Farmers' participatory performance evaluation of TRY 3 rice variety in high rainfall zone of Tamil Nadu

N THAVAPRAKAASH

ICAR-Krishi Vigyan Kendra (TNAU), Thirupathisaram, Kanyakumari 629901 Tamil Nadu, India
Email: thavaprakaash.n@tnau.ac.in

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ABSTRACT

Rice is the most staple food crop of high rainfall zone of Tamil Nadu and lack of suitable variety in late Samba (September-January) season is the most important bottleneck in production of rice. Farmers' participatory frontline demonstrations were conducted in ten farmers' fields with rice variety TRY 3 which was compared with existing ruling variety (TPS 3) in the zone. It was found that increased number of tillers (526.6/m^2), productive tillers (460/m^2), panicle length (34.5 cm), number of grains (164.2/panicle), number of filled grains (140.4/panicle) and grain yield (6,880 kg/ha) were recorded in TRY 3 rice variety compared to local variety TPS 3. Variety TRY 3 also led to higher gross return (Rs 1,12,440/ha), net return (Rs 56,330/ha) and B-C ratio (1.97) as compared to the local variety. Bold grain type of TRY 3 and equal or better unit market price also encouraged the farmers for cultivation of TRY 3 rice variety.

Keywords: Rice varieties; frontline demonstrations; grain yield; economic parameters

INTRODUCTION

Rice is the staple food crop of the world, India as well as of Tamil Nadu. Among rice growing countries India has the largest area (44 Mha) and its production is the second largest (104 MT) next to China. The productivity of rice in India is 3.37 tonne/ha as against the world's average of 4.25 tonne/ha (Suganthi et al 2017). Due to the burgeoning population in India and also many other challenges the productivity of rice in India needs to be increased (Nandhakumar et al 2015).

In Kanyakumari district, Tamil Nadu rice is the most widely cultivated food crop which occupies around 16,000 ha of area. But the area under rice cultivation is declining over a period of time due to less remuneration in rice and farmers are shifting to other cash crops such as banana, tapioca etc. Poor income in rice crop is mainly due to lack of high yielding varieties, poor awareness on latest cultivation technologies, poor knowhow on pest and disease management, poor market price due to continuous rains while harvest etc. Of them lack of varieties is felt-need of the farmers both in Kuruvai (June-September) and late Samba (September-January) seasons. Due to the release of TPS 5 variety the need of Kuruvai season was satisfied and the farmers needed a variety for late Samba season. To resolve this, ICAR- Krishi Vigyan Kendra demonstrated TRY 3 rice variety which had similar duration and characteristics to local ruling variety TPS 3.

MATERIAL and METHODS

Frontline demonstrations (FLDs) on TRY 3 rice variety were conducted by the Krishi Vigyan Kendra during late Samba (September-January) season of 2013-14 in the farmers' fields of Vembanoor village of Rajakkamangalam block in Kanyakumari district, Tamil Nadu located in the southern-most part of India at 08.09^{o}N latitude, 77.54^{o}E longitude and at an elevation of 37 m amsl. The district receives major rainfall in southwest monsoon (June-September) and northeast monsoon (October-December) and also during winter (January-February) and summer (March-May) seasons and hence it is identified as high rainfall zone of Tamil Nadu with average rainfall of 1,369 mm.

The demonstration area had assured canal irrigation facilities during September-January. Its soil was clay loam in texture, slightly alkaline in reaction (7.9-8.1), low in organic carbon (0.20-0.39%) and available nitrogen (120-160 kg/ha) and high in available phosphorus (13.0-18.1 kg/ha) and potassium (140-180 kg/ha).

Field survey was made to identify progressive nature of farmers and to demonstrate the advanced technologies and introduction of new varieties. Each demonstration was conducted in an area of 0.4 ha and adjacent to that rice crop was cultivated with farmers' practices/variety as given in Table 1. The selected farmers were trained by the scientists of the KVK on all scientific cultivation aspects of rice before and during the demonstrations. The demonstrations were regularly monitored by the scientists of the KVK.

