Received: 16 Nov 2020 | Revised: 03 Jun 2021 | Accepted: 09 Jun 2021

Electronic Journal of Plant Breeding

Research Article

NLR 3354 (Nellore Dhanyarasi): A short duration fine grain, blast tolerant rice culture for Andhra Pradesh

P. Ramesh Babu, Ch. Sreelakshmi*, R. Krishna Naik, M. Sreevallidevi, M. Subba Rao, P.V. Satyanarayana, U. Vineetha, P. N. Harathi, I. Paramasiva, P. Madhusudhan and P. Rajasekhar

Agricultural Research Station, Nellore, Andhra Pradesh-524003, India
***E-Mail** sreelakshmi.angrau@gmail.com

Abstract
The culture NLR 3354 is a cross derivative of NLR 34242 x NLR 34303 which was released during 2019 by SVRC, Andhra Pradesh with 120-125 days duration, high yielding ability and better adaptability. This culture with semi dwarf stature has efficient tillering capacity, medium droopy panicles with highly acceptable plant characters and is a good replacement for the rice variety NLR 34449 due to its high grain yield and pest and disease tolerance ability. It possess tolerance to leaf and neck blast. It recorded an average yield of 6410 kg/ha over the check of 5799 kg/ha in different trials conducted for a period of 9 years. It produces good quality cooked rice besides high milling and head rice recovery. It produces medium slender white rice with intermediate amylose, soft gel consistency and moderate gelatinization temperature. It produces good quality cooked rice besides high milling and head rice recovery.

Key words
NLR 3354, short duration, rice variety

INTRODUCTION

Rice is the wonder crop, it occupies and grows in almost all the agro ecological systems in the world. It is the major food of Indian people, with an average consumption of 75 kg/year/person. In India rice crop occupies an area of about 43.79 million ha, with a production of 116.42 million tons and an average productivity of 2659 kg/ha. Andhra Pradesh, a major rice growing state in India where rice crop is cultivated in an area of about 2.21million ha with a production of 8.25 million tons and productivity of 3733 kg/ha (Agricultural statistics at a glance, 2019). Rice occupies and will continue to occupy a pivotal place in global food and livelihood security systems.

The goal of a plant breeder is to develop high yielding variety. But now- a-days it includes improvement of the highly adaptable variety with respect to abiotic and abiotic stresses and also towards quality improvement. Hence, without disturbing the present yield component, the desirable features which the present day variety is lagging behind should be improved. Breeding efforts should concentrate on varieties with the potential to minimize yield losses under unfavourable conditions, and to maximize yields when conditions are favourable (Khush and Aquino1990).

In the entire Andhra Pradesh rice crop can be grown in the *kharif* season but in the southern zone of Andhra Pradesh where rice can be grown in the early *kharif* and *rabi* seasons. The early *kharif* crop can be grown in the areas where irrigation potential is enough for grown two crops. The early *kharif* season is characterized by quite high temperatures, high velocity hot winds, and the variety should mature in a shorter time. It also fetches good price in the market. In view of this, research programme was formulated at Agricultural Research Station, Nellore for the development of a short duration (120-125 days), fine grain, blast tolerant, non-lodging, dwarf rice variety.

MATERIAL AND METHODS

NLR 3354 is a derivative from a cross of NLR 34242/NLR 34303 effected during 2003 *rabi* season and stabilized in F_7 generation and identified as NLR 3354 through Pedigree method of breeding at Agricultural Research Station, Nellore. Performance of the culture was tested in different yield trails at ARS, Nellore form 2011-2014 along with short duration check varieties. The culture was tested in MLT during 2015 and 2017 in different Rice Research Stations of Andhra Pradesh covering different ecosystems. Under All India Coordinated Rice Improvement Programme (AICRIP) this new culture was evaluated as IET 26226 in Initial Varietal Trial – medium slender group during 2016 (IVT-MS). Based on the performance under MLT, it was tested under minikit testing during 2016-19 in farmers holdings comprising of 380 locations. Pest, disease and agronomical performance was tested under field conditions at ARS. Physical, cooking and biochemical properties of rice were tested along with checks of BPT 5204 at Indian Instituteof Rice Research, Hyderabad and Department of Plant Breeding, ARS, Nellore.

RESULTS AND DISCUSSION

The culture NLR 3354 recorded a mean grain yield of 7042 kg/ha over 5 experiments with an yield increase of 20.82 per cent over the check Swarnamukhi (NLR 145) and 9.86 per cent over NelloreMahsuri (NLR 34449). In Multi Location Trial conducted during *kharif,* 2015 (early group), it recorded an average of 7.09 per cent increase over the best check MTU 1010. NLR 3354 was tested as IET 26226 in All India Co-ordinated trials during 2016 under Initial Variety Trial-Medium Slender grain group. It recorded an average grain yield of 4941 kg/ha in 25 centres. The cultures recorded the highest grain yield of 7917 kg/ha at Gangavathi centre and it recorded an increased grain yield of 6 per cent over national check (WGL 14) at Tamil Nadu state (**Table 1**).

