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Front Line Demonstration of Turmeric Cultivation on Raised Bed with Drip System in Telangana

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ABSTRACT: Krishi Vigyan Kendra, Malyal conducted front line demonstration of Turmeric on raised bed with drip system during *Kharif* seasons of 2017-18, 2018-19 and 2019-20 at Bethol, Aleru, Chinnamupparam and Nellikuduru villages of Mahabubabad district, Telangana for efficient use of natural resources and minimizing the pest and diseases in order to get bumper yields and income. Cultivation of turmeric by conventional flat bed method in the region leads to poor drainage, more pest and disease incidence and low yields. The demonstration comprised of seed treatment with metalaxyl + mancozeb @ 2 g/l + monocrotophos @ 1.5ml/l of water followed by soaking in *Trichoderma viride* @ 5g/l of water, sowing as paired row on raised beds of convenient length, 90 cm width and 20-25 cm height, FYM @ 10 t/acre, Neem cake @ 2 q/acre, NPK fertilizers @ 70:24:45 kg/acre and plant protection measures with chlorantraniliprole @ 0.3ml/l, propiconazole @ 2ml/l and resulted in 35.72% higher yield (75.33q/ha) as against 55.50q/ha in check. Besides increase in yield, the demonstration was free from rhizome rot in all the three seasons. Extension gap (19.83) is higher compared to technology gap (9.66) and technology index (11.03) which shows that the technology may be popularized on large scale to lessen the extension gap.

Keywords: Drip irrigation, dry rhizome yield, raised bed cultivation, rhizome rot, turmeric.

INTRODUCTION

Turmeric (*Curcuma longa*) an important crop, is extensively cultivated worldwide though native to Southeast Asia (Dosoky and Setzer 2018). It belongs to the family Zingiberaceae. Turmeric is an important ingredient and popular worldwide due to its wide range of applications in food, cosmetic and pharmaceutical industry (Saiz de, 2014). Distinctively, the attentiveness of this tuberous species lives in its utilization as a colouring and flavouring agent, as well as in its several therapeutic functional activities, such as anticancer, antioxidant, anti-inflammatory, neuro and dermoprotective, antiasthmatic or hypoglycaemic (Ibanez *et al*., 2020), being recently communicated that turmeric can even effectively bestowed against the life threatening viral disease COVID-19 by impairing the main protease enzyme (Rajagopal *et al*., 2020). It has unique sensory characteristics: a yellow/brown colour externally, with a deep orange inner part, a characteristic flavor and a bitter, hot taste. These properties make turmeric rhizome ideal for various food and pharmaceutical applications. Particularly, it is the vital kitchen ingredient of curry powders accounting for about 10-30% of the blend (Dosoky and Setzer 2018). In India, turmeric is used in many religious rituals, as a dye, cosmetic and it typically contains carbohydrates (69.4%), protein (6.3%), fat (5.1%), and minerals (3.5%) (Chempakam and Parthasarathy, 2008). Turmeric oleoresin is as an ingredient in brine pickles and to some extent in mayonnaise and relish formulations, non-alcoholic beverages, gelatins, butter, cheese etc.

In India, Turmeric is grown in around 0.29 million hectares of area with an annual production of 1.1 million tonnes of turmeric (Spice board, 2021). In Telangana, turmeric is an important horticultural crop grown in an area of 55,879.20 ha and the major contributing erstwhile districts are Karimnagar (29%), Adilabad (23%), Warangal (22%) and Nizamabad (18%). The popular trade varieties of turmeric in India are Alleppey Finger Turmeric, Madras Turmeric (Erode /Salem), Laka dong Turmeric and Rajapori Turmeric. The Popular Market Centers for turmeric in India are Nizamabad (Telangana), Alleppey (Kerala), Erode (Tamil Nadu), Cudappah, Guntur (Andhra Pradesh) and Sangli (Maharashtra).

Farmers generally grow turmeric by adopting traditional method of sowing in the flat beds. This method results in increased incidence of rhizome rot which increases cost of cultivation, decreases yield and economic returns. Planting method influence growth and yield of turmeric (Chattopadhayay *et al*., 1993; Gill *et al*., 2002). Ridge and furrow method, raised bed method of turmeric cultivation decreases rhizome rot incidence. However, these methods are adopted in relatively lesser area in Mahabubabad district. Hence, the present study was conducted to demonstrate the ability of turmeric cultivation on raised bed with drip method of irrigation in farmers' field to facilitate larger adoption of the practices.

