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FLDs on Turmeric (*Rajendra sonia*) in Muzaffarpur, Bihar: Adoption Horizontal Spread and Satisfaction Level

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ABSTRACT

Keeping in view of effective extension approach of Frontline demonstrations (FLDs) for dissemination of technology FLDs on turmeric conducted by KVK, Turki, Bihar. The yield and economic performance of frontline demonstration, horizontal spread of technology, extent of adoption level and extent of satisfaction of respondent farmer over extension services and performance of demonstration was measured. It was observed that there was 15.0 to 19.6 per cent increase in fresh rhizome yield over local check and the average benefit cost ratio was higher under demonstration 3.3 as compared to control plots 2.5 during the all years of the study. The horizontal spread of turmeric cv. *Rajendra sonali* was estimated from about 13 ha during 2015-16 to 43 ha during the year 2019-20. The findings of the study also revealed that there was increase in adoption level ranging from 9.4 per cent of sowing time and method to 46.9 per cent of improved and quality seed after the FLD programmes. The majority of the respondent farmers expressed high extent (51.2%) to the medium (34.4%) extent of satisfaction from extension services and performance of technology under demonstrations. It can be concluded that frontline demonstrations are one of the important tool to demonstrate newly released crop production and protection technologies and its management practices in the farmer's field under different agro-climatic region and farming situations.

INTRODUCTION

Turmeric (*Curcuma longa*) (Family: *Zingiberaceae*) is used as condiment, dye, drug and cosmetic in addition to its use in religious ceremonies. India is a leading producer and exporter of turmeric in the world. Andhra Pradesh, Tamil Nadu, Orissa, Karnataka, West Bengal, Bihar, Gujarat, Meghalaya, Maharashtra, Assam are some of the important states cultivating turmeric, of which, Andhra Pradesh alone occupies 38.0 per cent of area and 58.5 per cent of production. During 2019-2020, the country produced 12.29 lakh tones of turmeric from an area of 2.34 lakh ha. Turmeric is cultivated in an area of around 238 m ha with an annual production of 1133 MT (NHB Database, 2019) and the major turmeric growing states are Assam, Bihar, Nagaland, Manipur, Orissa, Maharashtra, Kerala, Andhra Pradesh, Meghalaya, West Bengal, Uttar Pradesh, Gujarat and Tamil Nadu. In Bihar state total area under turmeric is 2.40 thousand ha with a production of 2.60 thousand tonnes (NHB Database, 2019). Turmeric is mainly grown as a major spice crop in north Bihar areas like Muzaffarpur, Samastipur, Vaishali, East Chaparan, Madhubani, Shitamarhi, Bhagalpur and Begusarai districts in Bihar. Despite of the importance of this crop, its cultivation anywhere in India is generally a subsistent to semi-commercial crop due to low productivity because of non-adoption of advanced technologies like improved varieties. To increase the production, productivity and quality of agricultural produce, varietal replacement demonstrations are being conducted at project area various farmers' field.

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Average national productivity of this crop is remaining very less (278 q ha^{-1}) due to low level of awareness among the farming community about area specific recommended package of practices, less availability of high yielding and resistant varieties, lower adoption of recommended plant production and protection technologies. Introduction of high yielding varieties tolerant to diseases can do the wonders in the growing area. Application of appropriate doses of fertilizers at right time with other recommended practices (irrigation and intercultural operations etc.) also play a crucial role with respect to the productivity of turmeric (Mishra and Singh, 2017).

