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NLR3186:Alongdurationblastresistantrice culturesuitableforirrigatedecologyofAndhraPradesh

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Abstract
The culture NLR 3186 was derived from a cross of NLR 28523 / Secandro Brazelio (5720-11-1-3-1) through Pedigree method of breeding at Agricultural Research Station, Nellore. It recordedan average yield increase of 19.97% over the check NLR 33892 in the station trials. In MultiLocation Trial conducted for 2 years it recorded 11.26% increase over the checks used for testingMTU1061.In3yearsofminikittestingtheentryNLR186recorded8.3%highergrainyieldthanthe check varieties tested. In AICRIP trial during 2012-13, it recorded on par with the nationalcheckMTU7029(4249kg/ha).Ithasnon-lodgingnature,highyielding,nitrogenresponsive,withmediumgreenfoliage,lowshatteringandcompleteexertionofpanicle.Itwastoleranttoleafblast,neckblastandsheathrot.Ithasgoodcookingandchemicalqualityasitexhibitsintermediateanddesired values of ASV, gel consistency, good linear elongation ratio and amylase content. It alsopossessesgoodheadricerecoverywithtranslucentgrainswhichisverymuchdesiredformarketing.
Keywords:Average,Kharif,Rabi, Trial,VarietyandYield

Introduction
Rice is the staple food and it has the ability to adopt in diverse agro climatic conditions throughout theworld.in India rice occupies an area of about 44 million ha whereas in Andhra Pradesh it occupies in 25lakhhectaresinkharifandrabiseasons.NelloreisoneofthemostimportantricegrowingdistrictinAndhraPradesh where rice crop has been cultivated for three seasons viz., early kharif (April-august), late kharif(August-January) and rabi (November-March) depending on the availability of irrigation water for ricecultivation.inearlykharifseasonshortduration(120-125days),latekhariflongduration(150days)andinrabi medium duration (130-135 days) varieties were generally cultivated in this area. Molagolukulu rice isthetraditionalricecultivatedinNellore,Prakasam,Chittoor,GunturandpartsofKadapadistrictsofAndhraPradesh state. Generally, molagolukulu varieties are of long duration, tall statured, lodging prone, darkglumedgrain,thickpanicleandthegrainswerearrangedinthreadlikemanneronthe rachisofthepanicle.These varieties are suitable to plant even under aged nursery conditions (40-50 days aged seedlings) buthavinggoodcookingandkeepingqualityofcookedrice,goodelongationofcookedricegrain.Thecookedrice cannot spoil even 20 hours after cooking also. Due to irregularities in mansoon pattern, the area hasdrasticallycomedownto30000haforthesevarieties.Buteventhen,thesinglecroppedareagrownforricecrop is majorly occupied by molagolukulu rice varieties in this area. At agricultural Research station,Nellore more than 10 improved molagolukulu rice varieties and released for cultivation long back. During2006, NLR 33892 (Parthiva) variety was developed and released which is the high yielder, blast tolerant,thick panicle but under high nitrogen application it may prone to lodging. Slowly because of healthconsciousnessamongthepublic,againthedemandisincreasingformolagolukuluricevarieties.Inviewofthe above, at Agriculture Research station, Nellore, NLR 3186 culture was developed to overcome theabovesaid difficultiesinmolagolukulurice cultivationandasan alternativeto NLR33892 ricevariety.

Materialandmethods
NLR 3186 rice culture was developed at ARS, Nellore, ANGRAU by following pedigree method ofbreeding. This culture is a derivative of NLR 28523 x Secandro Brazelio. This is a long duration cultureand the growing season was august month. It was tested for yield and its attributes at station level yieldtrails from2009-10to2011-12.TheculturewastestedinmultilocationtestinginANGRAU during2012-

13 and in 2017-18 under late maturity group trial. NLR 3186 was tested in AICRIP testing during 2012kharif season as IET 23660 in locations across the country. It was tested for pest and diseases in AICRIPunder NSN 2 nursery. It was tested in farmer's fields under minikit testing from 2017-18 to 2019-20 forthreeyearsin168,168and143locationsthroughoutthestateincomparisonwiththevariouschecks whichare ruling in that particular area. The data on quality parameters in comparison with e checks wereconducted ta RARS, Maruteru during 2017-18. It was deposited as an indigenous rice culture and got ICnumber for further reference. The DNA finger printing data was generated by using different markers atRARS,Maruteru, ANGRAU.

