

DRRH 7 - World's First Publicly Bred Rice Hybrid for Alkaline (Sodic) and Inland Saline Ecology with *Saltol* QTL

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Received: 3rd March, 2026; Accepted: 12th March, 2026

Abstract

DRRH-7 (IET 30165) is the first publicly bred rice hybrid developed for alkaline (sodic) and inland saline ecosystems. The introgression of the *Saltol* QTL in the restorer line (PSV 729R) provides tolerance to salinity stress under these target environments. The hybrid was developed from the cross IR79156A × PSV 729R. DRRH-7 was evaluated under the All India Coordinated Research Project on Rice (AICRPR) multi-location Alkaline and Inland Saline Tolerant Varietal Trials (AL&ISTVT) during 2021–2024. Across test environments, the hybrid consistently outperformed national and regional tolerant checks in Haryana, Uttar Pradesh and Tamil Nadu. It recorded a mean grain yield of 3.5 t ha⁻¹ under alkaline soil conditions and 3.4 t ha⁻¹ under inland saline conditions, signifying stable yield performance and stress resilience. The enhanced performance under sodic and saline stress highlights the effectiveness of *Saltol*-mediated Na⁺/K⁺ homeostasis in sustaining productivity. DRRH-7 exhibited moderate resistance to key fungal diseases including leaf blast, neck blast, brown spot and grain discoloration, along with moderate tolerance to plant hoppers, thereby ensuring yield stability under biotic stress pressures. The hybrid matures in 127–130 days (seed-to-seed) and possesses a long slender (LS) grain type with desirable milling, cooking and grain quality traits suitable for consumer acceptance. Based on its consistent multi-environment superiority and stress adaptability, DRRH-7 was released for commercial cultivation in the alkaline and inland saline ecosystems of Haryana, Uttar Pradesh and Tamil Nadu by the Central Sub-Committee on Crop Standards, Notification and Release of Varieties for Agricultural Crops vide S.O. 6123 (E) dated December 31, 2025 (CG-DL-E-31122025-268976).

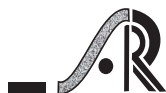
Keywords: Hybrid rice, Alkaline and Inland saline stress, MABB, *Saltol*, resistance to biotic and abiotic stress, long slender grains

Introduction

Salinity constitutes the second most unfavourable abiotic constraint to global rice production after drought, severely impairing productivity across coastal, inland saline and sodic ecosystems. Although hybrid rice technology has evidently enhanced yield potential over conventional inbred cultivars, its deployment under salinity stress conditions remains limited. In the context of escalating population pressure and progressive shrinkage of cultivable land,

the development of stress-resilient hybrids capable of sustaining productivity in marginal environments has become imperative.

To address this challenge, the ICAR-Indian Institute of Rice Research (IIRR) initiated a targeted breeding program to develop a hybrid specifically adapted to alkaline and inland saline ecologies. The restorer line PSV 729R was improved for seedling-stage salinity



tolerance through marker-assisted backcross breeding (MABB) by introgression of *Saltol* QTL. The improved restorer, when crossed with IR79156A, resulted in the development of hybrid IIRRH-155 (IET 30165), subsequently designated as DRRH-7. The hybrid was nominated to the All India Coordinated Research Project (AICRP) on Rice and evaluated under multi-location Alkaline and Inland Saline Tolerant Varietal Trials (AL & ISTVT) during 2021–2024.

Across diverse stress environments in Zones II (Haryana), III (Uttar Pradesh), and VII (Tamil Nadu), IET 30165 consistently demonstrated superior

performance under both alkaline and inland saline conditions, exhibiting stable yield advantages over national and regional checks. In alkaline ecologies, the hybrid recorded grain yield (**3537 kg ha⁻¹**) superiority over CSR10 (26%), FL478 (20%) and the sensitive check, Pusa 44 (40%). Under inland saline conditions, yield advantages (**3372 kg ha⁻¹**) were observed over CSR10 (14%), FL478 (13%) and Pusa 44 (83%). These results validate the effectiveness of *Saltol*-mediated ion homeostasis in conferring enhanced tolerance and yield stability under sodic and saline stress (**Table 1**).

