A Study on Turmeric in Telangana with Emphasis on Value Chain Analysis

Conducted by

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Knowledge • Technology • People

Directorate of Arecanut & Spices Development
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Study Team

ABBREVIATIONS

Ac	Acre
AIC	Agriculture Insurance Company of India Limited
AICRPS	of All India Co-ordinated Research Project on Spices
AMC	Agriculture Market Committee
APEDA	Agricultural and Processed Food Products Export Development Authority
CFTRI	Central Food Technological Research Institute
cm	Centi metre
COC	Cost of Cultivation
COGS	Costof Goods Sold
COP	Cost of Production
DAP	Di Ammonium Phosphate
DAS	Days After Sowing
DASD	Directorate of Aricanut Spices Directorate
DHSO	District Horticulture and Sericulture Officer
DMO	District Marketing Officer
DoH	Department of Horticulture
eNAM	Electronic National Agricultural Market
FGD	Focu Group Discussion
Fig	Figure
FLD	Front Line Demonstration
FPO	Farmer Producer Organization
FYM	Farm Yard Manure
GoI	Government of India
GoTS	Government of Telangana State
Ha	Hectare
INR	Indian Rupee
Kg	Kilogram
Km	Kilometre
MIDH	Mission for Integrated Development of Horticulture
MIP	Micro Irrigation Project
MOP	Muriate of Potash
MP	Madya Pradesh
MT	Metric Tonnes
NA	Not Applicable
NABL	National Accreditation Board for Testing and calibration Laboratories
Q	Qintal
SKLTSHU	Sri Konda Laxman Telangana State Horticultural University
SRSP	Sree Ram Sagar Project
TRS	Turmeric Research Station
UP	Uttar Pradesh
ZnSO4	Zinc Sulphate

EXECUTIVE SUMMARY

Turmeric is an important spice crop of India in general and Telangana in particular as it is the largest producer of this spice. No Indian kitchen is complete without turmeric and it occupies an important place in Indian households. This report tries to understand turmeric cultivation with a view to address key challenges in production and value addition. The study focuses on turmeric cultivation in the four major districts of Telangana State: Adilabad, Karimnagar, Nizamabad and Warangal. Most of the findings in this study have emerged from the firsthand account of farmers, the key stakeholder in the turmeric value chain. These findings have been validated through meetings and consultations with stakeholders at district and state level.

Turmeric is an important cash crop that is mostly grown for the anticipated profits it brings backed by a sentiment. It is considered a good omen crop which despite the high cost of production encourages farmers to cultivate on the smallest patch of land available. However, in recent times the prices have not been encouraging and are well below the heady highs of 2010-11. During 2015-16 turmeric was cultivated in an area of 42535 ha with a production of 184285 tonnes in Telangana State. In recent times concerns have been raised about the decline in acreage and production, though not alarming. An encouraging sign is the spread of this crop to new areas and is expected to make up for the small declines in traditional areas of production. The issue of varietal preferences is also studied and presented in the report. Seed material is an important cost and the most vital component in the turmeric cultivation. Traditional crop, as it is, there is lot of diffidence towards adoption of new varieties unless proven. This is also one of the reasons for the continued use of the same seed material over decades. Primary processing at the farmers' level is becoming cumbersome and adding to the high cost of production, almost 13% of cost of production. An important aspect is the enthusiasm of farmers in applying farm yard manure and tank silt well above the recommended levels. This practice is deep rooted, probably due to the nature of soils in which turmeric is being cultivated and the notion that good soil structure is a necessary condition for good turmeric yields. Lack of machinery and farm implements for sowing, weeding and harvesting operations is glaring. Primary processing involving boiling and drying of fresh turmeric also needs interventional support both in terms of technology development and adoption at farmers' end.

A major portion of turmeric grown in Telangana State is exported to regional markets like Maharashtra, Madhya Pradesh and Uttar Pradesh. Further, it moves to Haryana, Punjab and Delhi. A minor portion of this is consumed locally either as rhizome or powder. The absence of major processing facilities in the state is an issue that needs attention as it is a first important step in value addition and the cascading effect on other sectors. Turmeric offers opportunities beyond turmeric powder and has a potential export market for products such as curcumin, essential oil and oleoresin.

This study has identified constraints at various stages of the value chain: production, marketing and processing and involving various stakeholders: horticulture university, horticulture

and agricultural marketing department, institutional support through banks, risk mitigation through insurance and a few governance related such as developing enterprise through FPOs. Some of these challenges provide opportunities to reduce market inefficiencies, increase producers' share in consumer spending and generate local employment opportunities.

The priority interventions for short term in production and processing include: popularising methods which can reduce seed material requirement, development of implements for bed preparation, overcoming drip irrigation related issues and designing new farm machinery which can reduce manual labour requirement. For the medium term the interventions suggested are marketing related aspects such as price determination based on specified grading and curcumin content, addressing scale of finance and insurance issues. Development of high yielding varieties suitable to local agro climatic conditions, varieties with high curcumin content which is the primary requirement for secondary processing industry are the long term interventions which need an actionable template immediately.

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CHAPTER

INTRODUCTION

Background

Directorate of Arecanut and Spices Development (DASD) is a subordinate office under Ministry of Agriculture & Farmers Welfare, Government of India looking after the production of spices at National level. Directorate implements various development programmes like planting material production, technology dissemination through frontline demonstration, transfer of technology through Seminars/Workshops/Training, Skill development and other innovative productivity improvement programmes with an aim to enhance production, productivity and quality of the spices including turmeric.

Telangana is the largest producer of turmeric in the country. In Telangana, the four districts (erstwhile) viz. Nizamabad, Karimnagar, Warangal and Adilabad account for around 90% of the production of turmeric in the State and this area houses the important turmeric markets in the country. Turmeric crop plays a very important role in the livelihood of the farmers of these areas. However, the wide price fluctuation of the crop over the years lead to losses and affected the very existence of the farmers. This situation can be improved if the cost of production of turmeric is brought down through improvement in productivity with the introduction of new production technologies, better seed availability and improved varieties. Enhancement of quality of the produce through adoption of improved post-harvest technology may create better marketability for the crop.

With this background DASD has assigned CGG to conduct a study on the status of turmeric and its value chain in the erstwhile districts of Nizamabad, Adilabad, Karimnagar and Warangal. This study is proposed to analyse each link in the value chain of turmeric in the area and recommend ways to bring down the cost of production and improve marketability including exploring ways for developing a niche market for turmeric in the area with an aim to make the farmers resilient to price fluctuations.

Global Turmeric Scenario

India is popularly known as the “Spice Bowl of the World” as a wide variety of spices are grown in the country since ancient times. Turmeric (Curcuma longa L), the ancient and sacred spice of India is known as ‘Indian saffron’ and an important commercial spice crop grown in India. It is used in diversified forms as a spice, flavouring and colouring agent and as a principal ingredient in Indian culinary as curry powder. It has anti cancer and anti viral activities and hence finds use in the drug industry and cosmetic industry. ‘Kum-kum’, popular with every house wife, is also a by-product of turmeric. It finds a place in offerings on religious and ceremonial occasions. A type of starch is also being extracted from a particular type of turmeric. The increasing demand for natural products as food additives makes turmeric an ideal produce as a food colour. Turmeric is the dried rhizome of Curcuma longa L., a herbaceous perennial belonging to the family Zingiberaceae and a native of South Asia particularly India.

India is the largest producer, consumer and exporter of turmeric in the world. Other major producers are Thailand, other Southeast Asian countries, Central and Latin America and Taiwan. The global production of turmeric is around 11 lakh tonnes per annum. India dominates the world production scenario contributing 78 % followed by China (8%), Myanmar (4%) and Nigeria and Bangladesh together contributing to 6% of the global production.

India is the global leader in value added products of turmeric and exports. Other major exporters are Thailand, other Southeast Asian countries, Central and Latin America and Taiwan. United Arab Emirates (UAE) is the major importer of turmeric from India accounting for 18% of the total exports followed by United States of America (USA) with 8%. The other leading importers are Bangladesh, Japan, Sri Lanka, United Kingdom, Malaysia, South Africa, Netherland and Saudi Arabia. All these countries together account for 75% of the world imports and Asian countries are the main suppliers to the entire world. The remaining 25% is met by Europe, North America and Central and Latin American countries. United States of America imports 97% of its turmeric requirement from India and the remaining portion from the Islands of the Pacific and Thailand. Out of the total global production, UAE accounts for 18% of the imports, followed by USA (11%), Japan (9%), Sri Lanka, UK and Malaysia together accounting for 17% of the imports. [1]

Turmeric Cultivation in India

The state wise area, production and productivity of turmeric in select states for the years 2013-14 and 2014-15 is provided in

Table 1: State-wise Area, Production and Productivity of Turmeric in India (2013-2014 and 2014-2015)

States/UTs	Area (In ' 000 Hectare)		Production (In ' 000 MT)		Productivity (In MT/Hectare)	
	2013-14	2014-15	2013-14	2014-15	2013-14	2014-15
Andaman and Nicobar Islands	0.1	0.1	0.5	0.5	5.9	5.9
Andhra Pradesh	17.8	16.5	151.9	143.2	8.5	8.7
Arunachal Pradesh	0.6	0.6	2.9	2.9	4.5	4.5
Assam	16.3	16.6	15.8	16.3	1.0	1.0
Bihar	3.0	3.0	3.0	3.0	1.0	1.0
Chhattisgarh	1.0	1.1	0.8	1.0	0.8	0.9
Gujarat	3.0	3.2	50.5	52.1	16.9	16.5
Haryana	1.3	1.3	23.8	23.8	17.9	17.9
Himachal Pradesh	0.2	0.3	0.1	0.2	0.6	0.5
Karnataka	14.0	13.4	65.4	63.6	4.7	4.8
Kerala	2.6	2.5	6.9	6.8	2.6	2.8
Madhya Pradesh	1.5	1.4	0.6	1.6	0.4	1.1
Maharashtra	11.0	13.5	11.0	32.1	1.0	2.4
Manipur	1.4	1.4	16.4	16.4	11.7	11.7
Meghalaya	2.2	2.2	12.5	12.5	5.8	5.8
Mizoram	6.1	6.4	23.0	25.1	3.8	4.0
Nagaland	0.1	0.1	0.5	0.5	4.2	4.2
Odisha	2.5	2.5	30.0	30.0	12.1	12.1
Punjab	0.8	0.8	2.7	2.7	3.6	3.5
Rajasthan	0.1	0.1	0.4	0.4	2.8	2.8
Tamil Nadu	77.0	32.0	462.0	117.4	6.0	3.7
Telangana	49.6	43.5	252.1	216.3	5.1	5.0
Tripura	1.3	1.3	6.6	6.6	5.1	5.1
Uttar Pradesh	2.0	2.0	6.0	6.0	3.0	3.0
Uttarakhand	1.3	1.3	2.5	2.5	1.9	1.9
West Bengal	15.8	15.8	42.0	42.0	2.7	2.7
India	**232.7**	**184.4**	**1189.9**	**830.4**	**5.1**	**4.5**

Source: Spices Board, India.

[1] *http://agritech.tnau.ac.in/banking/PDF/Tumeric.pdf*

Table 1. Tamil Nadu and Telangana are two major turmeric cultivating states followed by Andhra Pradesh and Karnataka.

Turmeric Cultivation in Telangana

In Telangana turmeric crop is being grown in an area of 42535 ha with a production of 184285 MT during 2015-16[2]. The crop is being grown majorly in erstwhile four districts viz. Nizamabad, Adilabad, Karimnagar and Warangal. Though Nizamabad district stands first in cultivation of turmeric, the production is highest in Karimnagar district and scores second in productivity after Adilabad.

The district wise area, production and yield of turmeric in Telangana State are provided below.

Table 2: District wise area, production and yield of turmeric in Telangana State

S. No	District	Area		Production (MT)		Yield(Kg/ha)	
		2015-16	2014-15	2015-16	2014-15	2015-16	2014-15
1	Adilabad	7719	7094	41474	45777	5373	6453
2	Nizamabad	12242	12458	33825	47004	2763	3773
3	Karimnagar	10600	10363	53975	64986	5092	6271
4	Medak	1179	1566	5109	3715	4333	2372
5	Rangareddy	2253	3303	7822	11336	3472	3432
6	Mahabubnagar	8	36	35	179	4333	4974
7	Nalgonda	2	1	9	5	4333	4974
8	Warangal	8348	8482	41239	42410	4940	5000
9	Khammam	184	172	797	856	4333	4974
	Total	**42535**	**43475**	**184285**	**216268**	**4333**	**4975**

Source: Agricultural Statistics at a Glance, 2015-16, Dept of Economics and Statistics, Govt of Telangana

Though Telangana is the largest producer of turmeric in the country the trends in productivity and yields for the past few years indicate that all is not well. The deviation in production and productivity is much more than turmeric area when compared to the base year 2007-08.

Table 3: Index numbers of Turmeric area, production and productivity (Base: Triennium ending 2007-9=100)

	2011-12	2012-13	2013-14	2014-15	2015-16
Area	106.49	96.00	95.89	83.99	82.17
Production	92.66	88.09	77.30	66.32	56.5l
Productivity	87.01	91.76	80.61	78.96	68.77

Source: Agricultural Statistics at a Glance, 2015-16, Dept of Economics and Statistics, Govt of Telangana

[2] Agricultural statistics at a Glance, 2015-16, Dept of Economics and Statistics, Govt of Telangana, Hyd

The index numbers for the area under turmeric cultivation in Telangana reveals that there is a decline in the acreage in the past five years (Table 3). The same is reflected in the production of turmeric.

Objectives

The primary objective of the assignment is to understand the turmeric value chain in the four selected districts with a view to tap the opportunities available and the potential improvements that can be done for this purpose. The interventions related to establishment of seed clusters and varietal preferences also would be understood. The specific objectives of the assignment are as follows:

1. Value chain analysis of turmeric in four major districts of Telangana
2. To study the varietal preferences of turmeric crop in relation to various stakeholders in turmeric value chain
3. To study the feasibility of cluster approach for seed and commercial turmeric cultivation

Approach and Methodology

Study area:

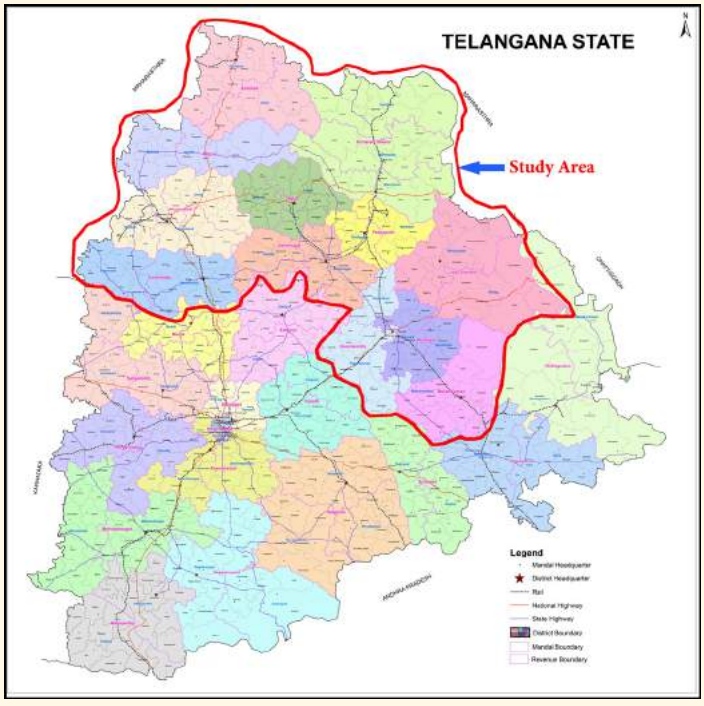


Fig 1: Map showing the study area

The study has been conducted in erstwhile districts of Nizamabad, Karimnagar, Adilabad and Warangal. After district reorganization the erstwhile Nizamabad district was divided into two districts viz. Nizamabad and Kamareddy; Karimnagar district was divided into Karimnagar, Peddapalli, Jagtial and Rajanna Sircilla; Adilabad district was divided into Adilabad, Kumuram Bheem Asifabad, Nirmal and Mancherial; whereas the Warangal district was divided into Warangal (U), Warangal (R), Jayashankar Bhupalpally, Mahabubabad and Jangaon. Among the new districts turmeric is grown to a larger extent in Nizamabad, Jagtial, Nirmal and Mahabubabad districts. (Fig 1)

Approach

The entire study was divided into three phases viz research phase, consolidation phase and reporting phase.

The first phase was research phase where in the secondary research was done by desk research of reports of Horticulture department, DASD, Spices Board, State Horticulture University, APEDA. The secondary research helped to have an overview of turmeric area and production in Telangana, recommended turmeric production practices by State Horticulture University, Infrastructure and logistic facilities available in the study districts. This has helped in production

cluster identification and scope for further infrastructure facilities to be provided in the region. This phase has also helped to gather information on market performance, price fluctuations, different value added products, export potential of different products etc. The secondary research was followed by the primary research, where in the data was captured through Focus Group Discussions (FGDs) with farmers. Further the primary data was also collected through personal interviews with Commission Agents, Aggregators, Trades, Processors, Cold storage owners in the district. To understand the production practices and processing technologies that are being adopted by the farmers, and perception of farmers towards growing turmeric as a seed crop in a cluster approach, the FGDs were conducted with the farmers.

Personal interviews were also conducted with officials of Horticulture and Agricultural Marketing departments and Turmeric Research Station, Kammarpalle to know their perception towards turmeric cultivation in the respective districts, awareness levels of farmers, quality issues, difficulties in implementation of departmental schemes, fluctuations in market prices, importance of value addition etc. Personal interviews were conducted with different actors in the value chain viz. commission agents, aggregators, trades, processors and cold storage owners to obtain data on price realization of the product at every stage of value chain, scope for further value addition, market price fluctuations etc.

During **consolidation phase** the data captured through primary and secondary research was analysed and consolidated to arrive at some conclusions and recommendations.

During **reporting phase** a draft report was prepared initially and presented to the review committee. After incorporating the suggestions of the review committee the final report was submitted to DASD.

Selection of Districts/ Mandals/ villages:

As per the study, the districts of Adilabad, Karimnagar, Nizamabad and Warangal were to be visited for field investigation and report preparation, the crux of the study. Due to the district reorganization that happened in Telangana State, the districts were selected in such a way that the major turmeric growing areas of the above mentioned districts got captured. In this process, Nizamabad area of Nizamabad district; Jagtial of Karimnagar; Nirmal of Adilabad and Mahabubabad of Warangal district emerged as the major turmeric growing areas and the same were selected for further selection of mandals and villages.

