SHORT COMMUNICATION OPEN ACCESS

Performance of zinc rich rice cultivar - DRR Dhan 48 in farmers' fields

Jyothi Badri*, Jai Vidhya LRK, Lakshmidevi G, Subhakara Rao I, Nandini V, Chiranjeevi M, Laha GS and Subba Rao LV

ICAR-Indian Institute of Rice Research (ICAR-IIRR), Rajendranagar, Hyderabad-500030
*corresponding author (Email: jyothirishik@gmail.com)

Received: 15th November 2020; Accepted: 15th December 2020

Abstract

Biofortified variety 'DRR Dhan 48' was recently notified and released [CVRC S.O. 1379 (E) dt. 27.03.2018]. It has a high zinc content of 27 and 22 ppm in brown and polished rice, respectively and introgressed with three bacterial blight resistant genes (*xa5, xa13* and *Xa21*). It also has desirable grain quality parameters and agro-morphological characteristics akin to the popularly grown Samba Mahsuri. DRR Dhan 48 is distinguishable from other rice varieties of comparable grain type and duration using morphological, biochemical and molecular markers. Seed production was taken up in participatory mode in the farmer's field in Aroor village, Valigonda mandal of Yadadri-Bhuvanagiri district in Telangana State during *kharif* 2020. Roughing at regular intervals was done by breeders to maintain seed purity. DRR Dhan 48 is well accepted by the farmers and gradually gaining popularity. This cultivar is spreading from farmer to farmer and seed produced in farmer's field during *kharif* 2020 was distributed among farmers across 3 states viz., Telangana, Andhra Pradesh and Karnataka for cultivation during *Rabi* 2020-21.

Keywords: DRR Dhan 48, biofortification, zinc, bacterial leaf blight, maintenance breeding, MS cultivar

Introduction

DRR Dhan 48 [RP 5898-182-22-4-3-2-1 (IET 24555)], a high zinc, bacterial leaf blight resistant medium slender grain rice variety derived from the cross of RPBio226*1/CSR27, developed at ICAR-IIRR was notified and released in 2018 [S.O. 1379 (E) dt. 27.03.2018] for cultivation in the five southern states of India (Andhra Pradesh, Telangana, Tamil Nadu, Karnataka and Kerala). DRR Dhan 48 resembles popularly grown BPT5204 (Samba Mahsuri) in general agro-morphological and grain quality characteristics, in addition also possesses high zinc content (27 ppm in brown rice and 22 ppm in polished rice) and shows good level of resistance to bacterial leaf blight (BLB) and leaf blast. It is marker positive for three BB resistance genes (*xa5, xa13* and *Xa21*) and also resistant to lodging as it possesses strong culm. It possesses desirable grain quality parameters *viz*., medium slender (MS) grains, high milling recovery (69.4%), head rice recovery (HRR-60.9%) and good cooking quality with intermediate amylose content (AC-24%), soft gel consistency (GC-28mm) and alkali spreading value (ASV-7.0).

