



TNAU Rice Hybrid CO4 (TNRH 174)- A New Fine Grain Rice Hybrid

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TNAU Rice Hybrid CO 4 (TNRH 174) a derivative of the cross TNAU CMS 23 A/ CB 174 R, released during the year 2011 matures in 130-135. The hybrid recorded a mean productivity of 7327 Kg/ ha with 14.5 and 11.3 per cent increase over CO (R) 49, the fine rice check variety and 27P11, the private hybrid respectively. It gave higher yield under SRI than normal method and showed better agronomic efficiency than the check variety CO(R)49. The hybrid produced medium slender white rice with the L/B ratio of 2.96, with high milling percentage (68.6%) and head rice recovery (62.5%). It has intermediate amylose content (24.01), soft gel consistency (65) and moderate gelatinization temperature indicating its superior cooking quality. Upon cooking, linear elongation ratio (1.7) and volume expansion (5.0) ratio were higher than 27 P 11 and CO (R) 49. This hybrid showed higher yield, better pest and disease resistance and good cooking quality in comparison to the checks CO (R) 49 and 27 P11 and hence was released as a new medium duration hybrid, TNAU Rice Hybrid CO 4 for cultivation during late *samba* / *thaladi* season throughout Tamil Nadu.

Key words: TNAU Rice hybrid CO4, (TNRH 174) medium duration, medium slender rice

Rice occupies the important prime place among the food crops cultivated around the world. It is the staple food of 60 per cent of Indian population and it accounts for 43 per cent of total food grain production. India produced 102 million tonnes of rice from an area of 44 million hectares with a productivity of over two tons per hectare (Department of Agriculture and Corporation, 2012). To meet the demands of increasing population and to maintain self sufficiency, the current production level needs to be increased up to 130 million tons by the year 2025. Since land is shrinking, increasing food production by expanding the area under cultivation is impossible. Introduction of semi-dwarf varieties with non lodging, erect plant type and high responsiveness to fertilizers in mid sixties boosted the rice production of India substantially. However the production has come to a plateau and all efforts have failed to give tangible results to break the present genetic yield barrier in rice. The current situation necessitates looking for some innovative technologies to boost rice production (Hariprasad *et al.*, 2011). Hybrid rice promises to be the most effective available genetic tool to break the yield barrier and to achieve the targeted production (Viraktamath *et al.*, 2010).

Rice quality is of great importance for all people involved in producing, processing and consuming rice, because it affects the nutritional and commercial value of grains. Grain quality is based

upon objective and subjective criteria, the relative importance of which depends upon the particular end-use. The most important quality components, common to all users, include appearance, milling, cooking, processing and nutritional quality. By choosing appropriate parental lines, it is possible to develop hybrids with desirable grain and cooking quality traits as per the region specific requirement of the consumer (Abdus Salam Khan *et al.*, 2009).

A total of 46 rice hybrids have been released both from public (29 hybrids) and private sectors (17 hybrids) for commercial cultivation. In Tamil Nadu, out of the total 20.5 lakh hectares of area under rice, nearly three-fourth of the area grows medium and late duration (>135) rice varieties during *samba*/ late *samba* season. To overcome the plateauing yield in the *Samba*/ *thaladi* seasons, hybrid rice technology is considered a viable option. Hence, attempts were made for the development of a medium duration, pest and disease resistant rice hybrid with good grain quality.

Materials and Methods

TNRH 174 is a derivative of the cross TNAU CMS 23 A x CB 174 R - the test cross effected during 2005 at Department of Rice, Centre for Plant Breeding and Genetics, Tamil Nadu Agricultural University, Coimbatore. The hybrid matures in 130-135 days and was evaluated as IET 20741 and IET 21449 under All India Coordinated Rice Improvement Programme for four years from 2008-09 across the

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country in Initial Hybrid Rice Trial – Medium (IHRT–M) and Initial Hybrid Rice Trial–MS (IHRT – MS).

The hybrid was tested in multi location trials in different rice research stations of TNAU covering different ecosystems of Tamil Nadu along with the varietal check CO (R) 49 and the private hybrid check, 27 P 11. Based on the performance under MLT, it was tested under Adoptive Research Trials (ART) during 2009 -10 in 16 districts and eight KVKs in Tamil Nadu of which the culture out-yielded the checks in 14 districts and eight KVKs. On Farm Trials (OFT) were conducted during 2009 - 2010 in 30 locations in six districts. Pest and disease performance was tested under artificial and field

conditions at Coimbatore and Gudalur. Agronomical performance of the culture was tested under SRI system and physiological efficiency was measured during 2008-09 at Department of Rice. Physical, milling, cooking and biochemical properties of this hybrid were tested along with the checks BPT 5204, 27 P 11 and CO (R) 49 at DRR and Department of Rice, TNAU, Coimbatore.