In each district 2-3 mandals having highest turmeric area were selected. Morthad, Armoor and Nandipet mandals in Nizamabad district, Korutla, Jagtial(R) and Ibrahimpatnam mandals in Jagtial district, Mamda and Laxmanchanda mandals in Nirmal district and Kesamudram and Nellikuduru mandals in Mahabubabad district were selected. In each selected mandal one village having highest turmeric area was selected. In each village one FGD was conducted in which a heterogeneous group consisting of small, marginal and big farmers were present.

Table 4: Sampling frame for the study

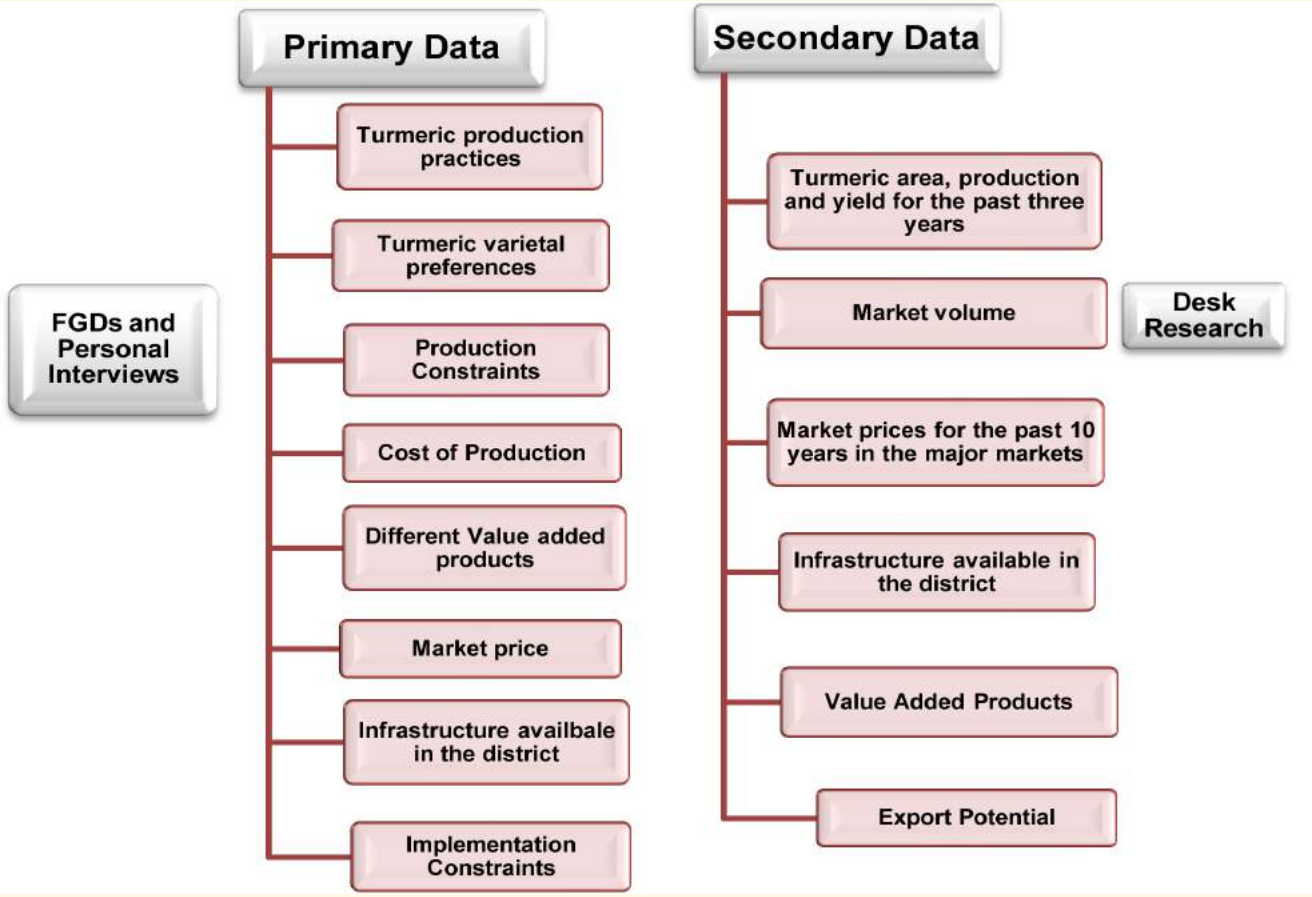
S. No	Erstwhile district	New district	Mandal	Village	No. of FGDs
1	**Nizamabad**	**Nizamabad**			
i			Morthad	Morthad	1
ii			Nandipet	Donkeshwar	1
iii			Armoor	Armoor	1
				Total	3
2	**Karimangar**	**Jagtial**			
i			Korutla	Joginipalli	1
ii			Jagtial(R)	Laxmipur	1
iii			Ibrahimpatnam	Ibrahimpatnam	1
				Total	3
3	**Adilabad**	**Nirmal**			
i			Mamada	Koritikal	1
ii			Laxmanchanda	Laxmanchanda	1
				Total	2
4	**Warangal**	**Mahabubabad**			
i			Kesamudram	Inugurthy	1
ii			Nellikuduru	Chinnamupparam	1
				Total	2
				Grand Total	10

To obtain data from farmers, other actors of value chain and officials, four separate questionnaires were prepared and were administered. These questionnaires were pretested in Naskal village, Parigi mandal of Vikarabad district to evaluate its strength and accordingly it was modified and froze for actual survey purpose. The research team from CGG along with the officials from DASD visited the villages in coordination with local Horticulture department officials. The CGG team also visited the major turmeric markets viz Nizamabad, Metpally, Warangal and Kesamudram in association with officials of marketing department and conducted personal interviews with commission agents, traders and other intermediaries. The CGG team visited Turmeric Research Station, Kammarapally to interact and validate the data especially with regard to production practices, suitability of varieties and processing technologies etc obtained in the field.

Data capturing process

The primary data obtained through FGDs was related to package of practices in turmeric cultivation, cost of production and other challenges faced at the farm level. The primary data

obtained through personal interviews of market participants and officials focused on the trends in market arrivals, issues faced in the market, infrastructure and price related aspects.



The secondary data contained in various reports of the departments provided the turmeric production details in the districts, trends in area sown, market arrivals, export potential and prices.

Data Analysis and Report Preparation

The primary information captured through FGDs and personal interviews and the data obtained through secondary research were analyzed systematically in order to achieve the objectives of the study. Production practices of turmeric that are being adopted by farmers were captured in detail and gap analysis against the recommended practices was done. Economic analysis of the produce was done to arrive at the cost of cultivation. The value chain mapping was done and role of each player in the chain was discussed with price realization in every stage. Cluster analysis was done to identify different production and seed clusters.

A detailed value chain map of the turmeric in the study areas was prepared with estimated volume of market transactions. Value addition of the turmeric including cost of production and distribution of margin along the chain has been presented.

Qualitative data of the study has been summarised and presented in a descriptive form in the report. Tables, figures and graphs are also used for the presentation of data. Triangulation and validation of the data are done to the extent possible with use of different sources including reports from government departments, publications, websites etc.

2

CHAPTER

PRODUCTION PRACTICES AND ECONOMICS OF CULTIVATION OF TURMERIC

Production Practices

In Telangana state especially in the study districts turmeric is being grown in red sandy soils locally known as Red Chalka soils. However, keeping its structure in mind farmers over several years have been adding several tonnes of tank silt which makes the soils appear as black clay loams. Duggirala locally known as Erra Guntur variety is the only variety grown in Nizamabad, Karimnagar and Adilabad districts where as in Warangal district a mix of Erraguntur, Tekurpet and local varieties are being cultivated for the past few decades. Though some improved varieties like Prathibha were tried in the past, they were not adopted by majority of the farmers as they could not perform better than the local variety. The varietal preferences and performance of different varieties will be discussed separately in the later sections of the report. Post harvest, after cleaning of the rhizomes, farmers separate good quality fingers and keep them aside for seed purpose. The seed is being heaped under shade in the field itself and covered with turmeric leaves or sometimes at their home.

A summary of package of practices currently adopted in the four study districts of Telangana against the recommended practices are presented in Table 5.

Seed and seed treatment:

On an average nine quintals of fingers having three to four buds are being used as seed material. Less than 10-15% of the farmers are adopting seed treatment since they feel that it is a laborious task. Further they think that the practice does not make a difference to the yield and it adds additional cost to already higher cost of production. In general seed treatment is done with Dithane M 45+Mancozeb which could prevent leaf spot disease to some extent. However farmers do not follow the method of treating the seed with the recommended Ridomil. Farmers find themselves helpless with the prevalence of rhizome rot as they are not able to control it, once the disease appears in the field. Further, to avoid extra cost and time, seed was being treated for a few minutes by a few farmers which also could be one of the reasons for less effectiveness of seed treatment. This needs awareness and also demonstrations to show the difference between the plots with seed treatment and with no seed treatment. This would result in increased confidence levels of the farmers and adoption of preventive methods.

Planting methods:

In general flat bed method and ridge and furrow method of sowing is being adopted. Recently the state Horticulture department has introduced and tried to popularise raised bed method. However it needs some more time for adoption because of the initial resistance of farmers to adopt new technology and less availability of proper farm machinery to make raised beds. During May, the land is prepared and immediately after onset of monsoons sowing is started. In general sowing will start from June 2nd week and close by last week of June or first week of July. Inter cropping with maize is a common practice in the state. However different ratios are being

practiced such as 1:1, 1:2, 1: 3 either as a pure row or a mixed row (maize and turmeric). Basically maize is grown as an intercrop to provide shade to turmeric as the crop needs shade in the initial three months period. Further it also has some complementary effect and yields about 10-12 Q/ac which is an additional income to the farmer. Therefore no exclusive management practices are adopted for maize. However by keeping the maize yields in mind, farmers are applying fertilizers of a slightly higher dose than the recommended in a few parts of the state. A spacing of 15X30, 15X45 and 15X15 cm is being adopted across the state. Most farmers prefer to go for a dense planting to avoid weeds and with an assumption of reaping higher yields. This attitude also makes the farmers difficult to shift from conventional method to raised bed method where a paired row with wider spacing of 15X60 cm is recommended. The early adopted farmers have drawn a conclusion that the yields have not been compensated in the thinly populated raised bed method compared to the conventional method.

Manures and Fertilizers:

To improve the soil fertility, several tonnes of farm yard manure or poultry manure is being added to turmeric fields every alternate year. Crop rotation is being followed in all the study districts. In Nizamabad, Karimnagar districts, maize is being grown in the same piece of land in the succeeding year where turmeric was grown in the preceding year. In Adilabad and Warangal districts cotton and maize crops follow in the succeeding year. After harvest of turmeric at the end of seventh month, bajra or gingelly (sesamum) are being grown as a second crop in the districts of Nizamabad, Karimnagar and Adilabad. In Warangal district only one crop i.e. turmeric is being grown in a year.

For calculation of economics, only one third of FYM or tank silt added to turmeric crop is considered in Nizamabad, Karimnagar and Adilabad districts since in the first year three crops are raised and in the second year two crops are raised. In Warangal district half of the FYM or tank silt added to turmeric is considered since only one crop in the first year and two crops in the second year are being raised. Most of the farmers believe that FYM addition impacts soil fertility and subsequently growth and yield of turmeric. FYM, though it is not available with most of the farmers, is being sourced from nearby places. In case of poultry manure, farmers source it from poultry farms close to Hyderabad which increases the cost of production. However the quantum of FYM added to the soil depends on availability of the material and affordability of the farmers. In Nizamabad, Karimnagar and Adilabad districts approximately 20 MT and in Warangal district 10 MT of FYM is being added. In Nizamabad belt tank silt is being transported from Pochampadu reservoir which is about 30 km away. Most farmers apply fertilizers as per the recommended dose only. In Nizamabad and Adilabad area 12-32-16 (Baraah Battees Solah) complex fertilizer is used, in Karimnagar district mostly DAP is being used, where as in Warangal district farmers are slowly shifting towards SSP. Neem cake and $ZnSo_4$ are not widely applied in the state. Availability of fertilizers is not an issue and they are available in sufficient quantity, spatially and temporally. However availability of quality neem cake in the open market limits its usage.

Irrigation:

About 50 percent of total turmeric area in the state is cultivated with drip irrigation (Table 6). Drip irrigation is prominent in Nizamabad, Karimnagar and Adilabad districts whereas in Warangal district the adoption of drip irrigation is very low. Most of the turmeric farmers in Nizamabad, Karimnagar and Adilabad adopted drip irrigation method whereas in Warangal district it is not. In the drip irrigated fields farmers practise fertigation with Urea and MOP. However, usage of liquid

fertilizers is not popular as they are costlier than the solid fertilizers. Farmers do not understand the economics of liquid fertilizers vis-à-vis solid fertilizers and their efficiencies. In general 40 irrigations are given through the drip system where as in flat bed or furrow method approximately 35 irrigations are being given in the entire season. However, the frequency of irrigation changes depending on the soil type and rainfall distribution.

Weed Control:

Mostly manual weeding is done 4-5 times. In a few districts Atrazine is being used as a pre emergence herbicide. Since maize is grown as an intercrop, no selective herbicide is recommended as post emergence herbicide. However, labour shortage during peak season; high wage rates force farmers to incur approximately 9% of total cost of production towards weed control.

Plant Protection:

Leaf blotch (locally called as Marraku tegulu) and rhizome rot are predominant in the entire study area. Rhizome fly is also observed to some extent. In low lying areas where water stagnates for longer periods or during the periods when there is continuous rain for more than 10-15 days, the crop cannot escape rhizome rot. To avoid this problem, raised bed method is recommended.

Harvesting:

Farmers in Nizamabad, Karimnagar and Adilabad districts go for a short duration crop like bajra or sesamum, after early harvest of turmeric in February. Erra Guntur variety is the only variety grown in this area which has a crop duration of 240 days. However, the harvesting starts by the end of 200-210 days. Early harvesting might lead to reduced curcumin content. Since the crop is harvested early, the leaves are still green and fresh and need to be cut at the base of the plant. Later with the help of a hand tool called *konki*, the rhizomes are dug out from the soil. In Warangal district the crop is harvested after its full maturity of 8 months. Hence the dried leaves are burnt and the soil is ploughed to dig out the rhizomes. This is one of the significant differences observed between Nizamabad region and Warangal region. The dug out rhizomes are cleaned and separated manually. This is one of the most laborious, time consuming processes which warrant some mechanical intervention. This operation alone contributes to 10% of total cost of production.

Processing:

The primary processing done at farmers level involve three operations viz. Boiling, Drying and Polishing. In Nizamabad, Karimnagar and Adilabad areas steam boiling is done using tractor mounted steam boilers, where as in Warangal district still farmers are practicing conventional methods of pan (kadai) boiling. However in both the methods huge quantities of firewood is required. Generally farmers cut the trees on the field bunds if available, or purchase firewood from the market for boiling. This type of boiling practice is causing loss of green cover. In other terms this practice is violating the basic objective of **Harithaharam**, a prestigious programme of the state government which aims to improve the forest cover from existing 24% to 33%. Instead of steam boilers, electrical boilers should be popularised. In Warangal district farmers are still using pan method (Kadai) of boiling where boiling is not uniform and results in poor quality turmeric.

Table 5: Summary of Package of Practices observed in Study Area

S.No	Item	Recommended practice	Observed Practice			
			Nizamabad	Karimnagar	Adilabad	Warangal
1	Most suitable soils	Clay loam to sandy clay loam soils	Red sandy loams	Red sandy loams	Red sandy loams	Red sandy loams
2	Land preparation	5-6 times (Mold Board plough, Rotavator, Cultivator)	5	5	5	5
3	Seed rate(Q/ac)	Mother Rhizome-8-10 Fingers-6-8	8	9	10	10
4	Varieties	Duggirala, ACC.No.48 (IISR Pragathii-48), Acc No.79, NDH-8, NDH-98, Rajapuri, Rajendra Sonia, Rajendra Sonali, Waigon	Erra Guntur	Erra Guntur	Erra Guntur	Erra Gun-tur,Tekurpet, Local
5	Seed Treatment	With Ridomil	<15%	<10%	<10%	<10%
6	Type of Rhizome as seed	Mother Rhizome / Primary Rhizome	Finger	Finger	Finger	Finger
7	Seed material	Two budded	3-4 budded	3-4 budded	3-4 budded	3-4 budded
8	Time of planting (month)	May end to July 1st week	June 2nd week to July 1st week	June 2nd week to July 1st week	June 2nd week to July 1st week	June 2nd week to July 1st week
9	Method of planting	4 rows Raised bed / Ridges & Fur-row method	Flat Bed and Ridges and Fur-rows	Flat Bed and Ridges and Furrows	Flat Bed and Ridges and Furrows	Mostly Flat Bed
10	**Organic matter and Fertilizers**					
a	FYM*	10MT/Ha	23	19	20	10

S.No	Item	Recommended practice	Observed Practice			
			Nizamabad	Karimnagar	Adilabad	Warangal
b	Tank silt*	10MT/Ha	70	150	50	120
c	Fertilizer Type and Qty (kg/ac)					
i	Neem cake	400	0	0	100	225
ii	$ZnSo_4$	10	7	0	10	10
iii	SSP	150 (12-32-16)	133 (DAP)	150 (DAP)	75 (DAP)	200 (SSP)
iv	Urea	150	83	50	100	125
v	MoP	75	67	50	75	75
d	Method of application of Fertilizer	Place near base of the plant	Place near base of the plant. Most of the drip users, follows fertigation	Place near base of the plant. Most of the drip users, follows fertigation	Place near base of the plant. Most of the drip users, follows fertigation	Place near base of the plant
11	**Irrigation**					
a	Method	Furrow / Drip	Mostly Drip	Mostly Drip	Moderately Drip	Sparsely Drip
b	Frequency(No)					
i	Light soils	36 (for every7-8 days)	30 (Furrow)	-	20 (Furrow)	40
ii	Heavy soils	21 (for every 10-15days	-	-	-	-
iii		Drip (Twice a day for 30min)	40	40	40	
12	**Pesticides and Fungicides**					
a	Incidence of Common pests &Pesticides used	Rhizome fly- Dimethioate @ 0.2% Profenofos @ o.2% spray Carbofuran 3G @ 10 kg per acre Neem cake @ 100 kgs per acre	Sporadic-Carbofuran 3G/4G	Sporadic-Carbofuran 3G/4G	Sporadic-Carbofuran 3G/4G	Sporadic -Carbofuran 3G/4G

