Golden cassava varieties (Vitamin A fortified)

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Summary

Millions of people in Sub-Saharan Africa are relying on cassava as the main food staple, but the crop varieties that are commonly grown by farmers have low levels of vitamins and minerals. This is an important cause of widespread malnutrition and hidden hunger on the continent, with 50% of children between 0.5 to 5 years suffering from vitamin A deficiency according to World Health Organization. Insufficient intake of vitamin A is the leading cause of preventable blindness in children, it compromises the immune system increasing the risk of death from diseases like measles, diarrhea and respiratory infections. Conventional and transgenic breeding techniques allow to raise the level of provitamin A in cassava and offer a viable avenue to sustainably improve nutrition in rural communities and add value for farmers. Roots of so-called golden or yellow-fleshed cassava are packed with beta-carotenoid which give its characteristic color, and after ingestion these compounds are converted into vitamin A by enzymes as per the need in the body, which results in balanced nutrition unlike is the case for synthetic supplements. A range of golden cassava varieties have been released and are marketed in Sub-Saharan Africa, and through close collaboration between seed companies, farmers, policy makers and researchers these seed technology has been successfully scaled in major growing areas.

Technical Description

Golden cassava varieties can be developed by crossing natural lines that have elevated provitamin A content with elite land races and hybrid lines that got high yield potentials and improved agronomic traits such as disease resistance and drought tolerance. These biofortified varieties are containing six to 15 micro-grams of beta-carotene per gram, which makes the roots yellow. Breeding techniques assisted by genetic markers enable rapid development of golden cassava varieties that contain 2 to 3 times more provitamin A than the original parent material from which it was developed, reaching levels that allow to fulfil a large part or all of the nutritional requirements in communities who depend on this food as staple. Genomic modification is further used to silence the activity of enzymes that breakdown provitamin A, and does not reduce yield potential and interfere with other agronomic traits. Scaling programs for golden cassava in Sub-Saharan African countries demonstrated to be highly effective in reducing vitamin A deficiency and related health issues in children and adults, and have boosted value creation for farmers at the local and regional scale by increasing the production and value of grain.

Uses

Golden cassava varieties are highly suitable and cost-effective for tackling malnutrition in rural communities that rely on the crop as staple food. Lines of provitamin A bio-fortified cassava are available for a wide range of growing areas in Sub-Saharan Africa, and can be adapted to the conditions in any type of agro-ecosystem. Studies on public acceptance show that consumers do not object to the color and like the flavor of provitamin A enriched cassva. There is a range of open pollinating lines of golden cassava that can be multiplied by community and private enterprises that enable to rapid scaling and commercialization in growing areas. Hybrid types of provitamin A enriched cassava typically possess other improved traits that make them highly appropriate for farming systems where production is limited by diverse challenges, but are more expensive to buy.

Composition

Golden cassava varieties have been developed that are suitable for major production zones in African countries and achieve a similar or higher yields than natural or hybrid lines under a range of soil and weather conditions; e.g., UMUCASS 36, UMUCASS 37, and UMUCASS 38. In Nigeria and Benin various lines of vitamin A fortified cassava have been successfully released to hundred thousands of farmers.

Means of application

Yellow-fleshed cassava varieties are multiplied and cultivated 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 in order to control infections and associated yield losses. Different modes for planting can 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. Because of their high nutritional value, roots from golden cassava varieties are perfectly suited for manufacturing of flour or processed foods, such as bread, garri or crisps, which can be retailed on local and international markets.

Agroecologies	All Agroecologies.
Regions	Africa South of Sahara.
Developed in Countries	Nigeria.

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

Commercialization

Commercialization Category

Commercially available

Startup Requirements

1) Define quality parameters, norms and screening methods for golden cassava varieties from the viewpoints of all actors in the cassava value chain, 2) Multipliers and seed companies in the region need to produce and market high quality seed that get the same or higher root yield than non-biofortified varieties, 3) Link seed suppliers, cassava growers, food processors and consumer groups to create demand for nutritional food, and 4) Provide financial support for local suppliers and smallholder farmers that catalyzes investments and purchases of golden cassava planting material.

Production Costs

Development of golden cassava varieties involves advanced breeding techniques in the lab and screen house, and extensive testing of in the field that require significant investment from commercial and non-commercial breeders. The costs associated with producing lines with high carotene levels are not substantially different from a common hybrid variety that is not biofortified, making that prices for planting materials are similar. Farmers need to co-invest in fertilizer inputs, and crop and soil management practices, in order for the use of golden cassava to result in effective and sustainable increases of nutrition and income.

