

NLR 40054 (IET 23194): A High Yielding Blast Tolerant Aromatic Short Grain Rice Culture**P. Ramesh Babu, Y. Suryanarayana, Ch. Sreelakshmi, M. Sreevalli Devi, R. Krishna Naik, C.P.D. Rajan, P. Rajasekhar and U. Vineetha**

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The traditional and improved basmati rice varieties were mostly cultivated in North and North Eastern states were characterised by long slender grain with aroma and more elongation on cooking. Besides these there is vast diversity of aromatic short grain rices exists in India which have unique aroma with good cooking quality accompanied with low productivity, long duration, tall plant stature with lodging habit and susceptibility to major biotic stress components. Recently much attention was paid for improvement of short grain aromatic rices due to increased market demand and consumer preference especially in south India. Hence it is imperative to develop high yielding, aromatic fine grain, semi dwarf, non lodging, short to medium duration varieties with resistance to major pests and diseases in order to create domestic and export market for the fine/short grain aromatic rices. With this objective, a breeding programme was initiated to develop a variety with comparable cooking quality and with a wide spread biotic resistance with pleasant to strong aroma, suitable to grow in *rabi* as well as in early *kharif* seasons at Agricultural Research Station (ARS), Nellore, ANGRAU, A.P., India.

Hybridization was effected during 2000-01 between MTU 7029 (Swarna) and RNR 19994. MTU 7029 is a high yielding, medium to long duration (140 days) semi dwarf variety having dark green foliage and possess profuse tillering habit, resistant to bacterial leaf blight with susceptible to lodging. RNR 19994 is an aromatic fine grain, erect plant habit, medium duration variety with tolerance to gall midge. A homozygous aromatic line was identified in the pedigree nursery and was fixed as NLR 40054 in F₄ generation during *rabi* 2005-06 at ARS, Nellore, ANGRAU, AP. Morphological description of the culture is furnished in Table 1.

Table 1: Morphological description of the rice culture NLR 40054

S. No.	Morphological description	Value/Observation
1.	Plant height	: 85-95 cm
2.	Plant type	: Erect
3.	No. of tillers/ plant	: 10-15
4.	No. of panicles /sq. M	: 250
5.	Flowering duration	: 100-105 days
6.	Panicle type	: compact
7.	Panicle exertion	: Well exerted
8.	Awning	: Awn less
9.	Apiculus colour	: Green

When tested at ARS, Nellore, from 2006-07 to 2009-10 NLR 40054 recorded an average grain yield of 6453kg/ha in five trials with 22.25% yield increase over NLR 30491 and 18.6% over NLR 34449 respectively (Table 2). In multi location testing during 2009-10 under medium duration group where it recorded 6124 kg/ha. This culture was evaluated in All India Coordinated Rice Improvement Project

(AICRIP) from 2012 *kharif* to 2014 under aromatic short grain (ASG) group at 21 locations where it recorded an average grain yield of 4302kg/ha which is 48.24% increase over national check (Badshabhog), 51.74% over regional check (Kalanamak) and 23.30% over local check respectively. (DRR annual reports 2012, 2013 and 2014) (Table 2).

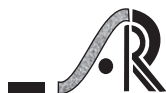


Table 2: Performance of (IET 23194) NLR 40054 at Station level and in AICRIP trials

Characters	Year of testing	Name of the trial	Test entry	Check Var 1	Check Var 2
			NLR 40054	NLR 30491	NLR 34449
Agricultural Research Station, Nellore					
Plant height (cm)			95.30	98.6	91.5
Days to 50% flowering			100	93.5	88.5
Panicles /m ²	Average of 2006-2010		400	421	492
Panicle length(cm)			21.452	22.425	21.05
Grain Yield (Kg/ha)	2006-07	OVT	7552	6677	4848
	2007-08	PVT	7500	4557	6157
	2008-09	AVT	4616	4858	5161
	2009-10	AVT II	6471	5021	5598
	2009-10	MLT (M 375)	6124	-	-
	Mean		6453	5278	5441
%increase over check				22.25	18.60
AICRIP data	No.of locations tested	IET 23194	NC (Badshabhog)	RC (Kalanamak)	LC
2012	21	4048	2946	2801	3658
2013	19	4074	2558	2552	3210
2014	18	4841	3214	3175	3587
	Mean	4245	2853	3806	3468
% increase over check			48.92	51.44*	23.44*

The culture NLR 40054 had strong and pleasant aroma, short slender grain type with 1000-grain weight of 14.5g and L/B ratio of 2.7. The kernel is white and translucent. The studies conducted at DRR from 2012 to 2014 indicated that it had good milling (72.33%) and high head

rice recovery (70.9%) (Table 3). The rice had intermediate amylose content (23.87%), which tends to remain non sticky and tender even after cooking. The culture showed good linear elongation ratio (1.71) and had good shape to the cooked rice.