Maintenance of Pure Seed of DRR Dhan 48

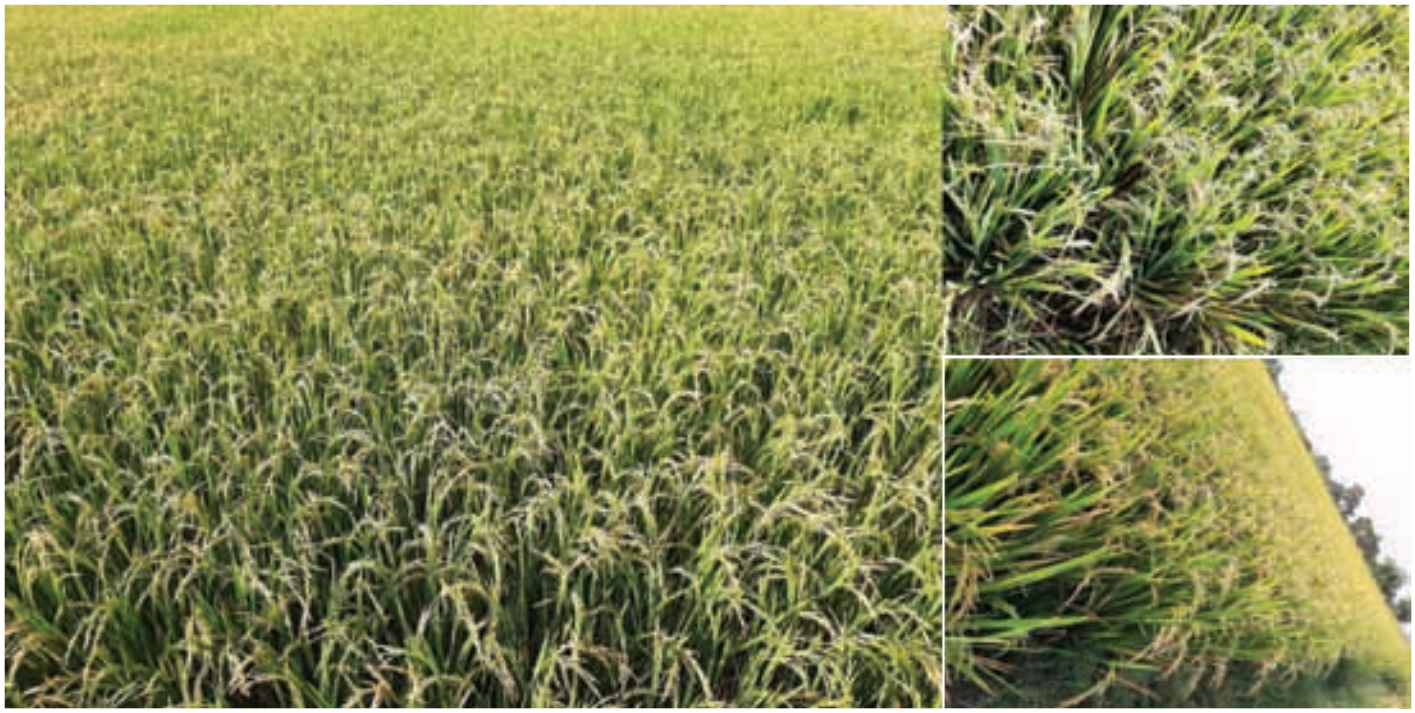
DRR Dhan 48 is distinguishable from rice cultivars of similar grain type and duration using morphological, biochemical and molecular markers

Morphological markers- plant type, grain type, eating and cooking quality characters akin to BPT 5204, resistance to bacterial blight and leaf blast

Biochemical markers- High zinc content (>20%) in brown and polished rice

Molecular markers- Presence of three BB resistance genes- *xa*5, *xa*13 and *Xa21*

Nucleus seed production of released cultivars is a regular breeding activity. Hundred panicles were selected randomly during 2019 dry season (*Rabi*) at Ramachandra Puram farm of ICAR-IIRR located



Field view of DRR Dhan 48

in ICRISAT campus and were grown during *Kharif* 2019 following ear to row/panicle to row (PRT) method. Seeds from the individual panicle were grown in two rows leaving one row between each PRT. Observations were recorded on yield and yield related traits along with disease reaction to bacterial leaf blight. In field, selection was carried out based on DRR Dhan 48 designated traits (90-95cm height, semi-dwarf, compact, heavy and exerted panicle type, medium slender grain type, days to 50% flowering being 105-110 days and seed to seed duration being 135-140 days) and lines showing the same were chosen. Also, the PRTs were inoculated with bacterial blight pathogen at maximum tillering stage by leaf clipping method under field conditions.

The freshly harvested grain from fourteen PRTs possessing morphological similarity with BPT 5204 and resistance to BLB (Figure 1a) were subjected

