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Impact of Paddy Varietal Demonstrations in Adoption, Knowledge Gain and Economic Perspective of Tiruvallur District, T.N., India

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ABSTRACT

Krishi Vigyan Kendra, Tiruvallur has been instrumental in conducting frontline demonstrations on high yielding, pest and disease resistant, submergence and salinity tolerant paddy varieties like CO 51, TKM 13, CR 1009 Sub 1 and TRY 3 in order to improve the existing yield level, net returns and also to address the specific environment related issues faced by the farmers. The KVK, Tiruvallur and the Department of Agriculture conducted varietal demonstrations and extension activities resulting in the adoption of CO 51 across 11,580 ha (25.7% of short-duration paddy area) and TKM 13 across 8,915 ha (17.29% of medium-duration paddy area). CO 51 provided an additional income of Rs. 24,935/ha over ADT 43, with a cost saving of Rs. 5,510/ha. While TKM 13 yielded Rs. 25,330/ha more than BPT 5204, with a cost saving of Rs. 8,600/ha. Economic impact realized by way of cultivating CO 51 in an area of 11580 ha and TKM 13 in 8915 ha is 28.87 and 22.58 crores respectively. The introduction of CR 1009 Sub 1 in coastal area has helped farmers realize additional income of Rs.24150/ha over the check variety BPT 5204 and cost saving of Rs.5650/ha with economic gain of Rs. 72.45 lakhs in 300ha. The introduction of TRY 3 variety has gained popularity among the coastal farmers and cultivated in about 215 ha and earned an economic gain of Rs. 7,33,150 to the farmers apart from addressing problems due to salinity like poor establishment and grain sterility. Cost saving of Rs. 3700/ha and additional net income of Rs.3410 over the check variety BPT 5204 has also been realized. This study clearly indicates the higher economic gains attained by the farmers. The area spread of the popular varieties shows an increasing trend and more area coverage is expected in the coming years. The knowledge gain by the farmers of various blocks of Tiruvallur had significantly improved after intervention where 82-86 per cent farmers had more than 50% knowledge about the high yielding varieties.

***Key words**: CR 1009 Sub 1, Economic gain, Front line demonstration, Paddy, KVK Tiruvallur, TKM 13*

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Introduction

Tiruvallur District lies in the North Eastern Zone of Tamil Nadu (Prasad *et al*., 2020) where Paddy is the major crop cultivated in about 96,609 ha during Sornavari (April-May), Samba (Aug-Sep) and Navarai (Nov-Dec) seasons with the productivity of 4340kg/ha. Samba is the major paddy growing season, covering about 51,567 ha (54.4 % of the total paddy area in Tiruvallur), while the remaining 45,042 ha (46.6 % of the total paddy area in Tiruvallur) is covered under Sornavari and Navarai seasons. Farmers cultivate medium and long duration varieties during the Samba season which starts from August and extends up to Dec/Jan and short duration paddy varieties during the Sornavari and Navarai seasons. Usually, two or three paddy crops in a year are raised in succession by the farmers in a cropping pattern: Paddy-Paddy-Pulses/Oilseeds or Paddy-Paddy-Paddy, depending upon the availability of water from the North East Monsoon. Farmers' preference for varieties mainly depends on the yield and market price. BPT 5204 is the predominant variety grown by the farmers during the Samba season owing to the premium price fetched for the variety on the market. But the variety poses a lot of problems for the paddy growers by its susceptibility to major pests and diseases (Ganesh Kumar *et al.,* 2019) viz., blast, BPH, sheath rot, sheath blight and inability to withstand water stagnation and salinity. The reduction in yield due to pests and diseases accounts for about 40 to 75 % and abiotic stresses like submergence and salinity account for 30 to 60 %. Among the short duration varieties, ADT 37 and ADT 43 have been the choice of varieties among the paddy growers in Tiruvallur District. Though both varieties perform well in the Tiruvallur district, their yield level hovers around 5-5.5 t/ha. More of these varieties were released more than 20 years ago and need replacement by recent high-yielding varieties. CO 51 is a short-duration slender grain variety with a high yield potential of 6.6 t/ha released by TNAU as a replacement for ADT 43. TKM 13 is a medium duration high yielding slender grain variety with a yield potential of 5.9 t/ha and is non lodging and resistant to major pests and diseases of paddy. It has been released in 2015 to replace BPT 5204 in Tamil Nadu. CR 1009 Sub 1 is a long-duration bold grain variety with submergence tolerance introduced from IRRI, Philippines for submergence prone areas of Tamil Nadu during the year 2015. TRY 3 is a medium duration salinity tolerant variety with bold grain type suitable for special preparations like idly.