S.No	Item	Recommended practice	Observed Practice			
			Nizamabad	**Karimnagar**	**Adilabad**	**Warangal**
b	Incidence of Common diseases & Fungicides used	Taphrina leaf blotch-- Propiconazole @ 0.1% or Mancozeb @ 0.25% or Thiophanate methyl @ 0.1% Carbendazim @ 0.1%	Severe - Carbendizm + Mancozeb Mancozeb + Bavistin	Severe - Carbendizm + Mancozeb Mancozeb + Bavistin	Severe - Carbendizm + Mancozeb Mancozeb + Bavistin	Severe - Propiconazole
c		Anthracnose (Colletotrichum capsici) leaf spot-- Bordeaux mixture @ 1% Zineb @ 0.3% Carbendazim @0.1% Propiconazole @ 0.1%	-	-	-	-
d		Rhizome rot: (Pythium aphanidematum) -- Drenching with Ridomyl MZ @o.3% COC @0.25% Carbendazim @ 0.1%	Severe - Copper Oxychloride	Severe -	Severe -	Severe -
e	No. of Sprays		2	2	2	3
13	**Weeding**					
i	Manual (No)	5-7 times	5	5	4	4
ii	Chemical (No of sprays)	2	Rarely	Rarely	Rarely	Very rare
iii	Weedicides used	1. Glyphosate-at the time of land preparation 2. Atrazine 1DAS	Atrazine	Atrazine	Atrazine	Atrazine
14	**Harvesting**					
a	Indices and duration after sowing	Yellowing, Lodging and Tip Drying of leaves (7-9 months as per variety)	From 7 month onwards	From 7 month onwards	From 7 month onwards	After completion of 8 th month

S.No	Item	Recommended practice	Observed Practice			
			Nizamabad	**Karimnagar**	**Adilabad**	**Warangal**
b	Manual (or)	-	Digging with a hand implement i.e. Konki	Digging with a hand implement i.e. Konki	Digging with a hand implement i.e. Konki	Ploughing
c	Mechanical	Power tiller-For Ridges and Furrow method Tractor - Raised Bed method	-	-	-	-
d	Time (Month)	Feb to March	Start by Jan 2nd week	Start by Jan 2nd week	Start by Jan 2nd week	Start by 2nd week of March
15	**Processing**					
	Cleaning & Separation	With water under pressure	Manual cleaning and separation of bulb and fingers	Manual cleaning and separation of bulb and fingers	Manual cleaning and separation of bulb and fingers	Manual cleaning and separation of bulb and fingers
	Boiling	Steam or Electrical Boilers	Steam Boilers	Steam Boilers	Steam Boilers	Pan method
	Drying	Drying Platforms Solar Dying	Mostly drying on mud platforms. Cement platforms also used to some extent	Mostly drying on mud platforms. Cement platforms also used to some extent	Mostly drying on mud platforms. Cement plat-forms also used to some extent	Mostly drying on mud platforms. Cement platforms also used to some extent
	Polishing	Hand operated or Power operated drums/barrels	Power operate Polishers	Power operate Polishers	Power operate Polishers	Maize shellers or locally made drums are used
	Grading	Nil	Nil	Nil	Nil	Nil
	Packing	Polythene sheet contained gunny bags	Ordinary gunny bags	Ordinary gunny bags	Ordinary gunny bags	Ordinary gunny bags
	Storage	Malathion or Ethylene di bromide fumigated godowns	Very rarely stored	Very rarely stored	Very rarely stored	Very rarely stored

Institutional Support

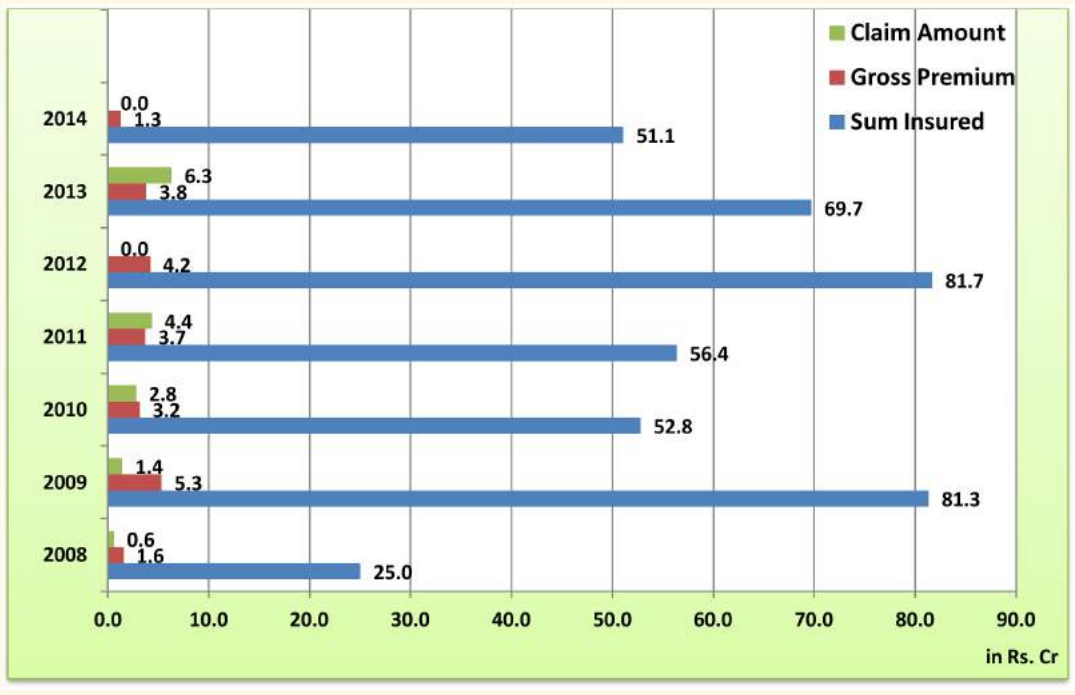
i) Credit

Credit through banks is the major source of institutional credit for farmers who were part of the FGDs conducted across the state. The current scale of finance for turmeric is pegged at an upper limit of Rs. 55,000 (Fifty five thousand rupees) per acre. During the FGDs most farmers did not express any concern about the scale of finance being low. This could be attributed to the allocation of farm credit available to a limit of one lakh rupees without mortgage of the cultivated land for different crops. The institutional credit obtained could have been utilized for turmeric after making lesser allocations for crops like paddy, maize.

ii) Crop Insurance

Currently turmeric crop is notified under mandal unit of crop insurance. The premium for turmeric crop is 5% of sum insured or actuarial rate, whichever is less. Currently the following rates of insurance premium are applicable for turmeric (commercial annual) in the districts provided in conjunction. [1]

S.No	Insurance Cluster	District	Applicable premium rate (%))
1	II	Nizamabad	1.50
2	III	Jagtial	2.44
3	IV	Warangal (R)	2.05
4	V	Vikarabad	1.50
5	VI	Mahabubabad	1.50



Source: AIC of India Ltd, Hyderabad

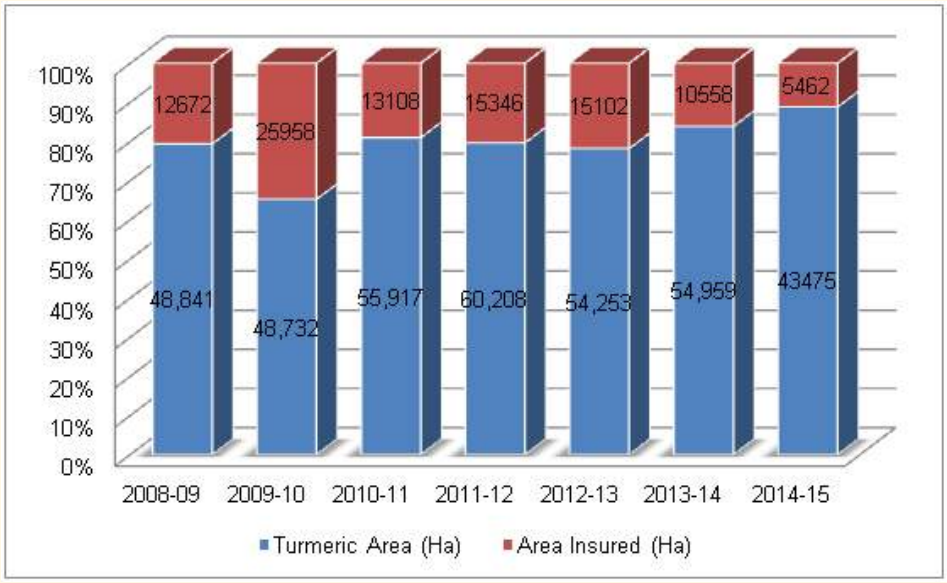
Fig 2: Turmeric Crop Insurance Trends in Telangana

[1] G.O.RT.No. 309, Agriculture & Co-operation (Agri-II) Department, dated: 08-06-2017

Analysis of the crop insurance data for turmeric for the years 2008-2014 reveal that the claims were settled for all the years except 2012 & 2014. However, the claim settled amount against the sum insured was always less than 9% in these years. This could probably be one reason for the discontent among farmers regarding crop insurance for turmeric (Annexure- I).

The gross premium paid against the sum insured has decreased during these years. This can be attributed to the rationalization of insurance premium costs over the years. The rise in sum insured could be due to compulsory linkage of farm insurance for farmers who avail institutional credit coupled with the increase in scale of finance during this period (Fig 2).

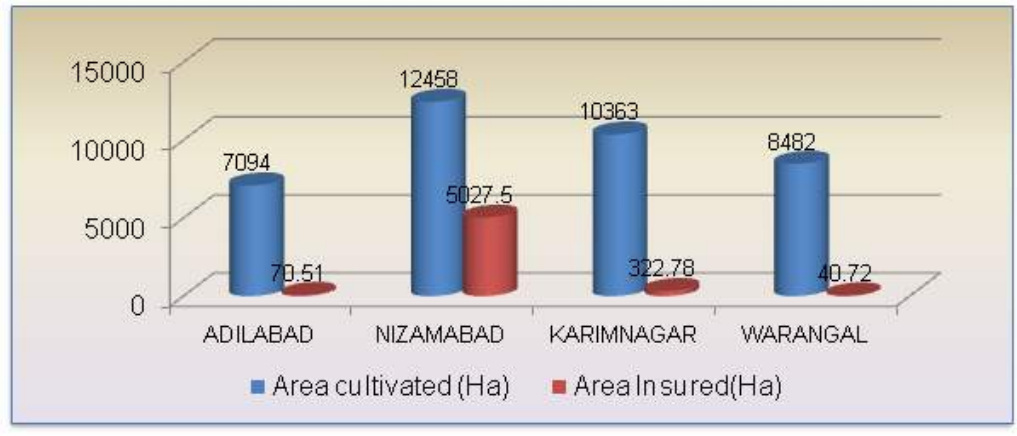
Turmeric acreage and area insured show a similar growth trend during the years 2008-14. However, there is a spike in the area insured during 2009-10, probably buoyed by the claims settled during 2008 and 2009 years. There could be other factors which could have caused this sudden spurt. The declining turmeric acreage since 2012 is matched by the declining coverage under insurance (Fig 3).



Source: AIC of India Ltd, Hyderabad

Fig 3: Trends in Turmeric Area Covered under Crop Insurance in Telangana

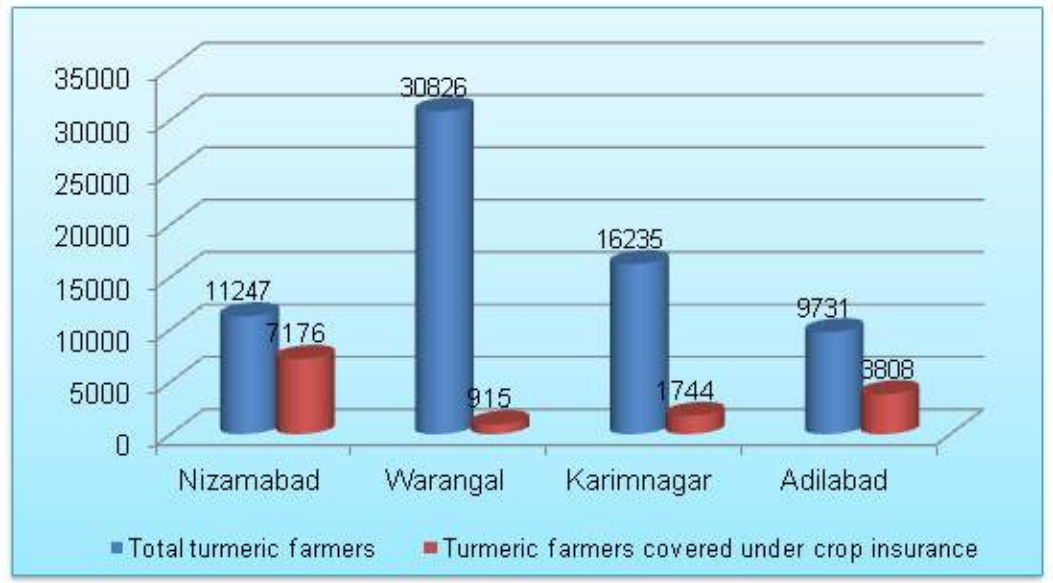
In the study districts, except Nizamabad the coverage of insurance against the cultivated turmeric area is very low. This can be attributed to access to institutional credit and awareness among farmers in Nizamabad. This can be attributed to higher than normal subscription of crop insurance by non loanee farmers (Fig 4).



Source: AIC of India Ltd, Hyderabad

Fig 4: Area cultivated vs Area Insured in study districts in 2014-15

The average number of farmers who have subscribed to insurance of the years 2008 to 2014 against the total number of turmeric farmers is projected in the graph below. Nizamabad has better farmer participation in crop insurance for turmeric. The relative better participation of Adilabad farmers could be attributed to smaller landholdings in this district (Fig 5) (Annexure - II to V).



Source: AIC of India Ltd, Hyderabad

Fig 5: Turmeric Farmers covered under Crop Insurance in study area

The other major concern of the farmers regarding crop insurance is that there is no transparency in premium paid. Farmers are not obtaining any receipts for the premium that is being deducted from their loan amount and paid to insurance company which makes them suspicious about the procedures and on the overall scheme. The guidelines are clearly indicated that account wise the bankers should display premium amount paid in the respective bank branches. But many of the farmers during the Focus Group Discussions complained that it is not happening in the field.

The unit of insurance is mandal in which the crop cutting experiments will be done on an average 10 per mandal which is very crucial to determine the yield. In the recent past due to climate change lot of variations are being observed in rainfall pattern among different villages within the mandal also. Because of these variations in rainfall, even within a limited area of 5-10 km, the yields recorded among the villages also vary significantly. But these variations are not taken into consideration while adopting the mandal as one insurance unit. Farmers opined that if the unit of insurance make as village instead of mandal it would serve them better.

Further it was observed during FGDs that many times the local calamities have not taken into consideration while determining the yield of a particular village or location. For example breaching of a tank caused enormous damage to the turmeric crop in villages like Donkeshwar in Nandipet mandal of Nizamabad district, but it was ignored while assessing the claim. These are a few factors that limit the farmer's enthusiasm towards crop insurance scheme, but it is not specific to turmeric, same is the case with other crops.

iii) Farmer Producer Organization (FPO)

It was observed that there is no Farmer Producer Organizations (FPOs) operating in the study area and the concept of Producer Organization (PO) was not known to many farmers. During the discussions with the farmers it became evident that awareness about FPOs and their functioning is almost nil. Farmers expressed interest in the concept of FPOs and the potential

benefits that can be harnessed. However, a little hand holding by local development agencies and NABARD would help turmeric farmers to aggregate their small scale of operations to attain economies of scale particularly in operations such as sowing, weed control, harvesting and primary processing. Further Small Farmers Agribusiness Consortium (SFAC) operates a Credit Guarantee Fund to mitigate credit risks of financial institutions which lend to the Farmers Producer Companies (FPCs) without collateral. This helps the FPCs (a form of PO) to access credit from mainstream financial institutions for establishing and operating businesses. Credit support would be available for business activities and creation of assets like building, machinery, equipment, specially designed vehicles for transportation etc. and/or working capital requirements including administrative and other recurring costs as part of the project.

Government Support for Turmeric Cultivation

Under Micro Irrigation Project, government has given priority to drip irrigation by providing more than 80% subsidy on unit cost. Under MIDH, the state Horticulture Department is providing support to Bed Raisers to encourage raised bed method. Further, to enhance the drying efficiency and obtain quality produce, tarpaulins are also being supplied. However, farmers are not interested to use tarpaulins for drying purpose as the moisture adhering to the tarpaulin sheet does not escape easily which causes mould infestation and deteriorates the quality of turmeric. Further the department also encourage by supplying Boiling machines, Polishers and Transplanters to reduce cost of production and also to improve quality of the produce. Government is also trying to popularise high curcumin varieties like PTS-10 and Salem. (Table 6)

Table 6: Technology Adoption in Turmeric in Telangana

S. No	Erstwhile district	New district	Area under Drip irrigation (Ha)	Area under raised Bed method(Ha)	Area under new varieties (Ha)
1	Nizamabad	Nizamabad	12276	228	172
2	Karimnagar	Jagtial	6532	49	NA
3	Adilabad	Nirmal	2180	104	NA
4	Warangal	Warangal	192	17	105
		Mahabubabad	108	28	54
		Jayashankar Bhoopalpally	NA	100	70
		Warangal Sub total	300	145	229
	Grand Total		**21288**	**672**	**631**

Source: Department of Horticulture, GoTS *NA-Not Available*

Initiatives of Govt. of Telangana for Promotion of Turmeric

Spice Park

To encourage turmeric growers of Nizamabad belt to make export oriented value added products and to withstand the fluctuations in prices, Govt of Telangana proposed a spice park in Nizamabad district. The basic objective of the spice park is to provide common infrastructure facilities for both post-harvest and processing operations of turmeric, which also aims at backward integration by providing rural employment. Turmeric Spice Park at Nizamabad is expected to have processing facilities at par with international standards in which the produces could undergo cleaning, grading, sorting, grinding, packing, warehousing etc. Apart from the above facilities, common infrastructure facilities like Roads, Water supply system, Power stations, Firefighting & Control systems, Weighing bridges, effluent Treatment Plants, Quality Lab for checking basic parameters, Bank & Post office counters, Restaurant, Business centers, Guest house etc. are to be developed for value addition close to production centres and enable farmers realize better price.