Table 3: Data on quality characters by IET 23194 (NLR 40054) in All India Co-ordinated trials (Mean of 2012, 2013 and 2014)

S. No.	Character	Mean value of 3 years
1	1000-Grain weight	: 14.5g
2	Grain type	: Medium Slender
3	Kernel length (mm)	: 4.97mm
4	Kernel breadth (mm)	: 1.84 mm
5	L/B ratio	: 2.70
6	Kernel appearance	: Translucent
7	Hulling recovery	: 81.07%
8	Milling recovery	: 72.33%
9	Head rice recovery	: 70.90%
10	Kernel length after cooking	: 7.83 mm
11	Water uptake	: 183.33
12	Alkali spreading value	: 4.67
13	Amylose content	: 23.87%
14	Volume expansion Ratio	: 5.03
15	Gel Consistency	: 41.67
16	Kernel Elongation Ratio	: 1.71
17	Aroma	: Strong

When the culture was tested for different nitrogen doses at ARS as well as AICRIP trials it didn't shown significant increase in grain yield with the increase of nitrogen dose from 80kg to 240 kg/ha. Hence, the recommended dosage is 80 kg N/ha (Table 4). The culture NLR 40054 is moderately thermo tolerant (TIR test) as it showed 90%

seedling survival with 26.5% reduction in root growth and 16.3% reduction in shoot growth compared to MTU 1010 and MTU 1001 (Table 5) which indicated that the culture can also withstand to the high temperatures, hot winds and it can be suitable for summer season also.

Table 4: Performance of NLR 40054 at different nitrogen levels at ARS, Nellore

Nitrogen dose (kg/ha)	Grain yield (kg/ha)											
	NLR 40054			NLR 40058			NLR 40065			NLR 30491		
	2013	2014	Mean	2013	2014	Mean	2013	2014	Mean	2013	2014	Mean
N80	5976	7227	6601	5712	6590	6151	5650	7437	6543	6302	7985	7143
N120	6487	6844	6665	5858	8112	6985	6112	7397	6754	7328	7741	7534
N160	6174	7215	6694	5996	7439	6717	6466	7974	7220	7350	9156	8253
N200	6524	6792	6658	6408	6665	6536	6587	6963	6775	7233	7675	7454
N240	6884	6486	6685	6592	6544	6568	6397	6233	6315	7233	7160	7196

Table 5: Response of IET23194 (NLR40054) to Thermo tolerance in screening of rice genotypes through TIR technique

Name of the entry	Percent survival of seedlings	Percent reduction in root growth	Percent reduction in shoot growth
NLR40054	90	26.5	16.3
MTU1010	80	38.6	40
MTU1001	90	21	54

The culture NLR 40054 was screened against all major pests and diseases of rice during 2012-14 in NSN1 & 2 nurseries and from 2009-10 to 2011-12 at ARS, Nellore. It showed resistant reaction ('0' score) to gall midge under artificial and natural screening conditions at many centres under AICRIP testing and it recorded less than 15% dead

hearts which indicates its tolerance to the major pest stem borer (Table 6). NLR 40054 recorded tolerance reaction to sheath rot and leaf blast as it recorded less than 5 score both at national level (NSN 1&2) as well as station level. (Table 7).

Table 6: Screening of IET23194 (NLR 40054) for major insect Pests at Agricultural Research Station, Nellore

Year of testing	30 DAT (% damage)			50 DAT (% damage)		
	Gall midge	Stem Borer	Leaf Folder	Gall midge	Stem Borer	Leaf Folder
	Silver shoots	Dead Hearts	Leaf Damage	Silver shoots	Dead Hearts	Leaf Damage
2009-10	1.3	0.6	3.1	2.8	0.5	0.1
2010-11	2.4	1.5	4.9	3.6	3.8	3.9
2011-12	1.4	1.3	5.2	4.9	5.2	4.3
AICRIP data						
	Dead Hearts (D%)	White ears (D%)	BPH (D%)	GM 4 (D%)	Leaf folder (D%)	WBPH (D%)
2012	16.7	5.4	8.8	0	-	8.3
2013	5.6	10.25	7.8	62.5	17.33	6.95
2014	12.55	17.45	8.4	0	11.56	5.0

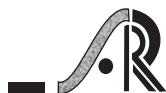


Table 7: Screening of IET23194 (NLR 40054) for major diseases

Year of testing	Sheath Rot	Leaf blast	Bacterial Leaf Blight	Neck Blast
Agricultural Research Station, Nellore				
2009-10	4.5	4.8	5.8	4.9
2010-11	5.0	4.6	5.5	4.8
2011-12	3.0	5.0	5.0	3.0
2013-14	4.4	4.7	5.8	5.0
AICRIP data (Susceptibility index)				
2012	3.8	5.6	6.4	6.6
2013	4.8	4.7	5.7	3.9
2014	4.6	5.0	6.2	5.2

Compared to traditional aromatic short grain rices, the new culture NLR40054 was medium duration rice with dwarf stature, non-lodging and has unique aroma throughout the crop growth period till serving of cooked rice, and it can be considered as an alternative aromatic variety for fine grain medium duration varietal group. With many desirable features like high yield, aroma, High HRR%, resistance to leaf blast, sheath rot, gall midge and tolerance to stem borer and it would cater the demands of the stake holders namely, farmers, traders, millers and consumers. It was submitted for Variety Identification Committee (VIC) for release at central level.

References

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