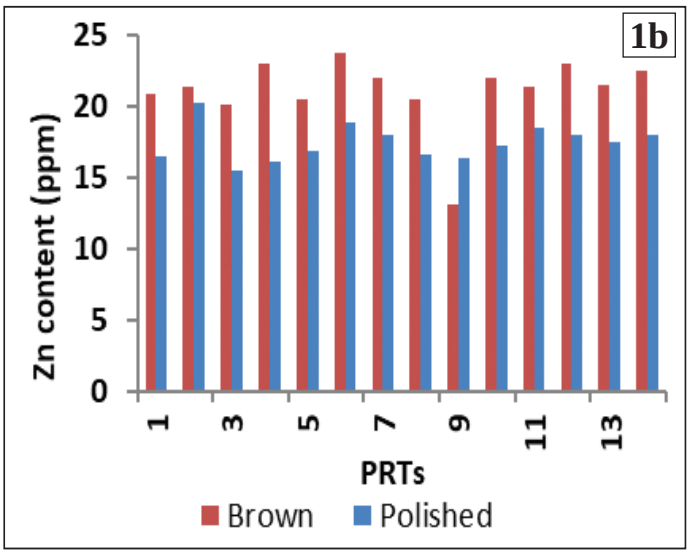
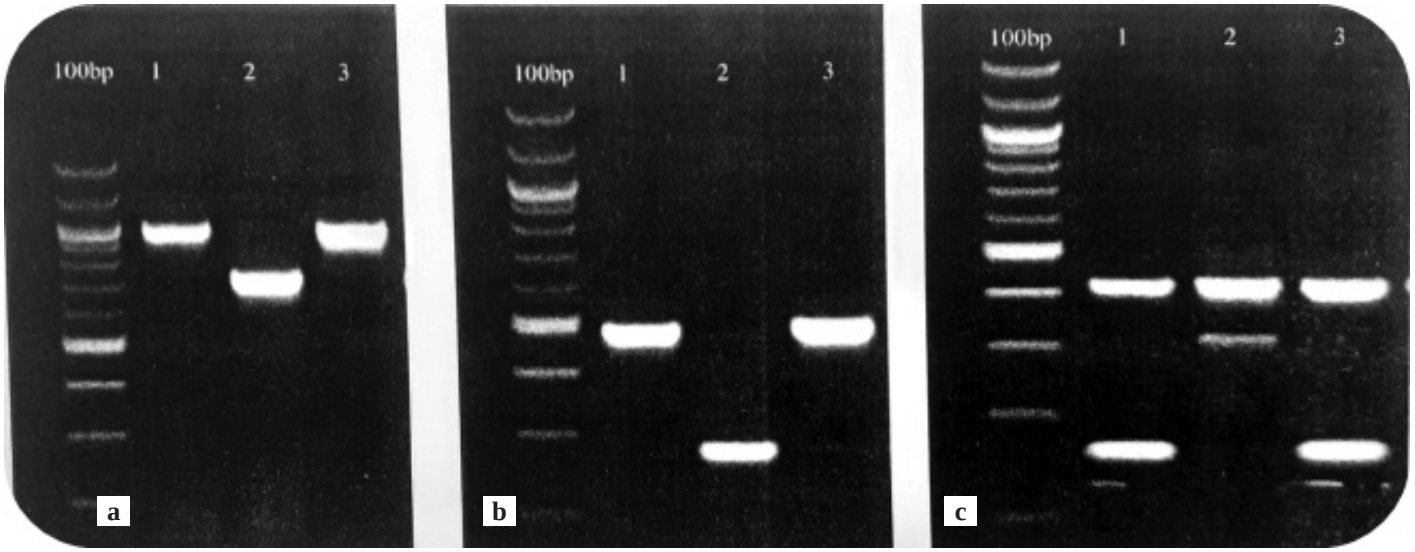


Figure 1a: Resistance to bacterial leaf blight (score 1) in DRR Dhan 48 similar to Improved Samba Mahsuri.
1b. Zinc (ppm) content in PRTs grown during kharif 2019



100bp=ladder. 1. Positive parent, 2. Negative parent and 3. DRR Dhan 48

Figure 2: DRR Dhan 48 with BLB genes a. *Xa 21* b. *xa 13* and c. x*a 5*

to both biochemical and molecular analysis. In biochemical analysis, Zinc was estimated in both brown and polished grains using XRF at ICAR-IIRR (Figure 1b). In molecular analysis, DNA isolated from leaf samples from 14 PRTs was tested for the presence of all three BLB resistant genes viz., *xa*5, *xa*13 and *Xa21* (Figure 2). Seed harvested during *Kharif* 2019 from 'PRT2' with morphological similarity to BPT 5204, resistance to bacterial leaf blight, marker positive to *xa5, xa13* and *Xa21* and zinc content of 24.4 ppm and 21.2 ppm for brown rice and polished rice respectively was chosen for seed multiplication during *Rabi* 2020.

Performance of DRR Dhan 48 in Farmer's field: Pure seed of DRR Dhan 48 multiplied during *Rabi* 2020 from 'PRT2'was grown in farmer's field of Shri. Sangi Nagaiah/Tummala Muralidhar of Aroor village, Valigonda mandal, Yadadri Bhuvanagiri District of Telangana, during *Kharif* 2020 in four acres. Breeders carried out regular field visits and undertook rouging to maintain the seed purity and explained the importance of carrying out rouging in seed production plots to the farmers (Figure 3). Farmers checked for the presence of roughs along with their regular farming activities. Farmers appreciated the traits of DRR Dhan 48 in

Figure 3: Field visit and rouging in DRR Dhan 48 in farmer's field during *kharif 2020*

terms of its desirable plant height (slightly shorter than BPT 5204), resistance to bacterial blight despite not taking up plant protection measures and grain type akin to BPT 5204 and appreciated high (15-18) productive tillers per plant. An average yield of 5104 kg/ha was obtained in the farmer's field under late sown conditions indicating the suitability of DRR Dhan 48 cultivation under late sown conditions. Seed samples collected from farmer's field as well as from IIRR Rajendranagar farm were used for zinc estimation at International Rice Research Institute South Asia Hub (IRRISAH), ICRISAT, Hyderabad. The average zinc content in seed samples collected in farmer's field ranged from 25.2 to 27.4 and 22.2 to 23.3 ppm in brown and polished rice, respectively, while in seed samples of IIRR farm ranged from 24.9 to 27.1 and 21.0 to 21.3 ppm in brown and polished rice, respectively. Varietal release to field performance of DRR Dhan 48 is schematically represented in Figure 4.