GoI has approved to extend technical support for establishment of Spice Park at Nizamabad for turmeric if land and funds are provided by the State. Accordingly, Govt of Telangana has issued GO. Ms No 143, Agriculture and Cooperation (Horti & Seri) Department dated 18 May, 2015 to allot-39.38 acres at Padgal Village of Vailpoor (Mandal), Nizamabad District.

Formation of Farmers Producer Organization (FPO) would help farmers come together for marketing of the turmeric powder by utilizing the facilities in Spice Park. Effective branding of turmeric by farmers helps in making the local product stand out and realize a better price. This will also help in preventing the adulterated product reaching the market because of availability of quality product with proper labelling and packing. Bulk packs can be marketed through an outlet in the Spice Park to cater to the needs of wholesale traders and institutional consumers such as hostels and hotels.

Spice Processing Unit

Traditional Indian cuisine mainly depends on turmeric powder, chilli powder, ginger and garlic paste and occupy an important place in each household. However the hazards due to adulteration of these products pose a serious problem to consumers. On the other hand, farmers are not able to get remunerative prices for these products due to wide price fluctuations. With an objective of supplying unadulterated quality food products to consumer providing remunerative prices to turmeric and chilli farmers, a spice processing unit is being established at Dulapally village, Quthbullarpur Mandal, Ranga Reddy district in an area of 15.56 acres by Telangana State Horticulture Development Corporation Limited (TSHDCL). Central Food Technology Research Institute (CFTRI), Mysore is providing technical support for establishment of this unit.

Economics of Turmeric Cultivation:

Most farmers cultivate turmeric with a commercial approach and try to combine traditional practices with modern and scientific recommendations. It is to be noted that farmers adopt practices strictly based on the benefit cost ratio, which have been imbibed through years of cultivation experience. This has been observed particularly in Nizmabad, Nirmal and Jagtial districts which are contiguous. It is to be assumed that the similarity in adopted practices could be due to

interaction among the farmers of these districts and proximity to common market, Nizamabad AMC. The cultivation of turmeric crop for seven months followed by a short duration crop during March-June months in Nizamabad, one such practice which initially might be surprising. However, farmers believe this as a portfolio rationalization and try to recoup any losses in turmeric with short duration crop such as sesamum/bajra/tomato. Even though it is argued that the potential yield is not realized, farmers stick to this template and try to market the produce as early as possible during February-March months. The cost of seed from the previous crop has been captured in the calculations. However, the opportunity cost of land in case of lease out has been deliberately not included in the costs. In case, imputed cost of land is to be added, an amount of Rs.10,000/- per acre has to be added to cost of cultivation.

Cost of Production of Turmeric in Nizamabad district

A summary cost of production for fresh/wet and dry turmeric in Nizamabad district is presented in Table 7 based on detailed discussions with groups of farmers in three mandals. The cost of one quintal (100 Kg) of fresh turmeric production comes to Rs.759 and of dry turmeric is Rs.4641.

Distribution of Costs

The distribution of major summary costs has been depicted in the pie chart (Fig.6) below. In Nizamabad district, manures and tank silt constitute 26% of the expenditure, followed by 16% for seed material and 15% towards primary processing.

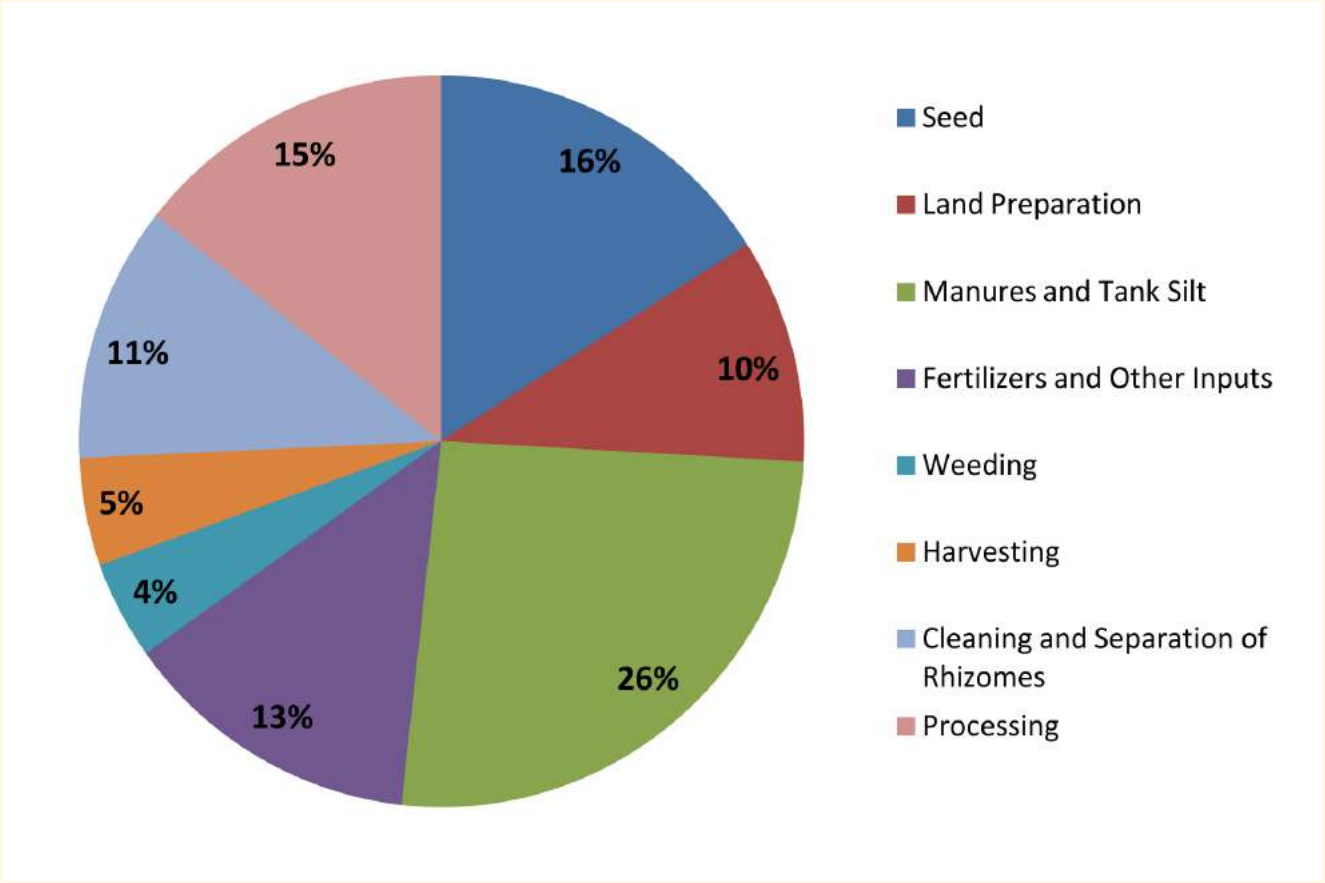


Fig 6: Distribution of costs in Nizamabad for turmeric cultivation

Source: Field study 2017

Table 7: Cost of Production of Turmeric in Nizamabad district

S.No	Item	Quantity	Unit	Rate per unit (Rs)	Total cost (Rs)
I	**Inputs**				
A	Seed	8	Quintal	2146	17167
B	Farm machinery for land preparation	10	Hours	866	8367
C	Manures	23	MT	515	11667
D	Tank Silt	70	MT	110	7667
E	Fertilizers	360	Kg		5779
F	Weedicides				117
G	Plant protection chemicals (Granules + Spray chemical)				2333
	Subtotal				**53096**
II	**Labour**				
A	Sowing	8	man-days	276	2300
B	Manures and Fertilizers	1	man-days	250	333
C	Weeding	23	man-days	200	4667
D	Plant protection	2	man-days	250	500
E	Irrigation	20	man-days	267	5333
F	Harvesting	11	man-days	31	333
G	Cleaning and separation of Rhizomes	37	man-days	326	12167
	Sub Total				**30417**
	COC for wet turmeric	**(I+II)**			**83513**
III	**Processing**				
A	Boiling	30	Drums	170	5100
	Firewood for boiling	10		333	3333
B	Drying	8	man-days	324	2700
C	Polishing	22	Quintal	114	2500
D	Transport to market	22	Quintal	85	1867
	Sub Total				**15500**
	Grand Total	**(I+II+III)**			**99013**
	Wet Yield (Q)				**110**
	Dry Yield (Q)				**22**
	COC (Wet) (Rs / Q)				**759**
	COP (Dry) (Rs / Q)				**4641**

Source: Field study 2017

Cost of Production of Turmeric in Adilabad district

A summary cost of production for fresh/wet and dry turmeric in Adilabad district is presented in Table 8 based on detailed discussions with groups of farmers in two mandals. The cost of one quintal (100 Kg) of fresh turmeric production comes to Rs.782 and of dry turmeric is Rs.4509. The costs of production are in line with that of Nizamabad district.

Distribution of Costs

The distribution of major summary costs has been depicted in the pie chart (Fig 7) below. In Adilabad district, manures and tank silt constitute 24% of the expenditure, followed by 13% each for land preparation and primary processing.

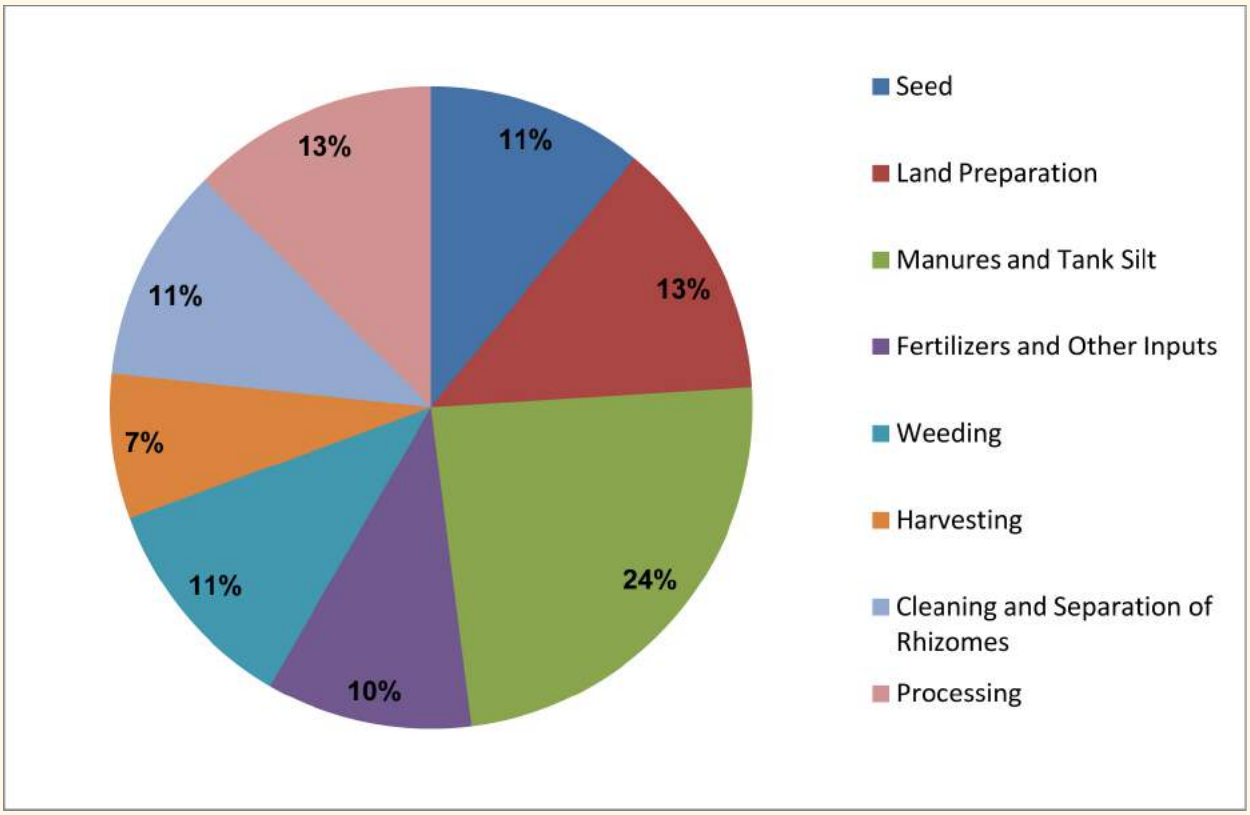


Fig 7: Distribution of costs in Adilabad for turmeric cultivation

Source: Field study 2017

Table 8: Cost of Production of Turmeric in Adilabad district

S.No	Item	Quantity	Unit	Rate per unit (Rs)	Total cost (Rs)
I	**Inputs**				
A	Seed	10	Quintal	1200	12000
B	Farm machinery for land preparation	12	Hours	929	11150
C	Manures	20	MT	425	8500
D	Tank Silt	150	MT	73	11000
E	Fertilizers	360	Kg		5175
F	Weedicide				525
G	Plant protection chemicals (Granules + Spray chemical)				2250
	Subtotal				**50600**
II	**Labour**				
A	Sowing	15	man-days	217	3250
B	Manures and Fertilizers				
C	Weeding	61	man-days	201	12150
D	Plant protection	1	man-days	450	450
E	Irrigation	29	man-days	103	3000
F	Harvesting	30	man-days	267	8000
G	Cleaning and separation of Rhizomes	40	man-days	298	11900
	Sub Total				**39350**
	COC for wet turmeric	**(I+II)**			**89950**
III	**Processing**				
A	Boiling	30	Drums	180	5400
B	Firewood for boiling				2250
C	Drying	15	man-days	100	1500
D	Polishing	23	Quintal	100	2300
E	Transport to market	23	Quintal	100	2300
	Sub Total				**13750**
	Grand Total				**103700**
	Wet Yield (Q)				**115**
	Dry Yield (Q)				**23**
	COC / Q (Wet)				**782**
	COP / Q (Dry)				**4509**

Source: Field study 2017

Cost of Production of Turmeric in Karimnagar district

A summary cost of production for fresh/wet and dry turmeric in Karimnagar district is presented in Table 9 based on detailed discussions with groups of farmers in three mandals. The cost of one quintal (100 Kg) of fresh turmeric production comes to Rs.899 and of dry turmeric is Rs.5512.

Distribution of Costs

The distribution of major summary costs has been depicted in the pie chart (Fig 8) below . In Karimnagar district, manures and tank silt constitute 22% of the expenditure, followed by primary processing (16%) and 12% each by seed material and fertilizers and other inputs.

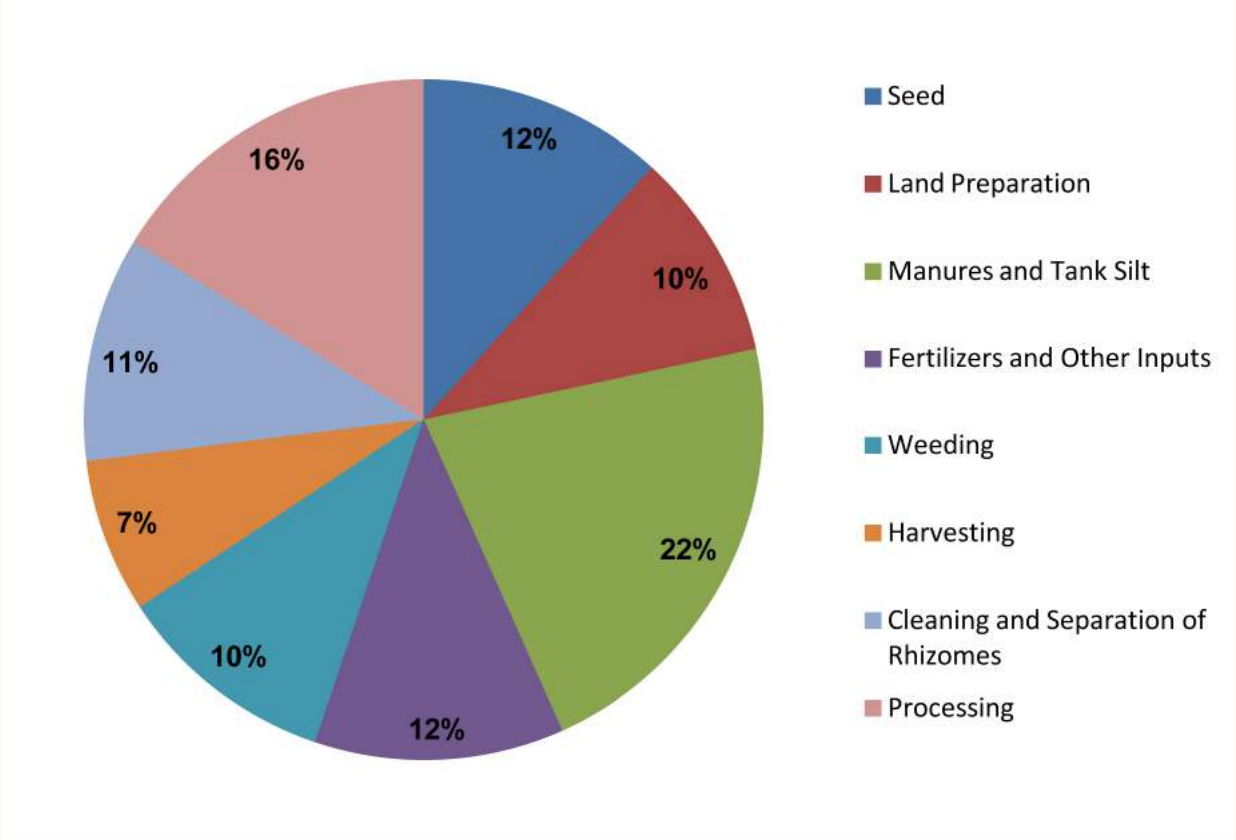


Fig 8: Distribution of costs in Karimnagar for turmeric cultivation

Source: Field study 2017

Table 9: Cost of Production of Turmeric in Karimnagar district

S.No	Item	Quantity	Unit	Rate per unit (Rs)	Total cost (Rs)
I	**Inputs**				
A	Seed	9	Quintal	1500	14000
B	Farm machinery for land preparation	9	Hours	1068	9433
C	Manures	19	MT	586	11333
D	Tank Silt	50	MT	35	1767
E	Fertilizers	283	Kg		4183
F	Weedicide				350
G	Plant protection chemicals (Granules +Spray chemical)				1967
	Sub Total				**43033**
II	**Labour**				
A	Sowing	9	man-days	257	2400
B	Manures and Fertilizers	1		250	333
C	Weeding	58	man-days	218	12583
D	Plant protection	2	man-days	400	667
E	Irrigation	13	man-days	500	6667
F	Harvesting	23	man-days	385	8733
G	Cleaning and separation of Rhizomes	46	man-days	280	12783
	Sub Total				**44167**
	COC for wet turmeric				**87200**
III	**Processing**				
A	Boiling	30	Drums	160	4750
	Firewood for boiling			0	3500
B	Drying	17	man-days	253	4400
C	Polishing	19	Quintal	168	3250
D	Transport to market	19	Quintal	181	3467
	Sub Total				**19367**
	Grand Total				**106567**
	Wet Yield (Q)				**95**
	Dry Yield (Q)				**19**
	COC / Q (Wet)				**899**
	COP / Q (Dry)				**5512**

Source: Field study 2017

Cost of Production of Turmeric in Warangal district

A summary cost of production for fresh/wet and dry turmeric in Warangal district is presented in Table 10 based on detailed discussions with groups of farmers in two mandals. The cost of one quintal (100 Kg) of fresh turmeric production comes to Rs.899 and of dry turmeric is Rs.5147. The higher costs of production in comparison to Nizamabad can be attributed to the nine months crop duration practised in Kesamudram area of Warangal district.

