RICE POST-HARVEST TECHNOLOGY IN NIGERIA: AN OVERVIEW OF THE CONTRIBUTION OF NATIONAL CEREALS RESEARCH INSTITUTE, BADEGGI

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ABSTRACT

Over the years, successive Nigerian governments have put in place several programmes with a view to closing Rice supply-demand gap. In 2003, the government initiated activities that led to the programme on increased rice production and processing. This paper highlights the contribution of the Agricultural Engineering Research and Fabrication unit of the National Cereals Research Institute, Badeggi towards achieving this aim. The institute has developed Rice threshing, parboiling, cleaning/grading and milling machines. It is also suggested that the government should put in enough resources to see to the multiplication of these machines to rural communities to enable rural farmers process their rice locally.

Keywords: Rice, Post-Harvest, Technology, Nigeria.

INTRODUCTION

Agriculture is traditionally characterized as the expected mainstay of the Nigerian economy. Thus it has many roles to perform in the course of the country's economic development (Owolorafe and Ogunjimi, 1999). In Nigeria today, rice is one of the most important staples. Consequently, the country has experienced a rapid growth of rice per capita consumption within the last three decades, from 5kg in the 60's up to 25kg in the late 90's (Bello, 2004). Nigeria produces about 3million tones of rice per annum out of its estimated demand of 5million tones leaving a demand gap of 2million tones per annum. The country resorted to rice import to meet the local demand. Imports rose steadily from $259million USD (N22.015billion) in 1999 to $756million USD (N96.012billion at $1=N127) in 2001-2002 respectively. Successive Nigerian governments have put in place programmes such as National Accelerated Food Production Programme, Operation Feed the Nation (OFN), The Green Revolution, Federal Rice Production Programme and Special Rice Production Programme (Japanese Grant-In-Aid Programme) all with a view of closing the supply-demand gap. These programmes have made their modest impacts, but the deficit still persists (Bello, 2004).

In 1953, a rice research station was established at Badeggi (now the headquarters of the National Cereals Research Institute (NCRI) by the Federal Department of Agriculture), with the national mandate for the genetic improvement of rice and to date it has been able to release for commercial production a total of 51 improved varieties of O. Sativa specie: 14 for upland, 29 shallow swamp, 5 irrigated and 3 for deep water swamp ecologies (Misari et al. 2001).

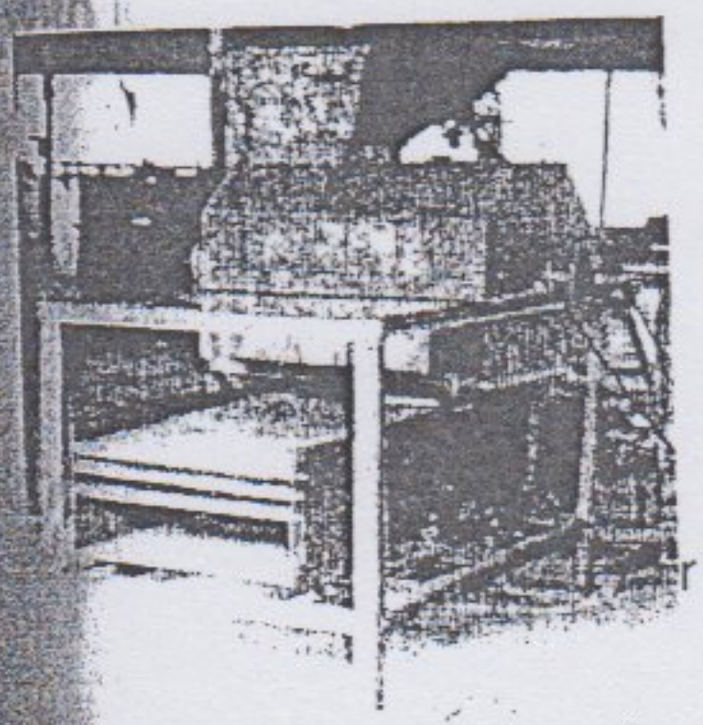
Post-Harvest grain loses significantly contributes to the low rice grain supply in Nigeria and consequently the wide gap between demand and supply of the commodity (Misari et al. 1999). The major task of Agricultural Engineering is to efficiently apply technological and engineering tools to increase the agricultural productivity and improve product quality, while conserving the environment. There is now the general awareness in Nigeria and other developing countries that the rapid development of agriculture depends to a large extent on the successful introduction of modern indigenous agricultural machinery (Dauda, 2003).

