

Molecular markers enable identification of upland NERICA varieties

Upland NERICA (New Rice for Africa) was developed by Africa Rice Center (AfricaRice, former name: West Africa Rice Development Association or WARDA) to meet increasing demand for rice in Africa. It originated from combinations between each of following three Asian rice (*Oryza sativa* L.), WAB 56-50, WAB 56-104, and WAB 181-18, and one African rice (*Oryza glaberrima* Steud), CG 14, comprising 18 varieties.

Although some varieties have identical seed morphological characters, most of them have to be observed in the field (plant morphology) to enable identification of each variety. However, plant morphology is sometimes affected by environmental factors specific to each cultivation area, making identification of varieties difficult. JIRCAS has been characterizing upland NERICA varieties based on various aspects such as agricultural traits, components and distribution of chromosome segments derived from parents or others, tolerance to abiotic stresses, and resistance to biotic stresses. The purpose is to evaluate their potential and develop new breeding materials. A survey of chromosome segments of upland NERICA varieties revealed that 18 microsatellite markers (SSR markers) enable classification of NERICA into varieties or groups.

The original seeds consisting of 18 upland NERICA varieties were provided by AfricaRice and multiplied at JIRCAS field (Tsukuba, Japan). Each variety was tested to confirm the uniformity of the plants. A total of 295 SSR markers distributed in whole genome chromosomes were used to genotype upland NERICA varieties, of which 243 markers showed polymorphism among CG 14, WAB56-104 and 18 upland NERICA varieties. The polymorphisms were derived not only from the difference between CG 14 and WAB56-104, but also from an unknown provenance. After comparing their chromosome components, 18 markers were finally selected based on their capability to differentiate upland NERICA varieties. The NERICA varieties were classified by those markers as follows: upland NERICA1, 5, 6, 7, 10, 14, and 17 were classified by their respective single markers; upland NERICA2, 12, 13, and 18 were classified by combining more than one marker (Table 1). On the other hand, the following varieties did not show any polymorphisms: upland NERICA3 and 4, upland NERICA8, 9 and 11, upland NERICA15 and 16 (Table 1). Thus, they were identified as three separate groups. This information can be used for quality control in seed production of upland NERICA varieties and their further utilization in breeding.

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Table 1. Differential markers for the 18 upland NERICA varieties and their differentiation capabilities

DNA markers (Chromosome)	WAB-56- 104	CG 14	NERICA																	
			1	2	3	4	5	6	7	8	9	11	10	12	13	14	15	16	17	18
a	RM7187(4)	A	B	C	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
b	RM3471(4)	A	B	A	C	A	A	C	A	A	A	A	A	A	A	A	A	A	A	A
c	RM7318*(1)	A	A	A	A	A	C	A	A	A	A	A	A	A	A	A	A	A	A	A
d	RM7356(8)	A	B	A	A	C	C	A	C	A	A	A	A	A	A	A	A	A	A	A
e	RM5704*(11)	A	B	A	A	A	A	A	C	A	A	A	A	A	A	A	A	A	A	A
f	RM7318*(1)	A	A	A	A	A	C	A	A	A	A	A	A	A	A	A	A	A	A	A
g	RM5704*(11)	A	B	A	A	A	A	A	C	A	A	A	A	A	A	A	A	A	A	A
h	RM566(9)	A	A	A	A	A	A	A	C	A	A	A	A	A	A	A	A	A	A	A
i	RM406(2)	A	B	A	A	A	A	A	A	C	C	C	A	A	A	A	A	A	A	A
j	RM3392(3)	A	B	A	A	A	A	A	A	A	A	A	B	A	A	A	A	A	A	A
k	RM1347(2)	A	B	A	A	A	A	A	C	A	A	A	A	A	C	A	A	A	C	A
l	RM6948(8)	A	B	A	A	A	A	A	A	C	C	C	A	B	B	C	A	A	A	A
m	RM5481(7)	A	B	A	A	A	A	A	A	A	A	A	A	A	A	B	A	A	A	A
n	RM7383(1)	A	B	A	A	A	A	A	A	A	A	A	A	A	A	A	B	B	A	B
o	RM5599*(11)	A	B	A	A	A	A	A	B	A	A	A	A	A	A	A	A	A	A	B
p	RM6335(12)	A	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	B	A
q	RM5599*(11)	A	B	A	A	A	A	A	B	A	A	A	A	A	A	A	A	A	A	B
r	RM5704*(11)	A	B	A	A	A	A	A	C	A	A	A	A	A	A	A	A	A	A	A

WAB 56-104: One parent for upland NERICA 1-8. CG14: Common parent among upland NERICA varieties.

A: WAB 56-104 type. B: CG 14 type. C: Other types

Polymorphism patterns enclosed by heavy lines are the unique patterns used to differentiate NERICA varieties.

* indicate markers which show more than one band.