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New Crop FactSHEET

Cassava

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Common Names

Yuca
Tapioca
Manioc

Scientific Names

Species: *Manihot esculenta* Crantz
Syn: *M. ultissima* Phol
Syn: *M. aipi* Phol
Family: Euphorbiaceae

Uses

Cassava is grown for its enlarged starch-filled roots, which contains nearly the maximum theoretical concentration of starch on a dry weight basis among food crops. Fresh roots contain about 30% starch and very little protein. Roots are prepared much like potato. They can be peeled and boiled, baked, or fried. It is not recommended to eat cassava uncooked, because of potentially toxic concentrations of cyanogenic glucosides that are reduced to innocuous levels through cooking. In traditional settings of the Americas, roots are grated and the sap is extracted through squeezing or pressing. The cassava is then further dried over a fire to make a meal or fermented and cooked. The meal can then be rehydrated with water or added to soups or stews. In Africa, roots are processed in several different ways. They may be first fermented in water. Then they are either sun-dried for storage or grated and made into a dough that is cooked. Alcoholic beverages can be made from the roots.

Young tender leaves can be used as a potherb, containing high levels of protein (8-10% F.W.). Prepared in a similar manner as spinach, care should be taken to eliminate toxic compounds during the cooking process. One clone with variegated leaves is planted as an ornamental.

Origin

Cassava originated in Brazil and Paraguay. Today it has been given the status of a cultigen with no wild forms of this species being known.

Crops Status

Cassava is a perennial woody shrub, grown as an annual. Cassava is a major source of low cost carbohydrates for populations in the humid tropics. The largest producer of cassava is Brazil, followed by Thailand, Nigeria, Zaire and Indonesia. Production in Africa and Asia continues to increase, while that in Latin America has remained relatively level over the past 30 years. Thailand is the main exporter of cassava with most of it going to Europe. It was carried to Africa by Portuguese traders from the Americas. It is a staple food in many parts for western and central Africa and is found throughout the humid tropics. The world market for cassava starch and meal is limited, due to the abundance of substitutes.

GRAS Status

Toxicities

Cassava is famous for the presence of free and bound cyanogenic glucosides, linamarin and lotaustralin. They are converted to HCN in the presence of linamarase, a naturally occurring enzyme in cassava. Linamarase acts on the glucosides when the cells are ruptured. All plant parts contain cyanogenic glucosides with the leaves having the highest concentrations. In the roots, the peel has a higher concentration than the interior. In the past, cassava was categorized as either sweet or bitter, signifying the absence or presence of toxic levels of cyanogenic glucosides. Sweet cultivars can produce as little as 20 mg of HCN per kg of fresh roots, while bitter ones may produce more than 50 times as much. The bitterness is identified through taste and smell. This is not a totally valid system, since sweetness is not absolutely correlated with HCN producing ability. In cases of human malnutrition, where the diet lacks protein and iodine, underprocessed roots of high HCN cultivars may result in serious health problems.

Traditional Medicinal Uses

Medicinal uses for cassava are not well-documented.

Botany

Taxonomy

Early literature on cassava described the genus with two edible species, *M. ultissima* Phol or sweet and *M. aipi* Phol, delineating species which have high and low cyanogenic glucoside concentrations respectively. More recently cassava was classified as all being the same species *M. esculenta*. It is the only one of 98 species in its family that is widely cultivated for food production. Cassava uniformly is 2n = 36. Other ploidy levels are not utilized, but have been produced experimentally. There are several closely related species found in the tropical and subtropical Americas that can be crossed with *M. esculenta*.

Crop Culture (Agronomy/Horticulture)

Ecology

Cassava is a tropical root crop, requiring at least 8 months of warm weather to produce a crop. It is traditionally grown in a savanna climate, but can be grown in extremes of rainfall. In moist areas it does not tolerate flooding. In drouthy areas it looses its leaves to conserve moisture, producing new leaves when rains resume. It takes 18 or more months to produce a crop under adverse conditions such as cool or dry weather. Cassava does not tolerate freezing conditions. It tolerates a wide range of soil pH 4.0 to 8.0 and is most productive in full sun.

Cultivars

Before the development of national and international breeding programs with cassava there were relatively few cultivars. This is because cassava is propagated vegetatively as clones. Recent releases from breeding programs include clones with resistance to many of the major diseases and pests. Specific cultivar names are mostly regional, with the exception of introductions from international research centers, which carry with them an institutional code. This code is often retained as the name of the cultivar. Cultivar classification is usually based on pigmentation and shape of the leaves, stems and roots. Cultivars most commonly vary in yield, root diameter and length, disease and pest resistance levels, time to harvest, cooking quality, and temperature adaptation. Some clones require 18 or months of growth before they can be harvested. Storage root color is usually white. A few clones have yellow-fleshed roots.

