

HARVEST AND POST-HARVEST OPERATIONS

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Background information

Harvest and post-harvest operations constitute principal constraints to rice production, especially in irrigated systems, because of the larger yield that has to be handled. Post-harvest crop losses of up to 35% have been reported and attributed to inefficiency of manual threshing of rice by small-scale farmers. This leads to poor grain quality and rejection of locally produced rice. The Africa Rice Center has spearheaded partnership in Senegal between private local companies (SAED) and the Senegalese Institute of Agricultural Research (ISRA) which led to the development of an improved rice thresher cleaner (ASI), in turn leading to a commercial release of the first prototype in 1997 in the Senegal River Valley. The ASI thresher has been widely adopted in Senegal because it enables farmers to produce high value rice with better competitiveness at the market level. The experience in Senegal has been successfully transferred to several West African countries.

The locally-made ASI-thresher can lessen the drudgery associated with hand threshing and improve the usable yield and marketability of rice. Labor is a serious issue in SSA agriculture, and machinery multiplies labor efficiency.

Unit 1 – Harvesting, threshing and cleaning NERICA paddy rice

Harvesting – when to harvest NERICA varieties?

Rice including NERICA varieties is ready for harvesting when the grains are hard and are turning yellow/brown. NERICA rice should be harvested when at least 80% of the upper portion of the main

panicles is straw-colored. The rest of the rice grains should be in the hard dough stage. NERICA varieties should be harvested when grain moisture content is not higher than 20–22%. This should be possible about 4 to 5 weeks after at least 50% flowering of the NERICA rice plants.

Timeliness of harvesting

Proper timing is an important factor in harvesting as it affects field losses and grain quality and then marketability. If harvesting is too early, the volume of immature paddy increases, leading to an increase in broken rice during milling and, consequently, lower head rice yield and quality.

When harvesting is late, the grains are vulnerable to excessive shattering, or can crack during threshing, resulting in grain breakages during milling. In addition, the crop becomes more exposed to attack by rodents, birds and insects; it will also be less resistant to lodging, making harvesting difficult.

How to harvest NERICA rice varieties?

Manual harvesting

Local harvesting methods commonly involve cutting the NERICA stems with a sickle about 10–15 cm above the ground or cutting the panicles. The harvested crop is placed in an upright position for drying before threshing.

Threshing

This operation should be started immediately after harvesting to avoid the harvested stalks turning yellow and associated discoloring.

Mechanical threshing in West Africa is on the increase thanks to the ASI-Thresher developed by WARDA and its partners. ASI is the most widely-used rice thresher in the Senegal River Valley. It is a highly successful product of the partnership-owned R4D system, which is lessening the load of drudgery previously associated with threshing and improving the usable yield and marketability of rice. The success of the low-cost threshers can be seen as the beginning of the path to commercialization for smallholders. Labor is the number one issue in SSA agriculture, and machinery multiplies labor efficiency.

How to thresh NERICA varieties?

Manual

The most frequent threshing method in West Africa is to beat the harvested stalks on a drum or with a stick. However, threshing is best done on a clean tarpaulin and never on the bare ground. This avoids stones mixing with rice, which reduces the quality and the subsequent marketability of the NERICA rice.



Figure 25. Mechanical threshing of NERICA varieties

Cleaning of grain

Clean threshed grain to remove impurities such as bulky straws, chaff, weed seeds, leaves, pods, sticks, stones and other foreign matter. Clean grain has improved storability, better milling output and quality resulting in a higher marketable value.

Winnowing

Winnowing helps remove light and chaffy material and can be done manually without delay after threshing to avoid contamination and poor quality black rice. Modern rice mills reduce the burden of winnowing mainly carried out by farmers.

Unit 2 – Drying, storing and milling NERICA varieties

Grain drying

Because of their short cycle the NERICA varieties may be ready for harvest during the rainy season with consequent difficulties of sun drying.

Given that the paddy NERICA rice is harvested in the field at a moisture level of 20–22%, attempting to store it in this condition will cause grain quality deterioration. To maintain seed quality during storage, paddy rice should therefore be dried to a moisture content of 13–14% (wet basis).

When and how should NERICA varieties be dried?

Drying of grain should immediately follow threshing. Drying should be on concrete floors or mats and should be carried out gradually for the first few days to reduce breakage during milling. To reduce the introduction of sand pebbles and other foreign matter into the paddy, it is important to avoid drying on bare floors.

Sun drying is the traditional method used by most farmers in West Africa, because it is freely available and may give better than or

comparable results to conventional but costly methods (Somado *et al.*, 2006). However, the viability of the grain as seed can be adversely affected by untimely sun drying. Rice grain can be sun-dried 4 to 6 hours a day for 5–7 days by spreading grain in thin layers on the tarpaulin or clean floor. It is recommended to turn and stir the grain many times a day (5–6 times) for even moisture distribution and rapid drying. When the grain is suitably dried for quality storage (13–14% moisture content), it breaks easily into two when bitten between teeth. However, the use of a moisture meter can indicate the moisture level of the dried grain more accurately.

Storage

To ensure long and safe storage of NERICA paddy rice a few precautions are needed. NERICA is no exception. The paddy rice must not contain more than 13–14% moisture, and be handled in a way to avoid moisture absorption either from rainfall or the moist air. Paddy should be protected from insects and rodents.

Milling

The most critical factors that control optimum milling recovery (ratio of milled rice output to paddy input) include:

- moisture content: no more than 13–14%
- purity: the presence of impurities reduces the milling recovery and quality
- cracked grain: this breaks easily during milling and whitening, thus reducing milling quality
- varietal characteristics: varieties differ in their milling abilities.
immature grain – the husk content of immature grain can be as high as 40%

Milling equipment – the use of mortar and pestle (hand pounding) is still common in West Africa even if more modern equipment is progressively being used.