PRELIMINARY STUDIES ON THE MECHANICAL HARVESTING OF CASSAVA ROOTS IN NIGERIA

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SUMMARY

A mould board plough and a ridger exposed respectively approximately 75 and 81 percent of the roots of cultivar 53101. With either implement, about 40 percent of the roots were damaged and some were buried by the overturned soil. The third method using a ploughshare resulted in less, though still considerable root damage.

RESUME

Une charrue à versoir et une billonneuse ont déterré respectivement 75 and 81 pour cent environ de racines du cultivar 53101. Dans chaque opération 40 pour cent environ des racines ont été endommagées et certaines enfouies dans le sol. L'incorporation de soc à la charrue a limité les dégâts, mais de facon très peu sensible.

RESUMEN

Un arado de vertedera y un bordeador expusieron respectivamente 75 y 81%, aproximadamente, de las raíces del cultivar 53101. Con cualquiera de los dos un 40% de las raíces sufrieron daños y algunas fueron enterradas con el suelo volteado por los implementos. El tercer método, utilizando un arado de doble vertedera dañó menos las raíces, si bien que este daño aún fué considerable.

INTRODUCTION

Production of cassava in Nigeria is entirely manual from stem cutting, planting and weeding to tuber harvesting. It has been estimated that digging up the tubers alone during harvesting accounts for over 40 percent of the total cost of production[4].

There are three major problems involved in the mechanization of cassava root harvesting. These are:

1. The clearing of the above-ground parts of the plant.
2. Lifting and separation of the tubers from the soil with minimum damage.
3. Loading and transporting the tubers.

REVIEW

It is evident that, in the light of recent development in the processing and utilization of cassava tubers in Nigeria, peasant methods of production are inadequate to meet increasing food needs. Furthermore, labour is becoming more expensive, and if cost of production is to be kept to the minimum, mechanized cultivation and harvesting of cassava must be instituted.

Clearing the above-ground parts of the plant

At the time of harvest the vegetative growth above the ground weighs from 5 to 7 tons per hectare depending on cultivar and age. It is necessary to remove the top growth to make mechanical separation of the roots from soil and plant residue easier. Bates[1] suggested the use of a rotary saw or hedge trimmer for the operation of removing top growth. This equipment could be mounted in front of the tractor and powered by a separate engine, and a wide swath-board could be fitted to guide the cut stems clear of the row. Krochmal[2] suggested the use of a heavy shear in front of a tractor to push the tops down, and a rotary mower at the rear of the tractor to cut the felled tops into small pieces. The preliminary studies reported here tested the latter method which was considered the easier.

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Lifting the tubers

For lifting, Krochmal[2] reported on the use of a mould board plough as an aid to hand harvesting. Bates[1] discussed the possibility of using a potato spinner, but suggested himself that it would not be suitable for harvesting cassava tubers. Bates also suggested that the potato digger-lifter or the sugar beet harvester might be unsuitable. He suggested that, if a deep digger harvester were to be developed, to penetrate possibly 40-45 cm, the machine would then probably be too heavy in draught. Bates concluded by observing that harvesting equipment of an entirely new design is probably needed, a view we support.

METHODS AND RESULTS

A rotary chain chopper was fixed at the back of the tractor and its level adjusted so that the cassava stems were cut to ground level. The chopping was effective, but the debris left on top of the ridges posed two problems.

1. It was difficult to find the ridges. Time and heavy rainfall (1500mm) had reduced the ridges to less than 15 cm high. The chopped residues obscured the ridges.
2. The mass of chopped material caused serious clogging of both the ridger and plough used in lifting the tubers.

The problems were more serious when the lifting was done on the same day the top growth was cut. When the cut materials were allowed to wilt for about 48 hours after the chopping, the clogging of the implements was less serious.

Three different implements were tested for lifting the tubers. These were a mould board ridger (30 cm bottom), a general purpose mould board plough (30 cm bottom), and a mould board plough with the board removed leaving only the share.

The mould board ridger was set so that it split the ridge below the centre of the crest. The result of the test showed that an average of 75 percent of the roots were exposed to an extent that they could be picked by hand. There were three main difficulties encountered with this trial. The first was the clogging of the space between the ridger body and ridger frame with plant residues, thus disturbing the flow of soil round the vertical stem holding the ridger body. Secondly, some of the tubers that were lifted by the ridger were reburied under the upturned soil. Thirdly, over 40 percent of the tubers were broken or damaged.

The second method was the use of a mould board plough. The board was set to move the ridge to the side. With this method 81 percent of the tubers were sufficiently exposed so that they could be hand-picked. By this method also many tubers were reburied by the overturned soil and there were many damaged tubers.

The third method was the use of the mould board share, which was 30 cm long and 4 cm high. With this implement 83 percent of the roots were exposed for hand picking. There was less root damage than with the ridger body or the mould board plough.

Although the implements described above exposed the tubers to some extent, they can only be looked upon as adjuncts to reduce the tedium of, and the time required for hand harvesting. A desired cassava harvesting machine is one which will not only expose the roots, but also separate them from the soil and possibly load them into a container in one operation. The functional parts of such a harvester should consist of (i) A topping device for cutting and removing the above ground vegetation as described earlier.

(ii) A lifting device which not only lifts out the tubers irrespective of size, but does so with little or no breakage and with a minimum of power requirement.

(iii) A cleaning device which will bulk the cleaned tubers into containers, thus simplifying the loading problem.

DISCUSSION

The morphological characteristics of tuber development, in addition to the other physical properties of the plant are factors which must be considered before a reliable, functional lifting device can be achieved. Onochie, Makanjuola and Schulte (this book) discuss this further.

REFERENCES

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