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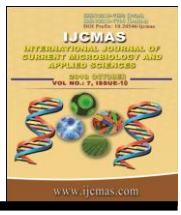

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Ratnagiri 8, a Medium Slender High Yielding Rice Variety for Six States of India

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A B S T R A C T

The rice variety Ratnagiri-8 (IET 25493; RTN 28-1-5-3-2) was evolved from the cross between IR64 and Karjat 184 using former parent as female through pedigree method of selection. The above variety is midlate in duration (135-138 days in *Kharif*), Semi-dwarf (102-110 cm plant height). Ratnagiri 8 rice variety recorded 38.52% higher grain yield over HYV's medium slender check Palghar 1 pooled over five years testing in Station Trial. It also recorded 10.50% higher grain yield over palghar 1 best check tested in Maharashtra State Co-ordinated Trial. Ratnagiri 8 (IET 25493) rice variety on overall basis of three years testing across the 62 locations in the country had recorded 14.80%, 7.21%, 30.37% and 1.58% higher grain yield over checks, BPT 5204, WGL 14, Zonal check and local check respectively in AICRP trials conducted during the 2015-2017. Ratnagiri 8 (IET 25493) is having medium slender grain type with translucent kernel. It has 5.4 mm kernel length, 2.0 mm kernel breadth and 2.7 LB ratio. It recorded high 75.8% hulling, 67.0% milling and 64.6% Head Rice Recovery (%). It is having intermediate amylose content (23.4%) and alkali spreading value (5.0). It is non scented with 22 gel consistency and excellent cooking qualities. In agronomical trial, the rice genotype, RTN 28-1-5-3-2 produced higher grain yield 62.03 q/ha by adopting 20 x 15 cm spacing and 120 kg N + 50 kg P_2O_5 + 50 kg K_2O/ha as fertilizer dose, which was 36.87% higher over cultivar BPT 5204 by adopting same package of practice during *kharif* season. RTN 28-1-5-3-2 (IET 25493) recorded (5616 kg/ha) 37.85% increase in grain yield over check BPT 5204 (4074 kg/ha) in 22 large scale demonstrations of rice culture conducted during *Kharif* 2017. Ratnagiri 6 rice variety showed moderately resistant to leaf blast and bacterial leaf blight diseases and moderately resistant to stem borer, leaf folder and gall midge insect pests at endemic sites. It recorded an average yield potential of 5.0 to 5.8 t/ha. Hence considering its consistent performance, yield superiority and excellent cooking and grain quality with wider adaptability over the locations and over three years testing, Ratnagiri 8 (IET 25493) is identified for release for commercial cultivation for the zones IIIrd (Orissa and Uttar Pradesh), Vth (Chhattisgarh and Maharashtra), VIIth (Andhra Pradesh and Telangana).

Keywords

Ratnagiri 8, Resistance, Quality, Medium, Grain yield

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Introduction

Rice is a staple food for above 60 per cent world's population. It is wholesome and nutritious cereal and source of complete carbohydrate. The world's capacity to sustain a favourable food production/population balance has again comes under the spotlight in

view of continued population increase and a drastic slowdown in growth of cereal production. According to United Nations estimates, the world population will grow to 8 billions in 2025 requiring about 40% more rice production to cater demand of the burgeoning global population. India is the foremost country of the world in area of rice cultivation and second to China in rice production. The total area under rice cultivation in India is about 44.11 m ha with a rough rice production of 105.48 m t (Anonymous, 2016).

In Maharashtra, rice is the second most important food grain crop of the people, which grown over an area of 15.57 lakh hectares with an annual rough rice and milled rice production of 52.95 lakh tones and 36.54 lakh tones, respectively. The average productivity of rough rice and milled rice of Maharashtra state is 3.40 t/ha and 2.35 t/ha respectively (2016). The average productivity of milled rice of the state is stable, which is low as compared to other rice producing states like Punjab (3.84 t/ha), Tamil Nadu (3.19 t/ha), Telangana (3.14 t/ha), Haryana (3.11 t/ha), Andhra Pradesh (3.02 t/ha), West Bengal (2.73 t/ha), Karnataka (2.67 t/ha), Gujarat (2.33 t/ha) and national productivity (2.39 t/ha) (2016).

Konkan region is a major rice producing area of Maharashtra. Nearly 3.69 lakh ha area of *Konkan* is under rice crop with rough rice production of 15.70 lakh tones. The average rough rice productivity of the *Konkan* region is 4.25 t/ha. *Konkan* region contributes 23.70% in area under rice crop and produces 29.65% rough rice at state level (Anonymous, 2016).

Medium slender, midlate duration rice varieties with good grain qualities are highly demanded by the rice growers of different region, traders and consumers. Hence efforts has been made to develop and release of midlate duration, medium slender grain type rice variety with excellent grain qualities and agronomical traits.

Materials and Methods

A cross was made between IR64 and Karjat 184 using IR64 as female parent at Agricultural Research Station, Shirgaon, Ratnagiri (MS). The selections were made for super fine and high yielding progenies from the segregating generations of above cross. Among the several selections in segregating populations of above cross, a promising pure line RTN 28-1-5-3-2 (IET 25493) was further tested in various trials *viz*., station trials, state coordinated trials and national co-ordinated trials at various locations in the state and country. This culture was also tested in Agronomical trial at Agricultural Research Station, Shirgaon, Ratnagiri (MS) during *Kharif* 2017. The 22 large scale demonstrations were conducted during *Kharif* 2017 in Maharashtra state. The culture was screened for resistance to various insect pests and diseases at endemic sites subsequently for three years during *Kharif* 2015 to *Kharif* 2017 in field and control conditions in AICRIP Rice system. The physical and biochemical quality parameters were analyzed at ICAR- IIRR, Rajendranagar, Hyderabad during 2015-2017. The yield data of various trials were statistically analysed according to Panse and Sukhatme (1967). Based on yield data of various trials, superior grain quality, resistance for disease and insect pest reactions and consistent yield performance at various test locations, Ratnagiri 8 (RTN 28-1-5-3-2) rice variety is identified for release for commercial cultivation for the zones IIIrd (Orissa and Uttar Pradesh), Vth (Chhattisgarh and Maharashtra), VIIth (Andhra Pradesh and Telangana) by the Central Variety Identification Committee (CVIC) during 14th April, 2018 held at ICAR-IIRR, Rajendranagar, Hyderabad.

