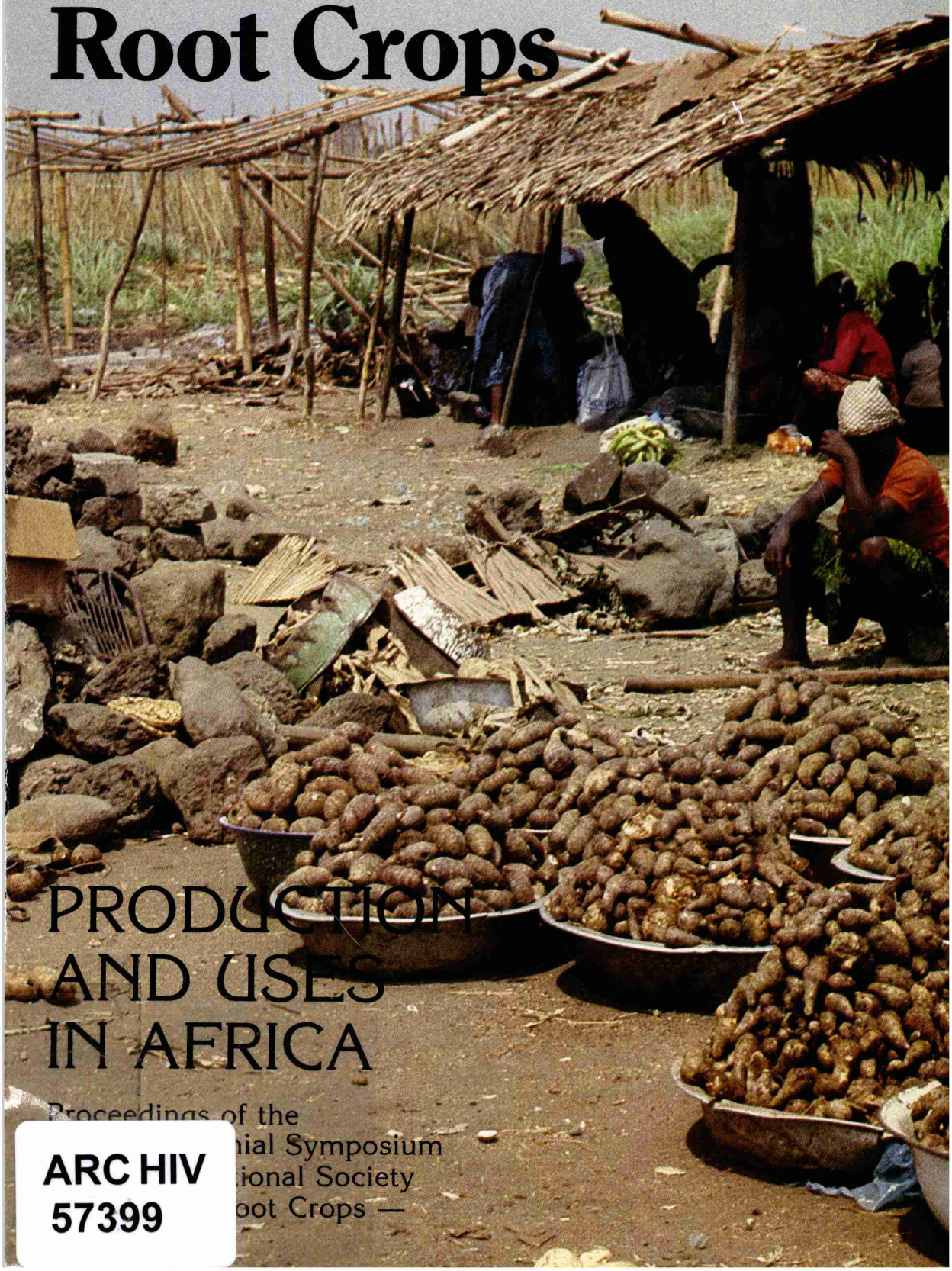
Tropical Root Crops



PRODUCTION AND USES IN AFRICA

Proceedings of the
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The International Society for Tropical Root Crops — Africa Branch was created in 1978 to stimulate research, production, and utilization of root and tuber crops in Africa and the adjacent islands. The activities include encouragement of training and extension, organization of workshops and symposia, exchange of genetic materials, and facilitation of contacts between personnel working with root and tuber crops. The Society's headquarters are at the International Institute of Tropical Agriculture in Ibadan, Nigeria, but its executive council comprises eminent root and tuber researchers from national programs throughout the continent.