Distribution of Costs

The distribution of major summary costs has been depicted in the pie chart (Fig 9) below. In Warangal district, manures and tank silt constitute 28% of the expenditure, followed by seed material (21%) and fertilizers and other inputs (13%).

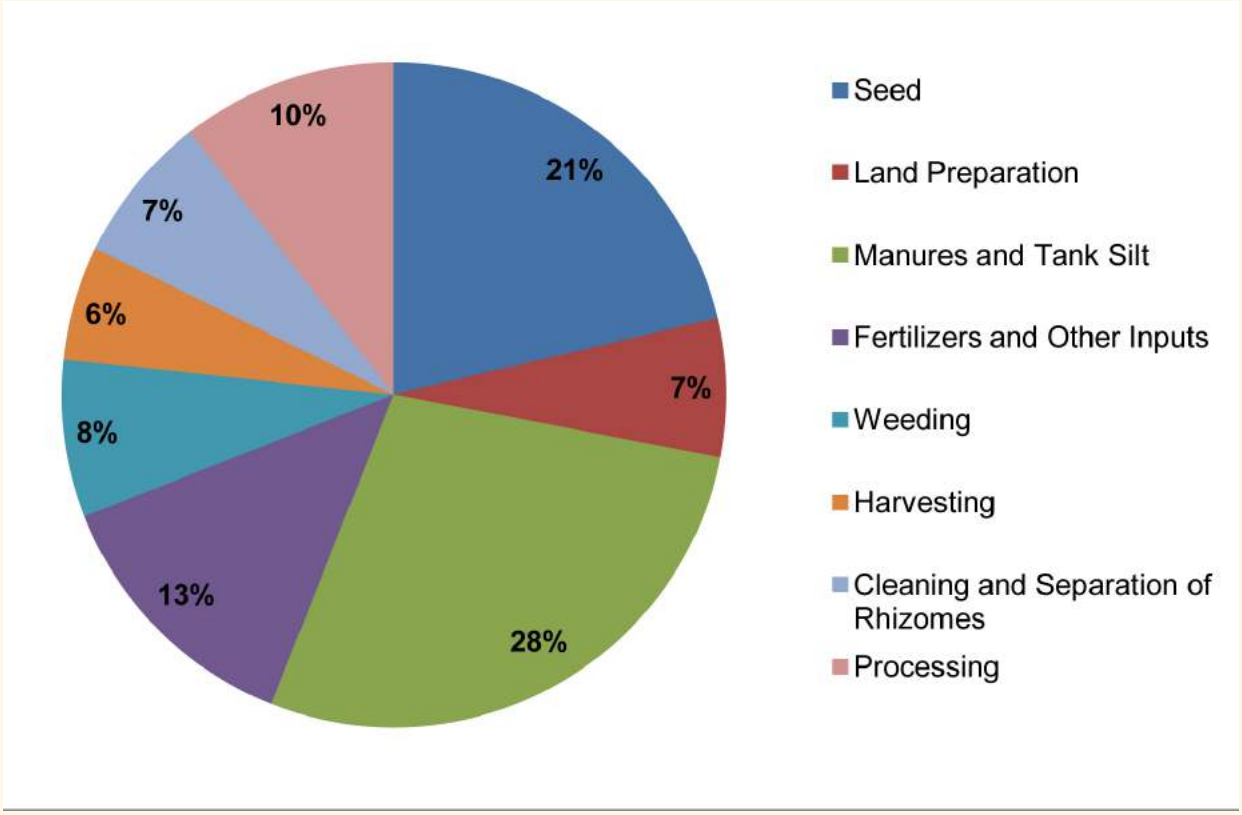


Fig 9: Distribution of costs in Warangal for turmeric cultivation

Source: Field study 2017

Table 10: Cost of Production of Turmeric in Warangal district

S.No	Item	Quantity	Unit	Rate per unit (Rs)	Total cost (Rs)
I	**Inputs**				
A	Seed	10	Quintal	2500	25000
B	Farm machinery for land preparation	10	hours	640	6400
C	Manures	10	MT	825	8250
D	Tank Silt	120	MT	42	5000
E	Fertilizers	535	Kg		5100
F	Weedicides				
G	Plant protection chemicals (Granules + Spray chemical)				3650
	Subtotal				**53400**
II	**Labour**				
A	Sowing	10	man-days	150	1500
B	Manures and Fertilizers		man-days		0
C	Weeding	52.5	man-days	171	9000
D	Plant protection	2.5	man-days	220	550
E	Irrigation	22.5	man-days	267	6000
F	Harvesting		man-days		6500
G	Cleaning and separation of Rhizomes	35	man-days	243	8500
	Sub Total				**32050**
	COC for wet turmeric	**(I+II)**			**85450**
III	**Processing**				0
A	Boiling	35	Drums	121	4250
B	Firewood for boiling			200	1750
C	Drying	17.5	man-days	79	3500
D	Polishing	19	Quintal	71	1500
E	Transport to market	19	Quintal	73	1350
	Sub Total				**12350**
	Grand Total	**(I+II+III)**			**97800**
	Wet Yield(Q)				**95**
	Dry Yield (Q)				**19**
	COC (Wet) (Rs/Q)				**899**
	COP (Dry) (Rs/Q)				**5147**

Source: Field study 2017

Average Cost of Production of Turmeric in Telangana State

A summary of average costs of production for fresh/wet and dry turmeric in Telangana State is presented in Table 11 based on cost of production arrived from the FGDs in the four districts of the study area. The average cost of one quintal (100 Kg) of fresh turmeric production comes to Rs.824 and of dry turmeric is Rs.4885 in Telangana State.

Distribution of Costs

The distribution of major summary costs has been depicted in the pie chart (Fig 10) below. In Telangana State, manures and tank silt constitute 25% of the expenditure, followed by seed material (15%) and 13% for primary processing. Together these three components account for more than half of the cost of production.

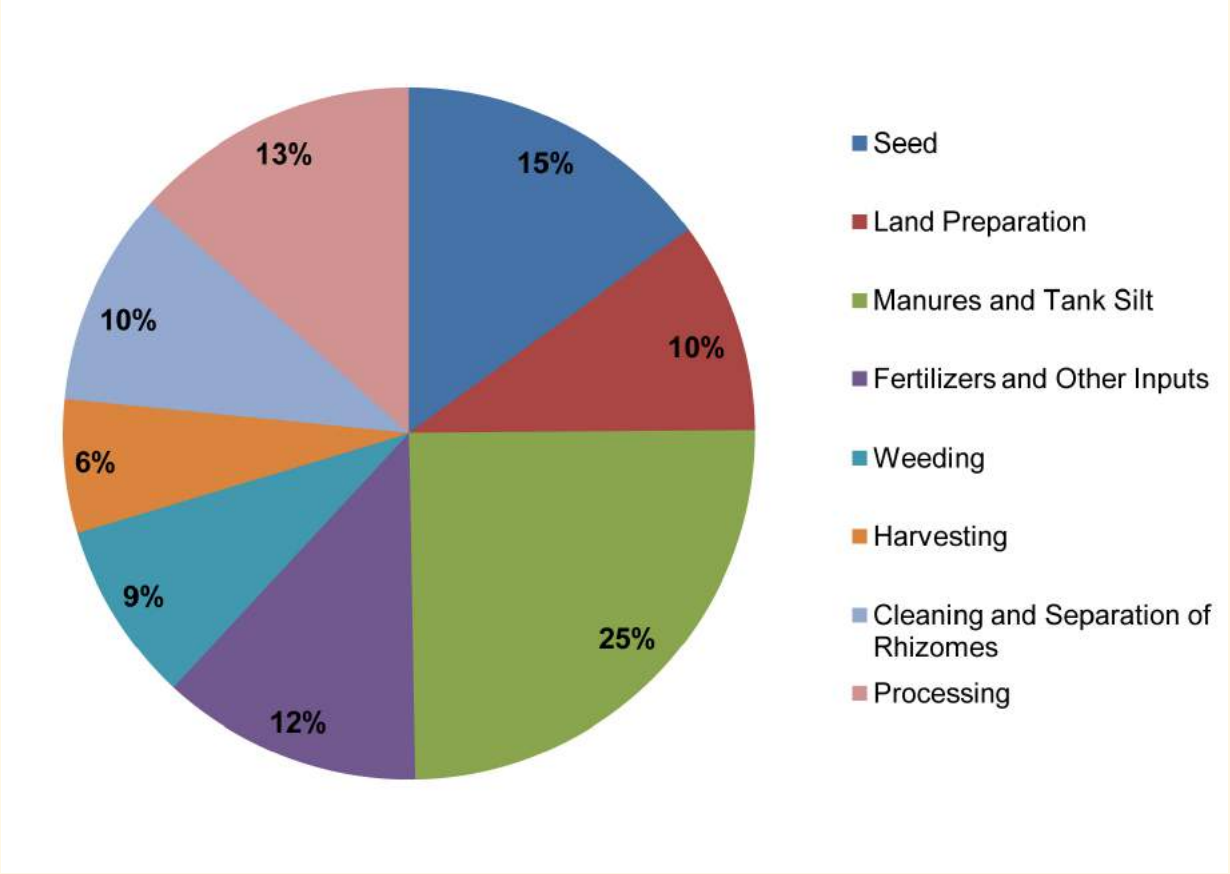


Fig 10: Distribution of costs in Telangana State for turmeric cultivation

Source: Field study 2017

Table 11: Average Cost of Production of Turmeric in Telangana State

S.No	Item	Quantity	Unit	Rate per unit (Rs)	Total cost (Rs)
I	**Inputs**				
A	Seed	9	Quintal	1826	17042
B	Farm machinery for land preparation	10	Hours	873	8838
C	Manures	18	MT	552	9937
D	Tank Silt	98	MT	65	6358
E	Fertilizers	385	Kg		5059
F	Weedicides	0			248
G	Plant protection chemicals (Granules +Spray chemical)	0			2550
	Sub Total				**50032**
II	**Labour**				
A	Sowing	11	man-days	221	2363
B	Manures and Fertilizers	1		250	167
C	Weeding	49	man-days	198	9600
D	Plant protection	2	man-days	302	542
E	Irrigation	21	man-days	248	5250
F	Harvesting	16	man-days	372	5892
G	Cleaning and separation of Rhizomes	40	man-days	287	11338
	Sub Total				**36496**
	COC for wet turmeric	**(I+II)**			**86528**
III	**Processing**				
A	Boiling	31	Drums	118	3688
	Firewood for boiling				2708
B	Drying	14	man-days	189	3025
C	Polishing	21	Quintal	113	2388
D	Transport to market	21	Quintal	110	2246
	Sub Total				**15242**
	Grand Total	**(I+II+III)**			**101770**
	Wet Yield (Q)				**105**
	Dry Yield (Q)				**21**
	COC / Q (Wet)				**824**
	COP /Q (Dry)				**4885**

Source: Field study 2017

3

CHAPTER

VARIETAL PREFERENCE AND PERFORMANCE

During the FGDs with farmers and discussions with traders and officials of Horticulture Department, various opinions emerged regarding the varieties to be cultivated both from the point of adaptability and adoption by farmers. The specific requirements of the farmers and traders in relation to the varieties to be cultivated in the study area vis-à-vis the previous experiences have been provided. For the past few decades, Duggirala, locally called as 'Erragunturu' is being cultivated. Prior to that 'Armoor' variety was cultivated, named after the place of origin, Armoor, Nizamabad district.

Varietal preference of farmers

Even though many promising varieties have been recommended for Telangana State (undivided Andhra Pradesh) (details provided in Annexure I), none of them showed encouraging results when compared to local cultivar, Duggirala. During the focused group discussions as part of this study, farmers' opined that Pratibha which was tried in the past did not perform well in comparison to Duggirala in terms of dry yield. Department of Horticulture is trying to introduce varieties like Salem and PTS-10 which have higher curcumin content by providing support in terms of subsidised seed and other inputs under FLD programme. Though Salem variety showed highest wet yield and good internal yellow colour, post boiling and drying the rhizome became very thin and lost its lustre and resulted in wrinkled fingers. The final produce was of inferior quality in terms of appearance and dry weight when compared to Duggirala. Prathibha variety neither resulted good yields nor good internal colour. Farmers observed an internal black colour rather than orange yellow (Kesari colour) and was sold for lower price. However, farmers' are willing to cultivate varieties with high curcumin content, provided price is determined based on curcumin content and compensates for dry yield loss, if any. At present no market in Telangana provides for price based on curcumin content. Farmers prefer short duration varieties with yields comparable to that of Duggirala, so that harvesting can be done in February-March months, followed by a short duration crop like sesamum/bajra. Further these short duration varieties would be suitable to areas where ground water levels deplete during the later stages of the crop life cycle. Farmers opined that recently introduced PTS-10 is also not showing better yields than the local variety. It is also susceptible to leaf blotch and rhizome rot like the local variety. It was observed that a variety will be popularised if it gives better results at least in any one character of the existing variety. A few farmers tried ACC-48 and 79, for which the seed was sourced from a farmer in Guntur district, Andhra Pradesh. Farmers noticed a good performance of ACC-79 when compared to ACC-48 with respect to its resistance to leaf blotch and rhizome rot, besides its other good quality of having higher curcumin content. However to popularise new varieties, these varieties need to be tested in different soils across different locations of the state.

Varietal preference of traders

Traders prefer 'Thonda' grade material which is a bold (full fill) finger usually of 3 inches or more length. (Other grades are discussed in the markets section of this report). As of now, traders look for size, lustre, moisture content and weight of the individual bulb/finger irrespective

of the variety. This indifference towards varieties is due to absence of standardization norms in the market and arrival of mixed variety turmeric stock. Traders are willing to purchase turmeric with high curcumin content, depending on the demand in terminal markets, provided grading and quality parameters are standardised and maintained at farmers' end. A few traders in Kesamudram market reported a high wastage during polishing with Salem variety. However it was preferred by the powdering industry due to its orange colour. Traders opined that at least a sizable quantity of 10MT of any new variety with high curcumin content harvested from a single village without any admixture has a scope to give some premium price to that produce. Further, the turmeric purchased in Kesamudram market is being traded to the processors at Erode. It was reported by the Erode based processors that high essential oil content in the varieties grown in Kesamudram area delays extraction of curcumin by 5-6 days when compared to other varieties. However it needs some scientific validation before concluding the performance of local Kesamudram varieties in relation to curcumin extraction.

Research Findings of Turmeric Cultivars for select parameters across India:

Among the different released varieties, eleven varieties with different yield and curcumin content were drawn from different sources and tested for their stability across different locations (Annexure-VI to IX). Field experiments were conducted in ten different agro climatic locations viz. Barapani, Meghalaya, Coimbatore, Tamil Nadu , Kumarganj, Uttar Pradesh , Kolasib, Mizoram , Kozhikode, Kerala , Chintapalli, Andhra Pradesh , Dholi, Bihar , Pundibari, West Bengal ,Raigarh, Chattisgarh and Jagtial, undivided Andhra Pradesh for three consecutive cropping seasons, during 2008–2011 and five testing environments for curcumin and curing per cent during 2010–2011 under Co-ordinating centres of All India Co-ordinated Research Project on Spices (AICRPS). According to these results it was noticed that Mega Turmeric, IISR Prathiba and IISR Kedaram were recommended for stable dry yields across the locations.

Genotypes viz., Rajendra Sonia, DuggrialaRed, IISR Prathiba, BSR-2 and Mega Turmeric for fresh yield per plant, IISR Kedaram and Rajendra Sonia for curcumin; BSR-2, Rasmi, IISR Alleppey Supreme,Suranjana, IISR Kedaram and IISR Prathiba for curing per cent , Duggriala Red, IISR Alleppey Supreme, Rasmi and IISR Kedaram for dry yield had values near to unit regression. Hence, these genotypes are suitable for over all environmental conditions and are considered as stable genotypes.

However, these findings are not good enough to introduce these promising genotypes in Telangana as none of the trials have been conducted in turmeric growing districts of the state, except in Jagtial which was chosen for fresh yield performance. Before these genotypes can be promoted in Telangana for higher curcumin content, there is a need to conduct location specific trials in major turmeric growing districts both in research plots and farmers' fields as the agronomic practices and management vary significantly.

4

CHAPTER

CLUSTER APPROACH FOR SEED AND COMMERCIAL TURMERIC CULTIVATION

Cluster Approach for Commercial Production

A production cluster, well identified, serves the needs of the producers and trade in general. A production cluster also enables the production, value addition and availability of a commodity at a competitive price to consumers through economies of scale and scope. It also reduces transportation costs to end markets as volumes are high enough for bulk transport and creates a favourable trade ecosystem. Production enablers like farm machinery services, seed suppliers, primary processing facilities like boilers, dryers and polishers and other infrastructure like drip irrigation are desirable in these production clusters.

