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Impact of Front Line Demonstration on Integrated Crop Management (ICM) in Turmeric in Adilabad district of Telangana

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ABSTRACT: The KVK, Adilabad had under taken the study to popularize the Integrated Crop Management (ICM) in Turmeric for efficient use of natural resources and minimizing the pest and disease for harvesting bumper yields and income. Cultivating turmeric by conventional flat bed method in the region leads to poor drainage, more pest and disease incidence and recording low yields. In order to disseminate the improved production technologies for reaping higher returns from turmeric cultivation conducted Front Line Demonstrations during 2019-20 to 2020-21 in different villages of Adilabad district of Telangana. The proven extension strategic approaches (focused group discussion, method demonstration, off and on campus training programmes, field visits, exposure visits) and need based package of practices (timely sowing, seed treatment, raised bed dimensions, different plant protection measures etc.) resulted higher yield in demonstrations (74.67qha^{-1}) over check (56.20qha^{-1}). There is an average of 32.85 % increased yield was observed in demonstrations over farmers practice during both the seasons. Then the high benefit cost ratio was recorded with demonstration as 1.7 and 1.85 as compared to 1.23 and 1.3 under farmers practice during both the years of front line demonstration. The knowledge level and adoption level were too higher between beneficiary and non-beneficiary farmers.

Keywords: Turmeric, Raised bed cultivation, black cotton soils, drainage, Yield, Economics.

INTRODUCTION

Globally *Curcuma longa* (syn. *C. domestica Valeton* and *C. brog Valeton*) is called as "turmeric" and "kurkum" in Arabic, and "haldi" in Hindi and Urdu. It is extensively cultivated worldwide but is native to Southeast Asia (Dosoky and Setzer 2018). Turmeric is a popular spice 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 (Ibáñez *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). Most of these vital health benefits and therapeutic properties principally come from the rhizome (Alvis *et al.*, 2012), a horizontal underground stem from which the shoots and roots arise (Sawant and Godghat, 2013). 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 and accounting for about 10–30% of the blend (Dosoky and Setzer 2018). In India, turmeric is used in many religious rituals, as a dye, and as a 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 and cheese etc. The institutional sector in the west buys ground turmeric and oleoresins, while in the industrial sector, whole dry turmeric is preferred.

In India Turmeric is grown in around 0.29 million hectares of area with the production of 1.1 million tonnes of turmeric annually (Spice board, 2021). The Telangana state accounts for 28.4% (0.3 million tonnes) of the total India production from an area of 49000 hectares and the major contributing erstwhile districts

are Karimnagar (29%), Adilabad (23%), Warangal (22%) 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); Sangi-(Maharashtra).

Adilabad is one of the 33 districts of Telangana state and is located in the northern region of Telangana state. The district has a population of 7.08 lakhs of which more than 75% rural population, among them 35% of people are tribes. The Gonds, Lambada, Kolams, Pardhan, Andh, Thoti comprise the tribal population and practicing rainfed agriculture (Poshadri *et al.*, 2020). Agriculture in Adilabad district is highly dependent on monsoon rainfall. Large share of crop production in the district is depending on rainfed system. Average rainfall for different blocks of Adilabad district varies from 1089 mm to 1204 mm and annual rainy days range between 60-67 days. High amount of rainfall during July and august month leads to water logging, flood, landslides, soil erosion, and loss of crop. This water logging condition is mainly caused by black soil which contains heavy clay material and holds more moisture in the root zone. Excess rainfall condition in September, October and even in rabi season causes water logging in early stage of rabi crops. This leads to crop damage or failure in early stages and affects productivity. Either excess rainfall or deficient pattern poses serious risks to turmeric as well as other crops cultivation in the district.

Out of total gross horticulture cropped area of the district, Fruits, Vegetables, Flowers and Spices and Condiments occupy 15.5%, 74.4%, 0.1% and 10.0% area respectively (NHB-2020). The erstwhile Adilabad district producing 41474 tonnes of turmeric from an area of 7719 ha and contributing 22.51% of state production. The production of Turmeric in tribal agency areas viz Indravelly, Gudihathnoor, Thalamadugu and Ichoda mandals of Adilabad district (Kumar *et al*., 2021). Majority of the farmers are cultivating turmeric in black cotton soils by conventional flat bed method which leads to poor drainage and recording low yields. Cultivating turmeric by conventional flat bed method leads to poor drainage, more pest and disease incidence and leading to lower yields and economic returns. Further, the problem of lower yields and low productivity of turmeric in this district is mainly attributed to many biotic and abiotic factors. The major issues in production of turmeric in the district are cultivation of old varieties, no use of seed treatment and inadequate use of recommended fertilizers and plant protection measures against various physiological, pest and disease management etc in a integrated crop management (ICM) approach.

