Transgenic RHBV Resistance and Breeding Selection of Advanced Lines in The Field

*Manuel A. Quintero, Luisa Fory, E. Tabares, Cesar P. Matínez, and Zaida Lentini**
** Corresponding author: z.lentini@cgiar.org*
International Center for Tropical Agriculture (CIAT)
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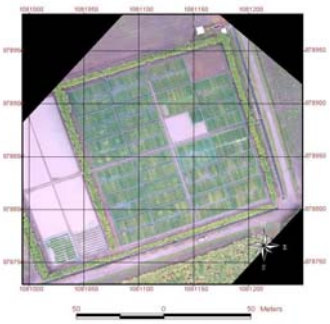
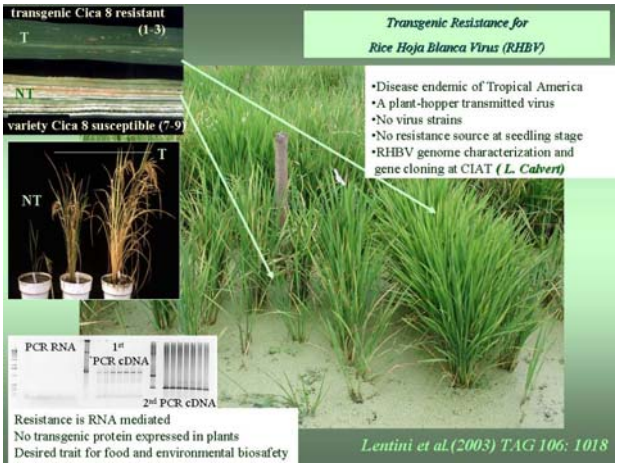
Introduction

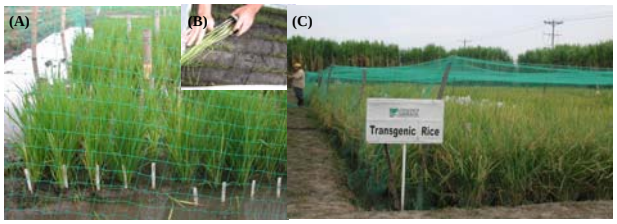
The transgenic RHBV resistant rice was generated by splicing in genes from the RHBV virus into Cica 8 variety (Lentini *et al*., 2003), selected by the breeders as potential parent donor of the transgene for future conversion of modern varieties because of its good grain quality, high productivity, and broad adaptation including low soil humidity, and acceptance to large and small resource farmers. Thus this transgenic resistance could be used to complement the breeding resistance that has been deployed so far and does not protect plants when younger than 5 to 20 day-old. In addition to selection for RHBV resistance and yield potential, the advanced lines were evaluated for tolerance to *Rhizoctonia*, resistance to *Pyricularia*, and grain quality traits. Progress in previous years led to a shift from the testing of concepts towards the final steps for its potential release to farmers' fields. The main goal for this project is to provide new source(s) of resistance to complement the single source of resistance present in most of the commercial varieties currently grown in Latin America.



Large scale evaluation (~1 Ha) of transgenic rice at CIAT experimental station under biosafety conditions

Materials and Methods



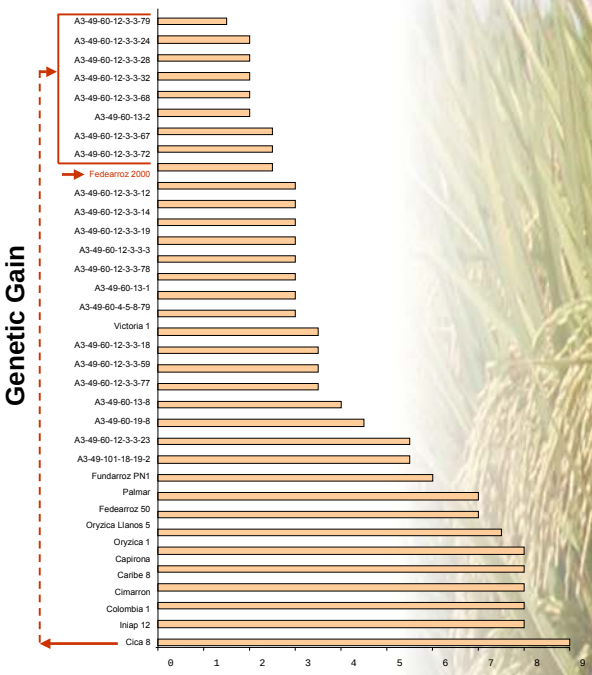


Evaluation for RHBV resistance in the field (A and B). Agronomic evaluation and selection of advanced generations of transgenic events and derived progeny plants from crosses (C).