The observations on growth parameters, yield and yield attributes were recorded. The total number of tillers/m^2 and productive tillers/m^2 was counted at maturity stage from five randomly-marked hills in the demonstration area. The conversion efficiency of tillers was worked out as follows:

$$\text{Tiller conversion efficiency (\%)} = \frac{\text{Number of productive tillers/m}^2}{\text{Total number of tillers/m}^2} \times 100$$

The panicle length was measured from the base of the plant to the tip of the panicle obtained from the marked five hills. The panicles were collected from the five tagged plants at maturity and counted for total number of grains and filled grains per panicle. From the total grains and filled grains, grain conversion efficiency was worked out by using the formula given as under:

$$\text{Grain conversion efficiency (\%)} = \frac{\text{Number of filled grains/panicle}}{\text{Total number of grains/panicle}} \times 100$$

The crop was harvested at physiological maturity, threshed and cleaned manually. The dry weight of grains and straw yield were recorded after proper sun drying. Harvest index was calculated by the following formula:

$$\text{Harvest index (\%)} = \frac{\text{Economic (grain) yield (kg/ha)}}{\text{Biological (grain + straw) yield (kg/ha)}} \times 100$$

The economics of different varieties was calculated by converting the total yield of the plot into money value. The cost of cultivation was estimated on the basis of prevailing market rate of expenditure. The gross return was calculated by adding the cost of grain and paddy straw according to prevailing market rates.

Gross return (Rs/ha)= Cost of grain (Rs/ha) + Cost of straw (Rs/ha)

Net return was obtained by subtracting the cost of cultivation from gross return.

Net return (Rs/ha)= Gross return (Rs/ha) - Total cost of cultivation (Rs/ha)

B-C ratio was calculated as per formula given below:

$$\text{Return per rupee invested (B-C ratio)} = \frac{\text{Gross return (Rs/ha)}}{\text{Total cost of cultivation (Rs/ha)}}$$

To study the impact of frontline demonstrations data from FLDs and farmers' practices were analyzed. The extension gap, technology gap and technology index were calculated using the formula as suggested by Samui et al (2000):

Extension gap (kg/ha)= Demonstration yield (kg/ha) – Local check yield (kg/ha)

Technology gap (kg/ha)= Potential yield of variety (kg/ha) – Demonstration yield (kg/ha)

$$\text{Technology index (\%)} = \frac{\text{Potential yield of variety (kg/ha)} - \text{Demonstration yield (kg/ha)}}{\text{Potential yield of variety (kg/ha)}} \times 100$$

RESULTS and DISCUSSION

Growth and yield parameters

The introduced rice variety TRY 3 recorded more number of tillers (15.8/hill and 526.6/m^2) and converted them into productive tillers (13.8/hill and 460.0/m^2) with the tiller conversion efficiency of 87.4 per cent compared to local cultivar (TPS 3). Similarly increased panicle length (34.5 cm), number of grains (164.2/panicle), filled grains (140.4/panicle) and also better conversion efficiency of grains (85.5%) were noted in TRY 3 variety. Increased productive tillers and filled grains/panicle in turn resulted in more grain yield (6,880 kg/ha) in TRY 3. Increased tillers ultimately increased the straw yield (8,500 kg/ha) of TRY 3 without change of harvest index. Hiremath and Nagaraju (2009) in onion, Dhaka et al (2010) in maize, Rai et al (2015) in vegetable pigeonpea and

Table 1. Characteristic features of the varieties under demonstration

Parameter	TRY 3	Local (TPS 3)
Year of release	2010	1993
Parentage	ADT 43/Jeeraga Samba	RP 31-492/LMN
Duration (days)	135-140	135
Season suitable	Samba/Late Samba/Thaladi	Late Samba
Average yield (kg/ha)	5,833	6,100
1000-grain weight (g)	23.2	21.0
Grain type	Short and bold	Short and bold
Special features	Highly suitable for Idly making, moderately tolerant to sodicity, resistant to leaf folder, stem borer, brown plant hopper, blast, brown spot, sheath rot and sheath blight	Resistant to blast and leaf folder, suitable for water-logged condition

