

Original Research Article

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## Performance of Annually Harvested Improved Turmeric (*Curcuma longa* L.) Cultivars Grown under Rainfed Conditions

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### ABSTRACT

The study assessed the performance of annually harvested improved cultivars of turmeric (*Curcuma longa* L.) under rainfed conditions in Mandi district of Himachal Pradesh. A total of 64 front line demonstrations (FLDs) were conducted consecutively for two years (*Kharif* 2014 and *Kharif* 2015). Two annually harvested turmeric cultivars Palam Pitambar and Palam Lalima were demonstrated under the FLD programme with the recommended package of practices against the widely grown local strain 'SuketiHaldi' as farmer's practice. The study revealed that in demonstration plots rhizome yield of both varieties was significantly higher over the farmer's practice in all the years. Overall, 270.02 q ha<sup>-1</sup> of rhizome yield with 38.85% increased production over farmer's practice and average net returns of Rs. 2,64,166 ha<sup>-1</sup> was obtained under demonstration plot in pooled data. The technology index value of 16.92% showed the better performance of FLD's interventions and thus annually harvested cultivars exhibited great potential in boosting the turmeric productivity with wider adaptability in the region. The technology and extension gap based on pooled data for two years FLDs programme was 54.98 and 75.55qha<sup>-1</sup> respectively emphasize the need to narrow down these gaps by deploying effective research and extension services.

#### Keywords

Extension gap, FLD, Technology gap, Technology index, Turmeric

#### Article Info

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### Introduction

Turmeric (*Curcuma longa* L.) is one of the most important spice crops and India is the largest producer & exporter in the world. India contributes about 80 % of the world turmeric production and 60% of world export (Anonymous 2018). Indian turmeric is considered to be the best in the world because of its high curcumin content. This crop can be grown in diverse tropical conditions ranging from sea level to 1500 m elevation. The

temperature range of 20-30°C with an annual rainfall of 1500 mm is ideal for its cultivation. Though it can be grown on different types of soil, but it thrives best in well-drained sandy or clay loam soils.

The tuberous rhizome or underground stems of turmeric have been used from antiquity as condiments, a dye, and as an aromatic stimulant in several medicines. Turmeric is also used as a coloring matter in drugs, confectionery, and food industries (Khan *et*

*al.*, 2014). Himachal Pradesh is one of the important hilly states of north-western (NW) Himalayas and the majority of the farmers are small and marginal. The cereal-based cropping systems are not remunerative to secure the livelihood of farmers. Further, despite various factors, monkey menace is a major problem faced by a large number of farmers compelling them to keep their land fallow. In such situations, turmeric cultivation can be a viable option for remunerative returns. Turmeric is grown mostly organic by default with no use of chemicals by farmers in Himachal Pradesh in general and Mandi district in particular. However, the productivity of this crop is quite low due to biennial local strains grown by the farmers.

Henceforth, KVK, Mandi Himachal Pradesh took initiative in this direction and introduced the annually harvested improved cultivars of turmeric through front line demonstrations (FLDs) in the district. Front line demonstrations (FLDs) are innovative extension methods for the transfer of technologies among the farmers and works on the principle of learning by doing and seeing by believing. Generally, any technology is not accepted as such in all respect and there always exists a gap between the recommended technology and adopted by the farmers. The identification of such gaps provides valuable information to planners, researchers, and extension workers to prepare guidelines for reducing these gaps. The technology and extension yield gaps have been identified in this paper and will be useful for framing up of strategies for enhancing turmeric acre age in the state.

## Materials and Methods

The study was carried out by Krishi Vigyan Kendra, Mandi during *kharif* 2014 and 2015. A total of 64 demonstrations covering 3.76 ha area were conducted in different villages of

the district viz, Padhar, Tandu, Masheran, Jalahar and Pipli(Drang block), Kothi (Balh block), Kotali, Palliand Pandoh (Sadar block), Nalini (Sundernagar block) and Nahuali (Chauutra block).

All other steps like site and farmer selection, layout of demonstrations, etc. were followed as suggested by (Choudhary, 1999). FLD's were conducted along with full package and practices especially in monkey menace areas under rainfed conditions.

Two annually harvested high yielding turmeric cultivars (Palam Pitamber and Palam Lalima) recommended by CSKHPKV, Palampur was demonstrated under FLDs while widely grown local strain 'SuketiHaldi' was taken as farmer's practice/check.