Resultsanddiscussion

ThehybridizationbetweenNLR28523xSecandroBrazeliowasattempteddurin g2003.Thebestprogenywas identified during F6 generation. Later on yield trials were conducted at station level for 3 consecutiveyearsfrom2009-10to2011-12anditwasrecordedanaveragegrainyieldof7272kg/haasagainstthecheckNLR 33892 (6030kg/ha) which is 19.97% increase over the check. It was tested in multilocation testingduring 2012 in 11 centres against the check MTU 7029 where it recorded an average grain yield of 6029kg/hawhichis9.57%increaseoverthecommoncheck(5502kg/ha)varietyused.In theyear2017againitwas tested in MLT in 9 centres against MTU 1061 (common check) where it recorded 7346kg/ha which is13.26%superioroverthecheck(6485 kg/ha)used.

The performance of any culture was proven when it was tested under large scale area in the farmers field.Theculturewastestedforthreeconsecutiveyearsfrom2017-18,2018-19and2019-20underminikittestingin 168, 168 and 143 farmers fields respectively. In minikit trials the culture was tested against respectiverice varieties grown in that particular area in different districts of Andhra Pradesh where it recorded anaverage grain yield of 6443kg/ha as against the check 5950 kg/ha which is 8.3% increase over the check.Theoverall meanoftheculturewas 6815 kg/ha.(Table 1).

During 2013 kharif season NLR3186 was nominated and tested as IET23660 along with 63 entries underIVT-L trial in 9 centres all over India under AICRIP testing along with three checks (National, Regionaland Local Checks).It recorded an average grain yield of 4249 kg/ha with the highest yield of 5093 kg/haat Raipur centre. NLR3186 recorded an increasedgrain yield of 33 % over the NationalCheck atBhubaneswar, 37.5% at Cuttack, 9% at Sharoli, 23.65% at Karnataka and 10.72% at Karaikal. On anaverageitrecordedatparyieldwithnationalcheckSwarna.ExceptNawagamcentre,NLR3186surpassedtheyie ldofSwarna(NationalCheck)intheAICRIPtesting.(Table2)(IIRRAnnualProgressReport2013,Vol.I,Page Nos. 1.215-1.226).

Diseaseandpestreaction:

TheculturewastestedforvariousdiseasesatAgriculturalresearchstation,Nellorefrom2010to2013andit showed prominent tolerant reaction to leaf blast disease.(Table 3) In AICRIP testing during 2013 it wastestedinNSN2 nursery,whereitwas foundtolerantforbothleafandneck blastdiseases.(Table 4).

AccordingtoNagendraReddy*etal*.,(2016),inastudyconductedonantibiosisandresistancemechanismsofresista ncetoBPH,thecultureNLR3186(IET23660)recordedresistantreactionagainstBPH(2score)(TN1susceptiblec heckscore:9,ResistantcheckPTBscore:2.1),lowfecundityofBPH,low%ofnymphalsurvival, longer nymphal duration, low growth of nymphs and less gain in body weight of BPH wasobserved whencomparedwiththesusceptible checkTN1.

Agronomicevaluation:

The culture NLR 3186 was tested for four different nitrogen levels for three consecutive years from 2016-2018 where it recorded 5342 kg/ha at 80kg nitrogen application per hectare. It responds even up to 160kgNbut theoptimumdosageis 80kg/ha(Table5).

Morphologicalfeatures:

The morphological features of the cultures were given in the table 6. The culture flowered 120days aftersowing and it grows upto a height of 90-100 cm and bearing 12-15 tillers per plant. The panicle length is25cm and the grains were in golden brown and having dark coloured furrows on the glumes. Short awnswerepresentonthetopgrainsinthepanicle.Theleaveswereerectandshowingdelayedsenescenceatthetime of maturity. Each panicle was fully exerted from the boot leaf and comprises 220 grains per panicle.Theharvest indexrangesfrom60-65%. (Table 6).