Results and Discussion

RTN-28-1-5-3-2 (IET 25493) recorded 31.17%, 27.36%, 35.30%, 65.11% and 30.44% increased grain yield over medium slender check Palghar-1 in different Station Trials conducted during Kh-2013, Kh-2014, Kh-2015, Kh-2016 and Kh-2017 respectively. Ratnagiri 8 rice variety recorded 38.52% higher grain yield over HYV's medium slender check Palghar-1 on pooled over basis for five years tested in Station Trials (Table 2).

Ratnagiri-8 (IET 25493) recorded 10.50% higher grain yield over medium slender check variety Palghar-1 in Maharashtra State Co-ordinated Trial (MSCRIP) conducted at 9 locations during *Kharif* 2017 across the state (Table 3). It was tested in All India Co-ordinated Rice Improvement Project trials (IVT MS, AVT1 MS and AVT 2 MS) during *Kharif* 2015-2017 at 62 locations (26, 21 & 15 locations) during 2015, 2016 & 2017 along with four checks (NC 1: BPT 5204, NC 2: WGL 14, Zonal check and Local check) (Table 4-7).

It showed consistent performance more than 5% yield advantage over NC 1, NC 2, Zonal check and local check and ranked top 5 in 16 locations among the total 62 locations tested for three years. Ratnagiri 8 (IET 25493) rice variety on overall basis of three years testing across the 62 locations in the country, it had consistently performed and recorded 14.80%, 7.21%, 30.37% and 1.58% higher grain yield over checks, BPT 5204, WGL 14, Zonal check and local check respectively in AICRP trials conducted during the 2015-2017. It also recorded 17.32%, 3.93% and 8.94% increased grain yield over the qualifying varieties *viz.*, IET 25523, IET 25520 and IET 25489 respectively tested along with proposed variety for three years across the 62 locations (Table 4-7).

Ratnagiri 8 (IET 25493) has recorded 14.91%, 9.43%, 22.65% and 19.76% higher grain yield over checks, BPT 5204 (NC 1), WGL 14 (NC 2), Zonal and local check in Zone IIIrd tested at 13 locations in 5 states over three years with ranking 4 times in top five entries. The IIIrd Zone comprised states *viz.*, Orissa, Bihar, Jharkhand, West Bengal and Uttar Pradesh. In Zone IIIrd IET 25493 also exhibited more yield advantage 15.66%, 17.05% and 1.51% over qualifying entries IET 25489, IET 25520 and IET 25523 on the basis of pooled data over three years. In Zone Vth consisting of states *viz.*, Madhya Pradesh, Chhattisgarh and Maharashtra, it recorded 21.96%, 18.87%, 26.10% and 24.06% increased grain yield over checks BPT 5204 (NC1), WGL 14 (NC2), Zonal check and Local check respectively on the basis of pooled data for three years tested as 8 locations. It also ranked 4 times in top five tested at 8 locations. In Zone Vth it recorded 13.25%, 10.54% and 3.17% increased over grain yield over qualifying varieties *viz*; IET 25520, IET 25489 and IET 25523 respectively on the basis of pooled data over three years.

On the basis of three years pooled data over 9 locations in Zone VIth (Maharashtra, Gujarat and Goa) IET 25493 given consistent yield performance and recorded 13.08%, 0.15%, 33.32% superior yield over check BPT 5204 (NC 1), WGL 14 (NC 2) and Zonal check respectively. It also recorded 13.77% and 7.81% higher grain yield over qualifying varieties *viz.*, IET 25520 and IET 25489 on pooled over three years. It ranked 3 times in top five among 9 locations. Ratnagiri-8 (IET 25493) recorded 15.05%, 6.08% and 36.88% increased grain yield on the basis of pooled data over the checks, BPT 5204 (NC 1), WGL 14 and Zonal check respectively three years tested across 29 locations in Zone VIIth (southern zone) comprising of 7 states *viz.*, Andra Pradesh, Telangana, Tamilnadu, Kerala, Karnataka, Pondicherry and Andman

& Nicobar. It also ranked four times in top five ranks among 29 locations. It showed 7.67% and 1.54% higher grain yield over qualifying checks *viz.*, IET 25489 and IET 25523 respectively tested in Zone VII[th] on the basis of three years pooled data (Table 4-7).

State wise performance of RTN 28-1-5-3-2 on three years pooled over basis and Recommendations

Considering mean performance of Chhattisgarh state, over three years testing, IET 25493 rice variety recorded 26.7%, 24.8%, 44.6% and 61.1% grain yield increased over BPT 5204 (NC1), WGL-14 (NC2), Zonal check and Local check respectively while as it also recorded 22.1%, 12.9% and 2.5% increased grain yield over qualifying entries, IET 25520, IET 25489 and IET 25523 respectively (Table 5).

It also recorded 18.4%, 10.3%, 24.8% and 9.4% per cent superior grain yield over BPT 5204 (NC1), WGL-14 (NC2), Zonal check and local check respectively and 14.6%, 10.5% and 0.8% higher grain yield over qualifying entries IET 25520, IET 25489 and IET 25523 by considering the state mean of Maharashtra state pooled over three years.

In case of Orissa state, it recorded 31.4%, 12.8%, 31.6% and 11.5% superior grain yield over BPT 5204 (NC1), WGL-14 (NC2), Zonal check and local check respectively and it also recorded 17.7%, 15.1% and 4.9% higher grain yield over qualifying entries, IET 25520, IET 25489 and IET 25523 respectively by considering three years pooled data.

Considering average three years pooled data of Andhra Pradesh state, IET 25493 recorded 17.3%, 5.4%, 37.3% and 9.3% superior grain yield over BPT 5204 (NC1), WGL-14, Zonal check and local check respectively and it also given 9.1% and 5.5% higher grain yield over qualifying entries, IET 25523 and IET 25489 respectively. IET 25493 recorded 5.3%, 8.4%, 5.7% and 29.2% superior grain yield over BPT 5204, WGL-14, Zonal and local check respectively and it also given 21.3% and 21.7% higher grain yield over qualifying variety, IET 25520 and IET 25489 respectively by considering state mean of Uttar Pradesh state pooled mean over three years data.