Planting was done during the second fortnight of May with a spacing of 30 x20 cm. The data on rhizome yield under demonstration plot as well as the farmer's plot was collected and analyzed. Fisher's Least Significant Difference (LSD) test was employed to analyze the difference in mean rhizome yield between demonstration plot and farmer's plot, (Yadav *et al.*, 2018).

Likewise, the increase in rhizome yield in the demonstration plot over farmers' practice was worked out as per the formula earlier used by various researchers (Choudhary *et al.*, 2009; Yadav *et al.*, 2018):

$$\begin{aligned} &\text{Yield increase over farmer's practice (YIOFP, \%)} \\ &= \frac{\text{Demonstration Plot Yield (DPY)} - \text{Farmer's Plot Yield (FPY)}}{\text{Farmer's Plot Yield (FPY)}} \times 100 \end{aligned}$$

Technology gap, extension gap and technology index was worked by the following formulae as earlier used by various researchers (Kadian *et al.*, 1997; Samui *et al.*, 2000; Yadav *et al.*, 2018):

**Technology gap** ( $q\ ha^{-1}$ ) = Potential Yield (PY) – Demonstration Plot Yield (DPY)

**Extension gap** ( $q\ ha^{-1}$ ) = Demonstration Plot Yield (DPY) – Farmer's Plot Yield (FPY)

**Technology Index (TI %)**

$$= \frac{\text{Potential Yield (PY)} - \text{Demonstration Plot Yield (DPY)}}{\text{Potential Yield (PY)}} \times 100$$

### Economic analysis of FLD's

The standard formula was applied for calculating the gross and net returns as earlier used by various workers (Choudhary *et al.*, 2009; Yadav *et al.*, 2018).

### Results and Discussion

#### Rhizome yield under turmeric cultivars

The performance of improved turmeric cultivars demonstrated under FLDs has been given in Table 1. Annually harvested turmeric cultivars Palam Pitambar and Palam Lalima was demonstrated under FLDs and compared with biennially harvested local “SuketiHaldi” under farmers practice.

The results revealed that turmeric cultivar Palam Pitambar provided the highest rhizome yield of 287.64q ha<sup>-1</sup> under the demonstration plot during *kharif* 2014 which was about 50% higher than the farmer's practice. During *kharif* 2015, this cultivar provided the rhizome yield of 279.62q ha<sup>-1</sup> with additional yield advantage to the tune of about 42% over local practice. The study also revealed that Palam Lalima cultivar of turmeric provided rhizome yield of 256.89 and 254.65q ha<sup>-1</sup> with the increased rhizome yield of 33.92 % and 28.70% over farmer's practice during *kharif* 2014 and *kharif* 2015 respectively. Overall, 270.02 q ha<sup>-1</sup> of rhizome yield was obtained under the demonstration plot in pooled data which was 38.85% higher against farmer's practice.

The study further revealed that mean rhizome yield in demonstration plots was significantly higher in both varieties over the farmer's practice in all the years. Demonstration of complete package under FLDs might be the reason for the superiority of these cultivars which otherwise was not followed under farmer's practice. The Similar results of yield enhancement of turmeric in front line demonstration have also been earlier reported by various workers (Barua and Tripathi, 2015; Mishra *et al.*, 2015; Dubey *et al.*, 2017; Kant *et al.*, 2020).

#### Economics of front line demonstrations

The economic analysis of demonstrated technology under FLDs in comparison to farmer's practice presented in Table 2 revealed that the highest net returns of Rs. 3,69,260 ha<sup>-1</sup> was observed in turmeric cultivar Palam Pitambar during *kharif* 2014 which was much higher than the farmer's practice. Turmeric cultivar Palam Lalima also provided a net return of Rs. 3,23,135 ha<sup>-1</sup> during this season. During *kharif* 2015, these two varieties provided net returns of Rs. 1,94,620 and Rs. 1,69,650 ha<sup>-1</sup> respectively which was higher against farmer's practice (Table 2). The average net returns to the tune of Rs. 2,64,166 ha<sup>-1</sup> was obtained under the demonstrated technology in pooled data of both cultivars. The higher net returns over the farmer's practice might be attributed to the adoption of improved technologies. Enhanced monetary returns through improved farm technology have also been earlier reported by various workers (Singh *et al.*, 2006; Barua and Tripathi 2015; Mishra *et al.*, 2015; Dubey *et al.*, 2017; Kant *et al.*, 2020).

