

GRAIN AND NUTRITIONAL QUALITY OF NERICA VARIETIES

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Background information

Grain quality, including taste, is one of the key selection criteria highly prioritized by farmers and consumers of the NERICA varieties as highlighted in the farmers' participatory varietal selection (PVS) trials across West Africa. Desirable NERICA varieties should have not only excellent agronomic performance but also grain quality acceptable to both farmers and consumers.

The pink color of milled rice of *O. glaberrima* (a parent of the NERICA varieties) as a result of its red pericarp is usually not appreciated at the market level. Frequent grain breakage is also an unfavorable trait of *O. glaberrima*. Therefore, for the NERICA varieties to have a high marketable value, these improved varieties should not inherit the unfavorable grain quality of *O. glaberrima*.

Unit 1 – NERICA grain quality characteristics

Background

NERICA is mainly consumed as milled rice in WCA. Milling characteristics of the NERICA varieties determine their grain quality.

In this manual, milling characteristics include i) the husking yield (i.e. the percentage ratio of brown rice/paddy on a weight basis), ii) the milling yield (the percentage ratio of milled rice/ brown rice on a weight basis), and iii) the head rice ratio (the percentage ratio of head rice/milled rice on a weight basis).

High husking and milling yields are indicative of small yield losses. A high head rice ratio corresponds to less grain breakage in milled rice, and this is a desirable trait at market, especially in urban areas. NERICA lines have showed better milling characteristics than *O. glaberrima* for all these parameters.

Many of the NERICA varieties have shown a similar level of good milling characteristics to a leading high-quality improved variety such as Bouaké 189, a popular improved rice variety in Côte d'Ivoire (Watanabe *et al.*, 2002b).

Highlights

The dimensions of a milled grain of a NERICA variety vary in the range of length (L), 5.6–7.7 mm; width (W), 2.3–3.3 mm; thickness (T), 1.7–2.1 mm; L/W ratio, 2.1–3.0. Rice with slender grains (grains with high L/W values) is generally preferred in WCA.

The average L/W ratio in NERICA varieties is 2.6, which is similar to the 2.7 measured in Bouaké 189, but lower than the L/W ratio of 4.0 measured in IDSA 85, another promising variety in Côte d'Ivoire (Watanabe *et al.*, 2002a and 2002b).

Aromatic rice is highly preferred in WCA. Several aromatic lines were identified among NERICA crosses. One example is NERICA1.

Amylose content has a strong influence on rice texture which is the most dominant factor to affect rice taste. Higher amylose content corresponds to harder texture in general. Amylose content of WAB56-104, the *O. sativa* parent, and CG 14, the *O. glaberrima* parent, is 21.7% and 26.0%, respectively. NERICA lines show a wide range of amylose content from 15.4% to 28.5%, with an average of 25.0%. Rice consumption preferences differ from one country to another. For example, consumers in Nigeria seem to prefer varieties about 25% amylose content while in Côte d'Ivoire the preferred value varies between 20 and 25%.

Viscosity of rice at high (during cooking) and low temperatures (after cooling) also affect rice texture. The NERICA varieties have quite large variation for this trait.

Unit 2 – NERICA nutritional quality: protein and amino acid content

Background

Rice is already an important staple food crop for millions of households or is rapidly becoming so in SSA. Increasing rice production and improving its nutritional quality is expected to make a tremendous contribution to improving the livelihoods of millions of households.

Both the high yield of NERICA varieties and their good nutritional quality are expected to play a significant positive role towards the elimination of hunger and malnutrition in sub-Saharan Africa.

Highlights

- NERICA varieties' consistent nutritional quality over years and across countries in West Africa.
- Parboiling has no effect on NERICA amino acid values.
- NERICA2 and NERICA7 (milled) have the highest protein contents (11.8%).
- NERICA4 (milled) has the lowest protein content (9%) – still greater than in imported rice.
- NERICA1 to NERICA6 (milled) have higher protein (9–11%) than imported (7.7%) and USDA standard rice (8.1%). This represents 26–32% higher protein.
- NERICA rice prepared by the parboiling method has higher average protein (10.7%) and amino acid balance than directly milled NERICA rice (10.2%).

- The milled NERICA varieties have higher protein contents and show a better balance of amino acids as compared to both imported varieties and the international rice standard.
- The high protein content and good balance of essential amino acids in NERICA varieties can play a significant role in combating malnutrition in many sub-Saharan African countries where rice is the main staple food.
- One could calculate the Africa-wide benefits of this extra protein from many angles: health, substitution for costlier protein sources, mental development in youths, etc.
- High micronutrient (iron and zinc) concentration in some interspecifics (Table 19).

Table 19. Rice varieties combining both high Fe and Zn concentration (mg.kg⁻¹) in brown rice samples

Ecology	Rice variety	Iron	Zinc
Upland	WAB 891-SG-25	21.1	53.2
	WAB 709-73-3-2	23.1	57.3
	WAB 488-161-2	25.3	48.7
Lowland	WAS 63-22-1-1-3-3	18.5	38.9
	WAS 127-B-5-1	15.8	42.9

Table 20. Protein and selected amino acid values (%) of NERICA rice from Guinea, analyzed* in 2003, and from Benin analyzed in 2005

Variety	Seed component	Polished 2003	Polished 2005	Parboiled 2003	Parboiled 2005
NERICA1	Protein	10.68	10.04	10.70	11.02
	Lysine	0.35	0.40	0.40	0.42
	Tryptophan	0.08	0.13	0.10	0.13
	Methionine	0.36	0.31	0.33	0.33
NERICA2	Protein	13.25	10.48	13.64	11.81
	Lysine	0.34	0.39	0.35	0.44
	Tryptophan	0.08	0.11	0.11	0.13
	Methionine	0.38	0.27	0.41	0.37
NERICA3	Protein	9.95	10.20	10.1	11.14
	Lysine	0.35	0.39	0.40	0.40
	Tryptophan	0.09	0.11	0.10	0.09
	Methionine	0.34	0.27	0.36	0.28
NERICA4	Protein	8.33	8.87	9.41	9.51
	Lysine	0.26	0.36	0.31	0.35
	Tryptophan	0.06	0.10	0.10	0.12
	Methionine	0.29	0.23	0.34	0.17
NERICA6	Protein	8.7	10.34	9.6	10.76
	Lysine	0.33	0.43	0.36	0.43
	Tryptophan	0.09	0.14	0.10	0.13
	Methionine	0.32	0.37	0.44	0.37
NERICA7	Protein	-----	10.43	-----	11.69
	Lysine	-----	0.40	-----	0.43
	Tryptophan	-----	0.12	-----	0.12
	Methionine	-----	0.34	-----	0.37
Taiwanese	Protein	7.58		-----	
	Lysine	0.34		-----	
	Tryptophan	0.08		-----	
	Methionine	0.38		-----	
Chinese	Protein	7.94	9.49**	-----	10.14**
	Lysine	0.33	0.37	-----	0.37
	Tryptophan	0.07	0.11	-----	0.10
	Methionine	0.37	0.31	-----	0.31

* Analysis of NERICA9-NERICA18 is being done and result will be reversed to an updated version of this Compendium

** Values are for NERICA8