Results and Discussion

Hybrid culture TNRH 174 was tested in station trials in samba/thaladi season for six years at Department of Rice, TNAU, Coimbatore during 2006-2011. This culture recorded a mean grain yield

Table 1. Overall yield performance of TNAU Rice Hybrid Co 4 (TNRH 174) in different trials

Name of the Trials	No. of trials	Grain Yield (Kg/ha)			
		TNRH 174	BPT 5204	27P11	CO (R) 49
Station trials (2005-2007)	3	7754	5895	-	-
Multi-location trials (2009-10)	7	6354	-	5487	5148
AICRIP- IHRT Medium - 2008	11	6110	5169	-	-
AICRIP- IHRT Medium Slender-09	27	6131	5099	-	-
Adaptive Research trial (2009-10)	81	7362	-	6556	6288
On Farm Trial	30	9050	5990	-	6490
No. of trials	159	71	88	118	
Overall weighted mean yield in Kg/ ha	7348	5520	6470	6272	
Per cent increase over the checks	33.1	13.6	17.2		

of 7754 Kg/ha, over 3 years of station trials with 31.5 per cent yield improvement over BPT 5204 and 17.80 per cent over CO (R) 48 (Table 1). Considering the stable performance under on-station experiments, the hybrid was proposed for multi-location testing.

Table 2. Resistance reaction of TNAU Rice Hybrid Co 4 (TNRH 174) against major rice diseases under artificial conditions in 2009-10

Culture	Blast	Neck blast	Brown spot	Sheath rot	RTD	Sheath blight
TNRH 174	4.0	4.0	4.0	5.0	5.0	5.0
BPT 5204	9.0	9.0	7.0	7.0	9.0	9.0

(Source: AICRIP Progress Report 2009)

respectively. TNRH 174 was evaluated under All India Coordinated Rice Improvement Programme for four years from 2008-09 across the country in Initial Hybrid Rice Trial –Medium (IHRT –M) as IET

Table 3. Resistance reaction of TNAU Rice Hybrid Co 4 (TNRH 174) against major rice pests under artificial conditions (2009-10)

Culture	BPH	WBPH	GLH
TNRH 174	5.0	5.0	5.0
27P11	7.0	9.0	5.0
BPT 5204	9.0	9.0	9.0
CO(R)49	7.0	5.0	5.0

(Source: Annual Research Meet -Rice 2008)

BPH: Brown plant hopper WBPH: White backed plant hopper GLH: Green leaf hopper

20741 and Initial Hybrid Rice Trial–MS (IHRT –MS) as IET 21449. In IHRT-M, this hybrid recorded a mean grain yield of 5929 Kg/ha with 14.0 per cent increased yield over local checks and ranked third in the western zone comprising Gujarat and Maharashtra. Under IHRT- MS, it recorded 6131 kg / ha which was 20.2 per cent increase over the National check BPT 5204.

TNRH 174 was also evaluated at different locations of Tamil Nadu in multi location trials during 2009-10 wherein it recorded the mean yield of 6354 Kg/ha with an increase of 23.40 and 15.80 per cent over CO (R) 49 and the private hybrid 27 P11

Under Adaptive Research Trials (ART) conducted in farmers lands in 16 districts and eight KVKs in Tamil Nadu, the culture out-yielded the checks in 14 districts and eight KVKs. It recorded a mean grain yield of 7343 Kg/ha in 90 locations which was 14.0 and 10.0 per cent higher yield than CO (R) 49 and 27 P 11. Under On Farm Trials (OFT), in 30 locations in six districts the hybrid was tested wherein it recorded a mean grain yield of 9050 Kg/ha which was 28.0 and 34.0 per cent higher than CO (R) 49 and BPT 5204.

In the overall performance, the culture TNRH 174 recorded a mean productivity of 7327 Kg/ha in five years of trials with 14.5 per cent and 11.3 per cent increase over CO (R) 49 and the private hybrid 27 P11 (Table 1). At Chitlapakkam in Kancheepuram district, the hybrid culture recorded the highest yield of 11250 kg/ha in the farmer's holdings thus demonstrating the high yield potential of this hybrid.

Table 4. Distinguishing morphological characters of TNAU Rice hybrid CO 4 (TNRH 174)

Early plant vigour	: Good	Panicle type	: Long, compact, droopy
Coleoptile	: Green	Awning	: Absent
Basal leaf sheath colour	: Green	Days to maturity	: 130-135 days
Leaf sheath	: Green	Seed coat (Kernel) colour	: White
Leaf blade colour	: Green	Junction of auricle	: Pale green
Leaf pubescence	: Intermediate	1000 grain weight (g)	: 20.40 g
Leaf length	: 55.0 cm (\pm 5.0 mm)	Hull (husk) colour	: Straw
Leaf width	: 1.50 cm (\pm 0.2 mm)	Thresh ability	: Good
Days to 50% flowering	: 100-105 days	Aroma	: Absent
Panicle exertion	: Well-exerted panicle	Grain yield per plant (g)	: 60-80 g
Stigma colour	: White	Grain	: Medium slender
Apiculus colour	: Straw	L x B	: 5.67 x 1.91 mm
Number of effective tillers	: 25-30	L / B ratio	: 2.96
Plant height (cm)	: 120 -130 cm	Rice grade	: Medium slender
Panicle length (cm)	: 28-30 cm	Milled rice colour	: White
No. of Grains/panicle	: 325 - 400	Abdominal white	: Occasionally present

