

Looking at rice adoption behaviour beyond Yield Criteria: How Farmers Adopt new rice varieties?

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Received: 3rd March 2018, Accepted: 18th May 2018**Abstract**

A study was conducted in Yadadri district of Telangana to understand the adoption behaviour among 80 rice farmers. The data were collected using personal interview method. An analysis of farmers' preferences and perceptions showed that majority of farmers expressed BPT 5204 variety has a better grain quality compared to other varieties grown. Head rice recovery of RNR 15048 harvested during *Kharif* season was better compared to that of Rabi. Farmers preferred the varieties which fetched the highest net income, having desired duration and having multiple stress resistance. Based on availability of other suitable varieties in this region, some of the predominant/existing varieties are likely to be discontinued. The continued adoption and discontinuation are influenced by several factors that go beyond yield criterion. The paper describes such factors.

Key words: Rice, Adoption behaviour, Farmers, Post adoption analysis**Introduction**

Rice is one of the important cereal crops in India. Rice is not only the principal food crop of India, but it also occupies the largest area under cultivation. It is the major staple food of more than two billion peoples in Asia and more than 80 per cent of world's population. Presently rice caters to about 42 per cent of the total food need of the world?. Rice is main source of income for millions of people in the world and it is grown in all continents of the world. The world production of rice in the year 2016-17 was 758.9 million tonnes. (FAO 2017).

India is an important centre of rice cultivation and is cultivated in about 42.5 million hectares in India. Developing countries account for 95 per cent of the total production, with China and India alone responsible for nearly half of the world output. Rice is rich in genetic biodiversity, with thousands of varieties grown throughout the world. It is life for thousands of millions of people in the globe. It is deeply embedded in the cultural heritage of their societies. About 4/5 of the world's rice is produced by small-scale farmers and is consumed locally.

With advent of novel trends in rice breeding varieties like transgenic breeding for improving yield, resistance/tolerance against biotic/abiotic stresses and grain quality to cater to national and international markets and development of herbicide-tolerant transgenic rice, development of transgenic rice with nutrient acquisition, we are surplus in rice production. Even though several technological advancements in rice breeding have progressed they are becoming obsolete and are not catering to the complete

needs of the rice consumers since there is a wide disparity in the consumption preferences of both rural and urban population. The most suitable variety is the one best meeting farmers' and consumers' needs.

The scientists' selection criteria will not always correlate with that of farmers. For example, apart from yield and panicle height, there was no significant correlation between breeders and the farmers' selection scores for quinoa variety selection in Equador (McElhinny *et al.* 2007). Due to the absence of varieties meeting their criteria, farmers will continue using the landraces or old varieties. In a participatory plant breeding (PPB) study in Ghana, Manu Aduening *et al.* (2006) reported that most farmers utilized the cassava landraces despite availability of modern varieties. In Zimbabwe, farmers were also growing old maize hybrids released in the 1970s and their own landraces in spite of availability of new and high-yielding hybrids (Derera *et al.* 2006).

Many such researches revealed that farmers may not always prefer the varieties with the highest yield potential and disease resistant traits, they also give preference to features such as good taste, high milling yield, whether the rice will be sold or consumed at their home. Hence, there is a need to lay emphasis on these factors; accordingly, more micro level studies should be planned. Based on the perception of the farmers, post adoption behaviour can also be guesstimated. Keeping these points in view the following study was undertaken to assess differential perception of farmers about different rice varieties, factors associated with adoption or discontinuation of rice varieties.



An attempt is also made to understand the socio-economic and other factors associated with the adoption and likely discontinuation of varieties in farmers' fields.

Material and Methods

The study was carried out in nearby villages of Bhongir mandal in Yadadri district in Telangana. About 80 farmers were selected for studying their perception on different rice that are in vogue. The selection of farmers was based on the condition that each respondent has experience in cultivating all the varieties viz., BPT 5204, RNR 15048, JGL 18047 and IR 64. The perception variable encompasses two factors; the first consists of quality factors such as taste, smell, cooking quality and HRR. The second consists of production factors such as quantity of seed and fertilizer, Man days required etc. The factors that influence the adoption of varieties were also studied. The statistical tools such as frequency, percentage and ranking were employed to draw meaningful conclusions.