Owing to the desirable morpho-agronomic plant type and grain type similarity to BPT 5204, resistance to bacterial leaf blight and high zinc content, DRR Dhan 48 is well accepted by the farmers and is gradually gaining popularity. This cultivar is spreading from farmer to farmer and seed produced in farmer's field of Nalgonda district during *Kharif* 2020 was distributed among farmers across 3 states *viz*., Telangana, Andhra Pradesh and Karnataka for cultivation during *Rabi* 2020-21.

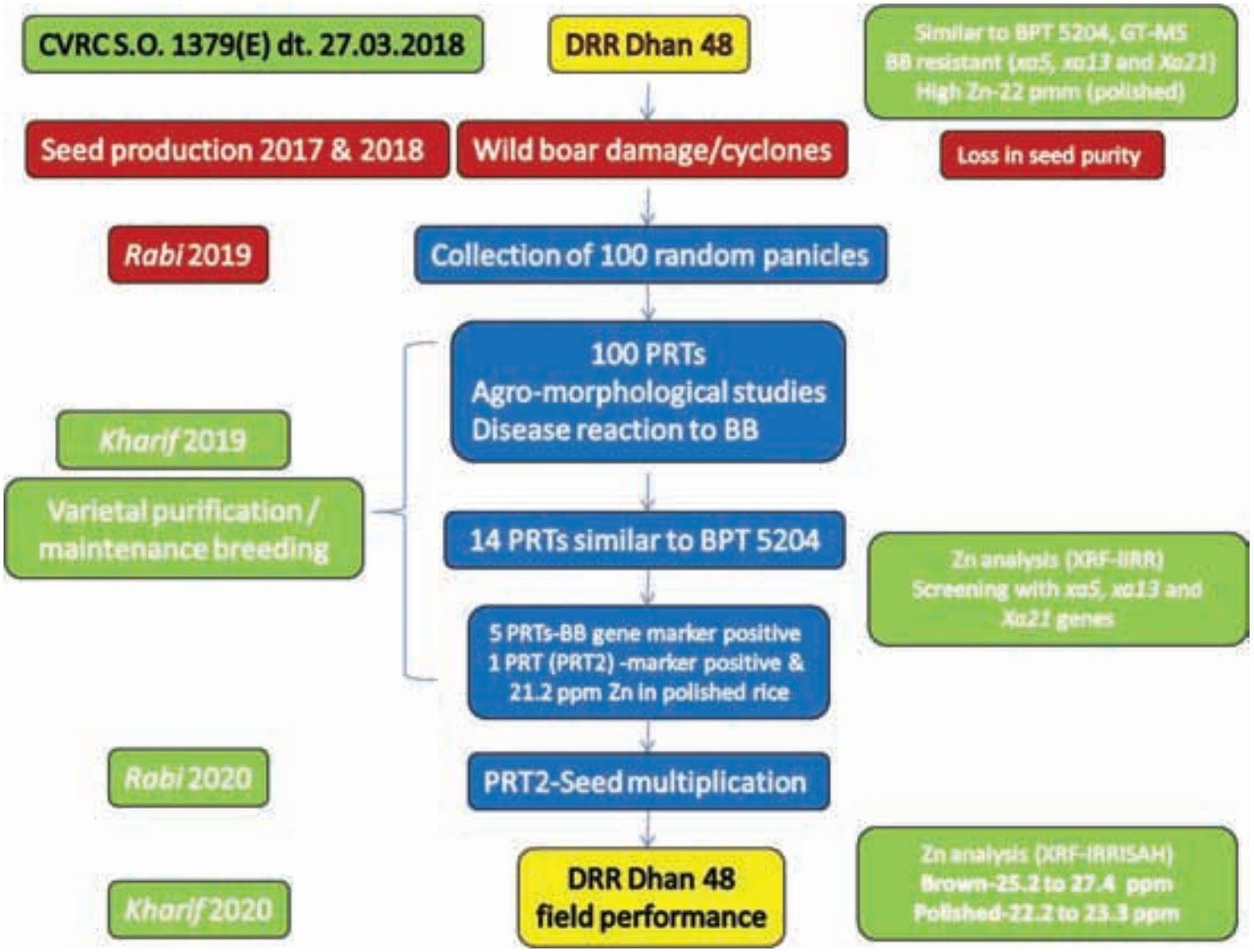


Figure 4: Schematic representation of varietal release to field performance of DRR Dhan 48