In line with this task, the Agricultural Engineering Research and Fabrication Unit of the National Cereals Research Institute, Badeggi has made remarkable developments in rice post-harvest technology. This paper

focuses on these achievements with the aim of promoting local rice processing in Nigeria.

THRESHING

Threshing is the first and most important post-harvest operation of grain crops. it involves the detachment of the grain from the stalk heads (Nkama, 1992). The traditional method of rice threshing in Nigeria could either be by beating the bundles against a solid object such as drums or logs of wood, foot threading or beating the bundle with sticks. Considerable levels of grain losses are experienced during the operations. This method is not only inefficient but also very laborious and the output is low resulting in delay in handling large volumes of harvested grain and subsequently leading to losses (Dauda and Adgidzi, 2002). Also it introduces considerable impurities into the paddy. A rice thresher was developed at the National Cereals Research Institute, Badeggi to minimize these problems (plate 1).



The main features of the rice thresher are: the hopper, the transmission unit, straw outlet, grain outlet and the supporting frame. The rice thresher works on principles of impact. Rice heads are fed uniformly into the hopper. The heads fall by gravity on the rotating cylinder and are threshed by impact of the spikes and are whirled round between the concave and the rotating cylinder. The grains and little chaff fall through the concave openings onto the collection chute/grain outlet, the blower air stream blows off the chaff over the second screen leaving behind clean grains (Dauda and Adgidzi, 2003). In contrast with the locally manufactured machines, the imported machines are usually prone to maintenance problems since the parts are not easily accessible locally(Dauda and Dzivama, 2004).

DRYING

Drying reduces the moisture contents of grain to a level that discourages the growth of micro-organisms. Most of the paddy produced in Nigeria is sun-dried. They are spread on mats, tarpaulins, flat rocks or specially prepared drying surfaces usually bare field. This method of drying is labour intensive and results in unevenly dried paddy. In the rainy season, significant amount of the grains are lost to microbial spoilage because of insufficient sunshine to dry the grain to a safe moisture level. In addition, sun-drying method exposes the grains to bird attack resulting in considerable losses (Misari et al. 1999). The National Cereals Research Institute, Badeggi uses a concrete platform dryer of two tones capacity which allows for drying of paddy at controlled rate and level and this enhances maximum head rice recovery during milling. It also affords the opportunity to maintain safe moisture content of 14% in poor weather conditions.

SEED CLEANING/GRADING

Freshly harvested seeds cannot be used for storage or sowing purposes because their physical conditions and quality needs to be improved. Seed processing improves seed condition and its quality. Rice seed processing is a selected conditioning operations on harvested seed lot and this is based on the physical characteristics of the crop seed and the contaminants so as to obtain a marketable seed of established standards (Dauda et al., 2002). In Nigeria, the art of seed processing is still the traditional method. Farmers keep part of the harvested grain lot for the next planting season. This practice has the disadvantage of transferring weed seeds from generation to generation and low viability because of the presence of high percentage broken, damaged and immature grains as well as other impurities.

National Cereals Research Institute, Badeggi has developed a seed cleaning/grading machine. The main features of the machine include: prime mover, feed hopper, transmission unit, reciprocating sieve assembly, grain outlet, blower and the frame. The sieve assembly comprises of three

sieves of different diameter perforations arranged at predetermined angles for free flow of paddy and is supported by four hangers on which it oscillates. The fan is positioned below the first sieve to achieve effective air/screen cleaning. Rice paddy is fed through the hopper onto the sieve assembly which is agitated by a cam to further grade the seeds (plate 2).