Besides these, effective management of biotic and a-biotic stresses at crucial time with the help of available chemicals and organic means is also very important to increase the productivity and production of the crop. Muzaffarpur, situated in the Gangatic plain fringes of Bihar, represented by sandy loam to loamy silt soil with temperature range from 2 to 36°C and receives about 1120 mm rainfall annually. The farmers of this district are trying to adopt the improved varieties and scientific technologies, however many of them still doing the farming with available local varieties and conventional practices. The field demonstrations conducted under the close supervision of scientists of the National Agriculture Research System is called front line demonstrations because the technologies are demonstrated for the first time by the scientists themselves before being fed in to the main extension system of the State Department of Agriculture. The main objective of front line demonstrations is to demonstrate newly released crop production and protection technologies and its management practices in the farmers' field under different agro-climatic regions and farming situations. While demonstrating the technologies in the farmers' field, the scientist are required to study the factors contributing higher crop production, field constraints of production and thereby generate production data and feedback information. Realizing the importance of FLDs in transfer of latest technologies, Krishi Vigyan Kendra, Turki, Muzaffarpur have regularly been conducting FLDs on turmeric at farmers' field in different villages of Muzaffarpur district of Bihar with the objective of convincing farmers and extension functionaries together about the production potentialities of production technologies for further wide scale diffusion. Keeping in view of an effective extension approach of FLDs for dissemination of turmeric technology, it was thought that impact of FLDs conducting by KVK, Turki was to be assessed.

MATERIALS AND METHODS

The study was confined to Front Line Demonstrations (FLD) conducted by KVK in Turki district of Bihar. The data on output were collected from FLDs plots and finally the grain yield; cost of cultivation, net returns with the benefit cost ratio was work out. For the purpose of investigation, 20 villages from 4 blocks (each block 5 villages) leading in turmeric production in Muzaffarpur district were selected for FLDs on turmeric during preceding seven years (*rabi* 2015-16 to 2019-20). A comprehensive list of FLD farmers was prepared. Out of this, 8 beneficiaries from each selected village were randomly selected. Thus, a total sample of 160 respondents was taken for the study. The adoption level of the farmers about improved production practices of turmeric before conducting and after conducting FLD was measured. Further, the satisfaction level of respondent farmers about extension services provided was also measured based on various dimensions like training of participating farmers, timeliness of services, supply of inputs, solving field problems and advisory services, fairness of scientists, performance of variety demonstrated and overall impact of FLDs. The data were collected through personal contacts with the help of well structured interview schedule. The gathered data were processed, tabulated, classified and analyzed in terms of mean percent score and ranks etc. in the light of objectives of the study. The client satisfaction index developed by Kumaran and Vijayaragavan (2005) was used for the purpose.

$$\text{Client Satisfaction Index} = \frac{\text{The individual obtained score}}{\text{Maximum score possible}}$$

RESULT AND DISCUSSION

Yield performance

During 2015-16 to 2019-20, result of turmeric variety *Rajendra sonali* demonstrations conducted at farmer's field revealed that there was 15.0 to 19.6 percent increase in rhizome yield over local check. The Table 1 shows that average yield in demonstrations varied from 140 q to 148 q/ha during all five years and highest yield in demonstration was recorded during 2019-20 (148) followed by 2018-19 (147 q/ha), 2016-17 (146 q/ha), 2017-18 (145 q/ha) and 2015-16 (140 q/ha), respectively. In checks, also same trend was found *i.e.*, maximum average rhizome yield (128 q/ha) was recorded during 2019-20 and lowest rhizome yield (120 q/ha) was observed during 2015-16. The overall average yield in demonstration plots (143/ha) was higher as compared to local plots (124 q/ha) and increase in rhizome yield was 17.1 percent over local checks during the study period (2015-16 to 2019-20). It might be due the soil type and its moisture availability, rainfall and weather condition as well as the change in the locations of demonstration plots every year. In general, in all the years tuber yield of FLDs plots was higher as compared to check which may be due to good variety, rhizome (Seed) treatment, recommended fertilizer doses, plant protection measures followed by the demonstrators and scientists in the demonstrations plots. The similar results were also observed by Kumar et al., (2012); Dayanan et al., (2013); Meena and Singh (2013); Lal (2014), Sharma and Choudhary (2014); Sahoo et al., (2015); Karthik and Amarnath (2014); Babu and Tirpathi (2015); Babu et al., (2015); Mishra and Singh (2017); Kant et al., (2020); Singh et al., (2020) and Chigadolli, et al., (2020). Hence, it can be

Table 1. Yield performance of frontline demonstrations on turmeric variety *Rajendra sonali*

Year	No. of demonstrations	Area (ha)	Average yield (q/ha)		Increase in yield (%) over local
			Demo.	Local check	
2015-16	30	12	140	120	16.7
2016-17	30	12	146	122	19.6
2017-18	30	12	145	126	15.0
2018-19	35	14	147	124	18.5
2019-20	35	14	148	128	15.6
Average	32	12.8	143	124	17.1

concluded that increased yield was due to adoption of improved variety and demonstrations of proven technologies.

