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**Proceedings of the Fourth Symposium of the  
International Society for Tropical Root Crops**

**Held at CIAT, Cali, Colombia, 1-7 August 1976**

**Edited by James Cock, Reginald MacIntyre, and Michael Graham**



**The International Society for Tropical Root Crops in collaboration with  
Centro Internacional de Agricultura Tropical  
International Development Research Centre  
United States Agency for International Development**

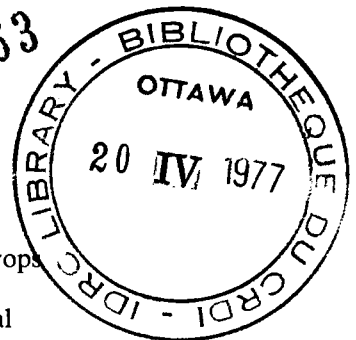
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**PROCEEDINGS**  
**of the**  
**FOURTH SYMPOSIUM**  
**of the**  
**INTERNATIONAL SOCIETY**  
**FOR TROPICAL ROOT CROPS**

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## A System of Food Delivery from Root Crops

T. O. M. Nakayama, James H. Moy, and Jose L. F. da Fonseca<sup>1</sup>

The production of stable convenience foods from root crops involves several steps that may be taken in diverse orders. For taro (*Colocasia esculentum*), it is possible to separate the acidity factors by gravitational means, stabilize the material by dehydration, and utilize it as the main component in a noodle like food that can be prepared by simple cooking. These steps are part of a larger study aimed at the entire system of delivering food calories from root crops.

The College of Tropical Agriculture of the University of Hawaii has engaged in production studies of taro for at least 75 years. The industry today is characterized by having one main product, poi. The College in cooperation with the U.S. Department of Agriculture has undertaken a study to elucidate the energy and materials requirements for a system that delivers food calories from root crops. The commodities chosen were taro (*Colocasia esculentum*) and sweet potato (*Ipomoea batatas*).

### Procedures

The areas of activity are: production; processing; and distribution. They were delineated by definite practical situations. Thus production and processing were enjoined when the cleaned root was put on the table. Likewise the processing and distribution phases were interfaced when a suitable stable product was produced. The product was tentatively described as being stable in storage at 38 °C for 1 year and rendered edible by using no more energy to prepare than that for cooking rice. The distribution phase was completed when the material was ingested.

Areas of activity were then translated into tasks which serve as the basic inputs for a systematic examination of the delivery system. The activities of the processing section on taro will be described here as an example of the study. The study on sweet potato will follow a similar format.

The task of the group is to transform the perishable raw food value (calories) into stable edible calories with a minimum of expenditure of energy and materials.

To accomplish this there were at least three tasks to be performed: processing to remove the acid taste, dehydration to stabilize the material, and storage to prolong the shelf life. Conceivably, there are several different routes in which these tasks could be performed. Likewise, there are many ways to accomplish each of these, either energy-intensive or labour-intensive.

### Results and Discussion

Removal of the acid taste could be accomplished by removal of the raphide (needles of calcium oxalate) containing cells (Sakai et al. 1972) or destruction of the acid factor by heat, i.e. processing at 121 °C for 1 h. The latter has the effect of gelatinizing the starch, which occurs at 75–85 °C (Goering and De Haas 1972) and renders the material difficult to dry. It was found that the raphide-containing cells could be removed by settling. Thus the settled material contained 0.16% calcium, whereas the supernatant suspended material contained 0.03% Ca (w/w). The acid taste was only apparent in the settled residue. Dehydration was studied by solar, hot air, vacuum, and freeze-drying. It was found that all of the methods could effectively dry the material in the form of slices under the conditions in Hawaii. Yields of dry material averaged 27–31% based on the fresh weight of corms. Residual moisture of the dried slices varied from 2.3 to 5.5% wet weight basis, with freeze dried samples having the lowest residual moisture and sun-dried samples the highest. A slurry could be dried at 60 °C in 4 h under similar conditions.

Materials prepared under these conditions are now being studied for changes in storage under adverse conditions of temperature and insect exposure.

The material so prepared could then be used to form noodles by a process of kneading, rolling, and cutting. It was found that the ma-

<sup>1</sup>Nakayama and Moy, Department of Food Sciences and Technology, University of Hawaii, Honolulu, Hawaii, and da Fonseca, Centro de Prequisas e Desenvolvimento, Bahia, Brasil. Journal Series Publication No. 2009 of the Hawaii Agricultural Experiment Station.

terial did not form noodles with the capacity to retain their shape upon boiling for 10 min. However, upon the addition of 10–20% soy flour, noodles that retained their shape were obtained. The addition is at the interface of processing and distribution. Such additions may be considered to be preventive measures to ensure against malnutrition induced by a convenient and inexpensive food staple.

## Conclusions

The production of stable convenience foods from root crops involves several steps that may be taken in diverse orders. For taro, it is pos-

sible to separate the acidity factors by gravitational means, stabilize the material by dehydration, and utilize it as the main component in a noodle like food that can be prepared by simple cooking. These steps are part of a larger study aimed at the entire system of delivering food calories from root crops.

Goering, K. J., and De Haas. *New starches. VIII. Properties of the small granule starch from Colocasia esculenta*. Cereal Chem. 149(6), 1972, 712–719.

Sakai, W. S., Hanson, Michael, and Jones, R. C. *Rhaphides with barbs and grooves in Xanthosoma sagittifolium (Araceae)*. Science, 178, 1972, 314–315.

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## Mechanization of Yam and Sweet Potato Production in Barbados

J. P. W. Jeffers<sup>1</sup>

A locally constructed planter and an imported transplanter were used to plant yam and sweet potatoes respectively on a field scale. Harvesting was carried out using a locally constructed harvesting-aid and an imported digger-elevator. The digger-elevator was successful in sweet potatoes, but will have to be modified to work on yams.

Yams (*Dioscorea alata*) and sweet potatoes (*Ipomoea batatas*) have long been cultivated in Barbados. Traditionally, they have been planted with sugar cane in either “thrown-out” or in preparation land. In recent years, due to the increasing labour shortage and to the physical effort involved, attempts have been made to mechanize the production of these crops. Mechanized production of sweet potatoes is very advanced, however mechanized planting of yams has been attempted but not yet perfected.

Preparation land may be cultivated with ridges 168 or 84 cm apart in keeping with the practice of planting sugar cane on ridges 168 cm apart. It is now recommended that the 84-cm ridges be used for yams and sweet potatoes rather than the previously used 168 cm. This recommendation is based on earlier work where we showed that larger yields and better

sized and shaped tubers were obtained from the smaller ridges.

## Mechanized Production of Sweet Potatoes

Sweet potato slips are normally planted by hand and after one or two hand weeding are harvested with a garden fork. This production method is labour intensive, time consuming, and physically laborious.

### Planting

A mechanical two-row transplanter was obtained in 1973 for use mainly with vegetable crops. We decided to plant potato cuttings or “slips” with the transplanter, and changed only the seating arrangement to seat four persons. The land was ploughed and harrowed to obtain a well cultivated flat seedbed. The transplanter was then used to plant the slip burying the butt end at least 10.6 cm in the soil. In operation, the planters work in pairs, one pair to a row.

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<sup>1</sup>Ministry of Agriculture, Science and Technology, Bridgetown, Barbados.