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Introduction of turmeric (*Curcuma longa*) high yielding cultivar IISR Prathibha in Mysore district of Karnataka, India

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Abstract
Turmeric (*Curcuma longa*) is one of the important spice crops grown for fresh and processing purpose all over the India, due to its wider adaptability under various agro-climatic conditions, which plays a major role in supplementing the income of small and marginal farmers of the Mysuru district of Karnataka state. The present study was carried out at Nanjungud Taluk of Karnataka district during 2021 and 2022. Varietal replacement was conducted on Turmeric by the active participation of the farmers with the objective of improved technologies of Turmeric production potential. The improved technologies consist improved variety (IISR Prathibha), balanced fertilizers application and integrated pest and disease management, etc. The development of the agriculture is primarily depends on the application of the scientific technologies by making the best use of available resources. One of the major constraints of traditional turmeric farming is low productivity because of non-adoption of advanced technologies like improved varieties. To increase the production, productivity and quality of agricultural produce, varietal replacement is being conducted at various farmers field. Result of the present study revealed the higher average yield in the varietal replacement demonstration was recorded (23.0 t/ha) as compared to farmers practice (16.25 t/ha) traditional adopted by the farmers. The percentage increase in the yield over farmer's was 28.26 recorded. The technology gap and extension gap were computed 16.20 and 6.75 t/ha respectively, along with 41.32 percent of technology index. The varietal replacement demonstration field gave higher average net return Rs. 2,76,150 and B:C ratio is 1:2.50. The result of the study indicated the gap existed in the potential yield and demonstration yield is due to soil fertility and weather conditions. Present results clearly show that the yield and economics of turmeric can be boost up by adopting recommended technologies.

Keywords: Turmeric, IISR Prathibha, technology gap, extension gap, technology index

Introduction
Turmeric (*Curcuma longa*) is one of the major traditional crop with very long history of growing in Asian countries. In India it is widely used as an spice an it is belongs to the Zingiberaceae family. Turmeric is originated to in India, perhaps in Eastern India or Malaysia (Sturlevant, 1919) [14]. Turmeric all parts is edible, major edible part was rhizome and contain abundant starch Bose *et al.*, 2003 [4]. Also rich source of major components of the diet viz. proteins, minerals and vitamins.

Turmeric in cultivation observed as neglected crop, their nutritional value is more. Apart from the low fat content, the crop is nutritionally superior to other spices in protein, mineral and vitamin contents Onwueme, 1978.

In India Turmeric is cultivated in an area of 246 m ha with an annual production of 939 MT (NHB Database, 2019) [1] and the major growing states are Assam, Bihar, Karnataka, Nagaland, Manipur, Orissa, Maharashtra, Kerala, Andhra Pradesh, Meghalaya, West Bengal, Uttar Pradesh, Gujarat and Tamil Nadu. In Karnataka total area is about 20.20 thousand ha with a production of 117.5 thousand tons (HCSK, 2019) [2].

Turmeric is also one of the major spice crop cultivating in India, despite of the importance of turmeric, its cultivation is neglected by most of the growers due to lower in yield and non adoption of new advanced techn ologies viz, improved varieties.

To increase in the yield, quality and income of the grower, Introduction of Turmeric (*Curcuma longa*) high yielding cultivar IISR Prathibha was at farmers field of Mysuru district in Karnataka.

Materials and Methods

Introduction of Turmeric (*Curcuma longa*) high yielding cultivar IISR Prathibha is an applied approach to increases the dissemination of proven technologies at farmer's fields along with the package of practice and new technologies with better use of locally available resources to increase the productivity, production and income and also construct the bridge between gap in the productivity Choudhary *et al.,* 2018 [5].

To mitigate the problems by the farmers in cultivation of turmeric crop, integrated crop production approach was followed in turmeric and it was conducted by ICAR JSS KVK, Mysuru during *Kharif* 2021 and 2022, in ten farmer's field of Mysuru district. In this approach mainly concentrated on highy yielding variety introduction i.e. improved variety IISR Prathibha was grown in 0.5 ha area each farmer with integrated management practices and the farmers practice i.e. traditionally grown in 0.5 ha area for comparison. The integrated management practices consisting the use FYM about 25 t/ha along with recommended fertilizers about 150:125:250 NPK kg/ha (UHSB recommendation).