The minikit testing in Nellore, Kadapa and Chittoor districts from 2016-17 to 2018-19, NLR 3354 recorded an average grain yield of 7606 kg/ha which was 9.76 per cent higher than the popular check variety NLR 34449 (6946 kg/ha). The highest grain yield of 10236 kg/ha was recorded by Sri G.Sreehari Naidu, JJpeta (V), Indukurupetamandal, Nellore Dt. It occupied about 5000 ha in Nellore, Kadapa, Chittoor districts of A.P and parts of Telangana state due to its blast tolerance, photoinsensitivity, dwarf nature, non-lodging and fine grain quality even before its release.

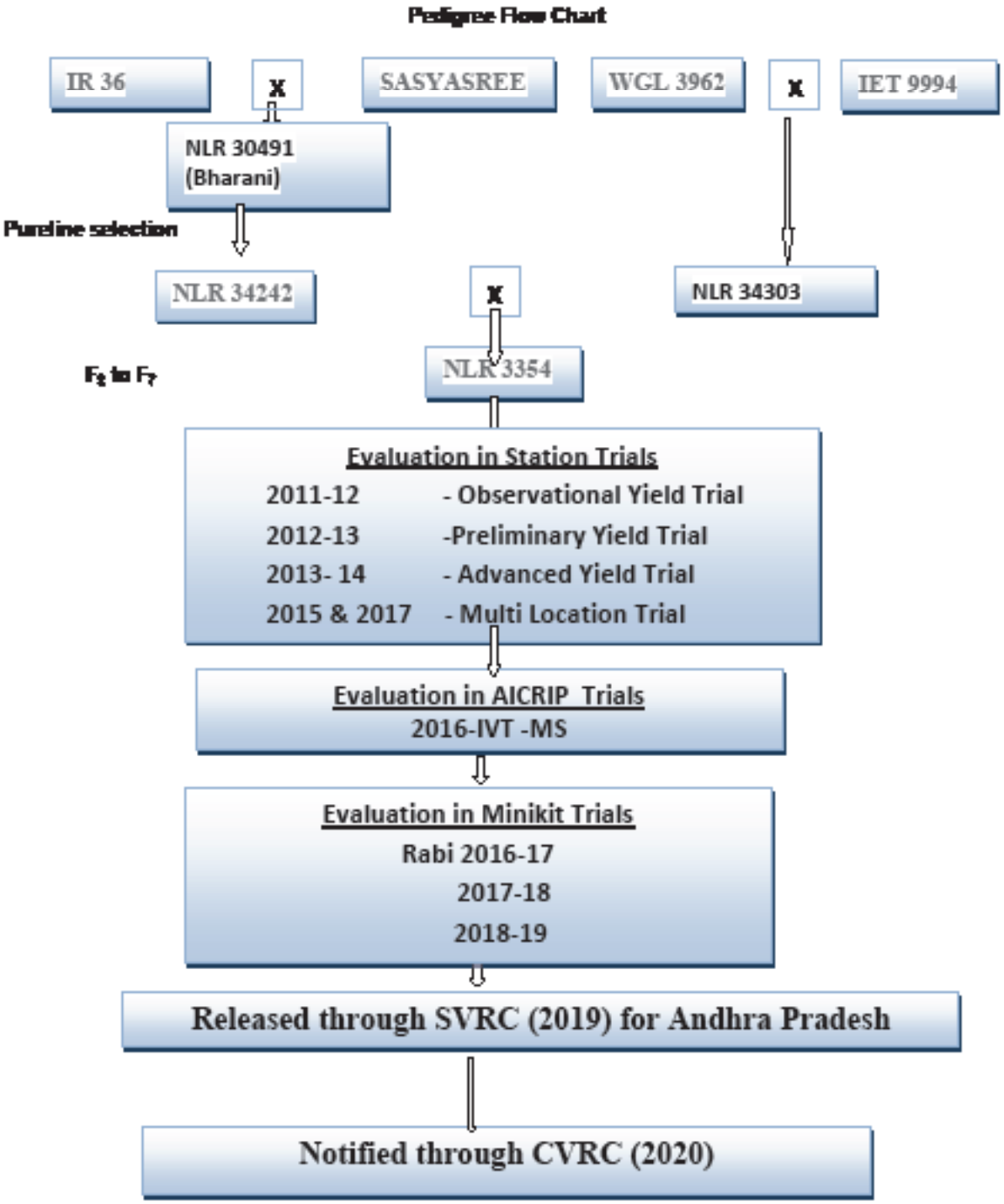
In the southern zone of Andhra Pradesh, an early *kharif* is the peculiar season where short duration rice varieties can be grown. Till now, NLR 34449 is the promising variety under fine grain group suitable for an early *kharif* as well as *rabi* seasons. NLR 3354 is promising culture for both the seasons. It has the ability to with stand such a harsh climatic condition during the early *kharif*. NLR 3354 is fine grain culture with non-shattering ability and high threshability for machine harvesting. Whereas, the NLR 34449 have poor threshability for machine harvesting during early *kharif* season. The morphological and distinguishing features of the variety NLR 3354 was presented in **Table 2**.