Economic performance

The year wise economics of turmeric production under demonstration was estimated and the result presented in Table 2. The data revealed that turmeric (*Rajendra sonali*) recorded higher gross returns (Rs. 319440), net returns (Rs. 224480) and B: C ratio (3.3) as compared to local check. Further, the Table 2 also shows that the cost of cultivation was more in local checks as compared to demonstrations plots. It was due the fact that farmers were practicing more seed rate and over doses of fertilizers. The cost of cultivation increased successively in demonstration and local plots due to hike in prices of inputs. The highest net return was received in the year 2019-20 (Rs. 225700) and lowest during 2015-16 (Rs. 223000). The higher net returns and B: C ratio in turmeric demonstration might be due to the higher rhizome yield and better pricing of the produce in the market. The overall average additional net return was Rs. 69360 over local plots. These results are in line with the findings of Yadav et al., (2004); Swain et al., (2007); Singh (2011); Meena et al., (2012); Meena et al., (2013); Singh (2013); Sharma and Chaudhary (2014); Tripathi and Selvarni (2014); Mehrya and Ramesh (2018); Singh and Sharma (2018); Morwal et al., (2018) and Ahuja et al., (2020).

Increase in area under

It is observed (Table 3) that the area under improved variety *Rajendra Sonali* was estimated only 13 ha during the year 2015-16 which horizontally increased and estimated 23 ha (2016-17), 27 ha (2017-18), 35 ha (2018-19), and 43 ha (2019-20), respectively, in the Muzaffarpur district of Bihar. It clearly shows that the horizontal spread was from about 13 ha during 2015-16 to 43 ha during the year 2019-20 and after introduction of turmeric (*Rajendra sonali*), it covered more than 53.4 percent area of the total turmeric area in the Muzaffarpur district during the year 2019-20. It might be due to the fact that the variety was superior in term of productivity, no rhizome rot problem, no leaf blight, no leaf spot at the time of harvesting and good quality of rhizome compared to Roma and Savrna. The findings confirm with the finding of Lal *et al.* (2013); Utapal and Tripathi (2014); Narappa et al., (2018); Singh et al., (2018) and Rajshee et al., (2020).

Extent of adoption level

The data regarding adoption of the improved turmeric production technologies were also recorded under two heads like; adoption before FLDs and after conducting frontline demonstration. The data in Table 4 reveals that they followed improved practices of turmeric production like; sowing time and method (81.3%), land preparation (78.1%), irrigation scheduling (70.6%), harvesting (68.8%), rhizome treatment (65.6%), scientific weed management (59.4%), storage (56.3%), improved and quality seed (40.6%), fertilizer application (37.5%) and plant protection (31.3%) before FLDs while other farmers started adopting the improved practices like; improved and quality seed (46.9 %), fertilizer application (38.8%), plant protection (36.3%), seed treatment (33.1%), weeding (29.4%), seed rate and spacing (26.9%), irrigation scheduling (25.0%), storage (21.3%), land preparation (18.8%), harvesting (16.3%) and sowing time and method (09.4%), respectively. The low level of adoption was found like; sowing time and method and storage due to the practices of late sowing and high seed rate with close spacing and over doses of fertilizers in turmeric cultivation. The findings of the study also revealed that increase in adoption ranged from 09.4% of sowing time and method to 46.9 per cent of

Table 3. Increase in area under improved variety of turmeric *Rajendra Sonali* in Muzaffarpur district of Bihar