Varieties considered in the present study: Farmers' perception about production and quality factors was elicited for three newly released rice varieties which are being compared to the mega variety BPT 5204(Samba Mahsuri). Among the new varieties of rice considered in the study, super-fine Telangana Sona (RNR 15048), a comparable variety of the existing BPT 5204 (Samba Mahsuri) is a 120-day crop released for the states of Telangana, Andhra Pradesh, Karnataka, Tamil Nadu and Chhattisgarh. Bathukamma (JGL 18047) is also being considered a replacement to the existing BPT 5204. It is a 120-day crop and gives average productivity of 3 t/ acre. Another new variety, Kunaram Sannalu (KNM118) is said to be equally good and provides almost the same yield. BPT 5204 (Samba Mahsuri) was the most consumed variety of rice in Southern India, which was originally released in 1986.

Results and Discussion

Varietal preference is a carefully weighed balance between consumption and production characteristics. Farmers would not only select the high yielding varieties but prefer varieties because of their taste, nutritional value, duration, the ability to grow with fewer inputs and in different abiotic stress conditions. The conventional approaches always focus on linear model of demonstrations where no options are provided to farmers to pick from. Choice of a rice variety is determined by certain plant characteristics and the local natural environment.

An attempt is made here to understand the socio-economic and other factors associated with the adoption and likely discontinuation of varieties in farmers' fields.

Table I. Profile characteristics of the respondents (n=80)

S. No.	Independent variables	Category	Respondents	
			Fre-quency	Per-centage
1	Age	Young age (< 35 years)	30	37.5
		Middle age (36-54 years)	38	47.5
		Old age (> 55 years)	12	15
2	Education	Illiterate	8	10
		Primary school	14	17.5
		Inter/Diploma	24	30
		Graduation	34	42.5
3	Farming experience	Below 10 years	16	20
		11 to 20 years	40	50
		21 to 30 years	24	30
4	Family size	Upto 5	64	80
		More than 5	16	20
5	Annual Income	Upto 2 lakh	32	40
		More than 3 lakh	48	60
6	Land Holding	1 to 5 acres	32	40
		6 to 10 acres	20	25
		11 to 15 acres	24	30
		More than 15 acres	4	5
7	Occupation	Farming	52	65
		Farming+ cast occupation	12	15
		Farming+ labour	16	20
8	Source of information	Friend and neighbours	22	27.5
		TV radio and mass media	20	25
		AEO+AO	20	25
		Scientists	18	22.5
9	Extension contact	Regularly	44	55
		Sometimes	24	30
		Rarely	12	15

Among the respondent farmers a considerable percentage was middle aged followed by young age. The plausible reason for the above trend might be the young and middle aged farmers are enthusiastic in making the choice of varieties for adoption. A glance of the above table revealed that 42 per cent of the farmers are graduates and 30 per cent of them had intermediate/diploma education followed by the rest belonging to primary school (17.5%) and illiterate category (10%). The above table illustrated that exactly half (50%) of the respondents had 11 to 20 years of farming experience followed by 30 per cent having 21 to 30 years of farming experience and a small portion of them had below 10 years of farming experience. This might be due to majority of the respondents belong to middle age (36-54) hence they had 11 years of farming experience.

A close investigation of the Table 1 reveals that three fourth of the farmers had up to five members in a family and only 25 per cent of the respondents had family size more than 5. It can be concluded from the above table that 60 per cent of the respondents are having annual income more than 3 lakhs followed by 40 per cent of them having below 2 lakhs of annual income. This is attributed to the family background of the respondents.

The Table 1 clearly shows that majority (40%) of farmers were owning 1 to 5 acres of land followed by 30 per cent of them having 11 to 15 acres of land, 25 percent had 6 to 10 acres land and only five percent of farmers possessed more than 15 acres of land. This reflects the representativeness of the sample selected for the study in terms of landholding.

It was evident from the table that about 65 per cent of the farmer's sole occupation is farming it is quite interesting to note that the farmers in the sample area mostly depend on farming for their livelihood followed by 20 per cent whose occupation is both farming and casual labour and about 15 % of them are relying on caste occupation along with farming.

