Yield gap analysis of Turmeric in Tirap district of Arunachal Pradesh

Abstract

Megha Turmeric-1 variety of turmeric was demonstrated under front line demonstration (FLD) programme dyring 2020-21 and 2021-22 respectively by Krishi Vigyan Kendra (KVK), Tirap, Arunachal Pradesh. The average FLD yield was 218 & 224 q/ha was recorded as compared to 164 & 179 q/ha under farmers practices. The Technology gap was 32 & 26 q/ha, extension gap was 54 & 45 q/ha and technology index was 13 & 10 respectively. The net income under FLD plot was higher over farmers practice during both's years of study (Rs, 290000 & 300000 vs. 210000 & 214000). Similarly, the B:C ratio was also better than farmers practice (2.45 & 2.02 vs. 1.77 & 1.76). Being a very low technology index, it assumes that turmeric production can be enhanced by dissemination of improved technologies at farmer's field.

Keywords:Improvedtechnology,Frontlinedemonstration, Megha turmeric 1,Yieldgap.

Introduction

Turmeric (Curcuma longa L.) is popular as the king of spices grown by the farmers of Arunachal Pradesh in their kitchen garden. The crop has the good potentialityto enhance the farm income as well as farmer'slivelihood ness in Arunachal state as well country.

It thrives in warm, humid climates with temperatures between 20 and 30 degrees Celsius with an ideal annual rainfall of 1500 millimetres. Many soil types, including rich loamy soils with natural drainage and irrigation capabilities, red soils, light black loams, clay loams, and rich loamy soils, are suitable for growing turmeric (Kaur et al., 2017).

Although the rhizomes are composed of 69.4% carbohydrates, 5.1% fat, 6.3% protein, 3.5% minerals, 5.0% volatile oil, and 7.9–10.4% oleoresin, curcumin or diferuloylmethane (2.5–6.0%), which is composed of curcumin I, or curcumin (94%), curcumin II, or demethoxycurcumin (6%) and curcumin III, or bis-demethoxycurcumin (0.3%), is what gives the rhizomes their yellow color (Raghuraja, 2016).

Turmeric has a wide range of culinary, medicinal, and cosmetic applications. According to Kaur et

al. (2019), it has antibacterial, anti-inflammatory, blood-purifying, stomachic tonic, and anti-parasitic properties (Soibam et al. 2021).

It is also utilized in the production of anti-cancer drugs and as an antiseptic. Rhizome juice in its raw form is anti-parasitic and used to treat a variety of skin conditions (Reddy, 2010).

The tribal farmers in the Tirap district of Arunachal Pradesh, who grow turmeric traditionally without access to improved scientific knowledge on the variety, agronomic practices, optimal nutrient management module, and quality planting material free of insect, pest, and disease infestation, could benefit greatly economically from this crop.

Turmeric's average production in this region is poor (160–170 q/ha, Table 1) due to a number of biotic and abiotic factors, two of which are the inadequate application of plant protection methods against pests and diseases and the cultivation of indigenous, inferior varieties. As a result, an effort was made to raise the region's low productivity by using site-specific technologies on turmeric, providing training, and holding demonstrations.

Through clonal selection, the high-yielding variety Megha Turmeric-1 was produced at the ICAR (Research Complex) for the NEH Region, Umiam, Meghalaya. It is also suitable to the conditions of Arunachal Pradesh, with a crop length of 300–315 and an average production potential of 268 q/ha. 16.37% dry matter, 6.8% curcumin, and 5.5% essential oil are present in this cultivar. According to Chandra et al. (2005), it has a good tolerance to the diseases leaf spot (Colletotrichum capsici) and leaf blotch (Taphrina maculans).

Consequently, there is a lot of room to grow turmeric's productivity. According to Manan et al (2019), farmers must apply 25% more phosphatic fertilizer than is recommended and employ mulching material at a rate of 6 t/ha in sandy soils with low NPK levels in order to maximize the rhizome yield of turmeric.

Thus, afrontlinedemonstrationonnutrientmanagementinturmeric(MeghaTurmeric-1variety)wasdemonstrated in various pockets of Tirap's districtof Arunachal Pradeshforthetwoyears.

MATERIALSANDMETHODS

Before conducting of demonstration, KVK Tirap conducted a field Krishi Vigyan Kendra (KVK), Tirap conducted a field level survey to know the reality, farmer'spractice's, local yield, insect- pest attack problems etc. in turmeric crop. As per the survey results, yield of farmer's practices was low due to non - adopting of scientific know-how.

The Front line demonstrations (FLDs) were carried out on 2 ha & 3 ha area of farmer's field

in different villages viz. Chasa, Noksa, Dadam, Noitang and Makat; during 2021 and 2022 respectively. The demonstration plot size of farmers was 0.20 ha. The total 10 & 15 numbers (during both years) of demonstration carried out during the study. For conducting FLDs, selection of farmers, layout of demonstration, farmers' participationetc.were followed as suggested by Choudhary (1999). The required inputs were supplied and regular visits to the demonstration fields by the KVK scientists ensured with proper guidance to the farmers. The recommended practices included treatment of rhizomes with Ridomil (2.5 g/l) for40 min before sowing as prophylactic measure for rhizome rot disease, seed (rhizome) @2500 kg/ha were sown @ 60 cm x 25 cm. Application of FYM @ 20t, N:P:K @ 30:50:60 kg/ha (Rinku *et al.*2020), intercultural operations andapplicationof1%Bordeauxmixtureat15days interval against leaf spot disease.Field days and groupmeetingswerealsoconductedtoprovidethe opportunities for other farmers of the same village aswellasneighboringvillageswitnessthebenefits ofdemonstratedtechnologies.Thedataoutputwas collected from both FLD plots as well as control plotsandcostofcultivation,netincomeandbenefit.