Most clones were selected by farmers from chance seedlings in their fields. Each growing region has its own special clones with farmers growing several different ones in a field.

Production Practices

Cassava is planted using 7-30 cm portions of the mature stem as propagules. The selection of healthy, disease-free and pest-free propagules is essential. The stem cuttings are sometimes referred to as 'stakes'. In areas where freezing temperatures are possible, the cuttings are planted as soon as danger of frost has past. The cuttings are planted by hand in moist, prepared soil, burying the lower half. When soils are too shallow to plant the cutting in an upright or slanted position, the cutting are laid flat and covered with 2-3 cm soil. Mechanical planters have been developed in Brazil to reduce labor inputs. Observing the polarity of the cutting is essential in successful establishment of the cutting. The top of the cutting must be placed up. Typical plant spacing is 1m by 1m. Cuttings produce roots within a few days and new shoots soon appear at old leaf petiole axes on the stem. Botanical seeds are used only for breeding purposes. Early growth is relatively slow, thus weeds must be controlled during the first few months. Although cassava can produce a crop with minimal inputs, optimal yields are recorded from fields with average soil fertility levels for food crop production and regular moisture availability. Optimal growth and productivity of the plant is related to its harvest index, root weight divided by total plant weight. The desirable indexes range from 0.5 to 0.7. Responses to macro-nutrients vary, with cassava responding most to P and K fertilization. Vesicular-arbuscular (VA) mycorrhizae benefit cassava by scavenging for phosphorus and supplying it to the roots. High N fertilization, more than 100 kg of actual N/ha may result in excessive foliage production

at the expense of storage root development and a low harvest index. Fertilizer is only applied during the first few months of growth. Commercially produced fungicides and pesticides are seldom used, with none being registered for use in the U.S.A. There is no mature stage for cassava. Plants are ready for harvest as soon as there are storage roots large enough to meet the requirements of the consumer. Under the most favorable conditions, yields of fresh roots can reach 90 t/ha while average world yields from mostly subsistence agricultural systems are 9.8 t/ha. Typically harvesting can begin as soon as eight months after planting. In the tropics, plants can remain unharvested for more than one growing season, allowing the storage roots to enlarge further. However, as the roots age, the central portion becomes woody and inedible.

Harvesting

Most cassava is harvested by hand, lifting the lower part of stem and pulling the roots out of the ground, then removing them from the base of the plant by hand. The upper parts of the stems with the leaves are removed before harvest. Levers and ropes can be used to assist harvesting. A mechanical harvester has been developed in Brazil. It grabs onto the stem and lifts the roots from the ground. Care must be taken during the harvesting process to minimize damage to the roots, as this greatly reduces shelf life. During the harvesting process, the cuttings for the next crop are selected. These must be kept in a protected location to prevent desiccation.

Processing

The shelf life of cassava is only a few days unless the roots receive special treatment. Removing the leaves two weeks before harvest lengthens the shelf life to two weeks. Dipping the roots in paraffin or a wax or storing them in plastic bags reduces the incidence of vascular streaking and extends the shelf life to three or four weeks. Roots can be peeled and frozen. Traditional methods include packing the roots in moist mulch to extend shelf life.

Dried roots can be milled into flour. Maize may be added during the milling process to add protein to the flour. The flour can be use for baking breads. Typically, cassava flour may be used as partial substitute for wheat flour in making bread. Bread made wholly from cassava has been marketed in the U.S.A. to meet the needs of people with allergies to wheat flour.

Fresh roots can be sliced thinly and deep fried to make a product similar to potato chips. They can be cut into larger spear-like pieces and processed into a product similar to french fires.

Roots can be peeled, grated and washed with water to extract the starch which can be used to make breads, crackers, pasta and pearls of tapioca.

Unpeeled roots can be grated and dried for use as animal feed. The leaves can add protein to animal feed.

Industrial uses where cassava is used in the processing procedures or manufacture of products include paper-making, textiles, adhesives, high fructose syrup and alcohol.

Germplasm

Collections

The largest germplasm collection is housed at the International Center for Tropical Agriculture (CIAT) in Cali, Colombia. The International Institute for Tropical Agriculture (IITA) in Ibadan, Nigeria maintains a germplasm collection for African needs. The largest national collection is in Brazil under the direction of the Brazilian Agricultural Research Network (EMBRAPA). All three institutions have breeding programs. Importation of cassava propagules into the U.S.A. is prohibited. This is to minimize the spread of the pests

and systemic diseases of this important food crop. Where permitted, plants in tissue culture can be safely exchanged if certified disease-free.

Commercial Seed Sources

There are no commercial seed sources for cassava in the U.S.A.

Key References

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