Usually supporting services such as warehouses and cold storages can be logistically established which also ensures high utilization, the basic criterion for profitability of storage units. Value addition through processing is also possible in such areas due to the availability of quality raw materials in such clusters, thus increasing employment opportunities for the local population.

Cluster analysis was done based on the production volume of turmeric in the study districts. Further the criteria like contiguity of mandals, infrastructure facilities like markets, cold storage units and processing facilities were also taken into consideration while identifying the cluster (Table 13 & Fig. 11)

Cluster-I: Nizamabad

The reorganized Nizamabad district has turmeric acreage of 15754 Ha with a production of 74349 MT which contributes 25% of the total turmeric production. Hence this belt is proposed as Cluster-I. There is a need to provide seed material facilities, farm machinery services, primary processing facilities in this cluster since a major share of turmeric cultivated in the state is traded in this cluster.

So far 20 cold storage units are available in this cluster, which are in and around Nizamabad AMC market (Table 12). Since these units are situated near the market the occupancy is almost 100% though out the year. However, it was possible not because of turmeric alone but due to storage of other commodities like bajra and red jowar seed. Further there are about 50 polishing units owned by traders in Nizamabad town itself. Though less than 10-15% farmers are in a position to cold store the stock, still there is a scope for one cold storage unit near Morthad & Kammarapalle mandals. Further NH 63 and NH 45 are passing through the Morthad –Kammarpalle belt connecting Nizamabad with Nirmal and Jagtial districts. This is an ideal location to establish a cold storage unit for serving the needs of turmeric farmers in nearby mandals of Balkonda, Morthad, Kammarapally and to some extent of Soan and Laxmanchanda mandals of Nirmal district.

It is envisaged that in due course of time when high curcumin varieties are cultivated in significant acreage; there would be scope for curcumin and oleoresin extraction plants. As of now

investors are willing to establish curcumin and oleoresin extraction plants as greenfield projects provided economically viable quantities of high curcumin turmeric is available.

In AMC market premises a quality lab was established by Department of Agricultural Marketing and contract was given to NABL accredited National Collateral Management Services Limited for one year to provide sampling and testing services. However the lab is not performing curcumin test since it takes four to five hours to test each sample.

Cluster-II: Jagtial

Jagtial belt which has turmeric acreage of 16378 Ha with a production of 81890 MT of production volume which contributes 27% of the total turmeric production. This is proposed as Cluster-II. There is a need to provide seed material facilities, farm machinery services, primary processing facilities in this cluster since significant volume of turmeric is cultivated in this cluster.

During the discussions with farmers and marketing officials, it is observed that cold storage facility in Metpally is underutilized. This belt is irrigated by SRSP due to which the cropping pattern is rice based and more importantly, farmers in this belt sell turmeric in Nizamabad market which is 70 Km away. The AMC at Metpally has recently revived dry turmeric trade. These conditions render establishing additional cold storage economically unviable.

Cluster-III: Nirmal

Nirmal belt has turmeric acreage of 8822 Ha with a production of 44113 MT of production volume which contributes 15% of the total turmeric production. This is proposed as Cluster-III. There is a need to provide seed material facilities, farm machinery services, primary processing facilities in this cluster since significant volume of turmeric is cultivated in this cluster.

There is a need to establish a cold storage in Nirmal belt as the turmeric farmers would like to have facility close to area of production. Apart from turmeric, other commercial crops like chilli and soybean produced in Nirmal belt will help in better utilization of cold storage facility. Even though a cold storage facility is proposed in Morthad –Kammarpalle belt, which is 40 Km from Nirmal, it would be prudent to establish a cold storage facility in this cluster.

Cluster-IV: Kesamudram

Kesamudram belt has turmeric acreage of 7216 Ha with a production of 43831 MT of production volume which contributes 14% of the total turmeric production. This is proposed as Cluster-IV. There is a need to provide seed material facilities, farm machinery services, primary processing facilities in this cluster since significant volume of turmeric is cultivated in this cluster. More importantly much focus has to be given to drip irrigation in this cluster since adoption in poor.

As on date, there is no cold storage facility in this belt. Apart from turmeric, chilli from Jaishankar Bhupalpally, Suryapet districts can make the cold storage viable in the AMC premises.

In Warangal AMC market, premises Department of Agricultural Marketing established a quality lab, but the lab has no equipment for curcumin testing. There is a need to strengthen the existing lab by providing required equipment.

Table 12: Status of Turmeric infrastructure facilities available in Telangana

S. No	District	Number of Cold storage units	Number of Polishing units	Number of powdering units	Number of Turmeric markets
1	Nizamabad	20	599#	11	1
2	Karimnagar	1	20	0	1
3	Warangal	20	75*	9	2
4	Adilabad	0	0	0	0

Source: Department of Horticulture

Includes 50 units available with local traders

* Includes 10 units available with traders

Table 13: Identified Turmeric Production Clusters in Telangana

S. No	Name of the production Cluster	Mandals in the Cluster	Total production (MT) of the Cluster	Cluster contribution to State production (%)
1	Nizamabad	Nandipet, Armoor, Velpur, Balkonda, Kammarapally, Jakranpally, Darpally, Dichpally, Sirikonda, Bhimgal, Makloor, Nizamabad	74349	25
2	Jagtial	Korutla, Metpally, Ibrahimpatnam Mallapur, Jagitial Rural, Kathalapur, Medipalli, Gollapalli Raikal, Sarangapur, Dharmapuri Bheerpur, Mallial, Pegadapalli Buggaram	81890	27
3	Nirmal	Mamada, Laxmanchanda, Soan Khanapur, Nirmal, Kaddam Sarangapur, Dilawarpur, Pembi Kuntala, Kubeer, Lokeshwaram Tanoor,Dasturabad, Narsapur Bhainsa, Mudhole	44113	15
4	Kesamudram	Kesamudram,Nellikuduru, Mahbubabad, Narsimhulapet, Chinnagudur, Kuravi, Torrur, Gudur, Maripeta	43831	14

Source: Field study 2017

Note: Calculations are based on first advance estimates 2017-18, Department or Horticulture, GoTS

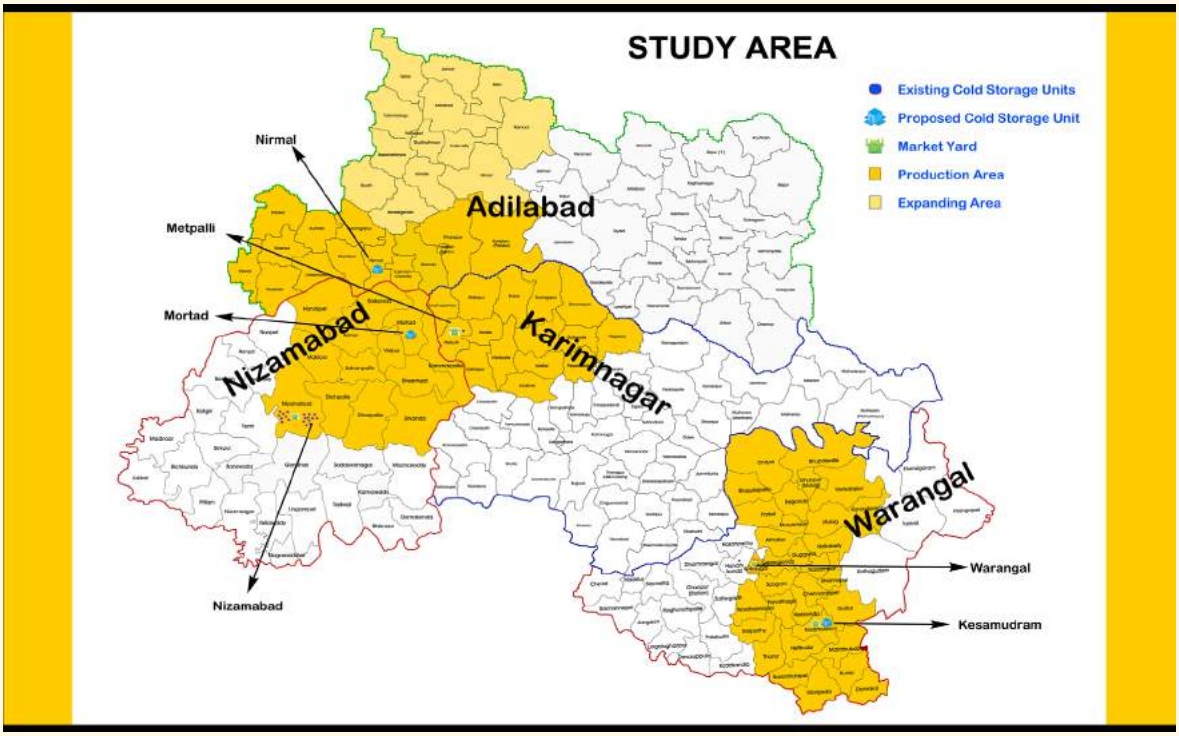


Fig 11: Identified production clusters of turmeric in telangana

Source: Field study 2017

Cluster Approach for Seed Production:

The reason for very poor seed replacement with the promising varieties released by IISR and those that are recommended for Telanagana could be less availability of pure seed and non availability of variety superior to Duggirala. In general farmers are using 9-10 Q of seed material per acre and most of them are using their own seed. At times they purchase the seed from fellow farmers. As most of the farmers are using their own seed, they are not considering the cost of seed in cost of production, which accounts for 15-16 % to total cost. Seed is one of the major contributors for increased cost of production in this region. As turmeric seed is bulky in nature, farmers are hesitant to purchase new seed from other sources which raises the cost of production. To mitigate this problem, Department of Horticulture is trying to popularise one budded seed method which would drastically reduce seed requirement from 10 Q to 2 Q. If farmers consider the seed cost in absolute terms, they could save seed cost of 8 Q or if it is processed and dried, it would add at least 1.5Q o f dry turmeric to total yield. But farmers are not able to perceive the economic benefit of using less seed by adopting new technologies like one or two bud method of any improved variety. To introduce a new variety in the major production areas of the state strategically cluster approach may be followed.

Clustering in seed production sector may create an enabling environment for seed growers and farmers. For the department of Horticulture also, it would be easy to disseminate the information as the seed farms would be contiguous in nature which is the pre-requisite in this approach.

During the interactions with farmers and department officials, cluster based approach in seed production was discussed and a few points have come up for easy implementation of the activities like introduction of new varieties under MIDH.

- A proven variety by Turmeric Research Station through its field trials in the turmeric belt of the state under different soils and climatic conditions only to be introduced. This is the precursor to start implementation of the programme.
- In the subsequent year, initially a little quantity of seed has to be given to the interested farmers of a contiguous area under subsidy.

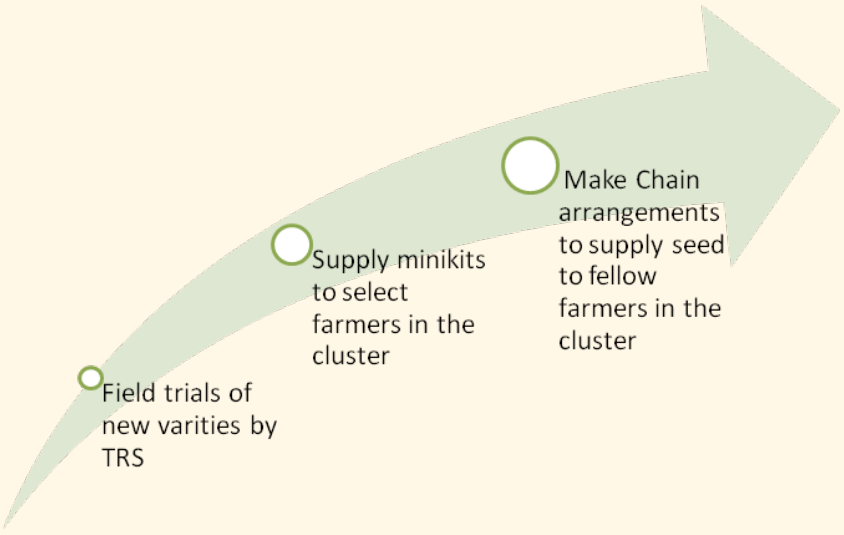


Fig 12. Process of Cluster development of seed production

- To popularise the variety, exposure visits are to be organised to the farmers of neighbouring villages in the cluster
- Based on the realistic data, price for the seed has to decided by a committee consisting of Horticulture Department officials, Scientists from Horticulture University and a few farmers representing all the clusters
- For the next 4-5 years the same has to be followed with new farmers and ensure that the entire seed produced in the cluster should flow into the seed chain only

Based on the interactions with farmers and officials of Horticulture the following seed clusters (Table 14 & Fig. 13) have been identified which are contiguous in nature and similar in soil types and agro climatic conditions. Further they contribute 40-50% to the total area and production of the Identified production cluster.

Table 14: Identified seed clusters in Telangana

S. No	Name of the production cluster	Name of the seed cluster	Area under Identified seed cluster (Ha)	Seed cluster area in the production cluster (%)	Production under Identified seed cluster (MT)	Seed cluster production in the production cluster (%)
1	Nizamabad	Armoor - Morthad - Nandipet - Velpur	9005	57	40607	55
2	Jagityal	Korutla - Metpally - Jagityal - Ibrahimpatnam	6910	42	40705	50
3	Nirmal	Mamda - Laxmanchanda	2786	31	13928	32
4	Keasmu-dram	Kesamudram - Nellikuduru	3799	52	23102	53

Source: Field study 2017

Note: Calculations are based on first advance estimates 2017-18, Department or Horticulture, GoTS

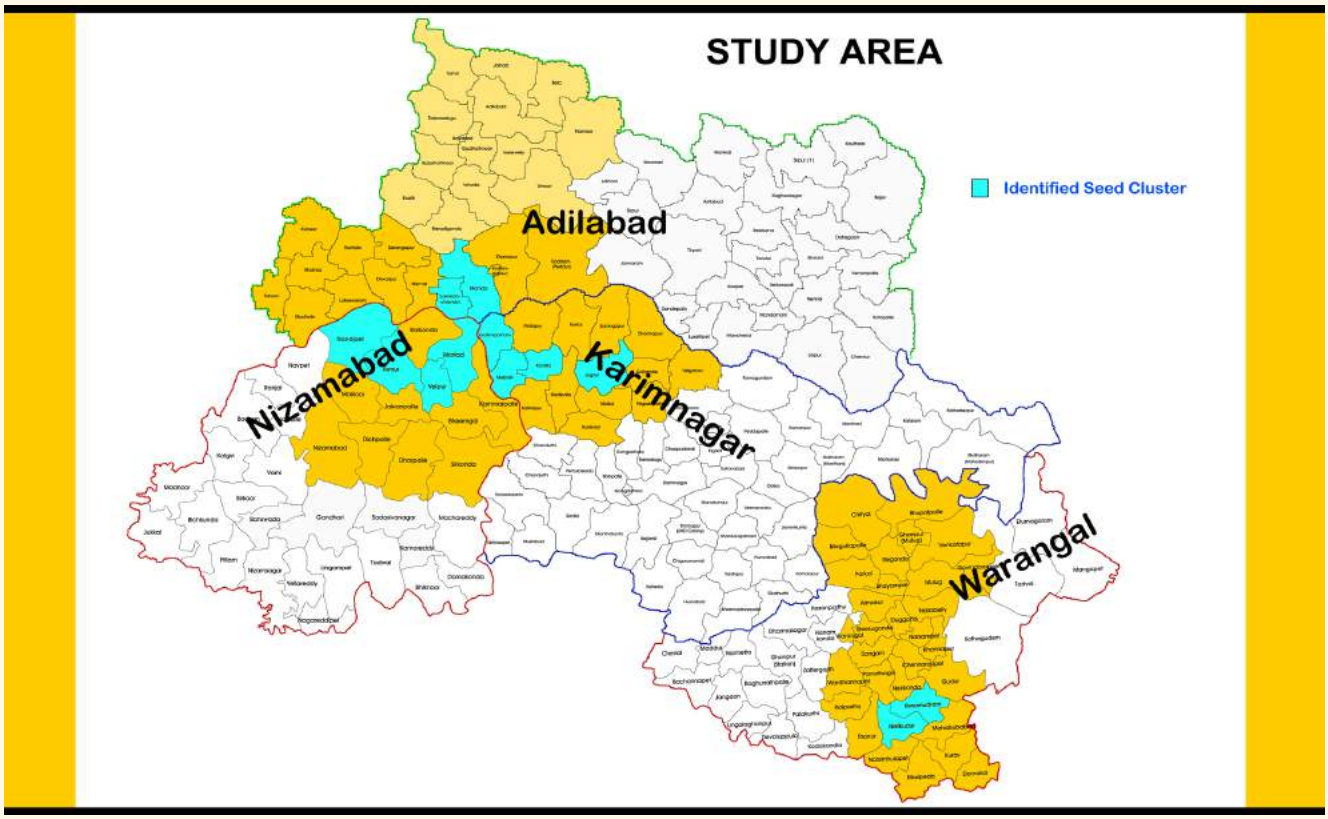


Fig 13: Identified seed clusters of turmeric in telangana

Source: Field study 2017

Protray Technology: Protray Technology can be an effective alternative to reduce the drudgery involved in storing, preservation and use of seed material. Particularly in Nizamabad district, it is observed that farmers prefer harvesting after 7 months to take up a second crop after turmeric. In order to improve turmeric yield and curcumin content, without compromising the short duration crop requirement of farmers, portray technology can be promoted. This is expected to reduce the crop duration by at least one month when compared to conventional seed material planting. However, the current price for each seedling works out to Rs.2.5. Further, providing portray seedlings at high subsidy during initial stages of technology introduction will help in large scale adoption and reduction of cost due to economies of scale in the district. It would be adopted by farmers if the portray seedlings are available at Rs.0.3-0.4 per seedling. The economics of this method in terms of savings in terms of seed material storage, labour and time should be explained to farmers for initial adoption. There is a need to increase scale for producing seedlings in large numbers in a cluster approach on incremental basis over 3-4 years so that it results in faster adoption and reduction in cost.

