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Impact of frontline demonstration on small onion (*Allium cepa* var. *aggregatum*) in Tirunelveli district of Tamil Nadu

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Abstract

Small onion (*Allium cepa* var. *aggregatum*) is one of the important vegetable crop cultivated over 800 ha area in Tirunelveli district of Tamil Nadu. Attempts were made to reduce the yield gap of onion by adopting integrated crop management practices through frontline demonstrations during 2019-2020 to 2021-2022 in 30 farmers' field. The integrated crop management practices comprised of high yielding CO (On) 5 onion variety, seed treatment with *Trichoderma viride*, integrated nutrient management practices, integrated plant protection measures were demonstrated. The results showed that average higher bulb yield of 138.4 q/ha recorded in demonstration plots compared to 113.4 q/ha in farmers practice (FP) with a yield advantage of 22% over the farmer practices. The average extension gap, technology gap and technology index were 24.9 q/ha, 41.6 q/ha, and 23.1% respectively. About 72.3% farmers were satisfied with the improved crop production technologies. Considering the above facts, Frontline demonstrations were carried out in a systematic and scientific manner on farmer's field to show the worth of improved production management technologies in onion for further adoption.

Keywords: Onion, frontline demonstrations, CO (On) 5, yield, economics, farmers satisfaction

Introduction

Multiplier onion (*Allium cepa* var. *aggregatum*) is an important commercial vegetable crop grown in Tirunelveli district of Tamil Nadu. In India multiplier onion is cultivated in an area of 7,56,000 ha. The production and productivity of multiplier onion in India is 12.16 Mt and 16.10 t/ha, respectively (www.nhb.gov.in). In Tamil Nadu multiplier onion is cultivated in an area of 30,255 ha with a production of 2, 86,000 t. The average productivity of multiplier onion in Tamil Nadu is 9.45 t/ha (www.tn.gov.in). This multiplier onion is commonly propagated by bulbs rather than nursery raising and planting of seedlings. It is famous for its use in sambar preparation, an important south Indian dish. It produces small size bulbs, many in number usually up to 6 numbers to form an aggregated cluster. In general the cost of cultivation of multiplier onion goes higher and the net income is reduced for farmers due to the high cost of bulb seed material and lack of awareness on ICM practices. In order to reduce the cost of cultivation, the cultivation of onion through seeds, nursery raising and transplanting techniques advocated to the farmers. Frontline demonstration is the new concept of field demonstration evolved by Indian Council of Agricultural Research, New Delhi with the main objectives of demonstrating new varieties or technologies and its management practices in the farmers' field. The newly and innovative technology having higher production potential under the specific cropping system can be popularized through FLD programme. The frontline demonstrations were carried out in a scientific way in order to show the worth of the new variety and improved practices for enhancingthe onion productivity.

Materials and Methods

The study was carried out in Tirunelveli District of Tamil Nadu during 2019-2020 to 2021-2022. An extensive survey was conducted to collect information from selection of farmers to give them improved package of practice. Preferential ranking technique was utilized to identify the constraints faced by the farmers in onion cultivation. The quantification of data was done by first ranking the constraints and then calculating the Rank Based Quotient (RBQ) as given by Sabarathanam (1988) [9], which is as follows:

$$RBQ = \frac{\sum fi\,(n+1-ith)}{N\,x\,n} \,x\,100$$

Where,
fi = number of farmers reporting a particular problem under ith tank
N = Number of farmers
n = Number of problems identified