In agronomic trials among the four levels of nitrogen tested viz., 80,120,160 and 200 kg/ha nitrogen, the culture NLR 3354 performed well at 120 kg N/ ha. There was no significant yield increase from 120 to 200 kgN/ha. Hence, 120 kgN/ha is found to be optimum for the early *kharif* and *rabi* seasons (**Table 3**).

Table 1. Overall yield performance of culture NLR 3354 in different trials

S.No	Name of the trial	Year	Grain yield (kg/ha)	
Station yield trials			**NLR 3354**	**NLR 34449/ NLR 145**
1	OYT	2011-12 *Rabi*	6613	5494
2	PYT	2012-13, *Rabi*	6738	6349
3	AYT	2013-14, *Rabi*	7430	5464
4	AVT	2013-14, Early *Kharif*	6290	6000
5	AVT	2014-15, *Rabi*	8141	7472
Multilocation trials				
1	MLT-1	2015	5250	4902
2	MLT -2	2017	4686	4625
3	Minikits	2016-17 to 2018-19	7606	6946
4	AICRIP	2016	4941	4940
	Mean		6410	5799
% increase over the check			**10.54**	

(NLR 34449 in early *kharif* and NLR 145 in *rabi* season)



NLR 3354 is a medium slender grain culture with an L/B ratio of 2.85 and it has a good hulling per cent of 81.6, milling per cent of 72, H.R.R per cent of 55, which is in accordance with Oko *et al.*(2012) and Robin *et al.* (2019), Saraswathi *et al.* (2019) and Pushpa *et al.* (2020) who reported a significant positive association of head rice recovery with milling outturn. It has an intermediate amylose (25 %) & alkali spreading value (5), besides good volume expansion ratio (5.6) and water uptake (220 ml) (**Table 4**). It has the test weight of 15.8 g/1000 grains with good cooking and organo-leptic properties. Based on the pest and disease screening trials conducted at ARS, Nellore during 2012-13 to 2014-15, it was found that the proposed variety was tolerant to leaf blast as well as neck blast (**Table 5 and 6**).

Table 2. Distinguishing morphological characters of NLR 3354

S.No	Trait / Character	Description
1.	Plant height	80-90 cm
2.	Habit	Erect
3.	Days to 50 % flowering	95-100 days
4.	Lodging	Non lodging
5.	Leaf blade colour	Medium Green
6.	Basal leaf sheath colour	Medium Green
7.	Leaf angle	Erect
8.	Flag leaf angle	Erect
9.	Leaf length	26 cm (medium)
10.	Leaf width	1.4 cm (medium)
11.	Leaf blade pubescence	Weak
12.	Ligule colour	White
13.	Ligule shape	Split
14.	Ligule length	3.2 mm
15.	Auricle colour	Pale green
16.	Collar colour	Pale green
17.	Culm angle	Erect
18.	Flag leaf angle	Intermediate
19.	Culm internode colour	Green
20.	Panicle length	20-22 cm
21.	Panicle type	Compact
22.	Panicle exersion	Well exerted
23.	Awns	Absent
24.	Apiculus colour	Straw
25.	Stigma colour	White
26.	Lemma palea colour	Straw
27.	Lemma palea pubescence	Hairs on upper portion
28.	Seed coat colour (bran)	straw
29.	Sterile lemma colour	Straw
30.	Senescence	Late
31.	Grain type	Medium slender
32.	Grain shattering	<2%
33.	Flowering duration (days)	8-10
34.	Dormancy (weeks)	-
35.	Harvest index(%)	60-65
36.	Filled grains/panicle	150-180
37.	Tillering ability	Moderate (7-14)