Qualityfeatures:

After grain yield second most important thing needs to consideration is quality which includes physical,milling,cookingandchemicalqualityparameters.TheultureNLR3186isamediumslenderculturewith a grain length of 8.2mm, width 2.6mm and the kernel length of 5.5mm, breadth 1.82 whereas the kernelL/bratiowas2.98.Theheadricerecoveryoftheultureis65%anditisacceptablerecoverytothemillers'pointofview.Absenceofgrainchalkinessandgoodkernelelongationratioof1.82andvolumeexpansionof3.3showsthegoodsignforcookingqualityoftherice.Thegrainsizebelongstomediumslendergroupandtheamylosecontent(24)andgelconsistency(25mm)werealsounderdesirablelimits(Table7).Intheorganoleptic test conducted by the group of people and it was found to that the rice was flaky, non-stickyandgoodcompatibility with curries whileeatingi.e.,good relishability.

In view of the above it was concluded that the culture NLR 3186 possess good yielding ability atstation level and also at farmers fields, good milling and cooking quality traits along with blast resistance,suitabletosowfromJulytoSeptembermonthevenunderdelayedtransplantingconditions(agedseedlings)itwas foundto besuitabletocultivateintheirrigatedriceecology ofAndhraPradesh state.

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IIRRAnnualProgress Reportoncropimprovement2013,Vol.I,PageNos.1.215-1.226.

Table1:YieldperformanceofNLR3186atstation,multilocationtrialsandatfarmersfield sinAndhraPradeshstate

S.No	Nameof the	Yearand seasonof increaseTrial overcheck	Grainyield(Kg/ha) NLR testing	Nameofthe 3186	Check Check	Percentage yield
1	OVT-L	2009-10Kharif	8886	NLR33892	6434	38.11
2	PVT-L	2010-11kharif	6221	NLR33892	5860	6.1
3	AVT–L	2011-12Kharif	6709	NLR33892	5796	15.7
4	MLT-I year	2012-13 11locations	6029	MTU7029 (Commoncheck)	5502	9.57
5	MLT-II yr	2017-18 9locations	7346	MTU1061 (commoncheck)	6485	13.26
6	Minikit trialsat farmers fields	2017-18 (168locations)	6373	NLR33892/ MTU1061 /RGL2537/ BPT5204	5828	9
7		2018-19 (168locations)	6372	NLR33892/ MTU1061/ RGL2537/ BPT5204/ MTU7029	5865	8.64
8		2019-20 (143locations)	6585	NLR33892/ MTU1061/ RGL2537/ BPT5204/ MTU7029	6158	6.93
		Average	6815		5991	13.45

b:Ancillaryparameters

Nameof thetrial	Yearand seasonof testing	Daysto50% flowering		Plantheight (cm)		Paniclelength (cm)		EBTS/m^2	
		NLR	Check Check3186 3186 33892	NLR	Check NLR NLR 33892	NLR 3186	Check NLR 33892	NLR 3186	NLR 33892
OVT-L	2009-10Kharif	127	120	109.1	123.6	24.8	24.5	420	405
PVT-L	2010-11kharif	124	124	96.5	107.3	24.5	24.3	495	424
AVT–L	2011-12Kharif	122	125	109.2	118.6	24.8	24.3	568	524
	Average	124	123	105	117	25	24	494	451

- Theentryrecorded150-155daysdurationformaturity.