MATERIALS AND METHODS

The present study of Front line demonstration on cultivation of turmeric with raised bed method was done at Bethol, Aleru, Chinnamupparam and Nellikuduru villages of Mahabubabad district, Telangana during *Kharif* seasons of 2017-18, 2018-19 and 2019-20. Before demonstration, baseline survey was conducted and problems associated with Turmeric cultivation were identified (Cultivation on flat beds, non adoption of seed treatment, inadequate use of recommended fertilizers and lack of awareness on plant protection measures). KVK, Malyal has undertaken the present study to popularize turmeric cultivation on raised bed with drip irrigation system for efficient use of natural resources and prevention of rhizome rot in order to get higher yields and net returns. Each year, the demonstration was conducted in 10 locations covering these four villages.

The demonstration on cultivation of turmeric by raised bed method with drip irrigation comprised of cultural, biological and chemical methods (Table 1). At each location, demonstration was laid out in an area of 0.4 ha and adjacent 0.4 ha was considered as control (Farmers' practice) for comparison studies and the demonstration was conducted in 10 locations for three consecutive years. Apart from showcasing the viability of raised bed method, farmers were also sensitized on the relevance of these technologies by organizing awareness programmes, focused group discussions, conducting method demonstrations, training programmes and sending timely messages through different ICTs. The FLD was conducted to study the potential yield reduction factors that are mainly due to the diseases and yield difference between the farmers' practice and demonstration.

Table 1: Details of treatments in Demonstration and Farmers' Practice.

Treatments	Components
Farmers' Practice (T_1)	• Without seed treatment • Cultivation of turmeric by flat bed method • Imbalanced application of NPK fertilizers • Non adoption of micronutrient sprayings
Technology Demonstrated (T_2)	• Seed treatment with metalaxyl + mancozeb @ 2 g/l + monocrotophos @ 1.5ml/l of water followed by soaking in *Trichoderma viride* @ 5g/l of water • Cultivation of Turmeric by raised bed (Paired row with drip) method (convenient length, 20-25cm height, 90cm width, 30cm between two beds for drainage and 45cm between the paired rows) • Application of FYM @ 10 t/acre, Neem cake @ 2 q/acre along with RDF (N: P: K-70:24:45 kg/acre) through drip irrigation. • Spraying of micronutrients and need based chemicals with chlorantraniliprole @ 0.3ml/l, propiconazole @ 2ml/l

The yield data were collected from both the demonstration and farmers' practice by random crop cutting method and analyzed by using simple statistical tools. The per cent increase in yield, other data parameters like cost of cultivation, gross returns, net returns and benefit cost ratio were recorded. The per cent increase yield, technology gap, extension gap and technology index (Samui *et al*., 2000) were calculated by using formulae as given below.

$$\text{Per cent increase in yield} = \frac{\text{Yield in demonstration} - \text{Yield in Farmers' practice}}{\text{Yield in Farmers' practice}} \times 100 \quad (1)$$

$$\text{Technology gap} = \text{Potential yield} - \text{Yield in demonstration} \quad (2)$$

$$\text{Extension gap} = \text{Yield in demonstration} - \text{Yield under existing practices} \quad (3)$$

$$\text{Technology index} = \frac{\text{Potential yield} - \text{Yield in demonstration}}{\text{Potential yield}} \times 100 \quad (4)$$

RESULTS AND DISCUSSION

A. Growth parameters

Observations recorded on growth parameters (Table 2) like mean tillers/plant (7.8), fresh rhizome weight (1154.5g), plant height (108.2cm) were higher in raised bed than flat bed method. In raised bed method due to availability of loose soil, wider space between plant to plant, better aeration and drainage between the beds, this method facilitates to gain more tillers as well as more rhizome weight over farmers' practice. The present findings are in agreement with Nagarjuna *et al.* (2021).

B. Per cent of disease damage

Observed lower incidence of leaf spot (9.6%) and 'nil' incidence of rhizome rot in demonstrated fields in all the three years of demonstration across all the locations while incidence of leaf spot (22.5%), rhizome rot (30.80%) was recorded in farmers' practice (Table 2). The advantage of better aeration and drainage helps in minimizing incidences of foliar diseases as well as rhizome rot. These results are also in confirmation with the finding of Sunil Kumar *et al.* (2021).

Table 2: Growth parameters and disease incidence in turmeric influenced by different planting methods.