Postal Address: Box 8500, Ottawa, Canada K1G 3H9
Head Office: 60 Queen Street, Ottawa, Canada

Terry, E.R.
Doku, E.V.
Arene, O.B.
Mahungu, N.M.

International Society for Tropical Root Crops. Africa Branch, Ibadan NG

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TROPICAL ROOT CROPS: PRODUCTION AND USES IN AFRICA

Abstract

A mixture of original research, updates on procedures, literature reviews, and survey reports, this document resulted from the second symposium of the International Society for Tropical Root Crops — Africa Branch, with 77 participants from 16 countries. The focus was cassava, yams, cocoyams, and sweet potatoes, from the perspectives of breeders, agronomists, soil specialists, plant pathologists, entomologists, nutritionists, food technologists, etc. Learning from past successes and failures, many of the researchers directed their efforts toward problems obstructing progress in reaching improved production and use of root crops and attempted to view, realistically, the context in which their results would be applied.

Résumé

Résultats de recherches récentes, mises à jour sur les méthodes de recherche, revues de publications et rapports de sondages sont contenus dans ce document issu du Deuxième symposium de la Société internationale pour les plantes-racines tropicales — Direction Afrique, qui a réuni 77 participants de 16 pays. Des communications sur le manioc, le taro, le yam et la patate douce ont été présentées par des phytosélectionneurs, des agronomes, des pédologues, des phytopathologistes, des entomologistes et des spécialistes de la nutrition et des aliments, entre autres. Tirant leçon de leurs succès et de leurs échecs, beaucoup de ces chercheurs ont dirigé leurs efforts vers la solution des problèmes qui entravent l'augmentation de la production et de la consommation des plantes-racines et ont tenté de considérer d'un œil réaliste le contexte qui sera celui de l'application de leurs recherches.

Resumen

Una mezcla de investigaciones originales, actualizaciones de procedimientos, reseñas de literatura e informes de encuestas, este documento es el resultado del segundo simposio de la Sociedad Internacional de Raíces Tropicales, Filial Africana, que contó con 77 participantes de 16 países. El simposio se centró en la yuca, el ñame, el cocoñame y las batatas, desde la perspectiva de los fitomejoradores, los agrónomos, los especialistas en suelos, los patólogos vegetales, los entomólogos, los nutricionistas, los tecnólogos alimenticios, etc. A partir de los éxitos y fracasos anteriores, muchos de los investigadores encaminaron sus esfuerzos hacia los problemas que obstaculizan el avance para lograr una producción y un uso mejorados de las raíces y trataron de obtener una visión realista del contexto en que los resultados pueden ser aplicados.

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TROPICAL ROOT CROPS:
PRODUCTION AND USES IN AFRICA

EDITORS: E.R. TERRY, E.V. DOKU, O.B. ARENE, AND N.M. MAHUNGU

PROCEEDINGS OF THE SECOND TRIENNIAL SYMPOSIUM OF THE INTERNATIONAL SOCIETY FOR TROPICAL ROOT CROPS — AFRICA BRANCH HELD IN DOUALA, CAMEROON, 14 – 19 AUGUST 1983

CONTENTS

PERFORMANCE OF A CASSAVA PEELING MACHINE

P.M. NWOKEDI[1]

Peeling constitutes a major problem in cassava processing in Nigeria. At present, the method of peeling is usually manual. This paper discusses the development, design, and manufacture of a peeling machine suitable for village use. The machine is an oval chamber that has holes cut along the walls and is lined with sharp wire gauze. Cassava roots are loaded in the chamber, which is mounted on two mild-steel rods, 35 cm in diameter, attached at either end. The rods allow the chamber to rotate clockwise. The left rod is connected to a 5-hp electric motor by means of a v-belt pulley. Thirty balls coated with wire gauze are added to the chamber. The machine is mounted on an angle — 33°. The angle permits the sharp edges of the chamber and balls to carry out effective abrasive peeling. The roots are cleaned as they are being peeled, the chamber passing through a water-filled pan underneath it.

Peeling is the most labour-intensive operation in processing cassava for use in traditional dishes in Nigeria. At present, peeling is done by hand. A peeling machine suitable for use at the village level would alleviate the drudgery involved in cassava processing and open the way for processing on a larger scale than household production. This thinking prompted my colleagues and me at the National Root Crops Research Institute (NRCRI) to design, manufacture, and test such a machine.