Considering Telangana state mean it recorded 19.1%, 8.0% and 26.2% and 2.6% higher grain yield over BPT 5204 (NC1), WGL-14 (NC2), Zonal check and local check respectively pooled over three years data.

In case of Tamilnadu state considering state mean data pooled over three years, IET 25403 given 13.4%, 10.0% and 48.1% superior grain yield over BPT 5204 (NC1), WGL-14 and Zonal check respectively and it also recorded 11.5% and 28.5% higher grain yield over qualifying entries, IET 25520 and IET 25489 respectively. Considering state mean data of Karnataka state pooled over three years, IET 25493 recorded 13.3%, 7.6% and 34.9% superior grain yield over BPT 5204 (NC1), WGL-14 and Zonal check respectively while in case of Bihar state it showed 2.5%, 18.8% and 5.2% superior performance over WGL-14 (NC2), Zonal and local check respectively.

Hence considering consistent performance, yield superiority and excellent cooking and grain quality with wider adaptability over the locations and over three years testing, Ratnagiri 8 (IET 25493) is identified for release for commercial cultivation for the zones III[rd] (Orissa, Bihar, Jharkhand, West Bengal and Uttar Pradesh), V[th] (Madhya Pradesh, Chhattisgarh and Maharashtra), VII[th] (Andhra Pradesh, Telangana, Tamilnadu, Kerala, Karnataka Puducherry and Andman & Nicobar).

Table.1 Characterization of RTN 28-1-5-3-2 (IET 25493) as per DUS guidelines

Sr. No		Characteristics	RTN 28-1-5-3-2	Stage of obs.	Type of Assessment
1.	(+)	Coleoptile: Colour	Green (2)	10	VS
2.	(*)	Basal leaf: Sheath colour	Green (1)	40	VS
3.		Leaf: Intensity of green colour	Medium (5)	40	VG
4.		Leaf: Anthocyanin colouration	Absent (1)	40	VG
5.		Leaf: Distribution of anthocyanin colouration	NA	40	VG
6.	(+)	Leaf Sheath: anthocyanin colouration	Absent (1)	40	VG
7.		Leaf sheath: Intensity of anthocyanin olouration	NA	40	VG
8.	(*)	Leaf: Pubescence of blade surface	Strong (7)	40	VS
9.	(*)(+)	Leaf: Auricles	Present (9)	40	VS
10.	(*)	Leaf: Anthocyanin colouration of auricles	Colourless (1)	40	VS
11.	(+)	Leaf: Collar	Present (9)	40	VS
12.		Leaf: Anthocyanin colouration of collar	Absent (1)	40	VS
13.	(+)	Leaf: Ligule	Present (9)	40	VS
14.	(*)(+)	Leaf: Shape of ligule	Split (3)	40	VS
15.	(*)	Leaf: Colour of ligule	White (1)	40	VS
16.		Leaf: Length of blade	Medium (34.0 cm) (5)	40	MS
17.		Leaf: Width of blade	Medium (1.7 cm) (5)	40	MS
18.		Culm: Attitude (for floating rice only)	NA	40	VS
19.	(+)	Culm: attitude	Erect (1)	40	VS
20.	(*)	Time of heading (50% of plants with panicles)	Medium (105 days) (5)	55	VG
21.	(*)(+)	Flag leaf: Attitude of blade (early observation)	Erect (1)	60	VG
22.	(*)	Spikelet: Density of pubescence of lemma	Strong (7)	60-80	VS
23.		Male sterility	Absent (1)	65	VG
24.	(+)	Lemma: Anthocyanin colouration of keel	Medium (5)	65	VS
25.	(+)	Lemma: Anthocyanin colouration of area below apex	Absent (1)	65	VS
26.	(*)(+)	Lemma: Anthocyanin colouration of apex	Absent (1)	65	VS
27.	(*)(+)	Spikelet: Colour of stigma	White (1)	65	VS
28.		Stem: Thickness	Medium (5)	70	MS
29.	(*)	Stem: Length (excluding panicle; excluding floating rice)	Very Short (1)	70	MS
30.	(*)	Stem: Anthocyanin colouration of nodes	Absent (1)	70	VS
31.		Stem: Intensity of anthocyanin coloration of nodes	NA	70	VS
32.		Stem: Anthocyanin colouration of internodes	Absent (1)	70	VS

33.	(*)(+)	Panicle: Length of main axis	Medium (23.0 cm) (5)	70-90	MS
34.	(*)(+)	Flag leaf: Attitude of blade (late observation)	Semi erect (3)	90	VG
35.	(*)(+)	Panicle: Curvature of main axis	Straight (1)	90	VG
36.		Panicle: Number per plant	Medium (5)	80-90	MS
37.	(*)	Spikelet: Colour of tip of lemma	White (1)	80-90	VS
38.	(+)	Lemma and Palea: Colour	Brown furrows on straw (4)	80-90	VG
39.	(*)(+)	Panicle: Awns	Absent (1)	90	VG
40.	(*)	Panicle: Colour of awns (late observation)	NA	90	VS
41.		Panicle: Length of longest awn	NA	90	VG-MS
42.	(*)	Panicle: Distribution of awns	NA	90	VS
43.	(+)	Panicle: Presence of secondary branching	Absent (1)	90	VG
44.	(+)	Panicle: Secondary branching	NA	90	VG
45.	(*)(+)	Panicle: Attitude of branches	NA	90	VG
46.	(*)(+)	Panicle: Exertion	Well Exerted (7)	90	VG
47.		Time maturity (days)	Medium (5)	90	VG
48.		Leaf: Senescence	Medium (5)	92	VG
49.	(*)(+)	Sterile lemma: Colour	Purple (4)	92	VS
50.		Grain: Wt. of 1000 fully developed grains	Low (18.77 g) (3)	92	MG
51.	(+)	Grain: Length	Short (8.18 mm) (3)	92	MS
52.		Grain: Width	Very Narrow (2.19 mm) (1)	92	MS
53.	(+)	Grain: Phenol reaction of lemma	Absent (1)	92	VG
54.	(*)(+)	Decorticated grain: Length	Medium (5.49 mm) (3)	92	MS
55.	(*)(+)	Decorticated grain: Width	Narrow (1.80) (3)	92	MS
56.	(*)(+)	Decorticated grain: Shape (in lateral view)	Medium Slender (3.05) (3)	92	MS
57.	(*)	Decorticated grain: Colour	White (1)	92	VG
58.	(+)	Endosperm: Presence of amylose	Present (9)	92	MG
59.	(*)(+)	Endosperm: Content of amylose	Medium (23.11%) (5)	92	MG
60.	(+)	Varieties with endosperm of amylose absent only Polished grain: Expression of white core	NA	90	MG
61.	(+)	Gelatinization temperature through alkali spreading value	Medium (3) (4.0)	92	MG
62.	(*)(+)	Decorticated grain: Aroma	Absent (1)	92	MG