Particulars	Raised bed method of turmeric cultivation	Flat bed method of turmeric cultivation
Plant height (cm)	108.2	90.5
No of tillers/plant	7.8	5.3
Incidence of Leaf spot & blotch (%)	9.6	22.5
Fresh Rhizome Weight (g)	1154.5	744.6
Rhizome rot incidence (%)	Nil	30.80%

C. Dry rhizome Yield

Better growth parameters accompanied with lesser leaf spot incidence and 'nil' rhizome rot incidences manifested in higher dry rhizome yield of 75.33q/ha in raised bed with 35.78% higher than that in flat bed (55.5q/ha) (Table 3). This could be due to the fact that, raised beds facilitate improved drainage and consequent better aeration to root system at times of heavy and continuous rains.

Table 3: Productivity, Technology gap, Technology index and extension gap of Demonstration and Farmers' practice.

Year	Area (ha)	No. of Farmers	Yield (q/ha)			% Increase in yield	Extension gap (q/ha)	Technology gap (q/ha)	Technology index (%)
			Potential	Demo	Check				
2017-18	4	10	85.0	75.00	53.75	39.53	21.25	10.00	10.76
2018-19	4	10	85.0	78.50	55.25	42.08	23.25	6.50	7.64
2019-20	4	10	85.0	72.50	57.50	26.08	15.00	12.50	14.70
Average	4	10	85.0	75.33	55.50	35.72	19.83	9.66	11.03

D. Economics

The economic data (Table 4) clearly revealed that, the net returns from the demonstration is substantially higher than farmers' practice, *i.e.*, the average net returns from the demonstration is Rs. 1,41,275/ha as compared to Rs. 44,217/ha in control. The cumulative effect of demonstration over three years, recorded an average benefit cost of ratio1.55, 32% higher than farmers' practice (1.17).

Table 4: Economic analyses of Demonstration and Farmers' practice.

Year	Cost of cultivation (Rs/ha)		Gross Returns (Rs/ha)		Net Returns (Rs/ha)		C:B Ration	
	Demo	Check	Demo	Check	Demo	Check	Demo	Check
2017-18	2,62,000	2,39,125	3,82,500	2,74,125	1,20,500	35,000	1:1.46	1:1.14
2018-19	2,45,625	2,47,150	4,08,200	2,87,300	1,62,575	40,150	1:1.66	1:1.16
2019-20	2,58,000	2,58,750	3,98,750	3,16,250	1,40,750	57,500	1:1.54	1:1.22
Average	**2,55,208**	**2,48,342**	**3,96,483**	**2,92,558**	**1,41,275**	**44,217**	**1:1.55**	**1: 1.17**

E. Performance of FLD

Yield of the frontline demonstration trials and potential yield of the crop was compared to estimate the yield gaps which were further categorized into technology and extension gaps (Hiremath and Nagaraju, 2009) reported that selection of quality seeds and seed treatment is necessary for achieving higher yields. The technology gap is the difference or gap between the demonstration yield and potential yield. A critical analysis of data revealed that the average technology gap was 9.66 q/ha. The technology gap observed may be attributed to variation in the soil fertility status, crop failure due to water logging conditions, low awareness on pest and disease control measures. In order to

mitigate the location specific problems and to harness the yield potential of specific turmeric under demonstration fields and the ability of farmers to follow the management practices (Choudhary *et al*., 2009; Singh *et al*., 2018) paved the way for expansion of area under improved production technologies. Hence, location specific recommendations under micro farming situation appears to be necessary to bridge the gap between the yields.

From the data it was also found that the average technology index reported was 11.03 per cent. This number indicates that there is a gap present between technology developed and technology adopted at farmer's field and represents the feasibility in conducting a demonstration. However, farmer perception towards the technology involving high initial costs and adverse climatic conditions resulted in the increasing trend of technology index values during the demonstration years. The socio-economic environment in terms of irrational attitude, illiteracy and impassive behaviors towards the adoption of new technologies are the major constraints in the improvement of agricultural productivity (Misra *et al*., 2015). As technology index denotes the gap between technology generated at research farm and farmer's field, lower the technology index more feasible will be the technology (Hiremath and Hilli, 2012).

CONCLUSION

From the present study, it was successfully demonstrated in farmer's fields that growing turmeric on raised bed method with drip system of irrigation would give better yields and economics besides reducing disease incidence and hence wider awareness programmes among the farmers could be taken up through mass and press media for its large scale adoption.

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