutritional value and selling price of

dried roots, which improves diets and income of subsistence farmers. Cassava varieties with high dry matter and carbohydrate contents are suited for replacing starch and glucose sources from wheat, barley, maize and rice that are more expensive which reduces costs of raw material supply for agri-food and industrial manufacturers.

Licencing Requirements

Most of the cassava varieties with high dry matter and starch content that are released in Sub-Saharan Africa are royalty-free for multiplication and sales by farmers but does require certification following national compliance for seed systems. Hybrid cassava varieties with improved root quality are marketed under a commercial license.

Innovation as a Public Good

The International Institute of Tropical Agriculture are responsible for the public development of golden cassava varieties that are released to countries in Sub-Saharan Africa.

Solution Images





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RESEARCH INSTITUTE**

BASICS-II

Farmer's Pride (TMS-961632)

High yielding (35 tons/ha)

High and stable dry matter (39%)

CMD resistant

Erect plant type excellent for mechanization

Good for starch and flour production

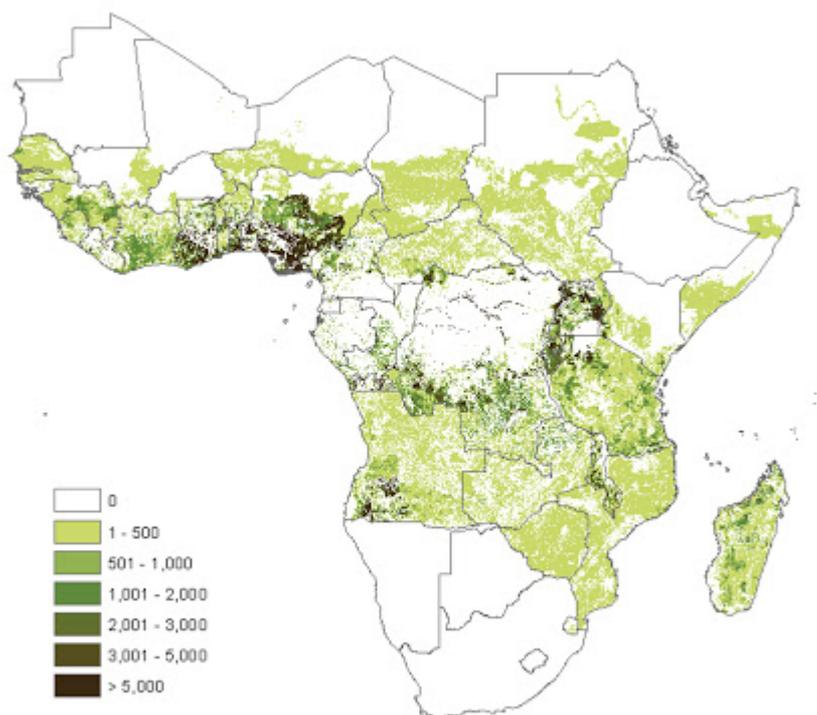




Cassava production (mt) (2000)

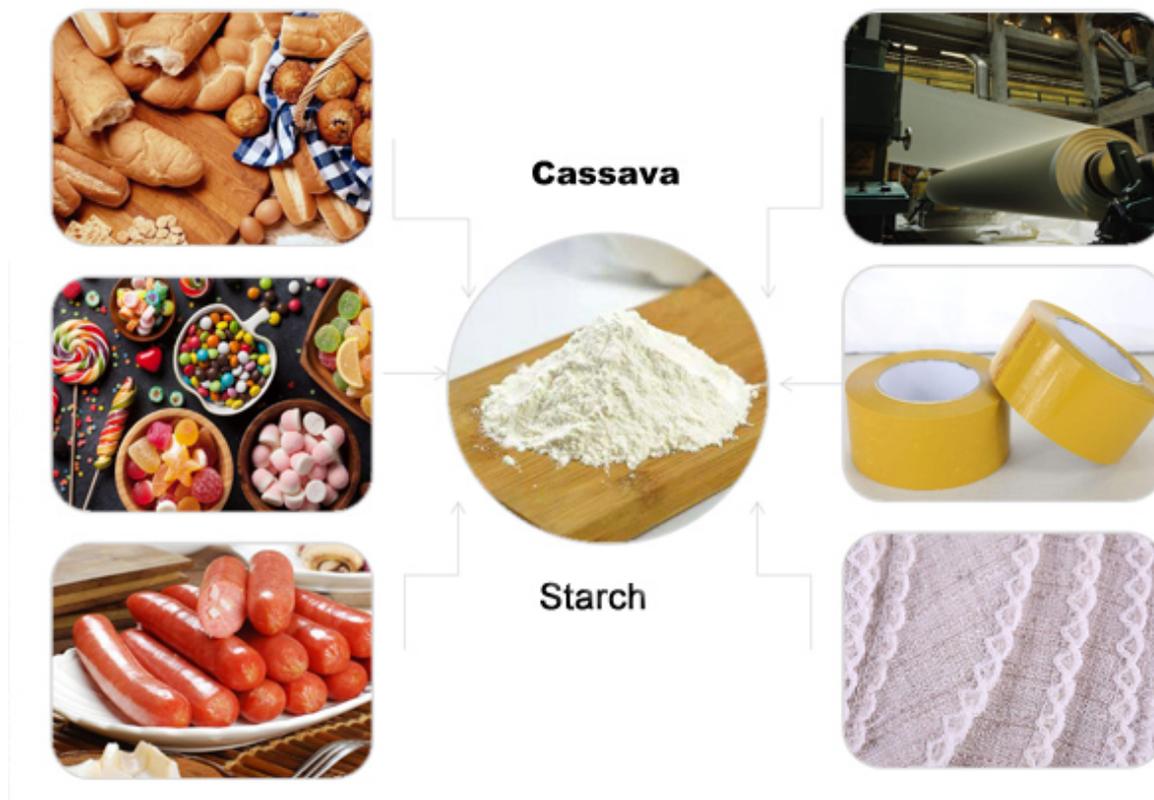
Spatially disaggregated production statistics of circa 2000 using the Spatial Production Allocation Model (SPAM). Values are for 5 arc-minute grid cells.

Source: You, L., S. Crespo, Z. Guo, J. Koo, K. Sebastian, M.T. Tenorio, S. Wood, U. Wood-Sichra. Spatial Production Allocation Model (SPAM) 2000 Version 3 Release 6.



Note: <http://mapsam.info>

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Institutions



Accompanying Solutions

Disease resistant cassava varieties, Golden cassava varieties, Integrated weed, pest and soil management system (GAP), Seed bulking for cassava multiplication