Front line demonstration (FLD) has been used as a useful extension tool to demonstrate (Singh and Kaur, 2021) high yielding varieties along with production, protection and management practices in the farmer's field under different agro-climatic regions and farming situations (Beigh *et al*., 2015). The improved cultivation practices followed in the National demonstrations have already shown high yield potential.Hence, front line demonstrations on the high yielding paddy varieties released/introduced recently by TNAU were conducted during the years 2015-2020 with the objective of promoting the adoption of new high yield varieties by farmers. But the adoption level and knowledge of general farmers towards these varieties need to be studied in order to assess the effectiveness of the frontline demonstrations and the impact on high yield varieties in terms of economic gains over the farmer's practice. Therefore, it is really essential to study the impact of front line demonstrations on rice conducted by KVK, Tiruvallur to assess its effectiveness and efficacy towards enhancement in yield, economic gains and knowledge of the farmers.

Materials and Methods

Front Line Demonstrations on Paddy varieties *viz*., CO 51, TKM 13, CR 1009 Sub 1 and TRY 3 were conducted from 2015 to 2020 by Krishi Vigyan Kendra, Tiruvallur in various blocks of Tiruvallur District. The number of demonstrations carried out, beneficiaries and the area coverage are given in Table 1. The beneficiaries were selected based on their interest to adopt newer high yielding varieties and were trained with improved package of practices for rice *viz*., seed treatment and soil application of biofertilizers *viz*., *Azospirillum* and *Phosphobacteria* and bio inoculant *viz., Pseudomonas fluorescens*; basal application of Paddy Micro nutrient mixture @ 12.5 kg/ha, SRI techniques and Integrated Pest and Disease Management practices. The yield obtained in improved varieties along with the check variety was recorded in the farmer's field and an increase in yield obtained by cultivating high yielding varieties was calculated and the gap in extension and technology was worked out. The data on Gross income, Gross cost of cultivation and Net income was collected and the cost benefit ratio was calculated for individual farmers and the average was worked out

for each high yielding varieties. Field days, trainings, paper messages, pamphlets, display boards, Television and Radio talks were conducted to give wider publicity of the high yielding varieties and the success stories were documented. Extension workers in the Department of Agriculture were also sensitized about the special characteristics and cultivation of the High yielding varieties and their suitability to specific environmental conditions. The area coverage and the no. of farmers adopting the high yielding varieties in Tiruvallur District during the year 2022 were collected from the Department of Agriculture to study the impact of the varietal demonstrations by KVK, Tiruvallur.

Benefit Cost Ratio

$$\text{Benefit Cost Ratio (BCR)} = \frac{\text{Total Income}}{\text{Total Cost}}$$

Extension gap

The extension gap refers to the difference between the demonstration yield and the yield achieved by farmer's practice

Extension Gap = Demonstration Yield– Yield in Farmer's practice

Technology gap

The technology gap is a term used to describe the difference between the potential field and the demonstration yield in agricultural

Technology Gap = Potential Yield – Demonstration Yield

Cost saving

The cost saving is calculated by subtracting the cost of cultivation in the demonstration plot from the cost of cultivation in farmer's practice. It quantifies the difference in expenses between the conventional farming approach used by farmers and the cost associated with implementing recommended technologies demonstrated in controlled settings practice.

Cost saving = Cost of cultivation in Farmer's - Cost of cultivation in demonstration

Effective gain

The effective gain is calculated by adding the additional net income to the savings in cost. It represents the combined financial benefit derived from both increased revenue and reduced expenses. The effective gain reflects the overall improvement in profitability resulting from the adoption of the recommended approach.

Effective gain = Additional Net Income+Saving in Cost

Economic gains

The economic gains were worked out by calculating the additional net income got by way of cultivating the high yielding varieties in comparison with the farmer's practice and multiplied with the area under the high yielding varieties

Economic gain = Additional Net Income × Area under High Yield Varieties

Technology Index

The Technology Index is calculated by subtracting the demonstration yield from the potential yield dividing it by the potential yield and multiplying by 100. This equation expresses the difference between the potential yield and the demonstration yield as a percentage.