Results and Discussion

Five F6 generation lines derived from crosses with Oryzica 1, and five T7 and T10 self progeny advanced transgenic lines were clustered jointly with Fedearroz 2000 showing the highest level of RHBV resistance (score ≤ 3). Based on this RHBV resistance profile, the agronomic performance including yield potential, sheath blight and blast resistance as well as for grain quality traits, three F6 generation lines from the cross with Oryzica 1, one T7 and four T10 from the original Cica 8 transgenic lines were included in the field final selection.

RHBV disease reaction of transgenic lines (A series plants), and commercial varieties in the field, inoculated at 15 days after planting. Resistant (score 0-1). Intermediate (score 3-5). Susceptible (score 7-9).



RHBV resistance and agronomic performance in the field of selected families derived from crosses (total 9) between Cica 8-RHBV transgenic resistant lines and commercial variety Oryzica 1, and Cica 8-RHBV transgenic resistant lines (total of 14) derived from self cross.

Pedigree	Families selected	[1]Range RHBV	Yield (T/ha) Potential	[2]DF	[3]DF 50%	Plant Height (cm)	F (%)	[4]Grain Quality
Transgenic lines								
A3-49-101-18-19/Oryzica 1-14-M-10-M-M	4	2.2 - 4.3	9.5	98	105	105	95	I
A3-49-60-4-13/Oryzica 1-13III-6-5-M-M	3	2.3 - 5.0	6.9	99	104	120	70	I
A3-49-60-4-5/Oryzica 1-15-15-11-M-M	2	3.7 - 5.0	13.7	110	116	105	95	I
A3-49-60-13-69-M-1-4-M	3	3.0 - 3.7	10.9	109	114	110	95	H
A3-49-60-12-3-20-M-13-2-1-M-M	5	3.0 - 4.3	9.4	98	105	115	97	I
A3-49-60-12-3-20-M-8-4-4-M-M	3	3.0 - 3.7	10.3	105	110	125	95	I
A3-49-60-12-3-20-M-8-6-4-M-M	3	3.7 - 5.0	7.9	102	106	125	95	H
Non-transgenic controls								
Cica 8/Fedearroz 50		5.0 - 7.0	9.8	105	110	120	90	I
Cica 8/Oryzica 1		5.0 - 7.0	7.9	96	110	115	80	H
Cica 8		7.0 - 9.0	6.6	98	105	110	91	I
Fedearroz 50		7.0 - 9.0	7.4	105	112	120	70	H
Oryzica 1		7.0 - 9.0	9.6	94	101	100	95	H
Fedearroz 2000		1.0 - 3.0	15.4	99	105	115	95	H
Colombia 1		3.0 - 5.0	10.1	101	105	155	85	I
A3-78-24 (Transgenic control suscetible)		9,0	7.5	107	113	110	95	I

[1] Average score value for RHBV resistance: Resistant (score 0-1). Intermediate (score 3-5). Susceptible (score 7-9). [2] DF days to flowering initiation. [3] Days to 50% anthesis. [4] Grain quality: H (high), I (intermediate).

Future Activities

The selected lines are currently being processed through anther culture to generate doubled haploid (complete homozygous) lines, convenient material for seed multiplication, replicated multi-location field trials and molecular genotyping.

References

Lentini Z., Lozano I, Tabares E., Fory L., Domínguez J., Cuervo M., Calvert L. 2003. Expression and inheritance of hypersensitive resistance to rice hoja blanca virus mediated by the viral nucleocapsid protein gene in transgenic rice. Theoretical and Applied Genetics 106: 1018-1026.

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