Year (*Rabi*)	Total area of turmeric in Muzaffarpur district (ha)	Estimated area under improved cv. *Rajendra sonali* in Muzaffarpur (ha)
2015-16	45	13
2016-17	59	23
2017-18	68	27
2018-19	78	35
2019-20	93	43
Average	68.6	28.2

Table 4. Extent of adoption level of the respondents regarding turmeric production technologies

Turmeric production technology	Before FLDs (%)	After FLDs (%)	Increase in adoption level (%)
Land preparation	78.1	96.9	18.8
Seed treatment	65.6	98.8	33.1
Improved and quality seed	40.6	87.5	46.9
Seed rate and spacing	46.9	71.9	26.9
Sowing time and method	81.3	90.6	09.4
Irrigation scheduling	70.6	95.6	25.0
Scientific weed management	59.4	88.8	29.4
Plant protection measures	31.3	67.5	36.3
Fertilizer application	37.5	76.3	38.8
Harvesting	68.8	85.0	16.3
Storage	56.3	78.1	21.9

FLD = Frontline demonstration

Table 2. Economic performance of frontline demonstrations on turmeric variety *Rajendra Sonali*

Year (*Kharif*)	Cost of cultivation (Rs/ha)		Gross return (Rs./ha)		Net return (Rs./ha)		Additional return (Rs./ha)	Benefit cost ration	
	IP	FP	IP	FP	IP	FP		IP	FP
2015-16	85000	84600	308000	240000	223000	155400	67600	3.6	2.8
2016-17	93500	91400	321200	244000	227700	152600	75100	3.4	2.6
2017-18	97800	95600	319000	252000	221200	156400	64800	3.2	2.6
2018-19	98600	95700	323400	248000	224800	152300	72500	3.2	2.5
2019-20	99900	97100	325600	256000	225700	158900	66800	3.3	2.4
Average	94960	92880	319440	201920	224480	155120	69360	3.3	2.5

IP= Improved practice; FP= Farmer practice

improved and quality seed after conducting the training and FLD programmes. This might be due the fact that increase in knowledge, skills and confidence level of farmers through training programmes on different production technologies of turmeric crop like; high yielding variety, seed rate and spacing, seed treatment, soil testing, soil treatment, weeding, plant protection measures, irrigation scheduling, fertilizer application and harvesting helped farmers to improve the yield of turmeric crop. The similar results were also reported by Meena et al., (2016); Morwal et al., (2018) Bishnoi et al., (2020); Kant et al., (2020); Singh et al., (2020).

Farmer's satisfaction

The extent of satisfaction level of respondent farmers on extension services and performance of demonstrated variety was measured by client satisfaction index (CSI) and results presented in Table 5. It is observed that the majority of the respondent farmers expressed high level (51.2%) to the medium (34.4%) level of satisfaction for extension services and performance of technology under demonstrations. Very less (14.4%) respondents expressed lower level of satisfaction. The results are in conformity with the results of Kumaran and Vijayaragavan (2005) and Meena et al., (2016). The higher to medium level of satisfaction with respect to services rendered, linkage with farmers, and technologies demonstrated etc. indicate stronger conviction, physical and mental involvement in the frontline demonstration which in turn would lead to higher adoption. This shows the relevance of frontline demonstration.

Table 5. Extent of farmers' satisfaction of extension services rendered

Satisfaction level	Percentage
Low level	14.4
Medium level	34.4
High level	51.2
Total	100.0

CONCLUSION

It can be concluded that the FLDs are playing one of the important role in motivating the farmers for adoption of production technology resulting in increased yield and profit. It was observed that the horizontal spread of turmeric (*Rajendra sonali*) was from about 13 ha during 2015-16 to 43 ha during 2019-20 and it covered more than 23.4 percent area of the total turmeric area in the Muzaffarpur district during the year 2019-20. The farmers expressed high to the medium level of satisfaction for extension services and performance of technology under frontline demonstrations. Frontline demonstration conducted under the close supervision of scientists is one of the important tools for extension to demonstrate newly released crop production and protection technologies and its management practices in the farmer's field under different agro-climatic regions and farming situations.

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