Regarding the utilisation of sources of information by the farmers, 27.5 per cent of them obtain information from their friends and neighbours followed by 25 per cent of them depend on Agricultural extension officer (AEO) and Agricultural Officer (AO) for their information needs. An equal percentage of the respondents utilized mass media sources viz. Television, radio and newspapers for their information needs and 22 percent of them interacted with scientists for fulfilling their information needs.

With regard to extension contact, 55 per cent of the farmers expressed that they had regular extension contact and 30 per cent reported that they meet the extension personnel sometimes and 15 per cent of them had rarely contacted the extension agencies such as State Agriculture Department or University Scientists.

Table 2 portrays perception of farmers on different rice varieties with regard to some key production factors. Regarding the availability of the quality seeds all the sample farmers stated that quality seeds are available for the varieties such as RNR-15048 and JGL 18047 on the other hand some of the farmers expressed that the quality seeds are not available for BPT 5204 and IR 64. Farmers usually purchase seeds from the market yards and few of them purchase from local dealers. According to farmers, higher seed rate was used (30 kgs per acre or 75 kg/ ha) for varieties like BPT 5204, JGL 18047 and IR 64 whereas RNR-15048 variety required only 20 kg/ acre which is equivalent to 50 kg/ha. The cost of seed for JGL 18047 and IR 64 per one bag of 25 kg was Rs. 950 and for RNR-15048 and BPT 5204 varieties were Rs.800 and Rs.1200 per bag (of 25 kg) respectively.

Table 2: Perception of farmers about rice varieties – production factors (figures in parenthesis represent %)

S. No	Category	BPT 5204	RNR-15048 <i>Kharif</i>	JGL 18047	IR 64	RNR-15048 <i>Rabi</i>	
1	Availability of quality seeds	Available	74 (92.5)	80 (100)	80 (100)	76 (95)	80 (100)
	Not available	6 (7.5)	0 (0)	0 (0)	4 (5)	0	
2	Quantity of seed sown (kg/ha)	75	50	75	75	50	
3	Cost of the seed (in Rs/bag)	1200	800	950	950	800	
4	Quantity of fertilizer applied (In bags/ acre)	Urea	3	1	2	2	1
		DAP	2.5	1.5	2	2	1.5
5	Man days required (no of men employed X days)	Less	0 (0)	68 (85)	24 (30)	0 (0)	68 (85)
		Medium	20 (25)	12 (15)	56 (70)	4 (5)	12 (15)
		high	60 (75)	0 (0)	0 (0)	76 (95)	0 (0)
6	Pests and diseases incidence (less/more)	Less	0	72 (90)	22 (27.5)	4 (5)	72(90)
		Medium	24 (30)	8 (10)	48 (60)	24 (30)	8 (10)
		high	56 (70)	0	10 (12.5)	52 (65)	0
7	Intensity of weed (less/more)	Less	56 (70)	6 (7.5)	56 (70)	0	6 (7.5)
		Medium	24 (30)	10 (12.5)	24 (30)	8 (10)	10 (12.5)
		high	0	64 (80)	0	72 (90)	64 (80)
8	Harvesting (in days after planting)	120	95-105	105	110	100	
9	Yield (t/acre)	2.25	2.47	2.30	2.25	3.0	
10	Gross Income (Rs/acre)	41625	44460	35420	34875	45000	
11	Tillering Capacity	Better	20 (25)	25 (31.25)	18 (22.50)	18 (22.50)	22 (27.50)
		Medium	40 (50)	42 (52.50)	35 (43.50)	32 (40)	39 (48.75)
		Shy	20 (25)	13 (16.25)	27 (33.75)	30 (33.75)	19 (23.75)



The fertilizer requirement of JGL 18047 and IR -64 varieties was identical, about 2 bags of urea and 2 bags of DAP are applied in three doses. While RNR-15048 required 1 bag urea and 1.5 bags DAP. However, according to the respondents, fertilizer requirement for BPT 5204 variety was more i.e. 3 bags of urea and 2.5 bags of DAP. Regarding the number of labour employed during the season - the RNR-15048 variety required extremely less number of workers, 70 per cent conveyed that moderate number of workers required in case of JGL 18047. While, 75 per cent opined that BPT variety required more man power or more labour days. The duration of variety, transplanting, weed population and pest incidence are the factors that influence number of workers to be employed during the crop season.