In designing the machine, we had to allow for the many variations in size and shape of roots from current varieties of cassava. The weight varies between 30 g and 400 g and there are spindle-shaped and carrot-like roots. The peels also vary in thickness, texture, and strength of adhesion to the root's flesh. The properties vary with the age of the roots both before and after harvest. Our task, therefore, was to design a peeling machine that would handle any roots from any source all year round.

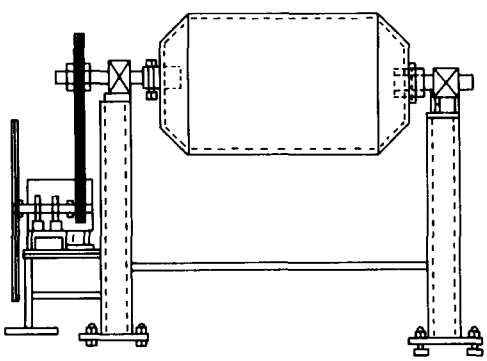


Fig. 1. *Front view of cassava peeler.*

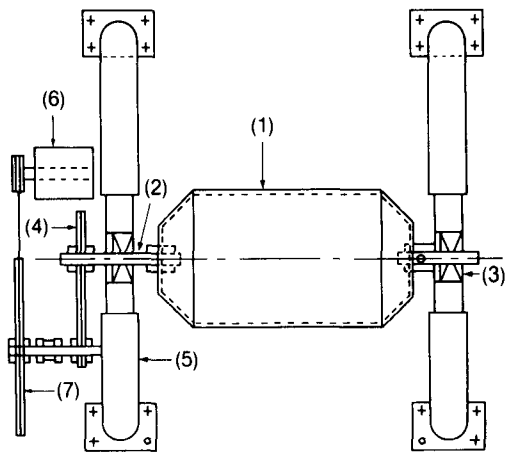
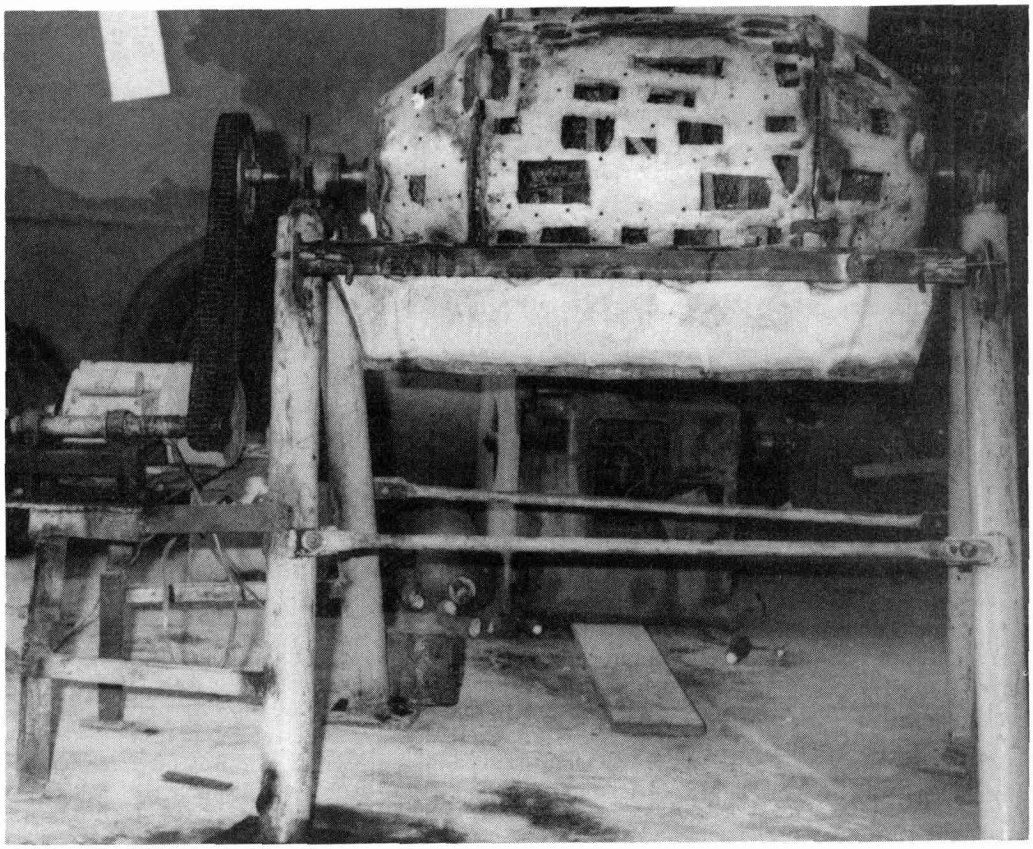