This hybrid culture, TNRH 174 was screened against all the five major diseases viz., blast, brown spot, sheath rot, sheath blight and rice tungro disease (RTD) under artificially inoculated conditions during 2008-09 and 2009-10. It was found to be resistant to blast (score 4) and brown spot (score 3) and moderately resistant to sheath blight (score 5), sheath rot (score 5) and RTD (score 5) (Table 2). The hybrid was evaluated for two years (2008-09) against major pests and the culture was found to be moderately resistant to WBPH (score 5) and GLH (score 7) (Table 3).

Table 5. Grain quality characteristics of TNAU Rice hybrid CO 4 (TNRH 174)

Grain Characteristics	TNRH 174	BPT 5204	27P11	CO (R) 49
Milling quality traits				
Hulling %	84.3	78.2	70.6	80.6
Milling %	68.6	65.4	66.0	62.5
Head Rice Recovery %	62.5	57.8	48.8	53.7
Physical grain quality traits				
Kernel length (mm)	5.7	4.8	5.8	5.6
Kernel breadth (mm)	1.9	1.8	1.7	1.7
LB ratio	2.9	2.7	3.4	2.8
Cooking quality traits				
Kernel length after cooking	9.5	9.0	8.9	9.0
Linear elongation ratio	1.7	1.8	1.5	1.6
Breadth-wise expansion ratio	5.0	4.2	4.5	4.6
Alkali spreading value	4	4	3	5
Gel consistency (mm)	65	25	48	72
Amylose content (%)	24.0	24.5	22.3	23.3

This hybrid is medium in duration (135 days) with 125 cm plant height and well exerted panicle. Distinguishing morphological characters of this hybrid is furnished in table 4. It has long, compact and droopy panicle with a length of 28-30 cm. The hybrid has 1000 grain weight of 20.40g.

Improvements in rice quality are very important in meeting the demands of consumers for healthy, high-quality food. In Tamil Nadu, during thaladi season medium duration rice hybrid, KRH 2 is the only hybrid available from the public sector. But, this

hybrid is having poor head rice recovery and poor cooking quality. Hence, there is a demand for the development of high yielding medium duration quality hybrid. TNAU Rice hybrid CO 4 has medium slender white rice with an L/B ratio of 2.96. It has high milling percentage (68.6%) and head rice recovery (62.5%) which is in accordance with Shivani *et al.* (2007) who reported significant positive association of head rice recovery with milling outturn and Rajeswari *et al.* (2012) also reported in medium duration high yielding variety CO (R) 49 with high milling percentage and head rice recovery. It has

Table 6. Performance of TNAU Rice Hybrid Co4 (TNRH 174) in Agronomy trials (2008-09)

Characters	TNRH 174 CO (R) 49			
	Normal	SRI	Normal	SRI
No. of productive tillers per hill	14-17	23-32	18-21	22-26
SPAD reading at flowering	39.17	42.26	40.65	44.46
Plant height at harvest (cm)	110	112	79.0	80.0
Panicle weight (g)	3.20	3.73	2.31	2.40
Grains per panicle (No)	177	221	136	162
Grain yield (kg/ha)	8889	9556	6556	7444
Straw yield (kg/ha)	9700	10389	7634	9089
Bio Mass (t/ha)	18.6	20.0	14.2	16.5
Agronomic efficiency (%)	41.6	46.6	34.2	40.8

intermediate amylose content (24.01), soft gel consistency (65) and moderate gelatinization temperature (4) indicating its suitability with superior cooking quality. Thyagarajan *et al.* (2009) reported the intermediate amylose content (21.7%) which is essential for softness of cooked rice in the short duration rice hybrid CORH3. Upon cooking, linear elongation ratio (1.67) and volume expansion (5.0) ratio were found to be higher than 27 P 11 and CO (R) 49 (Table 4).

The hybrid was evaluated under SRI system of cultivation in Rabi 2009-10 at Coimbatore. The culture recorded higher yield under SRI than normal method. The culture recorded better agronomic efficiency (41.6 and 46.6 % under normal and SRI respectively) than

the check variety CO (R) 49 (34.2 and 40.8% under normal and SRI systems) (Table 5).

This hybrid showed higher yield, better pest and disease resistance and good cooking quality in comparison to the checks CO (R) 49 and 27 P11 and was released as a new medium duration hybrid, TNAU Rice Hybrid CO 4 for cultivation during late samba / thaladi season throughout Tamil Nadu.

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