Based on the problems faced by the farmers the frontline demonstrations were designed and conducted at farmers' field. Each demonstration was conducted in an area of 0.4 ha and adjacent to the farmers' fields in which the crop was cultivated with farmer's practice/variety. The soil of the demonstration plots are clay loam in nature with the pH range of 6.8-8.2. The selected progressive farmers were trained on all scientific onion cultivation aspects like selection of varieties, seed treatment, sowing, integrated nutrient and pest management, harvesting and post harvest management before starting of frontline demonstrations. Scientific interventions under frontline demonstrations were taken as mentioned in (Table 1). The demonstrated fields were regularly monitored and periodically observed by the scientists of KVK. To study the impact of frontline demonstrations, data from FLD and farmer's practices were analyzed. Yield gap refers to the difference between the potential yield and actual farm yield. Potential yield refers to that which is obtained in the experiment station. At the time of harvest yield data were collected from both the demonstrations and farmers practice. Cost of cultivation, net income and benefit cost ratio were worked out. The yield is considered to be the absolute maximum production of the crop possible in the given environment, which is attained by the best available methods and with the maximum inputs in trials on the experiment station in a given season. Demonstration yield is the yield obtained on the demonstration plots on the farmers' fields in the study area. The conditions on demonstration plots closely approximate the conditions on the cultivators' fields with respect to infrastructural facilities and environmental conditions. Actual yield refers to the yield realized by the farmers on their farms under their management practices. The extension gap, technology gap and technology index were calculated using the formula as suggested by Samui *et al.* (2000) [10].

$$\text{Extension gap}\left(\frac{q}{ha}\right) = \text{DY (q/ha)} - \text{LY (q/ha)}$$

$$\text{Technology gap}\left(\frac{q}{ha}\right) = \text{PY (q/ha)} - \text{DY (q/ha)}$$

$$\text{Technology Index (\%)} = \frac{\text{PY (q/ha)} - \text{DY (q/ha)}}{\text{PY (q/ha)}} \times 100$$

Where,
DY = Demonstration Yield
LY = local Check Yield
PY = Potential Yield of variety

The farmers were personally interviewed with well structured interview schedule. Client satisfaction index was calculated as developed by Kumaran and Vijayaragavan (2005) [2]. The individual obtained scores were calculated by the formula

$$\text{Client Satisfaction Index (\%)} = \frac{\text{The individual obtained score}}{\text{Maximum score Possible}}$$

Table 1: Details of onion growing under demonstrations and existing practices

S. No	Operations	Existing practices	Improve practices demonstrated
	Variety used	Use of local/own seeds	CO On (5) an improved variety from TNAU, recommended for *Kharif* season.
	Seed treatment	No seed treatment	Seed treatment with *Trichoderma viride* @ 6 g/ kg.
	Nursery Rising	Flat bed or direct seed sowing without shade	Raised bed (3 m x 1 m size, raised up to 20- 25 cm.) covered with green shade net
	Method of Sowing	Broadcasting	Line sowing
	Fertilizer Application	Imbalanced application of fertilizer FYM,10 t/ha N:P:K @ 60:30:00 kg/ ha	Application of recommended dose of fertilizers along With foliar spray of micronutrients as recommended in TNAU.
	Weed Management	Hand weeding	Combined application of Oxyfluorfen 23.5% EC @ 1ml/L + quizalofopethyl 5% EC @ 2 ml/L at 20-25 days after transplanting (DAT) and at 30-35 DAT
	Sucking pests Management	Non-adoption of IPM Practices	Adoption of integrated pest management practices as recommended in TNAU.
	Disease management	Non-adoption of IDM Practices	Adoption of integrated disease management practices as recommended in TNAU.

Results and Discussion

Constraints in onion production

Before conducting the FLDs. Preferential ranking techniques were utilized to identify the constraints faced by the respondent farmers in onion cultivation. The ranks given by the different farmers are presented in (Table 2). The findings indicate lack of suitable high yielding varieties (83.53%), low soil fertility (80.32%) and sucking pest incidence (78.35%), Disease incidence (75.15%) were four major constraints. Similar findings were reported by Mahesh Choudhary *et al.* (2021) [3]. Based on the constraints, the frontline demonstrations farmers were conducted with high yielding multiplier onion new variety CO (On) 5, ICM practices developed by TNAU and other major critical inputs for cultivation (Table 2).