(Subba Rao *et al.*, 2013)
VS: Visual assessment by observation of individual plant or plants.
VG: Visual assessment by single observation of a group of plants or parts of plants.
MS: Measurement of number of individual plants or parts of plants.
MG: Measurement by a single observation of a group of parts of plants.
(*): Essential Characters (29); (+): Additional Characters (33)

Table.2 Yield performance of RTN-28-1-5-3-2 (IET 25493) in station trials

Sr. No.	Name of the Trial	Year	Grain yield performance (kg/ha)		% Increase over check
			RTN-28-1-5-3-2	CH. Palghar-1 (MS grain CH.)	
1	Initial Varietal Trial (Station) Quality (IVT-SQ)	Kh-2013	5269	4017	**31.17**
2	Advance Varietal Trial (Station) Quality (AVT-SQ)	Kh-2014	4837	3798	**27.36**
3	Advance Varietal Trial (Station) Quality (AVT-SQ)	Kh-2015	4925	3640	**35.30**
4	Advance Varietal Trial (Station) Quality (AVT-SQ)	Kh-2016	7184	4351	**65.11**
5	Advance Varietal Trial (Station) Quality (AVT-SQ)	Kh-2017	5189	3978	**30.44**
	Average		**5480.8**	**3956.8**	**38.52**

Anonymous (2014), Anonymous (2015a), Anonymous (2016d), Anonymous (2017a) and Anonymous (2018a)

Table.3 Yield performance of RTN-28-1-5-3-2 (IET 25493) in Maharashtra State Co-ordinated trial conducted during Kh-2017 at different locations in Advance Varietal Trial (Mah.) Quality (14-18g)

(Yield: Kg/ha)

Entries	*Konkan* Region (locations)				Western Maharashtra (locations)			Vidarbha (locations)		Mean	% increase over check
	Karjat	Ratnagiri	Palghar	Phondaghat	VDN	RDN	IGP	SKL	NGB		
RTN-28-1-5-3-2	4865	5882	4280	6967	5112	5881	3662	3247	5907	5089	**10.5**
Palghar-1 (CH)	5041	2604	4259	6170	4481	5318	4892	3178	5525	4608	

Anonymous (2018b)

Table.4 Summary of grain yield (kg/ha) data of co-ordinated varietal trials

Parameters	Name of Trial	Year of testing	No. of locations	Proposed Variety	Check Varieties				Qualifying Varieties		
				RTN 28-1-5-3-2 (IET 25493)	BPT-5204 (NC)	Zonal Check	Local Check	WGL-14	CR 3505-7-1-1-1-2-1 (IET 25523)	RP 5950-24-6-2-1-1-B (IET 25520)	CR 3511-3-2-2-5-1-1 (IET 25489)
Mean yield (Q/ha) a) Zonal b) across Zones (If applicable)	IVT-MS	Kh 2015	7	4941	5260	4980	4767	5208	5171	4948	5051
	AVT1-MS	Kh 2016	4	5876	5234	4284	5058	5216	5297	4619	4767
	AVT2-MS	Kh 2017	2	6190	4306	4603	4376	5117	6286	5137	4712
Weighted Mean			**13**	**5669**	**4933**	**4622**	**4734**	**5180**	**5585**	**4901**	**4843**
Per cent increase or decrease over the checks & qualifying varieties	IVT-MS	Kh 2015			-6.06	-0.78	3.65	-5.13	-4.45	-0.14	-2.18
	AVT1-MS	Kh 2016			12.27	37.16	16.17	12.65	10.93	27.21	23.26
	AVT2-MS	Kh 2017			43.75	34.49	41.45	20.96	-1.53	20.50	31.37
Weighted mean					**14.91**	**22.65**	**19.76**	**9.43**	**1.51**	**15.66**	**17.05**
Frequency in the top five group (pooled for three years)	IVT-MS	Kh 2015	7	00/07	02/07	01/07	00/07	03/07	01/07	02/07	00/07
	AVT1-MS	Kh 2016	4	02/04	01/04	00/04	00/04	00/04	01/04	00/04	00/04
	AVT2-MS	Kh 2017	2	02/02	00/02	00/02	00/02	00/02	01/02	00/02	00/02
Total			**13**	**04/13**	**03/13**	**01/13**	**00/13**	**03/13**	**03/13**	**02/13**	**00/13**

Name of proposed variety: RTN 28-1-5-3-2 (IET 25493), Adaptability Zone: III, Production conditions: *Kharif* (Rainfed)
Anonymous (2015d), Anonymous (2016a) and Anonymous (2017b)