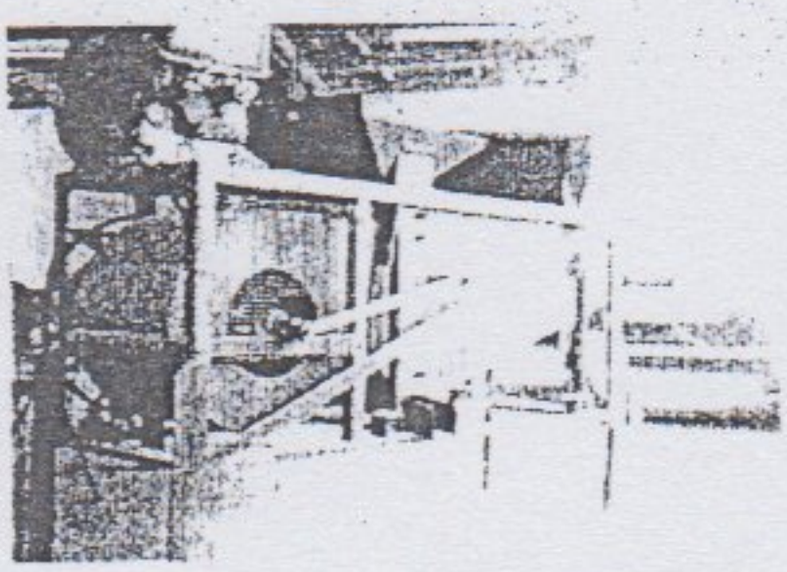


Plate 2: Rice cleaning/grading machine

PARBOILING

Rice being a hygroscopic material, can absorb water both as vapour and as a liquid, and thereby swells. Parboiling of rice toughens the kernel, resulting in less breakage during milling and thus increasing the yield of the finished rice (Dauda et al., 1999). In Nigeria, parboiling of paddy before milling is widely practiced. Local traditional method of parboiling involves soaking of winnowed paddy in cold water for about 24-48hrs. The soaked paddy is then transferred to a pot or drum that is half filled with fresh water and heated until the paddy cracks. Thereafter the parboiled paddy is sun-dried before milling. Rice grains processed in this way have poor characteristics. These includes undesirable odour due to fermentation resulting from over-soaking of the paddy, black specks due to partially filled and diseased grains that escaped winnowing and the impurities like sand and other soil contaminants packed along during threshing. Others are dirty brown or white belly appearance due to over parboiling or under parboiling respectively and broken grains resulting from over drying the parboiled paddy before milling.

The improved method developed by the National Cereals Research Institute, Badeggi has reduced the soaking time to a few hours (5-6hrs.) depending on the variety. This followed by steaming the paddy under atmospheric pressure (100°c) for 15-20mins. This hot water soaking method prevents fermentation odour inherent in the traditional method of parboiling. The steamed rice is first dried in the sun to 16% moisture content, then slowly dried to 13-14% in the shade and tempered for 12-24hrs. The milling product from this parboiling method has high milling recovery and high consumer acceptability, plates 3&4.