Table 1: Improved practices vs farmer's practices of Turmeric

Particular	**Technological intervention**	**Existingpractices**	**Gap**
Variety	Megha Turmeric 1	Very Old variety	Fullgap
Seed rate	2500 kg/ha	3500 kg /ha	Full gap
Rhizome treatment	Treated	Not treated	Full gap
Sowing method	Line sowing	Line sowing	Partial gap
Spacing	60 x 25 cm with 6 cm depth of sowing	45 x 20 cm with 8 cm depth of sowing	Partial gap
Application of recommended dose of manure	20 t/ha	Nil/without recommendation	Full gap
Application of Bio fertilizer	Soil application of Azospirillum & PSB @ 2 kg/ha mix with FYM	No application	Full gap
Drenching	drenching of *Trichoderma viride*at 5 g/liter	Not applied	Full gap
Weed management	Done at 30, 60 and 90 days after planting	Not common	Full gap

Spraying of Biopesticide	Neem oil @ 5ml/litre of water	Not sprayed	Full gap
Harvesting	Manual	Manual	No Gap

Table 2 :Production and other extension parameters of Turmeric

Year	Area	Variety	No of Demos.	Potential Yield	Average Yield (q/ha)		% increase over Check	Technology gap (q/ha)	Extension gap (q/ha)	Technology index (%)
					D	C				
2021-22	2	Megha Turmeric 1	10	250	218	164	32	32	54	13
2022-23	3	Megha Turmeric 1	15	250	224	179	25	26	45	10

Where D stands for Demonstration and C stands for Check

Table 3 : Economics of Turmeric cultivation

Year	Yield(q/ha)		Costof Cultivation (Rs/ha)		Gross Return (Rs/ha)		Net Return (Rs/ha)		BenefitCost ratio B:CRatio	
	D	F	D	F	D	F	D	F	D	F
2021-22	218	164	146000	118000	436000	328000	290000	210000	2.45	1.77
2022-23	224	179	148000	121000	448000	358000	300000	214000	2.02	1.76

Where D stands for Demonstration and C stands for Check

RESULTSANDDISCUSSION

It is clear from table 2 that demonstration plots of Megha turmeric 1 was performed better than check.The average yield of demo. Plots was 218 q/ha and 224 q/ha as compared to 164 & 179 q/ha from farmers practice. The demo yield was 32 % & 25 & higher over farmers practices which proved that demonstrated technology was economic viable. This is the combined effect of use of high yielding variety, timely sowing, use of manure and fertilizers, application of biofertilizers, biopesticides etc. (Chandra et al ,2005, Kaur *et al*. 2019, Barua, 2015).

The gap between potential yield and demonstration yield is known as technology gap(Mishra *et al.*, 2014). Here this gap was very minimum (32 q/ha & 25 q/ha respectively, Table 2). During the second-year technology gap was lesser than first year; which means the technology was impacted very positively at farmer's field. Though; there was full gap between variety used by farmers as well as FLD.

There was also full gap for seed treatment, weed management, nutrient management etc. which caused lower yield udder farmers practices. two systems(Raghuraja,2016).Thevariationin technology gap may be attributed to dissimilarity in the soil fertility status, agriculturalpracticesandlocalclimaticsituation(Reddy,2010).

The gap between demonstration plot and farmers practices is called extension gap (Mishra *et al.*, 2014). The first year's extension gap was 54 q/ha which was minimized during second's year of demonstration as 45 q/ha. Thid proved that Improved variety of turmeric- Megha turmeric-1 was viable at farmer's field (Rajhansa *et al.*2019).

It is the worth mentioning that targeted and precise extension methodologies can serve in better way for the welfare of farming community which can teach them, encourage them for better farm out.The new technologies will eventually leadto the farmers to discontinue the old technologyandtoadoptnewtechnology(Rao, 2017 and Manan *et al.*2019).

The average technology index during first year was 13 while 10 during second's year of study. The lower technology index mean technology is more feasible at farmer's field. This was only due to application of improved variety with full package of practices. This finding is also in confirmation of Rao *et al.*2017 and Ahuja, 2020.

The Cost of cultivation during the first year of study was Rs. 146,000 per ha and Rs. 148,000 per ha during second years of study under FLD while Rs. 118000 per & 121000 per ha under farmer's practice. The cost of cultivation includes cost of field preparation, seeds, labor, fertilizers, biopesticides etc.Yashashwini (2013). The gross return was Rs. 436000 & 448000 per ha under FLD as compared Rs 328000 & 358000 under farmer's field. The net return was higher under FLD plots as compared farmers practices (Rs. 290000 & 300000 as compared 210000 & 214000). The benefit cost ratio is the pivotal point in any farming. The FLD proved its economic viability over farmers practices. The new variety with full package of practices again proved its superiority over check (2.45 & 2.02 as compared 1.77 & 1.76). Similar dinding also reported by Mishra *et al.*(2014).

The increased grain production observed under better technology as compared to farmers'

practices may be the cause of the higher B:C ratio in improved intervention technology. Similar financial gains from the use of better technological interventions were also noted by Thakur et al. (2019) and Kaur et al. (2017).

CONCLUSION

The improved variety of turmeric- Megha turmeric 1 performed well with full package of practices; under supervision of KVK experts as compared to farmer's practice. It was concluded that FLDs on improved varietyofturmericcoupledwithotherpracticesand need based plant protection measures significantly increased the yield. Higher net return and benefit cost ratio were noticed in demonstration plots compared to farmer's practice. The technology is suitable for enhancing the productivity of turmeric cropandexpansionofareaunderthiscrop.Theuse of new production technologies will substantially augment the income as well as the livelihood of local population.

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