Table.5 Summary of grain yield (kg/ha) data of co-ordinated varietal trials

Parameters	Name of Trial	Year of testing	No. of locations	Proposed Variety	Check Varieties				Qualifying Varieties		
				RTN 28-1-5-3-2 (IET 25493)	BPT-5204 (NC)	Zonal Check	Local Check	WGL-14	CR 3505-7-1-1-1-2-1 (IET 25523)	RP 5950-24-6-2-1-1-B (IET 25520)	CR 3511-3-2-2-5-1-1 (IET 25489)
Mean yield (Q/ha) a) Zonal b) across Zones (If applicable)	IVT-MS	Kh 2015	3	4840	4047	3746	3561	4139	4945	4512	4505
	AVT1-MS	Kh 2016	3	5869	4717	4600	5249	4864	5193	5270	5137
	AVT2-MS	Kh 2017	2	4820	3968	3968	3707	4060	4913	3930	4406
Weighted Mean			**8**	**5176**	**4244**	**4105**	**4172**	**4354**	**5017**	**4571**	**4683**
Per cent increase or decrease over the checks & qualifying varieties	IVT-MS	Kh 2015			19.59	29.20	35.92	16.94	-2.12	7.27	7.44
	AVT1-MS	Kh 2016			24.42	27.59	11.81	20.66	13.02	11.37	14.25
	AVT2-MS	Kh 2017			21.46	21.46	30.02	18.70	-1.90	22.64	9.39
Weighted mean					**21.96**	**26.10**	**24.06**	**18.87**	**3.17**	**13.25**	**10.54**
Frequency in the top five group (pooled for three years)	IVT-MS	Kh 2015	3	00/03	00/03	00/03	00/03	00/03	01/03	00/03	00/03
	AVT1-MS	Kh 2016	3	02/03	00/03	00/03	00/03	00/03	00/03	00/03	00/03
	AVT2-MS	Kh 2017	2	02/02	00/02	00/02	00/02	00/02	02/02	00/02	01/02
Total			**8**	**04/08**	**00/08**	**00/08**	**00/08**	**00/08**	**03/08**	**00/08**	**01/08**

Name of proposed variety: RTN 28-1-5-3-2 (IET 25493), Adaptability Zone: V, Production conditions: *Kharif* (Rainfed)
Anonymous (2015d), Anonymous (2016a) and Anonymous (2017b)

Table.6 Summary of grain yield (kg/ha) data of co-ordinated varietal trials

Parameters	Name of Trial	Year of testing	No. of locations	Proposed Variety	Check Varieties				Qualifying Varieties		
				RTN 28-1-5-3-2 (IET 25493)	BPT-5204 (NC)	Zonal Check	Local Check	WGL-14	CR 3505-7-1-1-1-2-1 (IET 25523)	RP 5950-24-6-2-1-1-B (IET 25520)	CR 3511-3-2-2-5-1-1 (IET 25489)
Mean yield (Q/ha) a) Zonal b) across Zones (If applicable)	IVT-MS	Kh 2015	11	5450	4399	2955	4768	4874	4746	5022	4775
	AVT1-MS	Kh 2016	9	6060	5087	4338	6530	5668	6175	5914	5617
	AVT2-MS	Kh 2017	9	5098	4950	4841	5974	5114	5435	6037	5041
Weighted Mean			**29**	**5536**	**4812**	**4045**	**5757**	**5219**	**5452**	**5658**	**5144**
Per cent increase or decrease over the checks & qualifying varieties	IVT-MS	Kh 2015			23.89	84.43	14.30	11.82	14.83	8.52	14.14
	AVT1-MS	Kh 2016			19.13	39.70	-7.20	6.92	-1.86	2.47	7.89
	AVT2-MS	Kh 2017			3.00	5.32	-14.66	-0.31	-6.19	-15.55	1.14
Weighted mean					**15.05**	**36.88**	**-3.84**	**6.08**	**1.54**	**-2.15**	**7.62**
Frequency in the top five group (pooled for three years)	IVT-MS	Kh 2015	11	03/11	01/11	00/11	00/11	01/11	01/11	00/11	01/11
	AVT1-MS	Kh 2016	9	01/09	00/09	00/09	03/09	00/09	02/09	01/09	00/09
	AVT2-MS	Kh 2017	9	00/09	00/09	01/09	05/09	01/09	02/09	04/09	00/09
Total			**29**	**04/29**	**01/29**	**01/29**	**08/29**	**02/29**	**05/29**	**05/29**	**01/29**

Name of proposed variety: RTN 28-1-5-3-2 (IET 25493), Adaptability Zone: VII, Production conditions: *Kharif* (Rainfed)

Anonymous (2015d), Anonymous (2016a) and Anonymous (2017b)

Table.7 Overall mean performance RTN 28-1-5-3-2 (IET 25493) for grain yield (kg/ha) in AICRP varietal trials in Zone: III, V, VI & VII tested during 2015-2017

Parameters	Name of Trial	Year of testing	No. of locations	Proposed Variety	Check Varieties				Qualifying Varieties		
				RTN 28-1-5-3-2 (IET 25493)	BPT-5204 (NC)	Zonal Check	Local Check	WGL-14	CR 3505-7-1-1-1-2-1 (IET 25523)	RP 5950-24-6-2-1-1-B (IET 25520)	CR 3511-3-2-2-5-1-1 (IET 25489)
Mean yield (Q/ha) a) Zonal b) across Zones (If applicable)	IVT-MS	Kh 2015	26	4965	4307	3503	4752	4675	4878	4644	4611
	AVT1-MS	Kh 2016	21	5886	5034	4220	5760	5304	4220	5424	5262
	AVT2-MS	Kh 2017	15	5267	4700	4640	5355	5056	4640	5441	4922
Weighted Mean			**62**	**5373**	**4680**	**4121**	**5289**	**5012**	**4579**	**5170**	**4932**
Per cent increase or decrease over the checks & qualifying varieties	IVT-MS	Kh 2015	-	-	15.28	41.74	4.48	6.20	1.78	6.91	7.68
	AVT1-MS	Kh 2016	-	-	16.92	39.48	2.19	10.97	39.48	8.52	11.86
	AVT2-MS	Kh 2017	-	-	12.07	13.51	-1.64	4.18	13.51	-3.20	7.01
Weighted mean					**14.80**	**30.37**	**1.58**	**7.21**	**17.32**	**3.93**	**8.94**
Frequency in the top five group (pooled for three years)	IVT-MS	Kh 2015	26	04/26	02/26	01/26	03/26	05/26	04/26	01/26	01/26
	AVT1-MS	Kh 2016	21	07/21	01/21	00/21	03/21	00/21	02/21	02/21	00/21
	AVT2-MS	Kh 2017	15	05/15	00/15	01/15	05/15	02/15	07/15	05/15	01/15
Total			**62**	**16/62**	**03/62**	**02/62**	**11/62**	**07/62**	**13/62**	**08/62**	**02/62**

