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The *International Rice Research Notes* (IRRN) expedites communication among scientists concerned with the development of improved technology for rice and rice-based systems. The IRRN is a mechanism to help scientists keep each other informed of current rice research findings. The concise scientific notes are meant to encourage rice scientists to communicate with one another to obtain details on the research reported. The IRRN is published three times a year in April, August, and December by the International Rice Research Institute.

About the cover Indonesian scientists are trained on how to use the chlorophyll meter in Sukamandi, Java.

Inset: Chlorophyll (SPAD) meter for need-based, real-time nitrogen management in rice.

Cover photos: V. Balasubramanian

Contents

RESEARCH NOTES

Plant breeding

Senescence of leaves, especially that of the flag leaf, was slower in the DH lines than in the checks. These lines had long bold grains with white kernel. RCPL 1-29, RCPL 1-27, and RCPL 1-24 were resistant to leaf blast under field conditions, whereas improved check IET13459 and Bali were both susceptible to blast (Table 2). In addition, Bali lodged at maturity, whereas IET13459 and IET13783 lodged only under high-fertility conditions. In contrast, the DH lines did not lodge even under high-fertility conditions. Hulling percentages of the DH lines were 83% in RCPL 1-27, 80% in RCPL 1-29, and 79% in RCPL 1-24 (Table 2). Milling percentages were 76% in RCPL 1-27, 73% in RCPL 1-29, and 65% in RCPL 1-24 (Table 2).

A multilocation trial was conducted on regional research farms during the 1998 wet season in five states (Arunachal Pradesh, Manipur, Meghalaya, Mizoram, and Nagaland) of the North Eastern Hill. The average unmilled yields of RCPL 1-29, RCPL 1–27, and RCPL 1–24 were 3.3, 2.5, and 3.1 t ha^{-1}, respectively. The yield performance of RCPL 1-29 in Manipur and Meghalaya did not show a significant difference (4.7 t ha^{-1} in Manipur and 4.9 t ha^{-1} in Meghalaya). No blast incidence was recorded in the DH lines in any of the five states. Average yield improvement over local checks was 46% in Mizoram, 36% in Meghalaya, 28% in Arunachal Pradesh, 19% in Manipur, and 17% in Nagaland.

Reference

Gupta HS, Borthakur DN. 1987. Improved rate of callus induction from rice anther culture following microscopic staging of microspores in iron alum-haematoxylin. Theor. Appl. Genet. 74:95-99.

73

Petei and Mocoi: two rice cultivars developed through anther culture in Argentina

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We developed two rice varieties, Petei and Mocoi, through anther culture. These varieties were released in 1997 for commercial cultivation in Argentina. Petei was developed from a cross involving cultivars Quella and Guayquiraro, which were made available to the rice program at the Julio Hirschhorm Experimental Station, FCAF. Selected plants from the F_2 population of this cross were used for anther culture at the biotechnology laboratory, FCA, UNNE. Mocoi was developed from crossing two F_1s (H342 and H161-28-2-2-1). H342's parents were Guayquiraro and Nucleoryza, whereas H161-28-2-2-1 had Calady 40 and IR1103-15-10 as parents. Anther culture was performed on the F_1s and progenies were multiplied for further evaluation.

Anther culture was used following the protocol given by Marassi et al (1993). Panicles from F_1 H353 and F_2 H319 at the booting stage containing pollen at the mid-uninucleate stage were pretreated (8 °C for 8 d). Anthers were plated on N6, a callus induction medium (Chu et al 1975) supplemented with 2 mg naphthalene acetic acid L^{-1} and 0.5 mg kinetin L^{-1}, and incubated in the dark at 27 ± 2 °C. Shoots were obtained on the regeneration medium. Flasks were transferred under light at 27 ± 2 °C. Plantlets were transferred to a rooting medium composed of MS (Murashige and Skoog 1962) culture solution that was free of hormones and supplemented with 8% sucrose. Plants were then transferred to the soil in the greenhouse until maturity, and the progeny was multiplied by the pedigree method. Data on callus formation and plant regeneration from anther culture of the two crosses are given in the table. The efficiency of anther culture (proportion of plants transferred to the soil to total number of anthers cultured from the two crosses) was 8.4% for H319 and 5.4% for H353.

Petei is 90 cm tall, resists lodging, and has intermediate threshability. It matures in 115 d and its yield potential is 8.5 t ha^{-1}. Its grain is 5.9 mm long and 2.7 mm wide (short grain and special commercial type). The variety has 24.9% amylose, intermediate gelatinization temperature, 9.4% protein, and moderate resistance to blast. Because of its short growth duration, tolerance for low temperature, and good performance on saline soils, Petei is suited for growing in temperate climate under saline soil

Callus formation and plant regeneration from anther culture of rice.

Progeny	Anthers (no.)	Calli (%)	Calli with shoots (%)	Green shoots (%)	Plantlets transferred to soil (%)	Anther culture efficiency[a] (%)
H319 (F_2)	8,900	14.6	75	85	90	8.4
H353 (F_1)	8,100	11.0	70	80	87	5.4

$$^a\text{Anther culture efficiency} = \frac{\text{Number of plantlets transferred to soil}}{\text{Number of cultured anthers}} \times 100.$$

conditions. Petei was released for cultivation in areas near 36° S in Buenos Aires Province.