Table2:CentrewisePerformanceofNLR3186(IET23660)inAllIndiaCoordinatedtrials.Grainyield(Kg/ha)inIVT-(Late)Kharif –2013

IET23660(NLR3186)GrainYield(Kg/ha)				
Place	**NLR3186**	**NationalCheck(Swarna)**	**RegionalCheck(SambaMahsuri)**	**Localcheck**
Bhubaneswar	4138	3103	4138	4138
Cuttack	**4432**	3222	3524	4181
Chinsura	**3526**	4915	4434	5769
Raipur	5093	5489	4828	3042
Sharoli	4354	3993	4618	4347
Nawagam	2392	7562	7022	4398
Nellore	**4368**	4342	3414	3896
Karnataka	4772	3859	3589	5318
Karaikal	**5536**	5000	3732	6161
OverallMean	**4249**	**4249**	**4393**	**4717**
DFF(days)	125	114	112	115
EBTs/Sq.m(No.)	271	288	293	282

Table3a:ReactionofNLR3186todifferentdiseasesatA.R.S,Nellore

Year	Genotype	LeafBlast	Neck blast	Bacterial Blight	Sheathrot
2009-10	NLR3186	0	-	-	-
	NLR33892©	4	-	-	-
2010-11	NLR3186	1	-	-	-
	NLR33892©	5	-	-	-
2011-12	NLR3186	0	-	-	-
	NLR33892©	6	-	-	-
2012-13	NLR3186	1	7	5	5
	NLR33892©	1	1	6	3
2013-14	NLR3186	4	3	5	1
	NLR33892©	5	3	5	3
	SI	1.6	5	5	3
	• Inthestationscreeningtrialsitwasfoundtoleranttoleafblast.				

Table3b:ReactionofNLR3186toinsectpestsatARS,Nellore

Year	Variety	30DT(%damage)		
		GallMidge	DeadHearts	LeafFolder
2009-10	NLR3186	0	3.5	5.6
	TN1	4.5	19.5	12.5
2010-11	NLR3186	0	7.92	6.21
	TN1	3.0	17.5	22.5
2011-12	NLR3186	1.0	5.75	4.35
	TN1	5.0	21.75	24.5

Table4a:ReactionofNLR3186toLeafblastatAICRIPtestingduring2013

S.No	Place	Blastdiseasescore		
		LeafBlast	Swarna	HR12
		NLR3186	NationalyieldCheck	NationalSuceptiblecheck
1	Barapani	5	-	9
2	IIRR	3	9	9
3	Lenova	4	8	9
4	Nellore	5	4	8
5	Almora	3	5	9
6	Gaghraghat	5	5	4
7	Ranchi	4	5	7
8	Varanasi	4	6	5
9	Mandya	2	6	4
10	Malan	1	5	8
11	Hazaribhag	3	3	5
12	Rewa	3	4	5
13	Coimbatore	4	5	4
14	Warangal	5	3	4
15	Jagdalpur	2	2	2
16	Pattambi	4	4	4
17	Maruteru	3	4	7
18	Rajendranagar	3	1	5
19	Karjat	3	5	3
20	Ponnampet	0	1	8
21	Gangavathi	2	2	2
	SI	**3.1**	**4.3**	**5.5**

- **DS:DamageScore**

Table4b:ReactionofNLR3186(IET23660)againstinsectpestsinKharif2013(DRRScreeningnurseries)

Place	Entry	BPH (DS)	WBPH(DS)	Green LeafHopper(DS)	GallMidgeBiotype1% DP	Stemborer		Leaf Folder
						Dead hearts %DH	white ears %WE	%DL
IIRR	TE	2.8	8.3		38.5			
	NC	9.0	7.2		-			
Ludhiana	TE	9.0				3.0(65 DAT)		28.9(65 DAT)
	NC	9.0				2.6		29.4
Gangavathi	TE	26.4 (62 DAT)	25.7				4.6(Pre harvest)	10.7(62 DAT)
	NC	5.6	5.8				0.9	3.6
Chinsura	TE					19.2(65 DAT)	11.1(93 DAT)	
	NC					3.5	0.0	

SBP	TE			10.7(50 DAT)	
	NC			5.3	
Rajendranagar	TE				1.1 (123 DAT)
	NC				8.0
Jagdalpur	TE	19	5.8(50 DAT)		2.1(50 DAT)
	NC	8	25.2		6.3
Bharapani	TE		80(50 DAT)		
	NC		15		

Table5:ResponseofNLR3186toNitrogenfertilizeratA.R.S,Nellore.