Anonymous (2015d), Anonymous (2016a) and Anonymous (2017b)

Table.8 State wise grain yield (kg/ha) pooled performance of RTN 28-1-5-3-2 (IET 25493) in AICRP varietal trials in Zone: III, V, VI & VII tested during 2015-2017

Name of States	Proposed	Check Varieties				Qualifying Entries			Check Varieties				Qualifying Entries		
	RTN 28-1-5-3-2 (IET 25493)	BPT 5204	ZC	LC	WGL 14	CR 3505-7-1-1-1-2-1 (IET 25523)	RP 5950-24-6-2-1-1-B (IET 25520)	CR 3511-3-2-2-5-1-1 (IET 25489)	BPT 5204	ZC	LC	WGL 14	CR 3505-7-1-1-1-2-1 (IET 25523)	RP 5950-24-6-2-1-1-B (IET 25520)	CR 3511-3-2-2-5-1-1 (IET 25489)
Odisa	**4979**	3790	3784	4466	4413	4748	4229	4327	31.4	31.6	11.5	12.8	4.9	17.7	15.1
Bihar	**5330**	6144	4488	5068	5202	4457	5871	5483	-13.3	18.8	5.2	2.5	19.6	-9.2	-2.8
West Bengal	**4025**	5100	4975	4800	5900	5125	5275	5175	-21.1	-19.1	-16.1	-31.8	-21.5	-23.7	-22.2
Uttar Pradesh	**6324**	6007	5985	4896	5835	6667	5212	5195	5.3	5.7	29.2	8.4	-5.2	21.3	21.7
Chattisgarh	**5623**	4437	3889	3490	4504	5487	4605	4979	26.7	44.6	61.1	24.8	2.5	22.1	12.9
Maharashtra	**5039**	4256	4037	4605	4570	4998	4396	4562	18.4	24.8	9.4	10.3	0.8	14.6	10.5
Gujarat	**4949**	4348	3534	6388	5450	5080	4710	4989	13.8	40.1	-22.5	-9.2	-2.6	5.1	-0.8
Andhra Pradesh	**5080**	4332	3700	4649	4818	4655	5223	4814	17.3	37.3	9.3	5.4	9.1	-2.7	5.5
Telangana	**5808**	4878	4601	5660	5380	5909	6036	4969	19.1	26.2	2.6	8.0	-1.7	-3.8	16.9
Tamil Nadu	**5464**	4819	3690	5702	4967	5481	4900	4252	13.4	48.1	-4.2	10.0	-0.3	11.5	28.5
Karnataka	**6040**	5332	4477	7526	5614	6205	6363	6405	13.3	34.9	-19.7	7.6	-2.7	-5.1	-5.7
Oerall Mean	**5373**	**4680**	**4121**	**5289**	**5012**	**5283**	**5170**	**4932**	**14.8**	**30.4**	**1.6**	**7.2**	**1.7**	**3.9**	**8.9**

Ref. AICRIP, Varietal Improvement Progress Report-2015 (Page 1.491 to 1.498), 2016 (Page 1.500 to 1.505) and 2017 (Page 1.354 to 1.371).

Table.9 Performance of RTN 28-1-5-3-2 (IET 25493) against disease pests in AICRIP National Screening Nurseries tested during *Kharif* 2015 to *Kharif* 2017

Disease	No.of Locations	RTN 28-1-5-3-2 (IET 25493)	Sensitive Checks		Resistant Checks				WGL-14 (NC)	Qualifying Entries		
			BPT 5204 (NC)	TN-1 (NC)	IR-64 (NC)	Kalanamak (NC)	Ajaya (NC)	RP Bio-226 (NC)		CR 3505-7-1-1-1-2-1 (IET 25523)	RP 5950-24-6-2-1-1-B (IET 25520)	CR 3511-3-2-2-5-1-1 (IET 25489)
Leaf Blast	57	5.3	6.0	6.6	4.5	6.2	6.0	6.3	6.2	6.6	7.0	5.2
Neck Blast	18	6.3	6.2	6.9	6.0	7.2	6.3	7.3	4.9	5.8	6.5	7.2
Brown Spot	28	5.7	5.8	5.8	5.7	6.0	5.2	5.5	5.7	5.9	6.1	6.1
Bacterial Leaf Blight	61	5.9	5.6	7.3	5.7	6.1	5.3	4.1	5.4	6.1	4.7	5.9
Sheath Blight	54	6.2	6.2	7.1	6.9	6.4	6.5	6.7	5.6	6.4	6.2	6.3
Sheath Rot	27	5.7	6.2	6.0	6.1	5.3	6.5	6.2	6.1	6.1	6.2	6.0
Rice Tungro Disease	7	4.7	5.1	5.2	5.5	5.4	5.3	4.8	6.1	4.8	6.2	5.4
False Smut	2	3.0	2.6	3.0	1.5	3.0	3.0	3.0	1.0	3.0	1.0	1.0
Glume Discoloration	8	5.2	4.8	6.8	4.4	4.8	6.2	5.8	4.2	4.5	4.8	5.8
Leaf Scald	3	7.0	6.2	7.7	7.5	7.0	6.3	7.0	7.0	7.0	6.3	7.7

Anonymous (2015c), Anonymous (2016c) and Anonymous (2017c)

Table.10 Performance of RTN 28-1-5-3-2 (IET 25493) against insect pests in AICRIP National Screening Nurseries tested during *Kharif* 2015 to *Kharif* 2017