#### Technology and extension gap

Results in Figure 1 shows that the technology gap ranged between 37.36 to 70.35 q ha<sup>-1</sup> in annually harvested turmeric cultivars

demonstrated under FLDs. The highest technology gap to the tune of 68.11–70.35 q ha<sup>-1</sup> was observed in Palam Lalima during *kharif* 2014 and *kharif* 2015. Comparatively less technology gap (37.36-45.38 q ha<sup>-1</sup>) was observed in Palam Pitambar cultivar of turmeric during the seasons under study (Fig. 1). The overall technological gap based on pooled data for two years FLDs programme was 54.98 q ha<sup>-1</sup>.

The variations in the technology gap might be due to the variability in the soil fertility status, unfavorable agro-climatic conditions, and specific crop management problems thus require location-specific crop management measures to minimize these gaps. Earlier, various workers also reported technology gaps due to these factors in their respective studies (Choudhary, 2013; Kumar *et al.*, 2015; Yadav *et al.*, 2018).

While looking at the status of extension gaps in Fig. 1, the results revealed the decreasing trend of extension gaps in both cultivars of turmeric during the period under study. The extension gap ranged between 56.79 to 95.81 q ha<sup>-1</sup>, and Palam Pitambar cultivar of

turmeric recorded the highest extension gap (81.76-95.81 q ha<sup>-1</sup>) during both the seasons. The study also revealed that Cv. Palam Lalima recorded 65.06 q ha<sup>-1</sup> of extension gap during *kharif* 2014 followed by *kharif* 2015(56.79 q ha<sup>-1</sup>). On an average extension gap under two consecutive years of the FLD programme was 75.55 qha<sup>-1</sup> (Fig. 1). Lack of awareness for the adoption of improved farm technologies by the farmers might be the reason for extension gaps and thus emphasized the need to put more effort to educate farmers through innovative extension methods to bridge these gaps. These results are also supported by the findings of Dubey *et al.*, 2017 and Kant *et al.*, 2020.

### Technology index

The technology index presented in Fig. 2 showed an increasing trend over the years under study. The least technology index (11.50-13.96%) was observed in the Palam Pitambar cultivar of turmeric during both the years. On the other hand, this index varied between 20.96-21.65% for Palam Lalima. The lower value of the technology index indicates higher feasibility of the technology.

**Table.1** Performance of improved turmeric cultivars demonstrated under FLDs in Mandi district of Himachal Pradesh

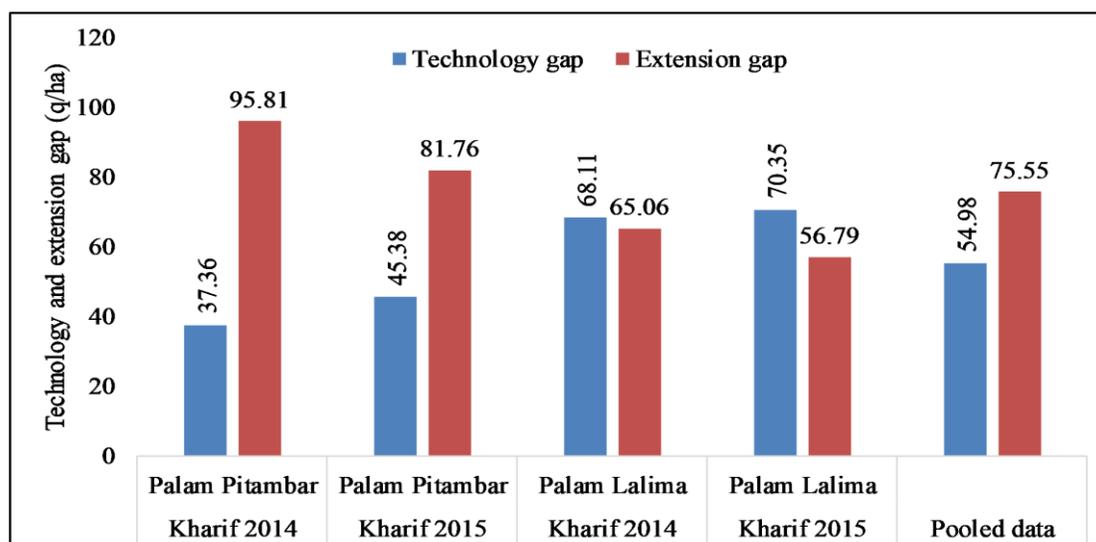
Year/ season	Variety under DP*	No. of demo.	Area (ha)	Rhizome Yield(q/ha)		LSD <sub>0.05</sub>	% increase
				DP*	FP**		
<i>Kharif</i> <b>2014</b>	Palam Pitambar	18	0.90	287.64	191.83	5.33	49.95
<i>Kharif</i> <b>2015</b>	Palam Pitambar	14	0.98	279.62	197.86	5.95	41.32
<i>Kharif</i> <b>2014</b>	Palam Lalima	18	0.90	256.89	191.83	7.69	33.92
<i>Kharif</i> <b>2015</b>	Palam Lalima	14	0.98	254.65	197.86	9.66	28.70
<b>Pooled data</b>		64	3.76	270.02	194.47	5.01	38.85