5

CHAPTER

VALUE CHAIN ANALYSIS

Turmeric Value Chain

Turmeric cultivation has a sentimental value due to the colour, medicinal and culinary value and its usage in religious rituals. In some parts of the state it is considered analogous to gold due to the beneficial value it imparts. Turmeric is an essential ingredient of cooking in Indian homes and is an essential part of the kitchen. Apart from this aspect, turmeric is considered to be profitable crop provided market conditions are 'favourable'. It is a crop which engages the farmer for 10 months of the year and provides a support system. However, of late there is a perception among farmers that cost of cultivation is on the rise. The same has been presented in the section dealing with cost of production of wet and dry turmeric.

Figure.14 illustrates the generic value chain map of turmeric cultivation in Telangana State. The map illustrates the various functions, actors and enablers of the turmeric value chain. The flow and transaction volumes based on the market arrival and production data is presented in the map.

Functions

The turmeric value chain involves functions such as input supply, production, aggregation, processing, trading and exporting. The major inputs in turmeric are seed, organic manure, fertilizers and pesticides apart from credit and insurance support. Technical knowhow and improved practices are inputs provided by the State Horticulture Department through Horticulture Extension Officers and Horticulture Officers. Turmeric Research Station, Kammarpalle is involved in research for improvement of turmeric cultivation practices. Most farmers produce turmeric for commercial purpose and the concept of turmeric for seed material is not prevalent in the study area.

Primary processing at household level, involves harvesting, cleaning, separation of rhizomes, boiling and drying in order to make dried turmeric. Commercial processing is usually done in major market centres. Trading usually consists of collection, local trading and regional or national trading. Some traders and processors are also involved in export of fingers which are converted into value added products such as curcumin, essential oil and oleoresin. The product reaches the domestic consumers through wholesalers and retailers.

Actors

Input Suppliers:

Seed is the major input in turmeric cultivation. Most farmers use their own seed and rarely procure seed from markets such as Sangli, Maharashtra. Manure, fertilizers, pesticides and labour are sourced from the nearby places. Manure is another important input whose availability is dwindling due to lesser number of animals being maintained by farmers than previously.

Farmers:

Most farmers cultivate turmeric for commercial purpose. Most farmers in the area of study

cultivate as little as half an acre to 4 acres. Apart from commercial motive, there is a 'sentiment' associated with turmeric cultivation. These farmers usually supply dry turmeric which is processed at farm to local traders at nearby regulated markets.

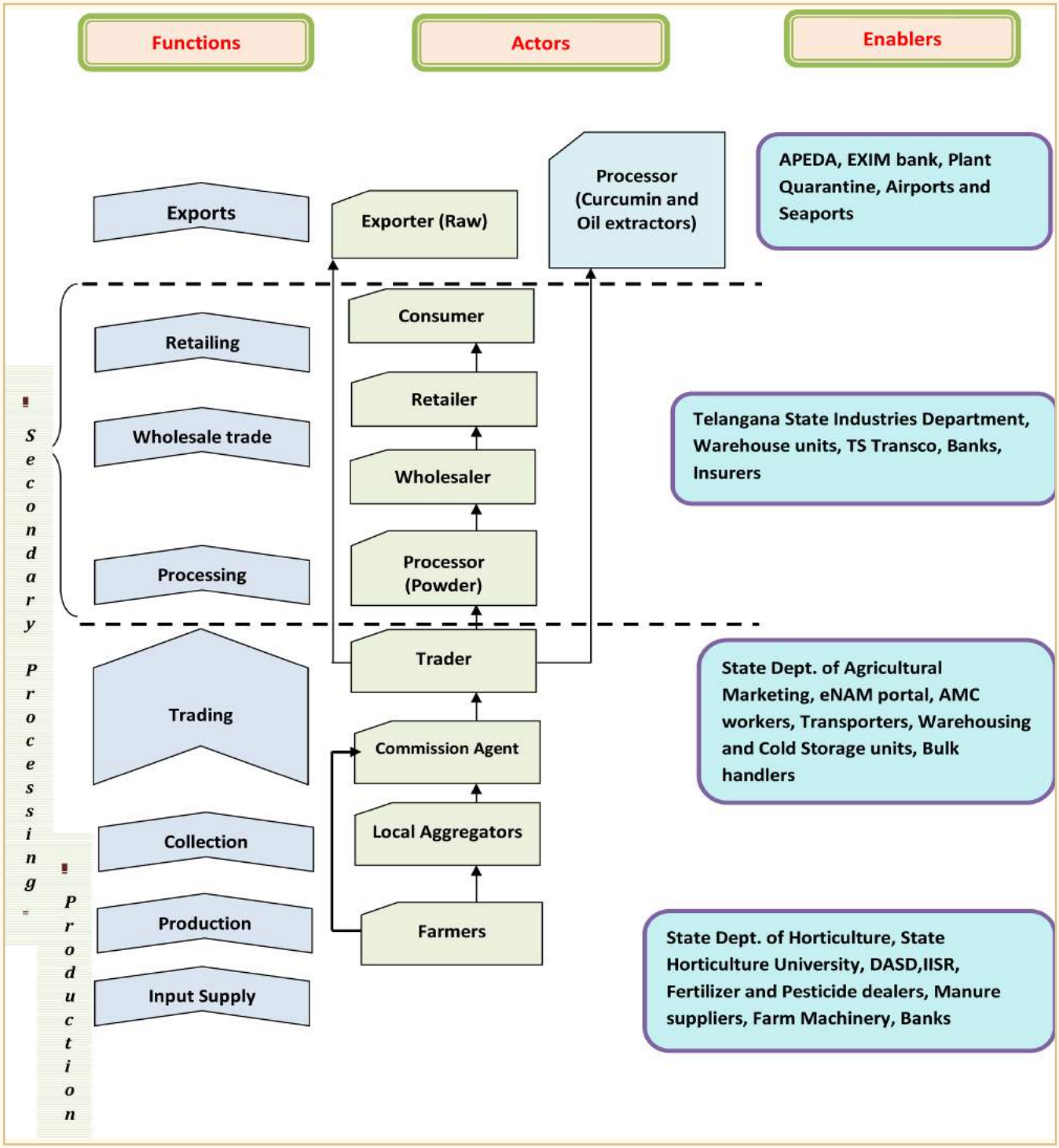


Fig 14: Value Chain Map of Turmeric in Telangana State

Source: Field study 2017

Small village level traders/Local Aggregators:

Small traders residing in the same village or neighbouring villages are involved in turmeric aggregation. They are frequent visitors to wholesale markets and deal with farmers and commission agents. Generally, they deal with small quantity and sell at nearby markets as farmers. They are aware of price information and try to take advantage of the price arbitrage and offer a 'better price' for the small lots.

Commission Agents:

In major markets like Nizamabad, commission agents play a crucial role and act as a conduit between farmers and traders. The role of commission agents starts much ahead of harvest of produce. At times commission agents provide credit to farmers and this is one probable reason for the farmers to depend on them heavily during the disposal of produce at the market.

Local traders:

In major markets like Nizamabad, 20-25 traders deal with approximately 71000 MT of turmeric during the harvest season starting from end of February to May (2016-17). In turn, the local traders deal with 70 odd commission agents during the harvest season for their trading needs. Produce from other areas such as Nanded (Maharashtra), Duggirala, Kadapa and Nandyal (Andhra Pradesh) is also brought to Nizamabad market by aggregators or group of farmers for better price realization. Kesamudram (Mahbubabad district) and Enumamula (Warangal district) are the other major markets in Telangana.

National level traders / Exporters:

Traders from states of Gujarat, Maharashtra, Tamil Nadu, Madhya Pradesh and Uttar Pradesh source produce from local traders in Telangana. Traders from Madhya Pradesh and Uttar Pradesh place orders for bulb while those from Gujarat buy fingers. Most exporters deal with traders in Japan, Europe, Middle East and North America, which are major export destinations for turmeric.

Processors:

The major processed product of turmeric is turmeric powder which is mostly used for culinary purposes. Turmeric powder is also used for rituals, as a cosmetic and in medicines. Most processors are involved in three major spice commodities i.e. chilli, turmeric and coriander which enables them to run the mills all through the year, thus optimizing establishment costs. Most processors are of the opinion that standalone turmeric mills would not be economically viable.

Curcumin and oleoresin extraction processing units are not present in Telangana; however, there is a growing awareness about value added products among local traders.

Enablers and Facilitators

In a value chain, the enabler includes all chain-specific actors providing regular support services or representing common interest of the value chain actors. For example, functions at the enabler level include public research and technology development, agreement on professional standards, promotional services, joint marketing or advocacy and other support service providers.

Enablers in Production and Local Processing Functions

At the farmers' level, District Horticulture and Sericulture Officer (DHSO), State Department

of Horticulture are working to disseminate different technologies in turmeric farming and processing. Turmeric Research Station, Kammarpalle is working on maintaining different varieties and developing new technologies for turmeric cultivation. Financial institutions like public sector banks are involved in providing credit and insurance facilities. Banks-both public and private sector are also involved in providing credit facilities for establishing cold storage and warehouses. Some local players are involved in offering services for boiling fresh turmeric and converting into dry turmeric.

Enablers in Trading and Export Functions

At traders' level, Agricultural Market Committees (AMC) facilitate trading activities through open auction method with/without the involvement of commission agents. AMC are also facilitating trading activities by providing technology and establishing collection centre through eNAM platform

At higher level, Spices Board of India, Agricultural and Processed Food Products Export Development Authority (APEDA) under Ministry of Commerce & Industry, Govt. of India assist in export of goods and maintain the export related data.

Economic Analysis

Cost of Production: The cost of production for fresh and dry turmeric in Telangana State has been discussed in the section Economics of Turmeric Cultivation. As presented in Fig.6 manures and tank silt constitute 25% of the expenditure, followed by seed material (15%) and 13% for primary processing. These are the major costs incurred in turmeric cultivation in Telangana State.

Farmers usually keep 10 Q of fresh turmeric as seed material from the harvest and use it for the succeeding season. The cost of seed turmeric is approximately 20% of the price realized for raw turmeric and is subject to wide price fluctuations. For e.g. if the price of dry turmeric in the market is Rs.7500 per Q, the cost of fresh turmeric is worked out as Rs.1500 per Q. (5Q of fresh turmeric yields 1Q of dry turmeric). The average cost of production of turmeric in Telangana works out to Rs. 4885/Q and the average model price across four major markets of Telangana comes to Rs. 5152/Q (2017 - 18).

In recent years, there is a decline in turmeric cultivation as farmers find the cost of turmeric production to be high and the income realization non remunerative. One support mechanism can be competitive price based on the domestic consumption and export of turmeric based products. In this context, farmers believe that there is a need to provide fair and remunerative price to turmeric similar to sugarcane.

Value addition in Turmeric

Turmeric is mainly used in preparation of dishes. It not only adds flavour but also colour to the food. It has an earthy, bitter, peppery flavour and has a mustardy smell. The active ingredient of turmeric is curcumin. Besides spice, it has been used in various products.

Medicinal use: Turmeric is extensively used in Ayurvedic system of medicine and is used as an antiseptic, forming a part of many ointments & lotions for external wounds and skin infections. It is also used in the treatment of arthritis and to treat jaundice in the initial stages. Curcumin, the main active component is believed to have a wide spectrum of biological actions. Turmeric has

been traditionally used for curing a number of diseases. It is popular for its anti-bacterial, anti-fungal, anti-ulcer and anti-tumoral effects.

Food industry: Turmeric is used in a number of products including dairy products, sauces, ketchups, biscuits and cakes. It is also used as a natural colouring agent in foods. It is also used in the food, pharma, confectionary and rice milling industries. Turmeric is widely used food additive for products that are specially packaged to protect from sunlight.

Cosmetics: Turmeric is used to manufacture various sunscreen, fairness creams and lotions. The anti-oxidant properties help to lighten the skin. It is widely used as part of cosmetic preparations from the traditional kumkum (sindoor) to anti- acne and pimple creams.

Natural Dye: Due to its strong colour, it is used as a natural dyeing agent for silk, wool, cotton and other fabrics.

The major value added products can be categorised as a) primary products, and b) secondary and derived products.

Primary Products

Turmeric powder Usually bulb grade turmeric is preferred for powder making as most of the inferior finger grade material is either sold in local markets and the superior quality finger material is exported. In case of turmeric grown in Telangana, most organized turmeric powder units are located in Hyderabad. Packages of the processed powder are made by the use of a packaging machine and are finally sold to market.

Secondary products

Curry powder: Turmeric is an important ingredient in the preparation of curry powders such as sabji masala, chole masala, chicken and meat masala. The turmeric content in curry powder blends ranges from 10-15% to 30%. Typical Indian curry powder for meat and fish dishes contains 20-30% turmeric, 22-26% coriander, 12% and 10% cardamom and cumin, respectively, 4% or 10% fenugreek, ginger, cayenne, cloves and fennel in proportions from 1% to 7%.26 Curry mixes for vegetarian dishes contain less turmeric, in the range of 5 to 10%, because of the bitter flavor it would impart to the dish. [3]

Oleoresins: These are obtained by solvent extraction of the powdered rhizomes. Depending upon the solvent used for extraction and on the turmeric type and cultivar, the process can yield about 12% of an orange/red viscous liquid which contains various proportions of the colouring matter, i.e. the curcuminoids, the volatile oils which impart the flavour to the product, and non-volatile fatty and resinous materials. The compounds of interest in turmeric oleoresins are the curcuminoids (40 to 55%) and the volatile oils (15 to 20%) [4]

Curcumin: The curcuminoids mostly consist of curcumin. Curcumin is a crystalline material, which is obtained by further purification of curcuminoids. It is preferably used as a natural food colorant in products where the turmeric flavour is undesirable, such as cheese, ice cream, beverages and baked products. Content of curcumin depends upon the variety being grown.

[3] http://www.fao.org/3/a-ax446e.pdf
[4] ibid

Turmeric essential oil: Turmeric essential oil is obtained by distillation, or by supercritical fluid extraction of the powdered rhizome. It is also the product of curcuminoids purification from oleoresins. The latter procedure, which consists in removing the oil with hexane or other lipophilic solvent, tends to alter the oil by loss of higher volatile molecules in the process of solvent evaporation; or, if alcohol is used as the solvent, artifacts are formed by esterification, etherification and acetal formation. The major compounds found in turmeric oil, up to 50-60%, are the sesquiterpene ketones, ß-, and ar-turmerone. The sesquiterpenes zingeberene and ar-curcumene were either not reported, or found at as high as 25% and 35%, respectively.[5]

Distribution of Costs and Margins

Table.15 provides approximate calculation of cost of goods sold and profit margin at each level. Turmeric as a commodity goes through various value additions from production at the farmer level to final consumption. The initial value addition involves conversion of fresh turmeric to dry turmeric which is sold at the AMC markets. This also involves a single polish which provides a better look and feel for the product. The calculations provided are tentative and are derived based on field discussions with farmers, traders, officials of agricultural marketing department, bulk handlers and processors. The major processing or secondary processing happens at the processors location, wherein raw turmeric is converted to powder which can be used by the consumers.

Based on the cost of production data and market prices, it is assumed the price of the dried turmeric to be at Rs.55.76/Kg and that of powder to be in the range of Rs.175-190/Kg, depending on the brand to the consumers. However, due to high fluctuation of price, especially of dried turmeric (from Rs.40 to 70), the selling price and profit margin can alter significantly.

When the farm gate price (market realized) is Rs.56/Kg, there is a margin of Rs.7/Kg approximately to the farmers. The local traders purchasing fresh turmeric add another Rs.6-7/Kg and trade with the processors. After processing raw turmeric into powder and selling at Rs. 129/Kg, the processors makes an approximate gross profit of Rs.18/Kg. Some processors also trade turmeric powder in local markets without any packing, incurring lesser costs and lesser profit as well. The greater value addition is done during the processing of the powder with proper packaging and marketing. The major cost involved during the processing of powder are the raw material cost, transportation cost, grading and processing cost, storage cost, packaging cost, marketing cost, financial cost, and administrative and operation cost. Loss of 5% is assumed during powder making, which can alter depending upon the quality of dried turmeric.

The total cost of goods sold for powder for estimated at wholesale trade is around Rs. 144/Kg. The estimated average profit margin for the wholesalers comes around 15-20% and that of retailer is 18-22% depending on the market and consumers.

[5] http://www.fao.org/3/a-ax446e.pdf

Table 15: Distribution of costs and margins

Production	Primary Processing	Trader (Dry turmeric)	Secondary Processing	Trading	Consumer

Particulars	Cost	Particulars	Cost	Particulars	Cost	Particulars	Cost	Particulars	Cost	in Rs.
Total expenses for 1 Kg production	8.24	Cost of fresh turmeric (5Kg wet turmeric yields 1 Kg dry turmeric)	42.25	Cost of dry turmeric	55.76	Purchase price	64.0	Purchase price	129.0	Commission to retailer
		Boiling cost	3.05	Transaction cost	1.12	Transport cost	0.5	Transportation cost	1.0	Rs. 20-35
						Grading	0.25	Rental cost	1.0	
		Drying cost	1.44	Storage cost	1.40	Storage	1.4	Financial cost	9.03	
		Polishing	1.14	Loading charges	0.1	Polishing loss	4.48	Operation cost	3.0	Consumer Price
		Transportation	1.07			Processing	5.0			Rs.175-190 / kg
						Packing cost	15.0			
						Marketing cost	5.0			
						Operating cost	10.0			
Total	8.24	Total	47.88	Total	58.38	Total	105.63	Total	143.03	
Loss (2.5%)	0.21	Loss (2%)	0.96	Loss (1%)	0.58	Loss (5%)	5.28	Loss (1%)	1.43	
COP for wet turmeric	8.45	COP for dry turmeric	48.84	COP for Trader	58.96	COGS	110.91	COGS	144.46	
		Farm gate price	55.76	Selling price	64.0	Mill gate price	129.0	Wholesale price	155.0	
		Profit per Kg of dry turmeric	6.92	Profit per Kg of dry turmeric	5.04	Profit per Kg of powder	18.09	Profit per Kg of powder	10.54	

Farmer	Farmer	Trader	Processor	Wholeseller	Retailer/ Consumer

Source: Field Study 2017

Price Spread and Profit margins

There is an approximate price spread of Rs.134/Kg in the Farmer-Trader-Processor Channel for turmeric powder as presented in table.16. However these are dynamic in nature and tend to change with fluctuations in dry turmeric prices over a few months to years. The share of producer in this channel is around 30%.

