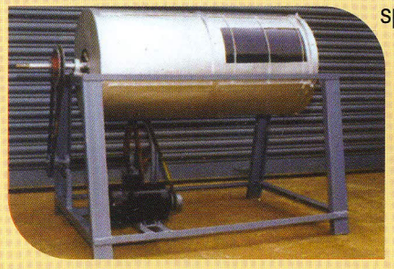
FEED GRANULATOR

The low palatability of the cassava based feed due to the powdery nature of flour gave way for the particle size up gradation by the process of pelleting, granulation or globulation. Development of a centrifugal granulator for feed preparation based on cassava flour offers better scope for the *in situ* consumption and farm scale processing of tubers.

A drum type centrifugal granulator consisted of a cylindrical drum mounted horizontally on a shaft installed on a trapezoidal angle iron frame work. Provision is made to spray water using a knapsack sprayer through one side of the drum while the granulator is in operation. A rectangular slot is provided at the down slope of the drum for feeding the materials and to take out the granulated feeds. The machine can be operated manually and also by an electric motor (3/4 hp). Flours of different feed formulations are fed to the granulator, started granulating by rotating the machine, simultaneously spraying the water using a knapsack sprayer and the resulting granules were dried. Feed granules of optimum properties can be obtained by adjusting the moisture content, rotational speed and time. The capacity of the machine worked out to be 20 kgh^{-1}



LIQUID ADHESIVE PLANT

Tuber starch forms an important ingredient in the manufacture of liquid adhesive or gums. The gums produced by incorporating starch has good flow characteristics, ready for use and ideal for small scale industry. It has wide applications in carton sealing, corrugated board, bottle and container labelling, bill pasting cigarette seaming and paper bag making The liquid adhesive plant consists of a double concentric stainless steel drum, the annular space of which is filled with oil for heating with the help of strip heaters. A stirring mechanism is provided at the top cover of the drum to uniformly mix the suspension while heating. The gums after preparation is taken out by a hand pump. Starch suspension at predetermined concentration is taken in the drum and heated up to 70-80°C with continuous stirring to avoid lumps formation. Sodium hydroxide, borax and formaldehyde were added at different proportions to get good tack and storability of the final product.

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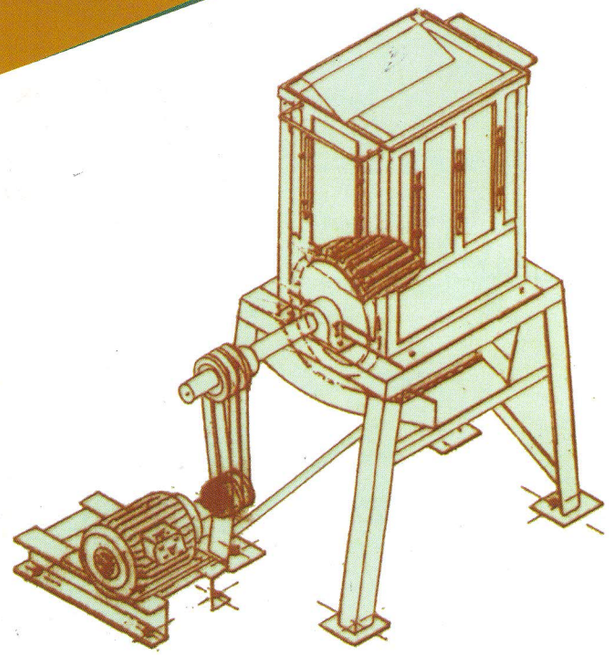
HARVEST AND POST HARVEST EQUIPMENT IN TUBER CROPS



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HARVESTING TOOLS

The conventional method of harvesting cassava is quite strenuous and slow process. Sometimes, damage in the form of cuts, bruises or complete breakage of roots occurring during the process of uprooting causes microbial infection reducing the storage life of the tubers. Cassava uprooting tools based on the principle of lever are low cost tools to reduce the effort of lifting of the tubers. The first order lever type harvesting tool comprises of a long lever supported on a fulcrum which in turn is supported at the top of a stand. The shorter arm is bent down and has a stem holding mechanism at its far end. During operation, the jaws open just enough to get around the cassava stem under spring tension on one side and rope tension on the other side. As the longer arm is lowered the rope tension increases, holding the .jows around the stem tightly. Further lowering of the longer arm uproots and raises the cassava plant out of the soil. The tool has a mechanical advantage of four i.e., reduce the effort of lifting the tubers to about one fourth. Second order lever type harvester has a mechanical advantage of 3.4. The height of the fulcrum at the far end of the lever can be adjusted which facilitates uprooting of cassava plants raised on flat bed as well as on mounds or ridges. A self- tightening mechanism has been used to grip the cassava stem between the two jaws. Initially the jaws are opened by means of a metallic wire rope to get a hold around the stem. After gripping the stem, the plant is uprooted by raising up the effort end of the lever. If the plant is uprooted by applying few gentle jerks, instead of a one-stroke uprooting, the tubers do not break and get easily detached from the soil.