Insect/Pests	RTN 28-1-5-3-2 (IET 25493)	Sensitive Checks		Resistant Checks				WGL-14 (NC)	Qualifying Entries		
		TN1 (NC)	BPT 5204 (NC)	Abhaya	Aganni	PTB-33	RP-2068-18-3-5		CR 3505-7-1-1-1-2-1 (IET 25523)	RP 5950-24-6-2-1-1-B (IET 25520)	CR 3511-3-2-2-5-1-1 (IET 25489)
Stem Borer Dead Hearts	3.8	4.5	3.9	5.8	3.3	5.8	5.3	2.8	2.2	3.2	3.3
Stem Borer White Ear	4.0	4.4	3.1	4.8	3.4	4.3	3.0	3.9	2.1	2.7	3.0
Leaf Folder	3.6	2.5	1.6	2.8	2.8	5.2	4.8	1.3	1.7	1.6	1.6
Rice Thrips	2.2	2.1	2.3	1.9	1.8	1.8	1.7	2.3	0.8	2.2	2.5
Whorl Maggot	2.0	1.0	1.8	1.0	1.0	1.0	1.0	2.0	1.0	1.0	2.0
Brown Plant Hopper	8.2	8.8	8.4	8.3	7.8	2.3	3.8	8.4	8.4	8.3	7.6
White Backed Plant Hopper	8.2	8.0	7.8	8.7	8.3	4.6	6.9	7.4	7.6	8.5	8.4
Plant Hoppers	7.2	7.3	6.6	7.7	7.2	1.8	5.7	6.0	5.2	7.0	5.3
Gall Midge Biotype	7.8	8.2	7.4	4.0	2.3	5.2	4.3	7.1	5.5	6.6	6.4

Anonymous (2015b), Anonymous (2016b) and Anonymous (2017d)

Table.11 Mean data of grain quality characteristics of for the year 2015-2017 of promising rice entry RTN 28-1-5-3-2 (IET 25493) along with checks and qualifying varieties in AICRIP trials

Sr. No.	Quality Parameters	Proposed Variety	Check Varieties			Qualifying Varieties		
		RTN 28-1-5-3-2 (IET 25493)	BPT-5204 (NC)	Zonal Check	WGL-14	CR 3505-7-1-1-1-2-1 (IET 25523)	RP 5950-24-6-2-1-1-B (IET 25520)	CR 3511-3-2-2-5-1-1 (IET 25489)
1	Hulling (%)	75.8	78.4	75.2	78.8	77.6	78.8	78.9
2	Milling (%)	67.0	68.4	66.1	69.5	69.2	70.8	72.1
3	Head Rice Recovery (%)	64.6	63.6	61.1	60.7	66.9	67.4	66.4
4	Kernel Length(mm)	5.4	4.8	4.7	5.0	5.3	5.2	5.9
5	Kernel Breadth(mm)	2.0	1.8	1.8	1.8	1.9	1.8	2.2
6	L: B ratio	2.7	2.7	2.6	2.7	2.8	2.9	2.7
7	Grain Type	MS	MS	MS	MS	MS	MS	LB
8	Grain Chalk	A	A	VOC	A	VOC	A	A
9	Alkali Spreading Value	5.0	4.7	6.0	4.7	4.7	4.0	4.3
10	Amylose Content (%)	23.4	24.4	23.8	24.3	23.0	23.2	23.9
11	Gel Consistency	22.7	23.3	25.0	24.0	22.3	22.3	39.7
12	Volume Expansion Ratio	5.5	4.5	4.8	4.7	5.1	5.0	4.9
13	Water Uptake	207.5	197.5	220.0	242.5	172.5	190.0	195.0
14	Kernel Length After Cooking (mm)	10.8	9.5	8.1	9.3	10.9	9.5	11.1
15	Elongation Ratio	2.0	2.0	1.7	1.8	2.0	1.8	1.8
16	Aroma	NS	NS	NS	NS	NS	NS	NS
17	Test weight (g) (1000 grain wt.)	17.7	16.1	17.0	15.1	17.3	15.3	23.9

Anonymous (2015d), Anonymous (2016a) and Anonymous (2017b)

Table.12 Effect of different spacing on grain yield (q/ha) of rice genotype RTN 28-1-5-3-2 and BPT 5204 variety and during *Kharif* 2017

Genotypes	Spacing			
	S_1: (15 x 15 cm)	S_2: (20 x 15 cm)	S_3: (20 x 20 cm)	Mean
V_1 (RTN 28-1-5-3-2)	53.01	**58.06**	55.64	**55.57**
V_2 (BPT 5204)	42.03	41.87	38.99	**40.96**
Mean	**47.52**	**49.97**	**47.31**	**48.27**

Parameters	Variety	Spacing	Interaction (Variety X Spacing)
S.E. ±	0.935	0.619	0.829
CD (0.05)	5.687	2.017	2.419

Table.13 Effect of different nitrogen levels on grain yield (q/ha) of rice genotype RTN 28-1-5-3-2 and BPT 5204 variety and during *Kharif* 2017

Genotypes	Nitrogen levels			
	N_1: (100 kg N/ha)	N_2: (120 kg N/ha)	N_3: (150 kg N/ha)	Mean
V_1 (RTN 28-1-5-3-2)	49.28	**60.27**	57.15	**55.57**
V_2 (BPT 5204)	39.10	44.16	39.64	**40.96**
Mean	**44.19**	**52.21**	**48.39**	**48.27**

Parameters	Variety	Nitrogen Levels	Interaction (Variety X N Levels)
S.E. ±	0.935	0.586	0.829
CD (0.05)	5.687	1.710	2.419

Table.14 Effect of different levels of nitrogen on grain yield (q/ha) of rice genotype RTN 28-1-5-3-2 during *Kharif* 2017

Spacing	Nitrogen levels			
	N_1: (100 kg N/ha)	N_2: (120 kg N/ha)	N_3: (150 kg N/ha)	Mean
S_1 (15 x 15 cm)	40.11	52.77	49.67	**47.52**
S_2 (20 x 15 cm)	47.13	**53.68**	49.10	**49.97**
S_3 (20 x 20 cm)	45.34	50.19	46.42	**47.31**
Mean	**44.19**	**52.21**	**48.39**	**48.27**

Parameters	Spacing	Nitrogen Levels	Interaction (Spacing X N Levels)
S.E. ±	0.619	0.586	1.015
CD (0.05)	2.017	1.710	2.962

Table.15 Performance of IET 25493 under different levels of nitrogen and spacing on grain yield (q/ha) in agronomical trial conducted during *Kharif* 2017