Table 2. Comparison of TRY 3 rice variety with local variety on plant growth parameters, yield attributes and yield

Parameter	TRY 3	Local (TPS 3)
Number of tillers/hill	15.8	13.2
Number of tillers/m^2	526.6	440.0
Number of productive tillers/hill	13.8	11.2
Number of productive tillers/m^2	460.0	373.3
Conversion efficiency of tillers (%)	87.4	84.8
Panicle length (cm)	34.5	25.3
Number of grains/panicle	164.2	155.3
Number of filled grains/panicle	140.4	128.0
Conversion efficiency of grains (%)	85.5	82.4
1000-grain weight (g)	23.8	20.8
Grain yield (kg/ha)	6,880	6,120
Straw yield (kg/ha)	8,500	7,200
Harvest index (%)	45.0	45.9

Saravanakumar and Srinivasan (2018) in sesame also reported earlier that the FLDs in the farmers' fields showed better results than the farmers' local varieties or technologies.

Economic parameters

Any variety or technology is acceptable by the farmers only when the economic parameters are better than the existing variety or technology. The economic feasibility of the improved TRY 3 variety over the existing local variety (TPS 3) was worked out based on the prevailing prices of inputs and output (Table 3). The demonstration fields with TRY 3 variety recorded higher gross (Rs 1,12,450/ha) and net return (Rs 58,320/ ha) with higher benefit-cost ratio of 1.97 compared to the local variety. However the cost of cultivation was higher in case of TRY 3 over TPS 3. Increased gross return was mainly due to the increased grain yield with same or excess market price than the prevailing local variety. Also additional straw yield (1,300 kg/ha) added to the gross return. Increased gross return with slightly enhanced cost of cultivation improved net return. Ratio between gross return and cost of cultivation (B-C ratio) was also noted higher in case of TRY 3 variety. The respondent farmers also expressed satisfaction over the performance of TRY 3 variety in terms of growth, yield, market price, quality characters etc. Better performance of introduced varieties through farmers' participatory frontline demonstration mode was also documented earlier by Saravanakumar (2017) in finger millet and Saravanakumar and Alagesan (2017) in greengram.

Table 3. Economic parameters of rice varieties under demonstration

Parameter	TRY 3	Local (TPS 3)
Gross return (Rs/ha)	1,12,450	99,868
Cost of cultivation (Rs/ha)	58,320	56,120
Net return (Rs/ha)	56,330	43,748
B-C ratio	1.97	1.78

Yield gap analysis

Yield of frontline demonstration trials and potential yield of the crop were compared to estimate the yield gap and it was categorized into extension gap, technology gap and technology index. The extension gap between the demonstration and local yield was 760 kg/ha (Table 4). The technology gap indicated the gap between the potential yield of the crop over demonstrated yield and it was 3,786 kg/ha. The observed extension and technology gap may be attributed to dissimilarities in soil fertility levels, not following the recommended technologies, indiscriminate use of chemicals agianst pest and disease incidence and improper usage of manures and fertilizers in the region. Hence to narrow down the yield gap, location specific technologies need to be adopted. Technology index showed the feasibility of the variety at the farmers' fields. The technology index value was recorded 35.3 per cent that indicated a fair chance of introduction of the specified variety (TRY 3) in the zone. The findings of the present study are in line with the findings of Dhaka et al (2010), Hiremath and Nagaraju (2009) and Rai et al (2015).

Table 4. Yield gap, extension gap and technology index of TRY 3 variety

Variable	Value
Potential yield (kg/ha)	10,666
Demonstration yield (kg/ha)	6,880
Farmers' variety yield (kg/ha)	6,120
Technology gap (kg/ha)	3,786
Extension gap (kg/ha)	760
Technology index (%)	35.3

CONCLUSION

The results of the frontline demonstrations indicated that the production and economic gain of the farming community was realized due to the cultivation of TRY 3. Hence TRY 3 rice variety was best suited in high rainfall zone of Tamil Nadu and has broader scope for increasing the productivity of rice in the area.

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