Table 3. Performance of culture NLR 3354 under different N levels

Treatment	Grain Yield (kg/ha)			Yield increase for every 40 kg N	Grain Yield (kg/ha)			Yield increase for every 40 kg N
N in kg/ha	Kharif 2016	Kharif2017	Average		Rabi 2016	Rabi 2017	Average	
80	4380	4892	4636		6337	7507	6922	
120	4461	5642	5052	416	6413	7937	7175	253
160	5031	5411	5221	170	6727	7826	7277	102
200	4603	5062	4833	-389	6671	8220	7446	169
Mean	4619	5252	4935	103	6537	7873	7205	-241

Table 4. Quality characteristics of culture NLR 3354

S. No.	Character	NLR 3354	BPT 5204
1.	Grain type	Medium slender	Medium slender
2.	Kernel length (mm)	5.22	4.98
3.	Kernel Breadth (mm)	1.83	1.85
4.	L/B ratio	2.85	2.69
5.	Hulling %	81.6	80.8
6.	Milling %	72	70.1
7.	Head Rice Recovery (%)	55	51.1
8.	Test Weight (g/1000 grains)	15.8	13.5
9.	Rice Grain Type	Medium slender	Medium slender
10.	Grain Chalkiness	VOC	VOC
11.	Amylose content (%)	25.16	23.4
12.	Alkali spreading value	5.0	4.0
13.	Water uptake (ml)	220	245
14.	Volume expansion ratio	5.6	5.2
15.	Kernal elongation ratio	1.87	2.04
16.	Kernal length after cooking (mm)	9.4	10.2
17.	Gel consistency (mm)	23	24

Table 5. Reaction of NLR 3354 to different diseases

Year	Genotype	Leaf Blast	Neck blast	Bacterial Blight	Sheath rot
2012-13	NLR 3354	5	-	-	-
	NLR 34242	8	-	-	-
2013-14	NLR 3354	5	3	5.5	5.5
	NLR 34242	8	8	9	9
2014-15	NLR 3354	5	3	5	5
	NLR 34242	9	8	8	9
SI		5	3	5.25	5.25

Table 6. Reaction of NLR 3354 to insect pests

Year	Variety	30DT (%)			50DT (%)			
		GM	DH	LF	GM	DH	LF	WE
2011-12	NLR 3354	5.25	1.46	6.47	11.76	0.65	6.07	0.00
	TN 1	4.78	3.60	9.6	21.58	1.7	7.51	0.00
2012-13	NLR 3354	2.08	8.8	12.8	0.87	1.20	6.68	0.21
	TN 1	4.21	13.5	21.6	2.21	4.56	12.45	1.20

GM: Gall midge, DH: Dead heart, LF: Leaf folder, WE: White ear

NLR 3354 with higher yield, disease tolerance with superior cooking quality in comparison with the check NLR 34449 was released through SVRC, Andhra Pradesh during 2019 and was notified during 2020 wide notification no. S.No.3482 (E). S.No.10. This variety can be grown in Andhra Pradesh wherever rice crop can be grown in the early *kharif* and *rabi* seasons.

REFERENCES

Agricultural at a glance, 2019. Directorate of Economics & Statistics, India

Annual progress report on crop improvement, 2016-17 by All India co-ordinated rice improvement project, Indian Institute of rice Research, Rajendranagar, Hyderabad.

Khush, G.S. and Juliano, B.O.1985. Breeding for high yielding rices of excellent cooking and eating qualities. In: Rice Grain Quality and Marketing, International Rice Research Institute, College, Laguna, Philippines, pp. 61-69.

Oko,A.O., Ubi, B.E. and Dambaba, N. 2012. Rice Cooking Quality and Physico-Chemical Characteristics: a Comparative Analysis of Selected Local and Newly Introduced Rice Varieties. *Food and Public Health*, **2**(1): 43-49. [Cross Ref]

Robin, S.,Mohanasundaram, K.,Manonmani, S., Rajeswari, S.,Jeyaprakash, P.,Pushpam, R,. Thiagarajan, K.,Rabindran, R.,Suresh, S.,Ravichandran,Vand Radhamani.S.2019. TNAU Rice CO 51 (IET 21605) - A high yielding short duration fine grain rice variety for Tamil Nadu.*Electronic Journal of Plant Breeding*, **10**(2): 324 -333. [Cross Ref]

Saraswathi, R., Santha, S., Pushpa, R., R.S.R.P. and V.Ravi, S.S.R.K.S. 2020. Rice ADT 51-A high yielding long duration rice variety suitable for samba season in Cauvery delta zone of Tamilnadu. *Electronic Journal of Plant Breeding,* **11**(3):721-726.

Pushpa,R., Sasikumar, D., Iyyanar, K and R. Manimaran, R.S.2019. Study of physic chemical cooking and nutritional properties of promising rice varieties of Tamil Nadu, *Electronic Journal of plant Breeding,* **10***(*3):1071-1078. [Cross Ref]