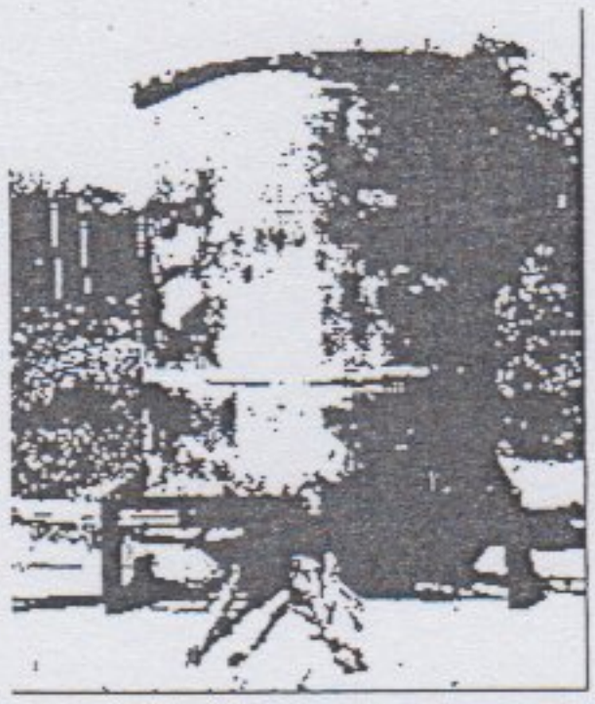


Plate 3: Single unit firewood parboiler

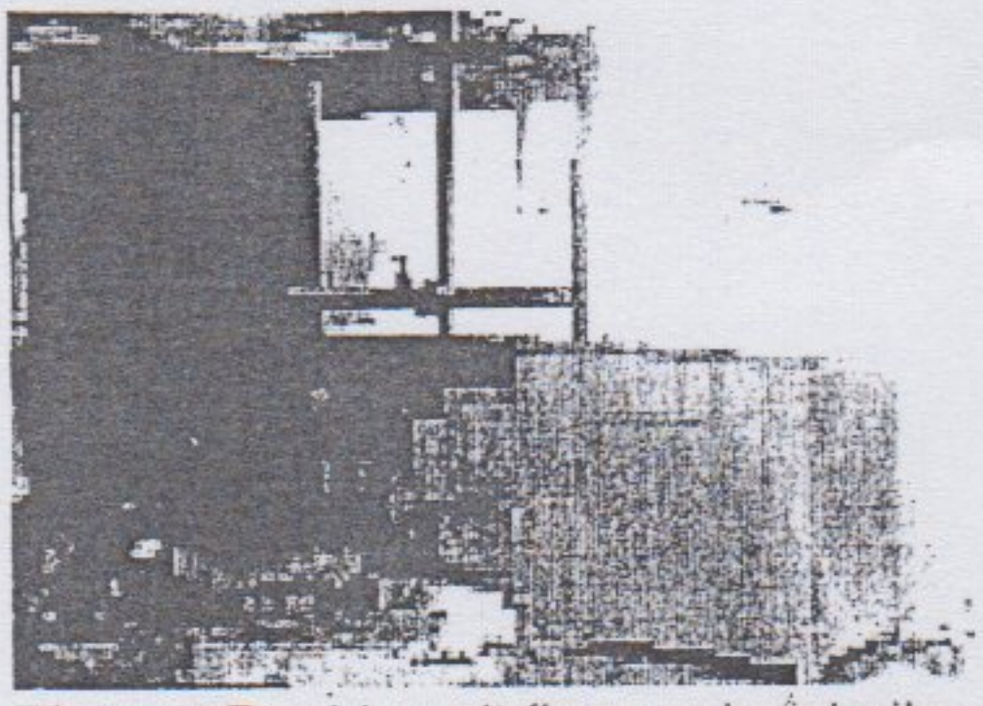


Plate 4: Double unit firewood parboiler

MILLING

Rice milling is the only rice processing operation that is mechanized to an appreciable extent in Nigeria. Four categories of mills are available in the country: the traditional mills, custom mills, improved custom mills and modern large scale mills.

The Traditional Mills involves hand pounding of paddy in a wooden mortar with pestle to separate the husk from the grain. This is followed by winnowing. This method however is tedious, labour intensive and inefficient.

Presently about 90% of the paddy rice milled in Nigeria is carried out by small scale custom mills with output of 230-290kg of milled rice per hour. These machines remove the husks and bran from the grain in one

operation. It is estimated that 30% of the existing mills are small (less than 200kg/hr). Grain coming out from such mills have poor quality and contain many broken grains.

Modern large scale mills constitutes only about 2% of these conventional industrial plants. They are equipped with sophisticated parts and accessories, and mill about 2% of the total paddy output in Nigeria. they process about 4 tonnes of paddy per hour with high percentage rice recovery.