The pest and disease incidence was less in case of RNR-15048 variety in *kharif* and *Rabi* seasons as 90 per cent of the farmers inferred it as low. On the other hand, 60 per

cent expressed that JGL 18047 has medium pest incidence and however IR64 variety and BPT 5204 have recorded high pest incidence rate (perceived by 65 per cent and 70 per cent of farmers respectively). In addition to this, severe rodent damage was also observed in BPT 5204 variety.

The weed intensity was very high in RNR-15048 and IR 64 varieties and low in case of BPT and Batukamma varieties. The plausible reason could be that spacing in earlier stated varieties is more; the thin spacing will aggravate the weed population. The harvesting was done after 120 days after transplanting in case of BPT 5204, JGL 18047 and IR-64 varieties whereas RNR-15048 variety is harvested in 95 to 105 days after transplanting. Farmers reported that RNR 15048, when transplanted before July 1st week, resulted in longer duration and when transplanted after July 1st week, resulted in most appropriate duration for Telangana state. In case of *Rabi*, the duration remained same in early and late planted condition.

Table 3: Perception of farmers about rice varieties – quality factors (figures in parenthesis represent %)

S.No		Category	BPT 5204	RNR-15048 Kharif	JGL 18047	IR 64	RNR-15048 Rabi
1	Taste	V. good	32 (40)	76(95)	0	0	16 (20)
		Good	48 (60)	4(5)	28 (35)	48(60)	40 (50)
		Average	0	0	52 (65)	32 (40)	24 (30)
2	Smell	V.good	72 (90)	36(45)	14 (17.5)	10 (12.5)	36 (45)
		Good	8 (10)	12 (15)	8 (10)	32 (40)	12 (15)
		Average	0	16(40)	58 (72.5)	38 (47.5)	32 (40)
3	Cooking quality	V.good	70 (87.5)	76 (95)	0	0	16 (20)
		Good	10 (12.5)	4 (5)	20 (25)	24 (30)	48 (60)
		Average	0	0	60 (75)	56 (70)	16 (20)
4	Head rice recovery (HRR) (%) Cumulative average		73	73	70	70	69

About 60 per cent of the respondents expressed that taste of BPT was good and 40 per cent stated it has a very good taste, 60 percent stated that IR64 has good taste and 65 per cent expressed JGL 18047 variety has average taste. It is quite interesting to note that the RNR variety in *Kharif* was having a very good taste compared to the RNR variety in the *Rabi* only 50 per cent opined that it has good taste. The differential taste perception between *Kharif* produce and *Rabi* produce is evident from the qualitative judgement of farmers. The varietal adoption may differ between *Rabi* and *Kharif*.

Among all the varieties BPT variety has very favourable smell as expressed by 90 per cent of the respondents; it has

characteristic aroma and fine grain quality. Hence it was still the ruling variety and remaining varieties fall under average category with respect to the smell.

The cooking quality of RNR variety during *Kharif* was perceived as very good (95%) and Good (5%) whereas the cooking quality of RNR variety in *Rabi* was good perceived by 60 per cent of the respondents.

The head rice recovery (qualitative ratings by respondents) revealed that all the varieties have good head rice recovery. But the HRR of RNR 15048 harvested during *Rabi* (dry) season has recorded lowest HRR, where the same variety recorded highest HRR in *Kharif*.

Rating of factors influencing Adoption behaviour

Based on the analysis of above factors, an attempt was made to rank the factors that are likely to influence the adoption behaviour of rice farmers in respect of these varieties. The results are presented in the following Table 4.

