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Cassava (Manihot esculenta Crantz) a Tropical Root Crop



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The Crop

Cassava, also known as yuca, mandioca, tapioca, and manioc is one of the most important human food crops in the tropical countries. The genus Manihot is a member of the Euphorbiaceae family and is represented by over 100 species. According to a FAO report, at least 300 million persons depend on cassava as their main food source.

The plant is quite frost sensitive, but some cultivars are found where occasional frosts occur, such as in southern Brazil or above 6,000 feet elevation. Because varieties are broadly adapted to moist and dry conditions, they are useful in regions of monsoonal rains.

Geographic Distribution

Cassava is grown world-wide, mostly in regions loosely defined as the "lowland tropics."

Although it is undoubtedly an American crop, having a primary center of origin in northern South America (Brazil, Guianas) and a secondary center in Mesoamerica (Mexico, Guatemala, Honduras), it is cultivated between 30° North and South latitudes at elevations ranging from sea level to 6,000 feet.

Production

Production statistics are inaccurate, as a large portion of the crop is consumed locally and does not enter into commerce. However, data available (FAO) indicates that, in 1964, 83,200,000 tons of roots were produced on 9,000,000 hectares, giving an average yield of 9.2 tons/ha. Africa is the world's largest regional producer, while Brazil produces more cassava than any other individual country.

Cassava is often described as back-yard crop. Large acreages seldom are grown on a farm, each family having a planting sufficiently large to support its needs. There are areas, largely in Brazil and Thailand, where the crop is grown to provide both for local requirements and as a cash-crop export to temperate zones. It is grown in pure stands or in multiple cropping schemes, mixed with corn, bananas or sweet potato.

Yield and Nutritional Value

As an unprocessed food cassava is consumed as a boiled or fried root or as a

crude flour. Commercial products that can be derived from cassava include starch for paper sizing, laundry starch, adhesives and tapioca. Fresh or dried roots are used as animal feed.

Maner and coworkers in the Colombian Agricultural Research Institute have conducted extensive feeding trials with swine using as the major source of energy cassava in green chopped, dried flakes and silage forms.

Cassava is considered a prodigious producer. Although the world average is 9.2 tons per hectare, some countries, Brazil, Thailand, Cambodia and Bolivia have national averages ranging from 14 to 18 tons/ha.

Where cassava is well tended as a plantation crop for commercial use, average yields of 24 tons/ha. are common, and 50 to 100 tons/ha. yields have been reported from individual plantings. One cultivar "Llanera," collected in the eastern plains of Colombia by the Colombian Agricultural Research Institute, has yielded more than 100 tons/ha. in rich black soils and in a 10 month period.

Cassava is a long-term crop, ranging from 10 to 18 months or longer from planting to harvest, and it contains about 30 to 40 percent dry matter. An average yield of 10 tons and an exceptional yield of 80 tons would produce 3 and 24 tons of edible dry matter, respectively.

Generally, cassava varieties are not outstanding nutritionally. Roots contain relatively small amount of protein (usually 0.5-1.5 percent) and fractional percentages of fat, vitamins and minerals. Analyses of 87 Colombian cultivars have shown that it is possible to find clones with a much higher level of protein. One of the collected cultivars contained 7.25 percent protein, (based on $N_2 \times 6.25$ calculations, with 0 percent moisture content). However, a portion of the total nitrogen present in cassava may be non-protein nitrogen and of low nutritive value for single stomach animals. The amino acids are similar to those of corn, with methionine being low, but with a content of threonine twice as high as in corn.

Cassava leaves are rich in protein. One survey of varieties showed a range of 3.7-10.7 percent protein on a fresh weight basis and of 21 to 36 percent on a dry weight basis. The essential amino acids are well represented having a deficiency in methionine only. Lysine content of 5.6 to 8 percent is acceptable.

There are toxic and non-toxic cassava varieties. The toxicity is due to the presence of hydrocyanic acid (HCN) which is derived from linamarin, a glucoside. Other glucoside, lotaustralin can be present also in minute amounts. Sweet or non-toxic varieties have a content of less than 50 mgr. of HCN per kilogram of fresh roots, while bitter, toxic types have a HCN content well over 100 mgr. per kilogram.

Plant Protection

An index of the lack of attention to cassava diseases is that in 1966 The Review

of Applied Mycology has 2 references to cassava diseases, 17 to carnation diseases and 234 to research on tobacco diseases.

In general, the literature implies that diseases and pests are not important on cassava, although sound information in the area is scarce. Mosaic, one of the known virus diseases of cassava, was estimated in 1956 to have caused an 11 percent loss in the British African colonies, and fields showing 100 percent mosaic infection yielded a ton or less per hectare. This suggests that competent surveys would reveal major international losses resulting from diseases and pests.

The most important pests in Colombia are the spider-mite (Mononychus planki); horn worm (Erinnys elow); Lonchaca chalybea and Cecidomyia cecropiae of the Dipterae, and thrips.

Agronomic Research

The Colombian Agricultural Research Institute has conducted some research to determine the best cultural practices for specific varietal types. For the cultivar "Llanera," some preliminary work shows the following results:

Spacing: The best spacing has been found to be 2x1 meters in the deep rich soils of the Cauca Valley.

Fertilization: In the Cauca Valley soils, no response has been obtained with up to 75 kg of N, 100 kg. of P_2O_5 and 75 kg. of K_2O per hectare.

Planting System: The best yields so far have been obtained from plantings made on raised beds, versus planting on the flat.

Type of Cutting: A stake of 3 cm. in diameter, seems to favor higher yields with up to 12% higher production, over 1 cm. stakes.

Although important as a food crop in the tropics, cassava has not been thoroughly studied on a continuous basis. Furthermore, the fact that it yields as well as it does, despite lack of improvement through plant breeding, would indicate that it could be vastly more productive than at present. Although cassava does not produce more yield or calories per day than most cereals, it does produce high yields in unfavorable ecologies where the principal cereals could not be grown under the same conditions.

For these reasons, strong research efforts are justified and these should include varietal improvement, development of an efficient production system, plant protection, and utilization. These areas of work constitute the core of CIAT's proposed research program to improve cassava production in the tropics.

CIAT has started a collection of the variability present in Colombia and up to now over 1300 entries have been collected. Collection in other latinamerican tropical countries has also started, with a collection trip being conducted in Ecuador at present.

The cultivars and wild species of *Manihot* are established in CIAT's experimental farm near Palmira, Colombia, and are being observed and classified, as a basis for future improvement work.