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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 2.21 million 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 Aquino 1990).

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 F7 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 Institute of 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 Nellore Mahsuri (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.Sreekhari 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) |
|------|------------------|----------|---------------------|
|      |                  |          | 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 exsion            | 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 | Kharif 2017 | Average | Rabi 2016 | Rabi 2017 | 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    |

https://doi.org/10.37992/2021.1202.046
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.

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