Therefore there is a need to popularize the improved technologies in ICM mode for enhancement of production and productivity of turmeric and raising the income level of the farming community. Keeping the micro-farming situation (crop damage, low yield and low economic returns) and high amount of rainfall during July and august month in mind, front line demonstration of ICM in turmeric coupled with raised bed cultivation of turmeric was popularized in the Adilabad district of Telangana state, India.

MATERIALS AND METHOD

The Krishi Vigyan Kendra, Adilabad (working under the administrative control of Professor Jayashankar Telangana State Agricultural University) had conducted a benchmark survey in different tribal villages. Diversified information was collected through structured personnel interviews of practicing turmeric growers in the tribal hamlets. Secondary information was collected from mandal Horticultural Officers, experienced turmeric growers, owners of turmeric cooking equipments and other key stakeholder in turmeric value chain (). The following problems were identified 1. Flat bed cultivation of turmeric 2. Non adoption of seed treatment 3. Inadequate use of recommended fertilizers 3. Inadequate use of plant protection measures. Then the KVK, Adilabad under taken the study to popularize the Integrated Crop Management (ICM) in Turmeric for efficient use of natural resources and prevention of rhizome rot for harvesting bumper yields and income. The front line demonstration (FLD) study was confined to operational area of Krishi Vigyan Kendra, Adilabad, Telangana State, India. The cost of production, yield and economic indicators of front line demonstration, the data on output were collected from demo farmers as well as other practicing farmer plots as check and finally the yield, cost of cultivation, net returns with the benefit cost ratio was calculated to assess the impact of front line demonstration (Kumar *et al.*, 2012). A sample of 40 practicing farmers was taken comprising 20 demo farmers (from 10 villages) and 20 check (non beneficiary) farmers. Frontline demonstrations on integrated crop management in turmeric were conducted during Kharif 2019-20 to 2020- 21 with full package and practices (Table 1 and 2) and taken equal representation for data analysis and interpretation. In FLD on ICM in turmeric, technology index was operationally indicated as the technical feasibility obtained due to conducting of Cluster Frontline Demonstrations. Assessed the technology gap, extension gap and technology index as well as add on cost, additional returns and effective gain according the previous studies conducted by researchers (Raghuveer *et al*., 2020; Yadav *et al*., 2004).

Table 1: Frontline Demonstration on Integrated Crop Management (ICM) in Turmeric.

Sr. No.	Particulars	Details	
1.	Crop & Season	Turmeric & Vanakalam (kharif)	
2.	Farming situation	Irrigated Black soils	
3.	Problem diagnosed	Low yields are recorded due to incidence of leaf spot, leaf blotch, rhizome rot diseases and imbalanced fertilizer application	
4.	Title of the FLD	Integrated Crop Management in Turmeric	
5.	No. of locations	20	Area: 4.0 ha
6.	Treatments	**Check –** 1. Without Seed treatment 2. Cultivation of Turmeric through ridge and furrow method 3. Imbalanced application of NPK (80:40:45 kg/acre) fertilizers 4. Unaware of micronutrient sprayings **Demo –** 1. Seed treatment with Ridomil MZ @ 3g/lit of water and *Trichoderma Viridi* @ 5g/l of water 2. Cultivation of Turmeric through raised bed (Paired row with drip) method (Bed height- 15 cm, Bed width- 90 cm, Channel width- 45 cm, Spacing- 45 × 22.5 cm^2) 3. Application of FYM @ 10 t/acre, Neem cake @ 2 q/acre along with RDF (N: P: K-70:24:45 kg/acre) 4. Spraying of micronutrients and need based chemicals.	

RESULTS AND DISCUSSION

The data obtained from FLD on ICM in Turmeric indicates that yield of demonstration plots was higher as compared to check (farmers practice) may be attributed to ICM and raised bed cultivation practices. The results of yield performance between demonstration fields and farmers practices are given in Table 2. The average percentage of increase in the yield of demonstration was 24.7 per cent when compared to farmers practice. Similar yield enhancement in turmeric crop in frontline demonstrations has been reported by Raghuveer *et al.* (2020) reported that the yield of chick pea was increased with front line demonstrations with the adoption of recommended agro-technologies in FLDs during study period. 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 in onions. The technology gap is the difference or gap between the demonstration yield and potential yield. A critical analysis of data (Table 2) revealed that the average technology gap was 10.33 q ha^{-1}. 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.