Table 4: Perceived ranking of factors influencing adoption

S. No.	Perceived Factors	Number of favourable responses	Ranking
1	Availability of quality seeds	64	V
2	Lesser Seed rate – without Yield Penalty	48	XI
3	Reasonable Cost of the seed	52	IX
4	Fertilizer Responsiveness	60	VI
5	Lesser need for Labour Man days	56	VIII
6	Less Pests and diseases incidence	68	IV
7	Less Intensity of weed	60	VI
8	Favourable (Medium) duration	72	III
9	Better Yield	78	II
10	Market price (Procurement price)	72	III
11	Net Income per acre	80	I
12	Favourable Taste	56	VIII
13	Mild favourable Smell	50	X
14	Good Cooking quality	64	V
15	Head rice recovery (HRR) (%)	58	VII
16	Abiotic Stress Tolerance (floods, drought)	68	IV

Farmers opined that their varietal choice depended on several factors as indicated in the table 4. Apart from net income and yield criteria, duration and market prices

Table 5: Post adoption Indicators (figures in parenthesis represent %)

S. No	Post adoption Behaviour	Category	BPT 5204	RNR-15048 Kharif	JGL 18047	IR 64	RNR-15048 Rabi
1	Continued adoption	For marketing	12 (15)	28 (35)	12 (15)	8 (10)	12 (15)
		Home Consumption	5 (6.2)	4 (5)	0	0 (0)	0 (0)
2	Discontinuation	Replacement	49 (61.3)	40 (50)	36 (45)	48 (60)	48 (60)
		Disenchantment	14 (17.5)	8 (10)	32 (40)	24 (30)	20 (25)

Conclusion

In most parts of the country, farmers continue to adopt rice varieties developed several years back. Most of the farmers are thinking to discontinue adoption of these varieties except for RNR 15048 during *Kharif*. The continued adoption is observed in case of BPT 5204 and RNR 15048

influenced adoption of a particular variety. In Telangana due to assured procurement of both fine and bold grain type varieties through *Indira Kranthi Patham* (IKP) centres by providing minimum support price, very thin line is left out between varieties having fine grain and bold grains in terms of marketability.

The reasons from varietal choice shifted from mere yields to other factors such as favourable duration (borewell irrigated conditions), abiotic stress tolerance (due to aberrations in climate), availability of seeds (non availability of a particular seed leads to adoption of some other variety), cooking quality (for family consumption) etc.,

When asked about the post adoption behaviour, interesting results were obtained. Most of the farmers are thinking to discontinue adoption of these varieties except for RNR 15048 during *Kharif*. The continued adoption is observed in case of BPT 5204 and RNR 15048 (in *Kharif*) for home consumption purposes where as for marketing purposes the results are not that encouraging.

The discontinuation of adoption of these varieties will stem from either replacement or dissatisfaction. BPT 5204 is likely to be replaced by Improved Samba Mahsuri, Jai Sree Ram and HMT Sona. RNR 15048 during *kharif* was perceived as good when it is planted after July. Farmers who plant before July wanted replacement of RNR 15048 with Jai Sree Ram and HMT Sona. Interestingly, IR 64 may see replacement with new varieties like DRR Dhan 44, MTU 1153 and JGL 24423, RNR 15048 during *Rabi* may get discontinued due to several reasons that led to disenchantment. Reverse adoption is observed where farmers are returning to MTU 1010 after having adopted RNR 15048 during last two *rabi* seasons.

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The research and development organisations need to focus on multiple factors such as grain quality, favourable duration, procurement method, abiotic stress tolerance, etc., apart from the yield criteria. Only yield criterion would never lead to adoption of new varieties. Breeding programs need clear, formal product profiles to guide them. These profiles must specify: - Which variety currently grown by farmers will be replaced by the new product? - Which features of the current variety must be improved to drive adoption (eg, a specific quality parameter or disease resistance) - Which features must remain unchanged in the new product.

Another important dimension is availability of the quality seed at right time. The breeding objectives may be defined to suit to a particular regions/ state/ ecosystem/ consumption pattern, before a variety is developed. The varietal development and targeting should be felicitous to the target producers and consumers. After the release of varieties, the line departments should target the best suited areas for the cultivation of these varieties rather prioritizing the popular age old varieties. While targeting the varieties, we need to take into consideration the factors that affect

the varietal choice among the farmers. This paper tried to highlight the way adoption studies need to be undertaken in describing the varietal adoption based on various qualitative parameters beyond 'yield alone' approach.

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