A higher Technology Index indicates that the technology is closer to achieving its maximum potential yield, suggesting higher efficiency or effectiveness. Conversely, a lower Technology Index implies that there is more improvement to approach the potential yield.

Technology Index = {(Potential Yield-Demonstration Yield)/Potential Yield} × 100

Adoption rate

The adoption rate was worked out by number of farmers adopting the high yield varieties during the year of data collection divided by the no. of farmers taken up the demonstration.

$$\text{Adoption Rate} = \frac{\text{No. of farmers adopting the high yield varieties during the year of data collection total Income}}{\text{No. of farmers taken the demonstration}}$$

Knowledge gain

The adoption of high yield varieties during and after the demonstration was compared in order to study the knowledge gain by the non-beneficiary farmers.

A sample of 70 farmers from all the 14 blocks of Tiruvallur district was selected and information regarding the knowledge about the high yielding varieties, cultivation practices, suitability to specific cropping seasons and adoption of high yielding varieties was gathered before and after intervention in order to assess the knowledge gained by the farmers

regarding the cultivation of high yielding varieties. The knowledge level is assessed on a 0 to 100 % scale based on information gathered from the farmers before and after intervention and categorized to frequencies ranging from 0-25%; 26-50%; 51-75% and 76-100%. The farmers were grouped in each category and the percentage of the total participants was worked out. Paired 't'-test was conducted to assess the significance of the improvement of knowledge levels among the farmers after an intervention.

Results and Discussion

The average grain yield obtained in the intervention, B:C ratio, extension gap, technology gap and Technology index are presented in Table 2. The extension gap yielding the difference in yield between the high yield varieties and the farmer's practice. A wide gap between the high yielding varieties and farmer's variety was noticed for CR 1009 Sub 1 (2250 kg/ha) followed by TRY 3 (1496 kg/ha). The difference between the varietal demonstration and the farmer's practice in these varieties may be attributed to the introduction of suitable varieties for the problematic area and the varieties cultivated by the farmers were unable to cope with the problems like submergence and salinity. The technology gap noticed for the variety CO 51 (1223 kg/ha) was higher than all other varieties owing to the varied level of technology adoption and improved package of practices among the farmers. The technology index also reflects the technology gap among the varieties and better extension services that need to be concentrated in the coming years to bridge the difference between the potential yield and demonstration yield. The results confirm to the findings of Girish *et al.,* 2011 and Beigh *et al.,* 2015.

The economic gain of the varieties gives a clear picture of the additional Net Returns, cost saving and effective gain of the high yield varieties (Table 3). The additional Net Returns from TKM 13 (Rs.25,330) was the highest among high yield varieties demonstrated followed by CO 51(Rs.24,935), CR 1009 Sub 1 (Rs.24,150) and TRY 3 (Rs.3,410). The saving in cost of cultivation in the high yield varieties also shows a similar trend with TKM 13 showing the highest cost saving followed by CR 1009 Sub 1, CO 51 and TRY 3. BPT 5204 being the choice of

Table 1. Demonstrations on high yielding varieties undertaken by KVK, Tiruvallur

Variety	Year	No. of Demonstrations	No. of Beneficiaries	Area coverage (ha)
CO 51	2015-2017	30	30	12
TKM 13	2015-2018	40	40	16
TRY 3	2014-2017	35	35	14
CR 1009 Sub 1	2018-2020	30	30	12

Table 2. Impact of KVK intervention

Variety	Yield (kg/ha)	B:C ratio	Extension gap (kg/ha)	Technology gap	Technology Index
CO 51	6602	2.72	1400	1223	15.63
TKM 13	5820	2.79	1230	402	6.46
CR 1009 Sub 1	6000	2.40	2250	652	9.80
TRY 3	5850	2.63	1496	425	6.77