The National Cereals Research Institute, Badeggi has developed mills having outputs of 0.5tonnes of milled rice per hour with two stage operation. They constitute about 18% of the total mills in Nigeria and mill about 8% of total paddy rice. They produce better quality rice than that from the one-pass mills. Investigations into the performance of some immediate commercial rice mills have shown that mills with rubber roll, fan, emery cone polisher or the National Cereals Research Institute mill with iron cylinders, produced rice with low broken grains (plate 5).

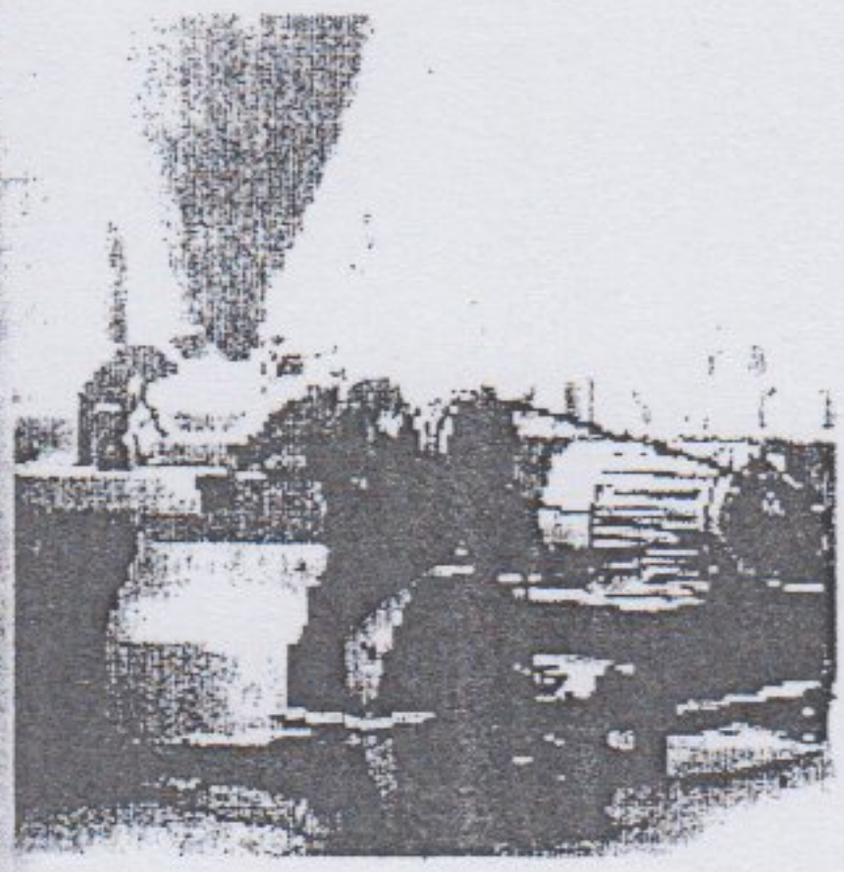


Plate 5. NCRI, Improved Custom Mill

CONCLUSION

An overview of the National Cereals Research Institute, Badeggi Rice Post harvest engineering efforts as it contributes to rice processing in Nigeria with the aim of achieving self sufficiency. The present self-sufficiency rating in Nigeria is about 84%, going by the Food and Agricultural Organization (FAO) reports. The country has the potentials to produce enough rice to meet local demands and even export the surplus.

Rice loss reductions tend to correlate with the extent of mechanization and at first glance, it might be considered that the most efficacious approach to reducing losses would be to increase mechanization.

The losses which occur during harvesting, storage and other handling phases in addition to threshing, drying, parboiling and milling are particularly dependent to some extent upon treatments accorded the rice prior to that stage.

In order to achieve these, the government should put in resources to fabricate more of these machines for distribution on co-operative basis to rural communities so as to enable the rural farmers process their paddy locally.

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