Improved variety of turmeric i.e. IISR Prathibha developed by pedigree method of open pollinated progeny selection from Indian Institute of Spice Research, Kozhikod, Kerala. Salient features of variety was it is able to yield 39.12 t/ha fresh rhizomes, matures by 225 days. Plant height upto 45-70 cm, leaf length–54 cm, number of tillers per clum–1.6, number of tillers per tilles-12.5, reddish yellow colored rhizome, 18.5 percentage of dry recovery and special features of the rhizome was Plumpy, bold with fibre content and root knot nematode resistant.

The production practices and technologies used while growing of turmeric followed in farmers practice and varietal introduction is given in table 1. Before initiating the programme, the farmers were given with training on various production practices and new technologies to be followed in turmeric cultivation along with the information about IISR Prathibha variety. The performance of crop was regularly observed by visiting the famers filed by scientists of ICAR JSS KVK, Suttur and advised the proper growing methods and recommendations.

At the time of harvest, data was collected from both treatments and practices. At the end, cost of cultivation, net income and cost benefit ratio were calculated. An average of cost of cultivation, yield and net returns of different farmers was analysed by the formula.

$$\text{Average} = \frac{(F1+F2+F3+ F4+ F5 + F6+F7+F8+ F9+ F10)}{N}$$

Where,
F= Farmer
N= Number of farmers

In the present study, technology index was defined as the technical feasibility obtained due to introduction on high yielding turmeric variety. To calculate the technology gap, extension gap and technology index following formula used as given by Samui *et al.*, 2000; Kamal *et.al*., 2020 [13, 8].

Technology Gap (t/ha) = P1 (Potential yield) – D1 (Demonstration yield)

Extension Gap (t/ha) = D1 (Demonstration yield) – F1 (Farmers yield)

$$\text{Technology index (\%)} = \frac{\text{Potential yield} - \text{Demonstration yield}}{\text{Potential yield}} \text{ X } 100$$

Gross income (Rs/ha)

Table 1: Technology gap between two practices

Sl. No.	Package of practices (Technology demonstarted)	Introduction of new variety (Recommended package of practices)	Farmers practice (Local/check)	Gap
01.	Varietal selection	Improved variety (IISR Prathibha)	Age old variety	Partial gap
02.	Testing of soil	Have been done in all the demonstrated plot	Not followed	Full gap
03.	Rhizome / Turmeric Seedlings rate	57,000/ha (Seedlings prepared by 8 q seeds)	25 q/ha (Rhizome rate)	Partial gap
04.	Rhizome / Turmeric Seedlings treatment	Seedlings treated with Mancozeb and Choloropyriphos	Not done	Full gap
05.	Spacing followed	70 cm x 60 cm	60 cm x 50 cm	Partial gap
06.	Nutrient management	150 kg N + 125 kg P_2O_5 + 250 kg K_2O per ha (50% N+ 100% P K at the time of planting and remaining 50% N applied at 40 days and 80 days after planting)	Imbalance and inadequate	Partial gap
07.	Correction of deficiency by using micronutrients	2 times Foliar spray of micro-nutrients 75 g + 15 lit water + lemon + 1 shampoo (Rs. 1).	Not used micronutrient	Full gap
08.	Irrigation	Drip irrigation depend upon soil condition	Flood irrigation twice in a month	Partial gap
09.	Weed control	Pre-emergence herbicide pendimethalin @ 1.5 kg a.i/ha, followed by hand weeding depend upon weed intensity.	Weeding is not common and did by hand weeding	Partial gap
10.	Plant protection measures for control of insect pest and diseases	Followed IPDM: Aphid and sucking pest-spraying with diamethoate (30 EC) 1.5 ml/L of water. Leaf eating catterpiller: spray NPV (250 LE/ha). Blight, pyithium rot & leaf blight – Spraying of (COC) blitox 50 – 3 g/L of water and need based spray	Not properly done by using IPDM	Partial gap
11.	Harvesting	Manual	Manual	No gap