First order lever type

second order lever type

CASSAVA CHIPPING MACHINES

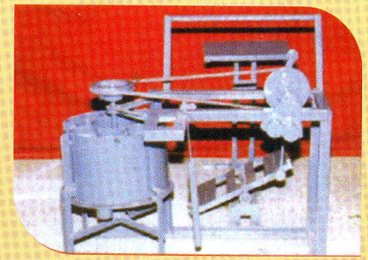
Conventional method of chipping cassava tubers by hand-knives produces about 10 to 40 kg h^{-1} for chip thickness varied from 2.7 to 12.5 mm. The chipping machines has the following advantages:

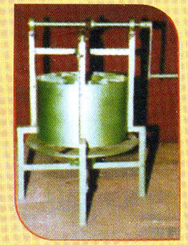
- higher output
- low operational cost
- moderate initial cost
- accommodates all sizes of tubers
- easy to operate
- requires no special skill to operate
- production of uniform chips
- adjustable chip thickness
- convenience of feeding the tubers into the machine.

The basic parts of these machines are two concentric mild steel drums, the annular space between which is divided into compartments for feeding the tubers. A rotating disc at the bottom of the drum carries the knives assembly. Thickness of chips can be changed by introducing spacing washers between the disc and the blade. Tubers are fed into the compartments from the top and the chips are collected at the bottom.

In the hand operated chipping machine, a pair of H.S.S. bevel gears is provided to operate the machine manually with a crank arm. The pedal operated chipping machine is a modified version of the earlier prototype with additional provision of a pivoted pedal for transmitting the power to the cutting disc through suitable belt and pulley drive mechanism. The motorized chipper is run with a 0.5 hp single phase motor through suitable belt drive.

The outturn of the hand-operated cassava chipping machine is from 40 to 120 kgh^{-1} for chip thickness varied from 2.3 to 6.9 mm. The capacity of the pedal operated machine ranged from 80 to 770 kgh^{-1} for increase in chip thickness from 0.9 to 6.9 mm. The output of the motorized machine ranged from 290- 1090 kgh^{-1} for chip thicknesses from 2.5 to 9.9 mm .



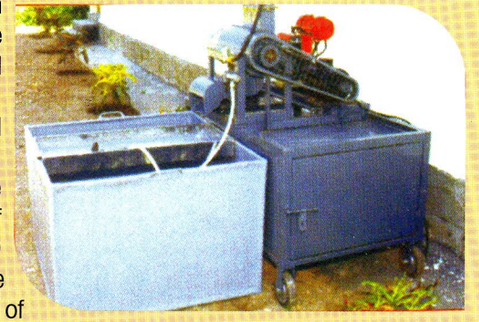


STARCH EXTRACTION EQUIPMENTS

Extraction of starch from raw tubers is generally done by wet extraction methods. The tubers after washing and peeling are crushed by adding enough water to get a pulp or mash and sieved with excess water to remove the fibrous residues. The starch milk passing through the sieve is channeled for settling in settling tanks or tables. When starch granules settle down, the supernatant water is decanted and the moist starch is crumbled and sun dried. In order to facilitate *in situ* starch extraction in the villages for value addition, different types of starch extraction equipments are available.

MOBILE STARCH EXTRACTION UNIT

The major components of the machine are hopper to feed the tubers, crushing disc or cylinder with nail punched protrusions rotating inside crushing chamber to crush the tubers, sieving tray to remove the fibrous and other cellulosic materials, stainless steel tanks to collect the sieved starch suspension, tuber storage chamber, handle and wheels for easy transportation from place to place and a frame to support these components. Addition of water during the processing can be controlled through a water pipe with holes fixed inside the hopper along its length and during sieving by a shower attachment connected to the water line. An electric motor (1 hp) or a generator (kerosene - petrol) attached to the frame can be used as the energy source to operate the machine.



The recovery of starch by using this machine is 84.2, 75.1 and 39.6% for cassava, sweet potato and *Amorphophallus*, respectively with the crushing capacity of 200,135 and 120 kgh^{-1} for the above tubers. Rasping effect of the machine ranged from 61 .10 to 40.32%

CASSAVA RASPER

The rasper consists of a crushing drum made up of a mild steel pipe with power hacksaw blades fixed on its circumference. The crushing drum is fixed on a shaft, power to which is provided by 3 hp 3 phase electric motor with belt and pulley. The drum is rotated inside the crushing chomber which is made up of two halves, the upper being act as hopper and the bottom half portion acts as outlet for the crushed mash to flow. Gap between the blade set and crushing chamber is adjusted to minimum. A changeable sieve plate is provided in the bottom half to filter the starch pulp with out any bigger pieces. Capacity of machine ranged from 800 to 1000 kg h^{-1}