Customer Segmentation

Suppliers of cassava planting materials, Subsistence and commercial cassava producers

Potential Profitability

The selling price for golden cassava roots on markets in Sub-Saharan Africa is up to 20% higher than that of white non-biofortified types. Cultivating provitamin A enriched cassava thus offers has a substantial economic advantage over similar yielding varieties and non-improved types which makes it attractive for commercial and subsistence

farmers. Other traits of provitamin A rich varieties such as a short growth cycle, and resistance to drought and pests, reduce risks of crop failure that lead to more stable incomes, especially benefiting smallholder farmers that have limited financial resources to invest. Taste panel testing which compared cassava flour from white and golden varieties have shown that the latter biofortified type is preferred because it adds to the appetites of consumers. The beta-carotene in golden cassava is preserved during storage and processing, unlike common varieties in which a large amount of provitamin A is oxidized and forms off-flavors, thereby increasing

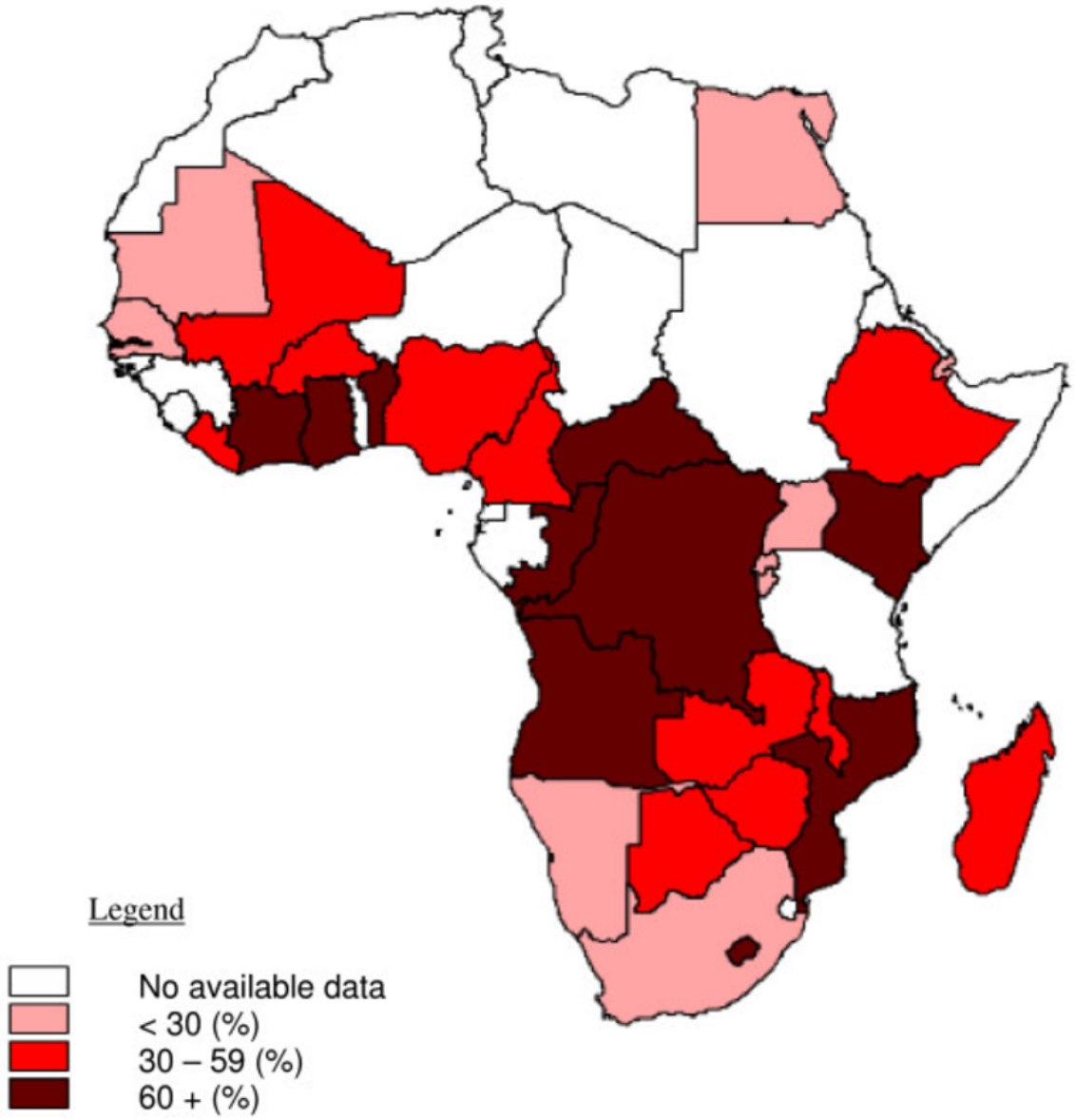
Licensing Requirements

Hybrid varieties of golden cassava are marketed under a commercial license, while open pollinating varieties are royalty-free for multiplication and sales by farmers but does require certification following national compliance for seed systems.

Innovation as 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


Legend
No available data
< 30 (%)
30 – 59 (%)
60 + (%)

Mowana™
MOWANA Mowana™ FOODS
Cassava Meal
YELLOW
GARRI
Gluten Free
all natural
MADE FROM 100%
CASSAVA GRANULES
Net Wt. 35.274 oz, 2.205 ibs (1kg)
Mowana™

Institutions

Accompanying Solutions

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