\* DP: Demonstration plot; \*\*FP: Farmers plot

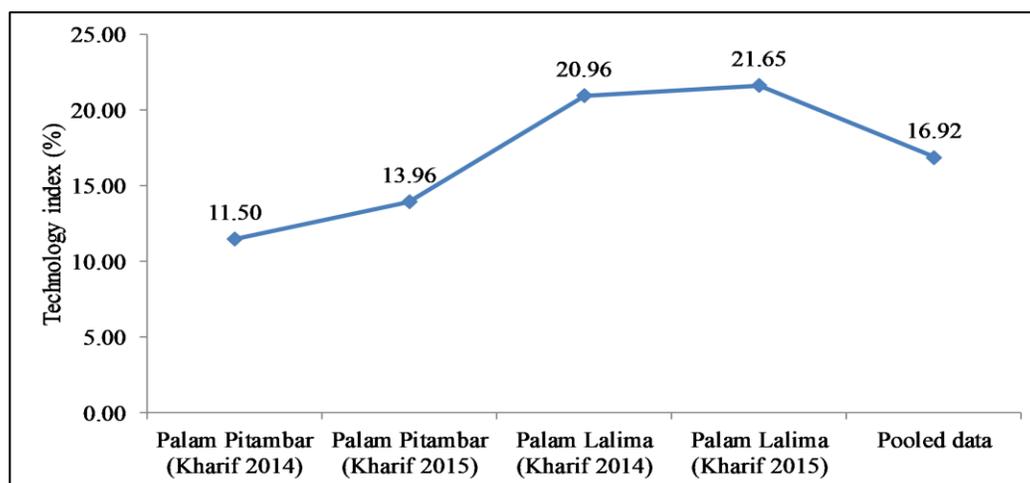
**Table.2** Economic analysis of turmeric cultivars demonstrated under FLDs

Year/ season	Turmeric cultivars	Gross Cost (Rs/ha)		Gross Return (Rs/ha)		Net Return (Rs/ha)		BC ratio	
		DP*	FP**	DP*	FP**	DP*	FP**	DP*	FP**
<i>Kharif 2014</i>	Palam Pitambar	62200	56200	431460	287745	369260	231545	6.94	5.12
<i>Kharif 2015</i>	Palam Pitambar	85000	72000	279620	197860	194620	125860	3.29	2.75
<i>Kharif 2014</i>	Palam Lalima	62200	56200	385335	287745	323135	231545	6.20	5.12
<i>Kharif 2015</i>	Palam Lalima	85000	72000	254650	197860	169650	125860	3.00	2.75
<b>Pooled data</b>	Average	73600	64100	337766	242803	264166	178703	4.85	3.93

\* DP: Demonstration plot; \*\*FP: Farmers plot



**Fig.1** Technology and extension gaps in turmeric cultivars demonstrated under FLDs



**Fig.2** Technology index in turmeric cultivars demonstrated under FLDs

Overall, a technology index of 16.92% was observed in pooled data which showed the better performance of FLD's interventions and require concerted efforts by extension personnel of the state department of agriculture to up-scale this technology for larger areas in the state. Dubey *et al.*, (2017) and Kant *et al.*, (2020) also reported the lower value of the technology index under demonstrated technologies in turmeric crop.

The annually harvested both cultivars of turmeric viz. Palam Pitambar and Palam Lalima proved to be superior in terms of productivity and profitability over the farmer's practice. However, some gaps are there, which need to look upon. Technology gaps cannot be narrowed down as these are concerning to environmental factors while extension gaps are manageable and under the control of management factors. Therefore, extension and research programmes should be designed in a way to reduce these yield gaps to further intensify the acreage of annually harvested turmeric cultivars in the region. This crop can also be a better option in those areas where farmers keep their land fallow due to monkey menace.

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