Fig 1: Regular visit and monitor during the planting and crop development stage

Fig 2: Organized field day to spread the technology to farmers

Table 2: Yield and Economics of introduction of Turmeric (*Curcuma longa*) high yielding cultivar IISR Prathibha in Mysore District (Year 2021-22 and 2022-23)

Particulars	Yield (t/ha)			Cost of Cultivation (Rs./ha)			Gross Return (Rs./ha)			Net Return (Rs./ha)			B:C Ratio		
Year	2021	2022	Avg.	2021	2022	Avg.	2021	2022	Avg.	2021	2022	Avg.	2021	2022	Avg.
IISR Prathibha	22.8	23.2	23.0	1,81,200	1,88,500	1,84,850	4,56,000	4,66,000	4,61,000	2,74,800	2,77,500	2,76,150	2.53	2.47	2.5
Farmers Practice with Local variety	16.2	16.3	16.25	1,99,920	1,97,500	1,98,710	3,24,000	3,26,000	3,25,000	1,24,080	1,28,500	1,26,290	1.62	1.65	1.63

Table 3: Yield technology gap and technology index of introduction of new high yielding variety of turmeric IISR Prathibha

Variables	Yield (t/ha)	Yield Increase (%) over farmers Practice	Technology gap (t/ha)	Extension gap (t/ha)	Technology index (%)
IISR Prathibha	23.00	28.26	16.20	6.75	41.32
Farmers Practice with Local variety	16.25	-	-	-	-

Results and Discussions

The results of the study clearly showed that the significant effect of introduction of variety over the farmer practices towards in increasing the high yield of turmeric in farmer fields by adapting new variety, timely plating, use of balanced fertilizers, proper irrigation methods, weeding and by following IPDM etc. The finding result is same confirmed by the Tiwari and Saxena (2001) [17]. For categorization of technology gap and extension gap, yield gap was estimated by yield of the introduction of high yielding variety and potential yield of the crop.

The results showed in the table 2, yield and economics of introduction of high yielding variety of Turmeric i.e. IISR Prathibha was 23.00 t/ha and which was 28.26% more than farmers practice with local variety (16.25 t/ha). The cost of cultivation found more in farmers practices i.e 1,98,710 rupees/ha compare to IISR Prathibha i.e 1,84,850 rupees/ha. The gross return, net return and B:C was found maximum in IISR Prathibha i.e. 4,61,000 rupees/ha, 2,76,150 rupees/ha and 2.5 respectively, when compare to lower gross return, net return and B:C was found in farmers practice i.e. 3,25,000 rupees/ha, 1,26,290 rupees/ha and 1.63 respectively. The

superiority of package of practices under introduction of new variety over farmer's practice was also reported by Mitra and Samajdar 2010; Balai *et al.*, 2012; Kamal *et.al*., 2020 [10, 3, 8].

The results showed in table 3 describe the technology gap in the varietal introduction yield versus potential yield which is 16.20 t/ha. The technology gap observed in the results may be due to associated with dissimilarity in fertility status of the soil, timely sowing/transplanting of the rhizomes/ seedlings and climatic conditions. Similar results was recorded by Mitra and Samjdar 2010 and Kamal *et al*., 2020 [10, 8]. The higher extension gap was observed. The extension gap ranged from 6.75 t/ha during the period of study that indicate the need to educate the farmers for adoption of improved production technologies to mitigate or reduce the extension gap.

From the present study findings, can be concluded that use of prescribed production technologies of turmeric cultivation can easily bring down the technology gap to a considerable extent resulting in to increased productivity of the Turmeric produce as well as quality in Mysuru Karnataka.

It need more effort by collaborative extension to increases the level of adoption and recommended improved production technologies among the growers to cut down these gaps. Therefore, in Mysuru district the agriculture related extension institutes need to follow turmeric growers by providing them good, new and needy technical guidance through various methods of extension to increases the income of the farmer as well as productivity and production in Mysuru district of Karnataka.

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