	2016		2017		2018		Mean	
	NLR 3186	BPT 5204	NLR 3186	BPT 5204	NLR 3186	BPT 5204	NLR 3186	BPT 5204
N40	5187	4622	5284	4860	4676	4298	5049	4593
N80	5288	5269	5559	5414	5541	5343	5463	5342
N120	5517	5269	5330	5447	5660	4865	5502	5194
N160	5624	5300	5739	5433	5096	4672	5486	5135
Mean	5404	5115	5478	5289	5243	4794	5375	5066

Summary: Amongthefourlevelsofnitrogentestedhere,NLR3186respondsevenupto160kgN.the optimumdosageis80kg/ha.

Table6:DescriptionofNLR3186

S.No	Trait/Character	Description
1.	Plantheight	90-100cm
2.	Habit	Erect
3.	Daysto50%flowering	120-125days
4.	Lodging	Nonlodging
5.	Leafbladecolour	MediumGreen
6.	Basalleafsheathcolour	MediumGreen
7.	Leafangle	Erect
8.	Flagleafangle	Erect
9.	Leaflength	32cm(medium)
10.	Leafwidth	1.4cm(medium)
11.	Leafbladepubescence	strong
12.	Ligulecolour	White
13.	Liguleshape	Split
14.	Ligulelength	3.2mm
15.	Auriclecolour	Palegreen
16.	Collarcolour	Palegreen
17.	Culmangle	Erect
18.	Flagleafangle	Erect

19.	Culminternodecolour	Green
20.	Paniclelength	25cm
21.	Panicletype	Compact
22.	Panicleexersion	Wellexerted
23.	Awns	Presentonthetopportionofthepanicle
24.	Apiculuscolour	Straw
25.	Stigmacolour	White
26.	Lemmapaleacolour	Straw
27.	Lemmapaleapubescence	Hairsonupperportion
28.	Seedcoatcolour(bran)	Darkbrown
29.	Sterilelemmacolour	Straw
30.	Senescence	Late
31.	Graintype	Mediumslender
32.	Grainlength(mm)	8.2
33.	Grainbreadth(mm)	2.6
34.	Kernellength(mm)	5.52
35.	KernelBreadth(mm)	1.82
36.	L/Bratio	2.98
37.	Hulling(%)	76.8
38.	Milling(%)	67.52
39.	HeadRiceRecovery	65.64
40.	1000grainweight	23.16g
41.	Chalkiness	Absent
42.	Gelatinizationtemperature	Intermediate
43.	Kernelelongationratio	1.82
44.	Keepingquality	Good
45.	Grainshattering	<2%
46.	Floweringduration(days)	8-10
47.	Dormancy(weeks)	-
48.	Harvestindex	60-65
49.	Filledgrains/panicle	210-225
50.	Tilleringability	Moderate(7-14)
51.	Distinguishingcharacters	Compact,erect,Non-lodging,highyielding,dwarf with medium green foliage, dark brownglumedgrains,mediumslender,translucent grainwithhighgrainnumberperpanicle.

Table7:GrainQualitydataofNLR3186

S.No.	Character	NLR3186	BPT5204	NLR33892
1.	Graintype	Mediumslender	Mediumslender	Mediumslender
2.	Kernellength(mm)	5.52	4.98	5.5
3.	KernelBreadth(mm)	1.85	1.85	2.3
4.	L/Bratio	2.98	2.69	2.39
5.	Hulling%	76.80	75.67	77.6
6.	Milling%	67.52	67.21	73.6
7.	HeadRiceRecovery	65.64	63.37	61.6
8.	TestWeight(gm)	23.16	14.2	18.2
9.	RiceGrainType	Mediumslender	Mediumslender	Mediumslender

10.	GrainChalkiness	VOC	VOC	VOC
11.	Amylosecontent	24.2	23.4	25
12.	Alkalispreadingvalue	5.0	4.0	3.0
13.	Wateruptake	167.5	130	175
14.	Volumeexpansion ratio	3.3	3.3	3.5
15.	Kernalelongationratio	1.82	1.74	1.8
16.	Gelconsistency	25	24	24
17.	Aroma	NS	NS	NS