Table 3. Economic gains over the check variety in demonstrations

Variety	Net Income (Rs.)	Additional Net Income (Rs.)	Saving in Cost (Rs.)	Effective gain (Rs.)	Economic gain in Demonstration (Rs.)	Overall Economic gain of the high yield varieties (Lakh Rs.)
CO 51	58400	24935	5510	30445	2,99,220	2887
TKM 13	63750	25330	8600	33930	4,05,280	2250
CR 1009 Sub 1	55350	24150	5650	29800	1,93,200	72.45
TRY 3	47200	3410	3700	7150	47,740	7.33

farmers during the Samba season is susceptible to major pests and diseases and hence requires more cost for plant protection measures. The cost of cultivation of the high yield varieties was comparatively low, by virtue of the high yield varieties to withstand the biotic as well as the abiotic stresses. The economic gain of demonstrating the high yielding varieties in the intervention area as well as with the current area spread under the high yield variety needs to be assessed to get an overall picture of the benefits derived out of the high yield varieties. The area covered by the short duration variety CO 51 (11580 ha) was the highest (11.99% among the total paddy area and 25.7 % among the short duration varieties) in Tiruvallur district followed by TKM 13 with 8915 ha (9.23% among the total paddy area and 17.29% among the medium duration varieties) (Table 4). Hence the economic gain derived out of the popularization of CO 51 was 28.87 crores and TKM 13 was 22.50 crores.

The area spread of CR 1009 Sub 1 and TRY 3 was 300 ha and 215 ha respectively. These varieties were not spread in a wide area in comparison to TKM 13 as these are confined to a few coastal blocks where submergence and salinity problems are witnessed. However, they are still covering a considerable area (about 20 % of submergence and 6.15 % of salinity prone area) in the coastal parts of Tiruvallur. The economic gain accrued by cultivation of CR 1009 Sub1 was estimated to be 72.45 lakhs and TRY 3 was 7.33 lakhs. The results confirm the findings of FLDs on Rice by Lathwal (2010); Dayanand *et al*. (2016) and Khade and Roy (2020). Hence it is understood that the front line demonstrations conducted were highly successful in terms of improving the grain yield and net returns of the farmers. This has been vividly captured by the area spread of these varieties in Tiruvallur district within 3-4 years of the demonstration.

The adoption level and adoption rate of the varieties by the farmers show an encouraging picture with CO 51 showing 25 % adoption followed by TKM 13 showing 17.9 % adoption among the farmers growing short duration and medium duration varieties respectively (Table 5). The adoption rate depicts the many fold increase in the adoption of high yield varieties by the farmers to the demonstrated farmers. Accordingly, CO 51 shows 1175 times increase in the farmers cultivating this variety and TKM 13 shows a 717.5-fold increase in adoption rate while CR 1009 Sub 1 and TRY 3 recorded 28.75 and 12 times increase in adoption of these high yield varieties. The higher the adoption rate, the higher must be the acceptance of the high yield varieties among the farmers and thus signifies the success of the demonstration. This result corroborates with the findings of Singh *et al.*, (2020).

The knowledge level of the farmers regarding the high yield varieties and their cultivation aspects were analysed before and after the intervention. The results indicate that there is a significant increase in the knowledge level *viz*., 208.14 % increase regard-

Table 4. Area coverage and Economic gain of high yielding paddy varieties demonstrated by KVK, Tiruvallur

Variety	Area (ha)	Production (tonnes)	Productivity (Quintals/ha)	Per cent area coverage to total Paddy area	Per cent area coverage to Short/ Medium duration Paddy area in Tiruvallur in Tiruvallur
CO 51	11580	76451	66.02	11.99	25.7
TKM 13	8915	51885	58.2	9.23	17.29
CR 1009 Sub 1	300	1800	60.0	0.31	0.58
TRY 3	215	1258	58.5	0.22	0.42

Table 5. Adoption level of high yielding paddy varieties demonstrated by KVK, Tiruvallur

Variety	Area	No. of farmers	Adoption Level (%)	Adoption Rate
CO 51	11580	35250	25	1175
TKM 13	8915	28700	17.4	717.5
CR 1009 Sub 1	300	575	3.48	28.75
TRY 3	215	420	2.55	12

Table 6. Knowledge level of high yielding paddy varieties demonstrated by KVK, Tiruvallur