Fig. 2. *Plan for cassava peeler: (1) chamber, (2) support shaft, (3) roller bearing, (4) sprocket/chain, (5) frame, (6) electric motor, (7) pulley.*

Within these constraints, we devised a simple machine, an egg-shaped cylinder with an inner chamber or lining of sharp wire gauze. The cylinder has holes cut in the walls so that when it

[1] National Root Crops Research Institute, Engineering Research Department, Umudike, Umuahia, Nigeria.



The peeling machine is functional, simple to assemble, and inexpensive.

rotates through a water-filled pan mounted below it, the water passes through the holes to wash the roots. The cylinder is supported on 35-cm-diameter mild-steel pipes, attached at both ends. These pipes serve as short shafts that allow the cylinder to rotate clockwise. The left shaft is connected to a 5-hp diesel engine by means of a v-belt pulley. The chamber contains 30 balls that are also coated with wire gauze. The machine is mounted at an angle of 33°; in this position, the sharp-edged chamber and the balls carry out effective abrasive peeling of the cassava roots. The chamber rotates through the pan containing water. It can peel 300 kg of roots at one time. There are two protective galvanized plates that are attached to the sides of the water-pan to prevent water from spreading.

Performance Tests

We tested the performance of the cassava peeling machine with roots harvested from Western Farm (NRCRI). We divided 3000 kg roots into three batches — one batch was peeled that day, a second batch was peeled the next day, and the third batch was peeled by hand (the traditional method). All the roots were weighed before being peeled. Three persons performed the manual operation. Both the machine and manual operations were timed, and the peeled roots were weighed. Another series of tests were undertaken with 1000 kg roots, but this time the roots were cut into straight pieces and sorted by size — small, medium, and large — before being peeled by the machine.

Results and Discussion

Naturally, the ideal is that the machine will remove the peel completely without removing useful flesh (Odigboh 1978). Unlike yams or other tuber crops, the cassava has roots with a relatively loose peel or cortex. Hand-peeled roots average about 80% of the total weight of

unpeeled roots, that is, the peelings constitute about 20% of the total weight.

When the unsized sample was mechanically peeled, the weight of the sample was considerably lower than the hand-peeled control. The small roots were peeled before the large ones and had disappeared completely by the time the larger roots were peeled.

To quantify the performance based on the ratio of peeled and unpeeled roots, we used the equation E = W − Wa/W − We where E was peeling efficiency index; W was mass of unpeeled roots; Wa was actual mass of peeled roots; and We was mass of peeled roots that would be obtained if only the cortex were removed (0.95 − 1.8 W). The closer the value is to 1.00, the higher the peeling efficiency. E, when less than 1.00, corresponds to incomplete peeling. E greater than 1.8 indicates loss of useful root flesh.

The peeling machine was least efficient when handling unsized roots — 45%; hand trimming was necessary. In samples that were separated by size, some hand trimming was also necessary for the small roots, but the efficiency improved to 68%.

Performance was observed to be best for the medium and large roots, peeling being complete and the losses of flesh negligible. If not excessive, flesh loss is better than hand trimming, which is time-consuming. In addition, the machine efficiency was improved when the balls in the machine were various sizes.

The three people peeling roots by hand were able to peel 300 kg/day. Their peeling rate was lower on the 2nd and 3rd days than on the 1st day, probably because the roots dried out enough to make peeling by hand more difficult. The throughput in mass/unit time depends on the root sizes, with higher rates for larger roots. The machine's rate for unsized roots was 15 kg/h, whereas, for sized samples, was as high as 500–1000 kg/25 minutes. However, this rate does not include the time spent in cutting the cassava roots into straight chunks about 80–100 mm or sorting the cut pieces.

Conclusion

The cassava peeling machine has been perfected by the NRCRI for the past 3 years. The completion of the machine is planned this year. The peeler functions best with sized lots of cassava; when set up for a specific size range, it has a peeling efficiency of up to 80%. Because the cutting and sorting are time-consuming, the machine needs to be carefully adjusted to peel at maximum efficiency to offset the time and labour and to avoid hand trimming.