Table 1: Grain yield performance of DRRH 7 in Zone-II (Haryana), Zone-III (Uttar Pradesh) and Zone-VII (Tamil Nadu)

Zones/States	DRRH-7 (IET 30165)	Superiority over checks (%)		
Mean Grain Yield (Kg/Ha)		ED Saline and Alkaline Check (CSR10)	Saline Tolerant Check (FL478)	Sensitive Check (Pusa 44)
Alkalinity*				
Zone-II[11 locations]	3364	2707 (24)	2736 (23)	2014 (67)
Zone-III[5 locations]	3497	2829 (24)	2574 (36)	2153 (62)
Zone-VII[15 locations]	3677	2865 (28)	3227 (14)	3021 (22)
Overall Weighted Mean [31 locations]	3537	2803 (26)	2947 (20)	2524 (40)
Inland Salinity#				
Zone-II [6 locations]	3372	2961 (14)	2974 (13)	1843 (83)
*Alkalinity includes Zone-II (Haryana), Zone-III (Uttar Pradesh) and Zone-VII (Tamil Nadu); # Inland Salinity includes Zone-II (Haryana).				

Alkalinity- Zone II, III and VII

		Year of Testing	DRRH-7 (IET 30165)	ED Saline and Alkaline Check, CSR10	Saline Tolerant Check FL478	Sensitive Check Pusa 44
Mean Yield (Kg/ha)	8	2021	3518	2471	2371	1960
	8	2022	4078	3497	3391	2622
	6	2023	3341	2782	3154	2576
	9	2024	2495	1448	2704	2958
Weighted mean			2607	2079(25)	2097(24)	1681(55)

Inland Salinity Zone-II

Mean Yield (Kg/ha)	1	2021	3793	2753	3053	2120
	1	2022	3800	3220	2987	1407
	2	2023	3484	2847	2687	1837
	2	2024	2835	3048	3215	1928
Weighted mean			3372	2961(14)	2974(13)	1843(83)

The hybrid exhibits moderate resistance to major fungal diseases including leaf blast, neck blast, brown spot, and grain discoloration, along with moderate tolerance to plant hoppers, thereby contributing to enhanced production stability. Grain quality evaluation revealed superior milling attributes, with hulling (80.33%), milling (70.87%) and head rice

recovery (61.97%) comparable to checks. DRRH-7 possesses intermediate amylose content (24.41%), alkali spreading value (4.0), gel consistency (46 mm) and a long slender grain type (kernel length 6.35 mm; kernel breadth 2.0 mm), fulfilling consumer-preferred cooking and grain quality standards (**Figure 1**).



Figure 1: DRRH-7 (IET 30165) Field View and paddy, brown and polished rice

Agronomically, the hybrid is recommended for sowing from the second week of June to the second week of July, synchronized with monsoon onset or supported by pre-sowing irrigation. A seed rate of 15 kg ha⁻¹ is optimal. Transplanting of 18–22 day-old seedlings at a spacing of 20 × 15 cm (1–2 seedlings per hill) is advised. Effective weed management may be achieved through manual or chemical control, and irrigation should be ensured during moisture sensitive stages, particularly active tillering, panicle initiation, booting and grain filling. DRRH-7 is an early-duration hybrid (127–130 days, seed-to-seed) with sustainable yield potential under recommended management practices within its target ecologies.

Based on its consistent multi-environment performance and stress adaptability, DRRH-7 has been approved for release and commercial cultivation in the alkaline and inland saline ecosystems of Haryana, Uttar Pradesh, and Tamil Nadu by the Central Sub-Committee on Crop Standards, Notification and Release of Varieties for Agricultural Crops (CVRC) vide S.O. 6123 (E) dated December 31, 2025 (CG-DL-E-31122025-268976). Collectively, DRRH-7 represents a significant advancement in hybrid rice breeding for inland saline and alkaline agro-ecosystems, offering a robust technological intervention for enhancing productivity and livelihood security in stress-prone regions.