Knowledge level of farmers	CO 51		TKM 13		CR 1009 Sub 1		TRY 4	
	Before	After	Before	After	Before	After	Before	After
0-25 %	51(72.9%)	1(1.4%)	45(64.3%)	1(1.4%)	31(44.3%)	1(1.4%)	37(52.9%)	1(1.4%)
26-50 %	17(24.3%)	11(15.7%)	23(32.9%)	8(11.4%)	27(38.6%)	11(15.7%)	25(35.7%)	11(15.7%)
51-75 %	2(2.9%)	39(55.7%)	2(2.9%)	45(64.3%)	11(15.7%)	33(47.1%)	7(10%)	36(51.7%)
76-100 %	0	19(27.1%)	0	16(22.9%)	1(1.4%)	25(35.7%)	1(1.4%)	22(31.4%)
Mean	22.1	68.1	24.6	69.3	33.6	69.6	29.1	69.4
Variance	167.9	223.7	184.4	183.8	379.3	328.4	245.1	245.9
'p' value	0.00001	0.00001	0.00004	0.00003				
Per cent Increase in knowledge level after Intervention	208.14	181.71	107.15	138.49				
Total no. of respondents	70							

ing CO 51 cultivation among the farmers of various blocks and 181.71 % increase in knowledge level about TKM 13; 107.15% regarding CR 1009 Sub 1 and 138.49% regarding TRY 3. On average the knowledge level of high yield varieties increased by about 152.65% after intervention. In general, about 82 to 92 % of farmers had less than 50 % knowledge about the high yield varieties before the intervention, which drastically improved after the intervention whereas 82-86 % of farmers had more than 50% knowledge about high yield varieties. Hence, the Front Line Demonstrations conducted by KVK have a positive impact on the improvement of knowledge on the cultivation of high-yield varieties among the farmers. The gain in knowledge level has been reported by Beigh *et al.* 2015.

Conclusion

Paddy varietal demonstrations conducted by Krishi Vigyan Kendra, Tiruvallur had significant impact in grain yield, income level, economic gain, adoption level, area expansion and knowledge gained by the farmers. The yield gap analysis indicates further need for the extension of improved technologies in crop cultivation to bridge the gap between the potential yield and the obtained yield. The higher economic gains from CO 51 and TKM 13 cultivation is mainly due to the large area brought under cultivation of the high yield varieties and more Net returns gained over the farmer's practice. Higher adoption level and Knowledge level of the high yield varieties directly implies the higher acceptance of these varieties among the farmers. Hence further increase in the cultivable area of these high yield varieties in Tiruvallur district is expected in coming years.

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Conflict of interest

We declare no known conflict of interests that could have appeared to influence the workreported in this paper.

References

Beigh, M. A., SZA, R. M., Matoo, J. M. and Sibat, F. K. 2015. Impact analysis of front line demonstration of rice (*Oryza sativa*) on the yield, economics and farmers knowledge in temperate region of India. *Scientific Research and Essays*. 10(14): 449-455.

Dayanand, R. K. and Mehta, S. M. 2016. Boosting mustard production through front line demonstrations. *Indian Research Journal of Extension Education*. 12(3): 121-123.

Ganesh Kumar, P., Prasanna Lakshmi, R. and Subramanyam, D. 2019. Effect of On-farm Trials in Popularization of Rice Variety NDLR-7 (Nandyal Sona) in Chittoor district of Andhra Pradesh. *International Journal of Agriculture Sciences*. 11(8): 8275-8276.

Girish, K. J., Burman, R. R., Dubey, S. K. and Gajab, S. 2011. Yield gap analysis of major rice in India. *J. Community Mobilization Sustain. Dev*. 6(2): 209-216.

Khade, S. D. and Roy, T. N. 2020. Economic analysis of impact assessment of production technology of paddy

cultivation in Nasik region of Maharashtra in India. *Economic Affairs*. 65(1): 63-68.

Lathwal, O. P. 2010. Evaluation of front line demonstrations on blackgram in irrigated agro ecosystem. *Annals of Agricultural Research*. 31(1&2): 24-27.

Prasad, S. A., Vijayashanthi, V. A., Manimekalai, R., Yogameenakshi, P. and Pirathap, P. 2020. Impact Assessment on knowledge of weather based agro-advisory services among farmers in Tiruvallur district, Tamil Nadu. *Current Journal of Applied Science and Technology*. 39(36): 96-101.

Singh, D. P., Chandra, V. and Tiwari, T. 2020. Impact analysis of front line demonstration on rice (*Oryza sativa* L.) the yield, economics and farmer's knowledge in Eastern Uttar Pradesh, India. *Int. J. Curr. Microbiol. Appl. Sci*. 10: 308-313.

Singh, K. and Kaur, K. 2021. Impact of front line demonstrations on cotton in Punjab. *Indian Journal of Extension Education*. 57(4): 88-94.