Genotypes	Spacing	Nitrogen levels			
		N_1: (100 kg N/ha)	N_2: (120 kg N/ha)	N_3: (150 kg N/ha)	Mean
V_1 (RTN 28-1-5-3-2)	S_1: (15 x 15 cm)	43.33	58.00	57.69	**53.01**
	S_2: (20 x 15 cm)	52.83	**62.03**	59.33	**58.06**
	S_3: (20 x 20 cm)	51.68	60.79	54.44	**55.64**
V_2 (BPT 5204)	S_1: (15 x 15 cm)	36.89	**47.55**	41.65	**42.03**
	S_2: (20 x 15 cm)	41.42	45.32	38.87	**41.87**
	S_3: (20 x 20 cm)	38.99	39.60	38.40	**38.99**
	Mean	**44.19**	**52.21**	**48.39**	**48.27**

Parameters	Variety	Spacing	Nitrogen Levels	Interaction (Variety X Spacing X N Levels)
S.E. ±	0.935	0.619	0.586	1.435
CD (0.05)	5.687	2.017	1.710	NS

Table.16 Yield performance of RTN 28-1-5-3-2 (IET 25493) under Large scale demonstration conducted on farmers' field during *Kharif* 2017

Sr. No.	Districts	No. of adaptive trials	Grain Yield (kg/ha)		% increase over check
			RTN 28-1-5-3-2	BPT 5204 (Ch)	
1	Sindhudurg	4	5570	4530	**22.96**
2	Ratnagiri	5	5700	4122	**38.28**
3	Raigad	4	5810	4050	**43.46**
4	Thane	4	5522	4258	**29.69**
5	Palghar	5	5477	3412	**60.52**
	Average	**22**	**5616**	**4074**	**37.85**

The Agronomical experiment was conducted at ARS, Shirgaon, Ratnagiri to study the effect of spacing and nitrogen levels along with common dose of phosphorus and potash on genotype RTN 28-1-5-3-2. The response of rice genotype, RTN 28-1-5-3-2 had significant effect on grain yield. The genotype, RTN 28-1-5-3-2 produced higher varietal response (55.57 q/ha) over check i.e. BPT 5204 cultivar (40.96 q/ha) which was to the tune of 35.67%. The response of genotype, RTN 28-1-5-3-2 to nitrogen levels was statistically significant. The level of nitrogen 120 kg N/ha (52.21 q/ha) and 150 kg N/ha (48.39 q/ha) were produced significantly higher grain yield over 100 kg N/ha (44.19 q/ha). Rice genotype, RTN 28-1-5-3-2 grown at spacing of 20 x 15 cm recorded significantly higher grain yield (49.97 q/ha) over 15 x 15 cm and 20 x 20 cm spacing. Individual interactions between variety x spacing, variety x nitrogen levels and spacing x nitrogen levels were found to be statistically significant. Rice genotype, RTN 28-1-5-3-2 grown at spacing 20 x 15 cm produced significantly higher grain yield (58.06 q/ha) over rest of treatment combinations and its increment was to the tune of 38.67% when rice cultivar BPT 5204 (41.87 q/ha) grown at same spacing. From agronomical trial it is concluded that, the rice genotype RTN 28-1-5-3-2 produced higher grain yield 62.03 q/ha by adopting 20 x 15 cm spacing and 120 kg N + 50 kg P_2O_5 + 50 kg K_2O/ha as fertilizer dose, which was 36.87% higher over cultivar BPT 5204 (45.32 q/ha) by adopting same package of practice during *kharif* season (Table 12–15).

The milling and cooking qualities of Ratnagiri 8 rice variety was estimated at the Indian Institute of Rice Research, Hyderabad during 2015-2017. It showed excellent kernel quality features like popular quality rice check variety Samba Mahsuri (BPT 5204). The variety Ratnagiri 8 showed higher hulling (75.8%), milling (67.0%) and Head Rice Recovery (64.6%). The kernel length (5.4 mm), kernel breadth (2.0 mm), length: breadth ratio (2.70) and translucent kernel observed to be an inherited traits in this rice variety which contribute to higher milling and head rice recovery in Ratnagiri 8 rice variety (Bhattacharya, 1980). Ratnagiri 8 rice variety recorded an intermediate amylose content (23.11 %) indicating better cooking qualities of kernels (Anonymous, 2004) (Shobha Rani, 2003).

The variety showed medium gel consistency (22 mm) and Alkali spreading value (5.0) and of 17.7 g test weight like BPT-5204 (Table 11). The above observation indicates that the new variety Ratnagiri 8 meets the requirements of millers and consumers for higher monitory returns to farmers.

Total 22 large scale demonstrations of rice culture RTN 28-1-5-3-2 (IET 25493) were conducted during *Kharif* 2017. It recorded (5616 kg/ha) 37.85% increase in grain yield over check BPT 5204 (4074 kg/ha) (Table 16).

The rice variety Ratnagiri 8 was screened for reaction to various diseases and insect pests at endemic locations in different screening station across the country.

The variety IET 25493 showed moderately susceptible reactions to Leaf Blast, Bacterial Leaf Blight, Neck Blast, Rice Tungro diseases, Sheath rot and Glum discoloration which were at par with reactions of resistant checks while, it was also recorded resistant reaction to leaf folder, whorl maggot, rice thrips and moderately resistant reaction to stem borers on the basis of pooled data of three years screening in National screening Nursery trials conducted during 2015-2017(Table 9 and 10) under endemic test locations (Anonymous, 2016).

Ratnagiri 6 rice variety is midlate in duration (135-138 days duration in *kharif* and 145-150 days duration in *rabi*/hot weather seasons), semi dwarf (102-110 cm plant height), medium slender kernel type, average 1000 kernel weight of 18.77 g with an average grain yield of 5.0 to 5.8 t/ha. The variety is non-lodging and non-shattering type. The details of salient features and characterization as per DUS guideline of RTN 28-1-5-3-2 (IET 25493) are presented in Table 1.

Hence considering consistent performance, yield superiority, excellent cooking and grain quality with wider adaptability over the locations on the basis of three years testing, Ratnagiri 8 (IET 25493) is identified for release for commercial cultivation for the zone IIIrd (Orissa and Uttar Pradesh), Vth (Chhattisgarh and Maharashtra), VIIth (Andhra Pradesh and Telangana).

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