Table 2: Constraints in onion production in Tirunelveli district

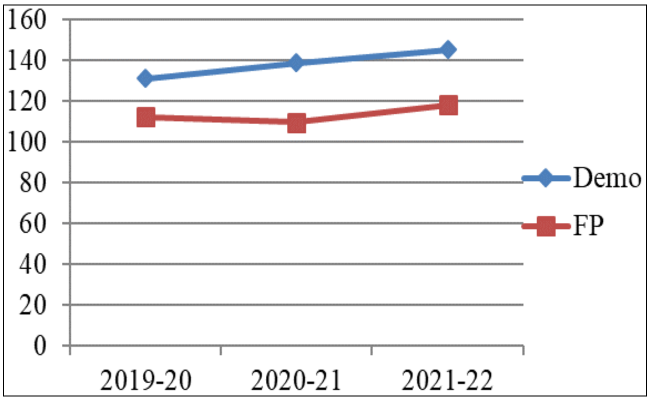
S. No	Constraints	RBQ	Rank
1.	Lack of high yielding varieties	83.53	I
2.	Low soil fertility	80.32	II
3.	Sucking pest incidence	78.35	III
4.	Disease incidence	75.15	IV
5.	Lack of scientific technical knowledge about field operations	72.50	V
6.	Lack of knowledge about seed treatment	71.37	VI
7.	Improper use of manures and fertilizers	65.81	VII
8.	Weed problem	61.72	VIII
9.	Labour shortage	50.25	IX
10.	Erratic rainfall at time of harvesting	35.005	X

Performance of FLD

It was evident from results that the under demonstrations the performance of newly introduced variety along with improved practices was found better than the local check in all the three years of the study under same conditions and reported (Table 3). The variety CO (On) 5 recorded higher average yield of 138.4 q/ha as compared to farmer's practices 113.4 q/ha. The per cent increase in yield over local was 22%. The higher average onion yield in demonstration fields compared to farmer's field was due to superior varietal characters of Co (On) 5 and integrated crop management practices. Similar observations were reported by (Rajajoslin *et al.* 2020, Sharmila Bharathi and Mohan 2018, Acharaya *et al.* 2015) [7, 12, 1] in CO (On) 5 onion. Fluctuations in yield observed over the years were mainly on account of variation in temperature, rainfall, sowing time and pest and disease management practices. The yield of frontline demonstration trials and potential yield of the crop was compared to estimate the yield gap further it was categorized into extension gap, technology gap and technology index. The extension gap and technology gap were 24.9 and 41.6 q/ha, respectively. The extension gap and technology gap observed that it may be attributed due to dissimilarities in soil fertility levels, pest and disease incidence, improper usage of manures and fertilizers in this region. Hence, to narrow down the yield gaps location specific technologies needs to be adopted. Technology index shows the feasibility of the variety at the farmers' field and it was reported 23.1%. These results were in line with the findings of (Ojha and Singh 2013, Rajput *et al.* 2018, Mahesh Choudhary *et al.* 2021) [5, 8, 3] in onion.

Table 3: Impact of improved production technology on realization of productivity and potential of onion

Year	Area (ha.)	No. of Demo	Bulb Yield (q/ha)			% increase	Tech. Gap (q/ha)	Ext. Gap (q/ha)	Tech. Index (%)
			Potential	Demo	FP				
2019-20	4	10	180	131.1	112.3	17	48.9	18.8	27.16
2020-21	4	10	180	138.7	109.8	26	41.3	28.9	22.94
2021-22	4	10	180	145.4	118.3	23	34.6	27.1	19.22
Average			-	138.4	113.4	22	41.6	24.9	23.1



Bulb Yield (q/ha)