Table 2: Productivity, Technology gap, Technology index and extension gap in Integrated Crop management in Turmeric.

Year	Area (ha)	No. of Farmers	Yield (q ha^{-1})			% Increase in yield	Extension gap (q ha^{-1})	Technology gap (q ha^{-1})	Technology index (%)
			Potential	Demonstration	Control				
2019-20	4	10	85	78	58.5	33.33	19.5	7	8.24
2020-21	4	10	85	71.34	53.91	32.33	17.43	13.66	16.07
	4	10	85	74.67	56.20	32.85	18.47	10.33	12.15

Table 3: Comparative C:B analysis of Integrated Crop management in Turmeric.

Year	Cost of cultivation		Gross Returns (Rs.ha)		Net Returns (Rs. ha)		B:C Ration	
	Demo	Check	Demo	Check	Demo	Check	Demo	Check
2019-20	242500	251000	413400	310050	170900	59050	1.70:1	1.23:1
2020-21	267313	274788	477643	361125	210330	86337	1.85:1	1.30:1
	254906.5	262894	445521.5	335587.5	190615	72693.5	1.74	1.27

Table 4: impact of Front – Line Demonstration (FLDs) on Integrated Crop management in Turmeric.

Technology	Area (ha)			
	Before demonstration	After demonstration	Change in area (ha)	Impact (% change)
	10	39	29	290

The average extension gap (Table 2) between demonstration and farmers practice was recorded 18.47 q ha^{-1}. Extension gap in the current study shown that there is a need to create awareness and mass adoption of improved production technologies in participatory approach over age old existing practices. The refinement in the local farmer's practices for higher adoption of local specific generated farm technology for sustaining crop productivity is another option for the research scientists (Singh and Chhina, 2015) and (Teggelli *et al*., 2015). Extension yield gaps are the indicators of lack of awareness for the adoption of improved farm technologies by the farmers (M.Raghuveer *et al*., 2020). The researchers Mishra *et al.* (2018) also reported that, location specific problems and the interventions may have greater role in the enhancement of crop productivity in green gram.

From the data it was also found that the average technology index reported was 12.15 per cent (Table 2). 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). This in a long run over the years and with more penetration at field level may result in decreasing trend of the technology index with précised use of demonstrated technologies in the field and suitable climatic conditions during demonstration period. As technology index denotes he 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).

The effect of front line demonstration on farm income (Table 3) indicates that the average cost of cultivation involved in demonstration was Rs. 254906 ha^{-1}, which is lower than the farmers practice (Rs. 262894 ha^{-1}). The data concluded that the higer gross monetary returns (Rs. 445521 ha^{-1}) as well as net monetary returns (Rs.190615 ha^{-1}) were obtained with the adoption of technology over farmers practice during the course of trial. Likewise, the average benefit cost ratio of demonstration plot was 1.74 which was more than the farmers practice (1.27).

The increase in the yield and monetary returns with demonstration might be due to the selection of suitable variety, Seed treatment with Ridomil MZ @ 3g/lit of water and Trichoderma Viridi @ 5g/l of water and timely application of fertilizers as well as integrated pest management practices. In demonstration fields the following observations were made such as i) vigorous vegetative growth in-terms of plant height and number of tillers/plant, ii) low incidence of leaf spot, leaf blotch due to timely spraying of need based chemicals, iii) very low incidence of rhizome rot due to good drainage facility for excess rainfall water, iv) harvested long and bold sized rhizomes. The higher additional returns and effective gain obtained under demonstration might be due to improved technology, non-monetary factors and timely operations of crop cultivation as well as scientific monitoring. Similar results were also reported by Singh and Chhina (2015).

CONCLUSION

Frontline demonstrations on ICM in turmeric during 2019- 20 and 2020-21 resulted that average yield of 78.0q ha^{-1} and 71.3 q ha^{-1} obtained with demonstration followed by 58.5q ha^{-1} and 53.91 q ha^{-1} with farmers practice. Then this yield difference clearly demarked the monetary returns in between demonstrations and farmers practice. The per cent increment in yield of Turmeric to the extent of 32.85 per cent in demonstration over the check created greater awareness and motivated the fellow farmers for adoption the improved package of practices for Turmeric. Further, the results in these demonstrations built the science-backed solutions for higher productivity and better management of natural resources. It is concluded that the FLD programme is an effective tool for increasing the area and productivity of Turmeric and changing the knowledge, attitude and skill set of the farmers. This has not only resulted in socio-economic up-liftment of farmers but and also minimized the crop failure due to poor drainage and improved the moisture conservation in black cotton soils.

Conflict of interest: Authors have declared that no conflict of interests exist

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