Mocoi has a height of 75 cm, resists lodging, and has intermediate threshability. It matures in 120 d and its yield potential is 10 t ha^{-1}. Its golden grain is 7.3 mm long and 2.3 mm wide (fine long commercial type). The endosperm has a high amylose content (26.6%) and the protein content is 8.4%. It is moderately resistant to blast. Mocoi is suited for cultivation at 32° S near Villageny City (central region of Entre Rios Province) and in Buenos Aires Province.

Both Petei and Mocoi are adapted to the new rice area (temperate with some saline areas) in Buenos Aires Province (34-36° S) where traditional varieties are not well adapted.

References

Chu CC, Wang CC, Sun CS, Chen H, Yin KL, Chu CY, Bi FY. 1975. Establishment of an efficient medium for anther culture of rice through comparative experiments on the nitrogen sources. Sci. Sin. 18:659-668.

Marassi MA, Bovo OA, Lavia GL, Mroginski LA. 1993. Regeneration of rice doubled haploids using a one-step culture procedure. J. Plant Physiol. 141:610-614.

Murashige T, Skoog F. 1962. A revised medium for rapid growth and bioassay with tobacco tissue culture. Physiol. Plant. 15:473-479.

Performance of cold-tolerant rice lines developed through anther culture for mid-altitude areas of Meghalaya, India

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Rice grown in mid-altitude areas (800–1,300 m asl) of the North Eastern Hill of India is exposed to suboptimum temperature during its life cycle, causing incomplete panicle exsertion, asynchronous flowering, and spikelet sterility. These factors reduce yield from 20% to 35%. Therefore, high-yielding indica cultivars do not have a significant impact in these areas because of thermosensitivity. Direct introduction of cold-tolerant japonica cultivars in these areas was not successful either. In addition, the long crop season does not allow more than one crop of rice per year; consequently, conventional breeding requires more time to develop new cultivars. Anther culture of F_1s, on the other hand, helps speed up the breeding cycle by rapid fixation of homozygosity and simultaneous transfer of genes from one parent to the other. We report here the development of anther culture-derived doubled-haploid (DH) lines with cold tolerance at the reproductive phase. One of the lines—DH7—was the most promising and outyielded all checks in the mid-altitude areas.

IR70 was crossed with a local cultivar, Khonorullo, which possesses cold tolerance at the reproductive phase and is grown in high-altitude areas (more than 1,400 m asl). F_1-derived anther culture produced 21 DH lines. These lines were evaluated in initial trials and, based on their performance, two lines, DH7 and DH21, were selected for a replicated yield trial. Both DH lines were evaluated along with high-yielding indica (IR70 and IR72) and improved cold-tolerant checks (RCPL 1-87-4 and RCPL 1-87-8) in replicated yield trials in three replications for 3 yr (1996-98) as transplanted rice in rainfed lowlands. The cold-tolerant parent was not included in the replicated trial because its yield was poor in the mid-altitude areas.

Data were recorded using the *IRRI standard evaluation system for rice*. Unmilled rice yield (t ha^{-1}) was calculated from the yield of 5-m^2 plots in each replication. The average unmilled rice yield of DH7 (3.9 t ha^{-1}) was significantly higher than that of the indica checks and cold-tolerant check RCPL 1-87-8. In addition, DH7 and DH21 matured 11 and 21 d earlier than the improved cold-tolerant checks RCPL 1-87-4 and RCPL 1-87-8, respectively (Table 1). Panicle length and seed fertility of both DH lines were either better than or comparable with those of improved cold-tolerant checks (Table 1). DH7 also

Table 1. Comparison of agronomic characters[a] of doubled-haploid (DH) lines, indica checks, and cold-tolerant checks, Meghalaya, India, 1996-98.[b]

Variety	Days to maturity	Plant height (cm)	Fertile tillers (no.)	Panicle length (cm)	Spikelets panicle^{-1} (no.)	Spikelet fertility (%)	Brown rice yield (t ha^{-1})
DH lines							
DH7	151 c	72.0 a	7.4 a	21.6 a	96.8 a	79 a	3.9 a
DH21	141 e	75.2 b	7.1 a	22.2 a	109.0 a	74 a	2.3 d
Indica checks							
IR70	158 b	67.4 b	6.5 a	20.2 cd	82.2 b	64 b	3.2 c
IR72	148 d	58.8 c	7.6 a	19.4 d	82.4 b	63 b	2.4 d
Improved cold-tolerant checks							
RCPL 1-87-4	162 a	70.8 ab	7.6 a	20.6 bcd	88.2 b	78 a	3.6 b
RCPL 1-87-8	162 a	71.0 ab	7.0 a	20.7 bc	76.6 a	76 a	3.3 bc

[a]Values followed by a common letter are not significantly different at the 5% level by DMRT. [b]Av of 3 yr.

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