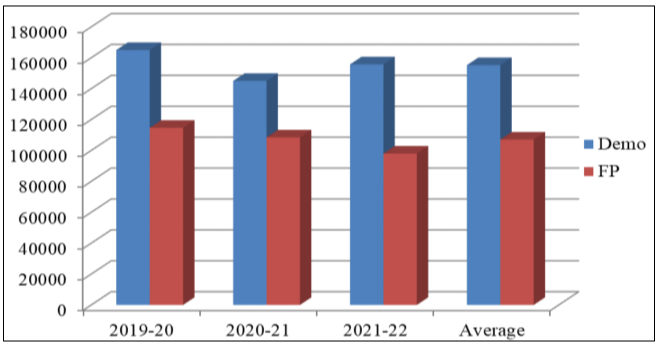
Fig 1: Impact of improved production technology on bulb yield (q/ha)

Gross return, Net return, B:C ratio

The economic feasibility of the scientific adoption of technologies over farmers practice was calculated depending on the prevailing prices of inputs and output costs. It was found that the average cost of cultivation of onion under improved crop production technology was recorded an (₹132100/ha) over the farmers practice and it was recorded as (₹139316/ha).Frontline demonstrated fields recorded the higher mean gross return of (₹287333/ha) and net return (₹155233/ha) with high benefit cost ratio of 2.17 (Table 4).These results were in line with the findings of Sharmila Bharathi and Mohan (2018) [12] and Naval Kishor *et al.* (2020) [4]. These results are clearly indicated that the adoption of scientific technologies was enhancing the onion production and economic returns from the demonstrated regions.

Table 4: Impact of improved production technology on economics of onion

Year	Cost of production (₹/ha)		Gross Return (₹/ha)		Net Returns (₹/ha)		B:C ratio	
	Demo	FP	Demo	FP	Demo	FP	Demo	FP
2019-20	130500	138250	295500	252900	165000	114650	2.26	1.83
2020-21	132000	139500	277000	247950	145000	108450	2.10	1.78
2021-22	133800	140200	289500	238190	155700	97990	2.16	1.70
Average	132100	139316	287333	246346	155233	107030	2.17	1.77



Net Returns (₹/ha)

Fig 2: Impact of improved production technology on economics of Onion

Farmers' Satisfaction

The extent of satisfaction level of the respondent farmers over extension services and performance of demonstrated variety was measured by Client Satisfaction Index (CSI) and the results revealed that majority of the farmers expressed high (72.3%) to medium (18.5%) level of satisfaction for performance of technology and extension services whereas very few (9.2%) farmers expressed the lower level of satisfactions (Table 5).The similar type of findings reported by Rai *et al.* (2015) [6] on vegetable pigeon pea crop and Saravanakumar *et al.* (2021) [11] on blackgram crop.

Table 5: Extent of farmer's satisfaction on extension services rendered during demonstrations

Satisfaction level	Percentage (%)
Low	9.2
Medium	18.5
High	72.3

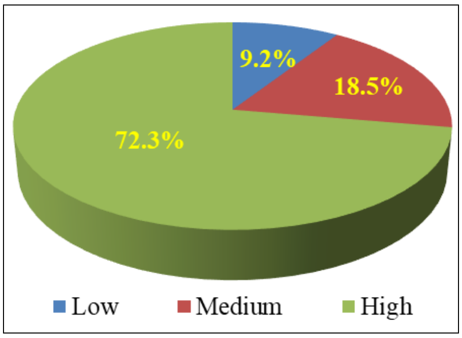


Fig 3: Extent of farmer's satisfaction on extension services rendered during demonstrations

Conclusion

On the basis of above finding in present study, it was concluded that front line demonstrations of improved technology reduce technology gap to a considerable extent, thus leading to increased production of onion in Tirunelveli district of Tamil Nadu. FLD is an effective extension mean to disseminate the proven technology at village level and to bridge the extension gap that increase the crop yield, monetary returns and livelihood status of the farming community. This also improved linkages between farmers and scientists, and built confidence for adoption of the improved technology. The economic details of the demonstrations give us a green signal to further popularize them among the farming community for large scale adoption.

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