Table 16: Price Spread in Farmer-Trader-Processor Channel (Rs./Kg)

Farmer	Net price	55.76
Trader	Purchase price	55.76
	Transaction costs	3.20
	Margin	5.04
	Sale price	64.0
Processor	Purchase price	64.0
	Processing costs	46.91
	Margin	18.09
	Sale price	129.0
Wholesaler	Purchase price	129.0
	Trade costs	15.44
	Margin	10.56
	Sale price	155.0
Retailer	Purchase price	155.0
	Trade costs	5.0
	Margin	30.0
	Sale price	190.0
Price spread		134.24
Producer's share		**29.35**

Degree of Value Addition

The degree of value addition is calculated by considering the price difference of the product and the purchasing price at each level. The margin is difference between the cost and the price difference. The margin divided by the purchasing price gives the degree of value addition and expressed as percentage. (Table.17)

Table 17: Degree of Value Addition Rs. / Kg

S.No	Particulars	Farmer	Trader	Processor	Wholesaler	Retailer	Consumer
1	Selling price	55.76	64.0	129.0	155.0	190.0	
2	Purchase price		55.76	64.0	129.0	155.0	190.0
3	Price difference		8.24	65.0	26.0	35.0	
4	Cost		3.2	46.91	15.44	5.0	
5	Margin		5.04	18.09	10.56	30.0	
6	Degree of Value Addition (%)		9.04	28.27	8.19	19.35	

Market Trends

Nizamabad, Warangal, Metpally and Kesamudram are the major markets in Telangana for turmeric trading. The volumes for Nizamabad and Warangal markets are significantly higher when compared to Metpally and Kesamudram. Metpally till recently was a market trading in fresh turmeric and served mostly as a conduit for inflows to Nizamabad market through traders. As per the data provided by the Department of Agricultural Marketing, the arrivals in major markets of Telangana are provided below in the Table.18

Table 18: Market Arrivals of Turmeric in major markets (2004-05 to 2017-18) Arrivals in MT

	Warangal	Nizamabad	Kesamudram	Metpally
2004-05	17089	NA	NA	NA
2005-06	10757	NA	NA	NA
2006-07	26422	NA	NA	NA
2007-08	80910	NA	NA	NA
2008-09	23014	55479	NA	9367
2009-10	23490	47514	NA	5465
2010-11	2774	52443	NA	3917
2011-12	64898	78152	NA	3319
2012-13	74986	94432	12753	6542
2013-14	50845	83688	9553	3559
2014-15	40413	99201	10242	3538
2015-16	22056	64822	6115	3204
2016-17	32790	71644	5273	4258
2017-18	148671	143705	NA	3409

Source: Department of Agricultural Marketing, GoTS

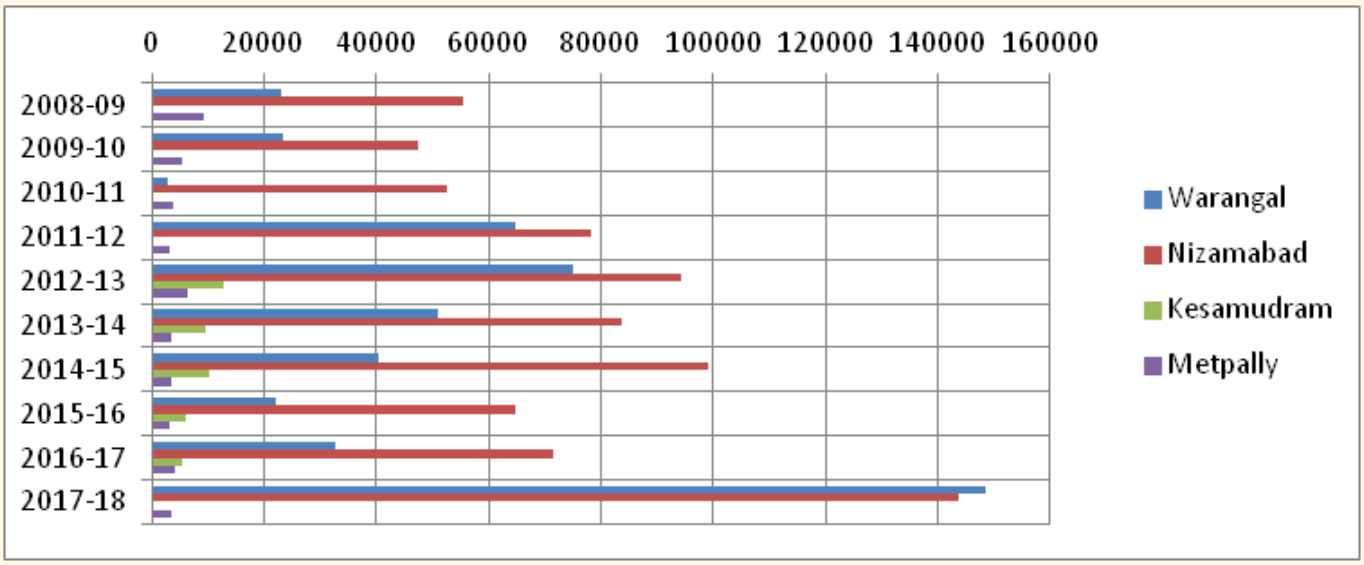


Fig 15: Turmeric arrivals to major markets

Source: Based on Department of Agricultural Marketing, GoTS data

The trends in market arrivals for the past 10 years indicate (Fig.15) that there has been an upswing in market arrivals to Nizamabad and Warangal markets except for the years 2008, 2009 and 2010 when the Warangal market saw dips in market arrivals. However, the market arrivals have been relatively consistent to Nizamabad market. Metpally market though small in terms of market arrivals has not seen consistency, probably due to the fresh turmeric trading prevalent in this market.

Price Trends in the Past Decade

Table 19: Turmeric modal price in major markets in Telangana in the last decade

	Warangal	Nizamabad	Kesamudram	Metpally
2004-05	2383	NA	NA	NA
2005-06	2018	NA	NA	NA
2006-07	1950	NA	NA	NA
2007-08	1830	NA	NA	NA
2008-09	3366	3850	NA	3200
2009-10	3290	11000	NA	3900
2010-11	12834	11500	NA	5600
2011-12	5413	3500	NA	8500
2012-13	4012	6400	3948	3500
2013-14	4778	6400	4829	4650
2014-15	5322	6850	5253	3150
2015-16	7541	8100	7117	5600
2016-17	7142	5850	7797	5019
2017-18	5369	5575	NA	4511

Source: Department of Agricultural Marketing, GoTS

Price Trends in the Past Decade (Contd..)

The modal prices in the four important markets are provided in the table.19. For most of the years since 2011-12, prices have been in the range of 3500-8500 per Q. During 2010-11, there was an abnormality in the prices, which hovered above Rs.11000/Q, due to lower arrivals in the markets and perceived shortages.

Movement of Turmeric into and out of Major Market Centres

Nizamabad Market: This is the major trading centres in India and Telangana State as well. Nizamabad market receives turmeric from Nizamabad, Adilabad and Jagtial districts due to participation of traders and commission agents. This market also receives dry turmeric from Nandyal, Duggirala and Kadapa (Andhra Pradesh). Bulb grade material from this market is traded in U.P and M.P and finger grade material to Gujarat and Maharashtra and then to export markets. Low grade bulb and finger material is purchased by powder mills in Hyderabad and Nizamabad. Eighty percent of the material goes to regional markets in other states and less than 20% is consumed locally in the state.

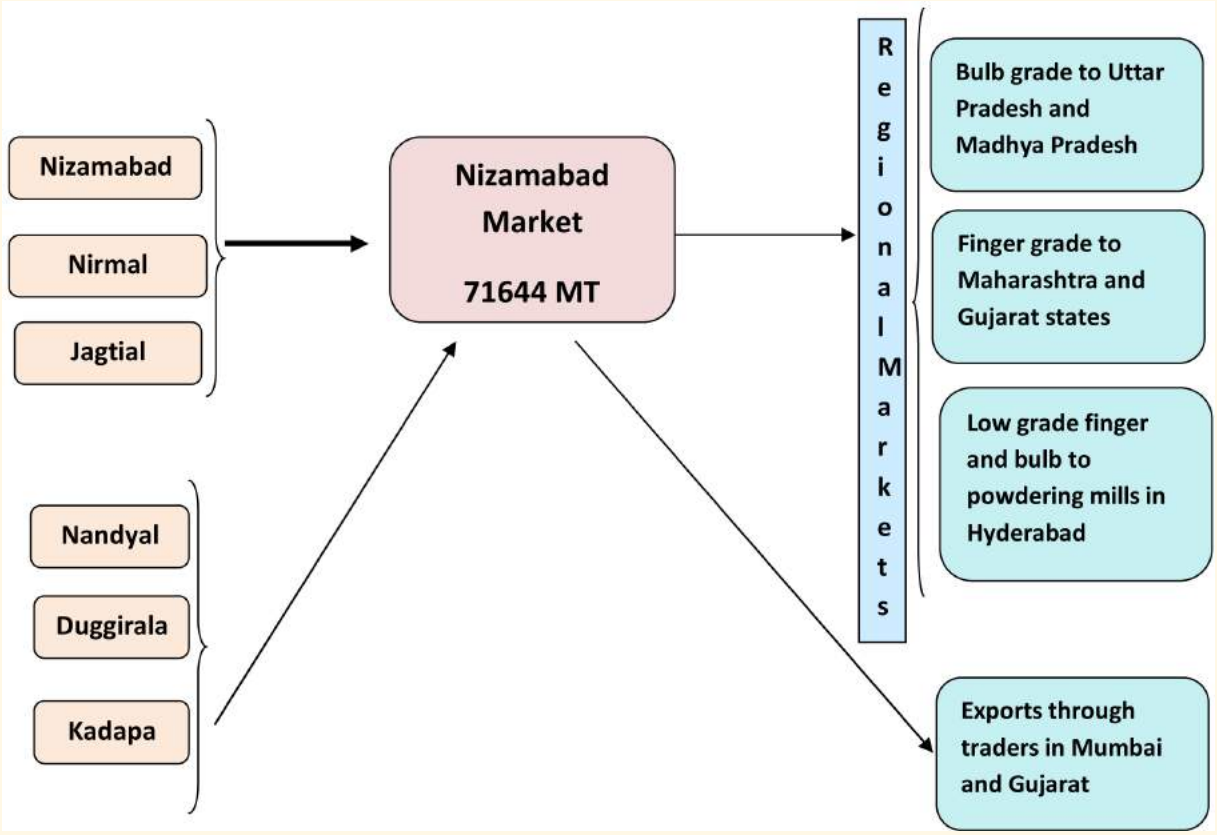


Fig 16: Movement of turmeric into and out of Nizamabad Market.

Source: Field study 2017

Warangal Market (Enumamula): This is the second major trading centre in Telangana State. Enumamula market receives turmeric from Warangal and Mahbubabad (minor quantity) districts. This market also receives dry turmeric from Nandyal, Duggirala and Kadapa (Andhra Pradesh). Bulb grade material from this market is traded in U.P, West Bengal and M.P and finger grade material to Gujarat and Maharashtra and then to export markets. Low grade bulb and finger material is purchased by powder mills in Hyderabad and Warangal.

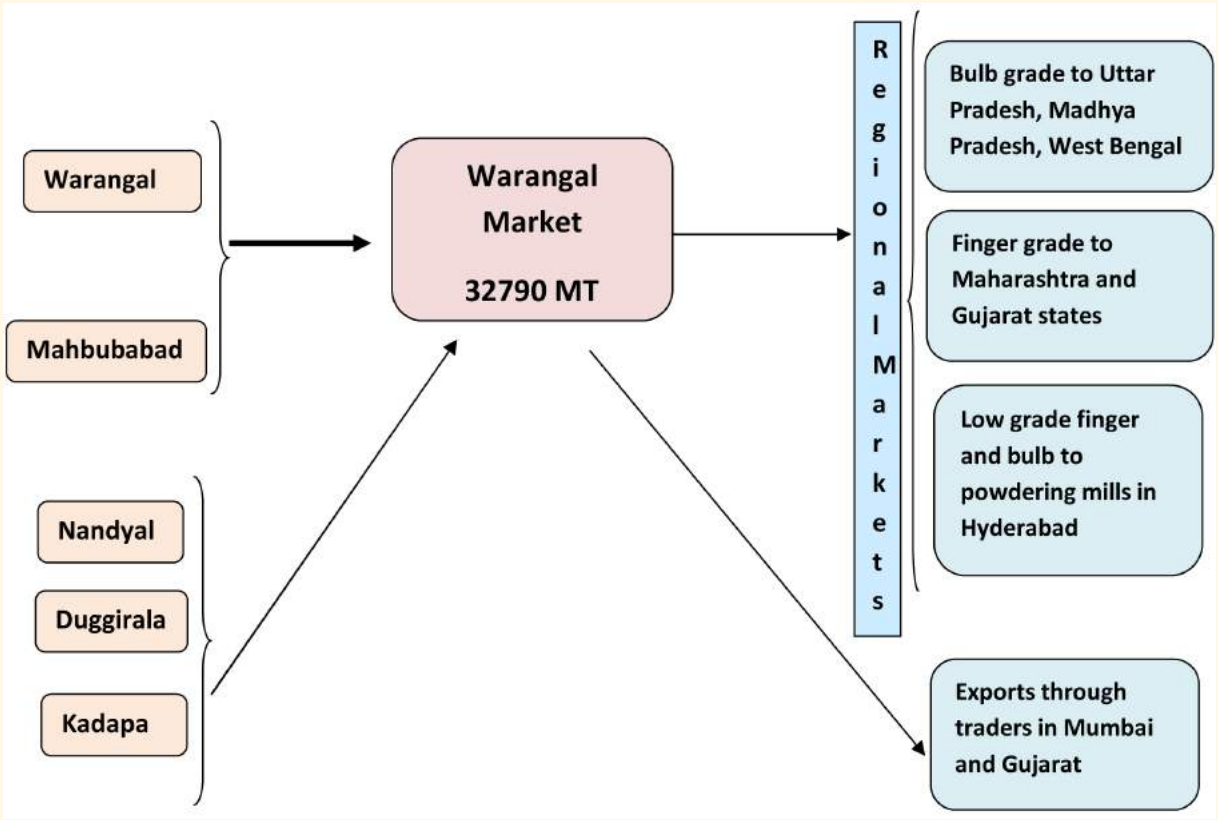


Fig 17: Movement of turmeric into and out of Warangal (Enumamula) Market.

Source: Field study 2017

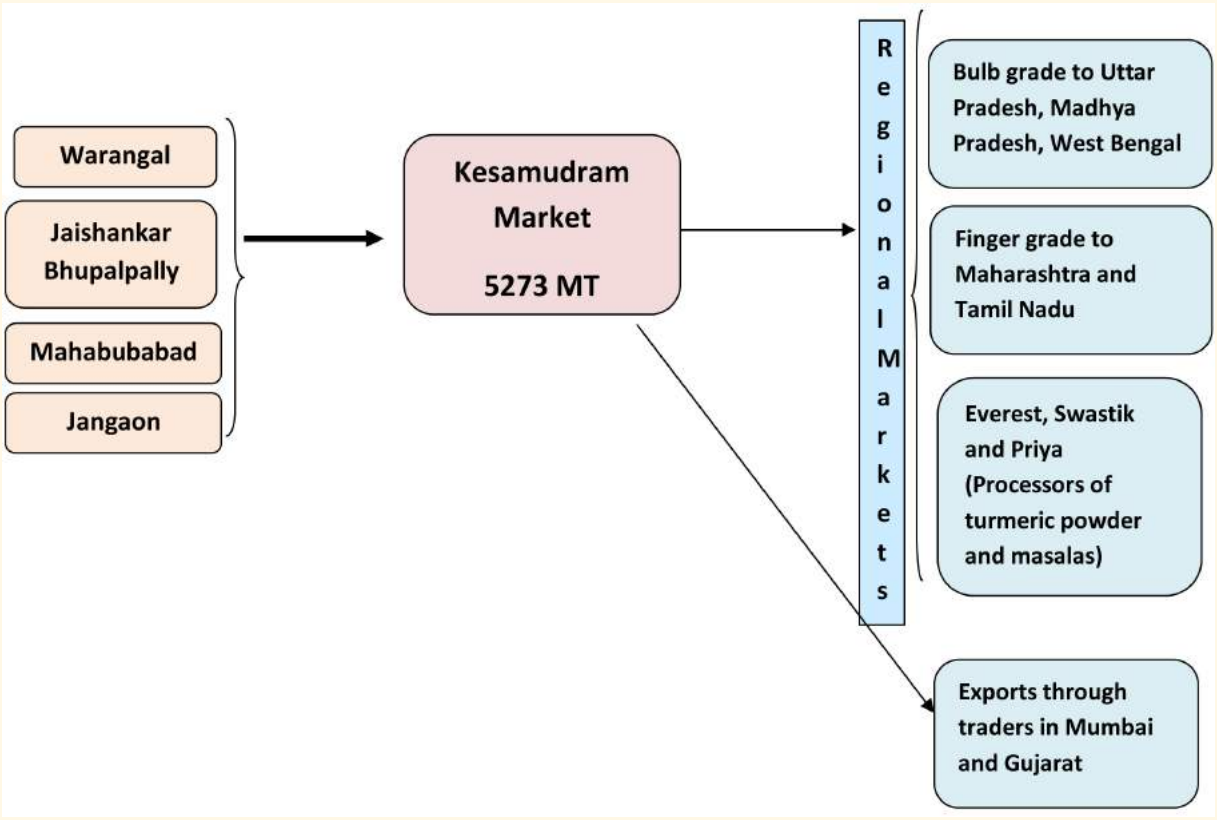


Fig 18: Movement of turmeric into and out of Kesamudram (Mahabubabad) Market.

Source: Field study 2017

Kesamudram Market: This is the third major trading centre in Telangana State. Kesamudram market receives turmeric mostly from Mahbubabad (major quantity), Jaishankar Bhupalpally, Warangal and Jangaon districts. Bulb grade material from this market is traded in U.P, West Bengal and M.P and finger grade material to Erode (Tamil Nadu) and Maharashtra and then to export markets. Many processors like Everest, Swastik, Priya procure material from this market.

Metpally Market: This is the minor trading centres in Jagtial district, Telangana State. Almost entire turmeric into this market is from Jagtial district. Further, traders from this market sell the produce in Nizamabad market and minor quantities in Sangli market (Maharshtra). Recently, trade has been established with Indore based traders. Previously, this market would fresh turmeric which is no longer observed. Most commission agents in this markets also act as traders.

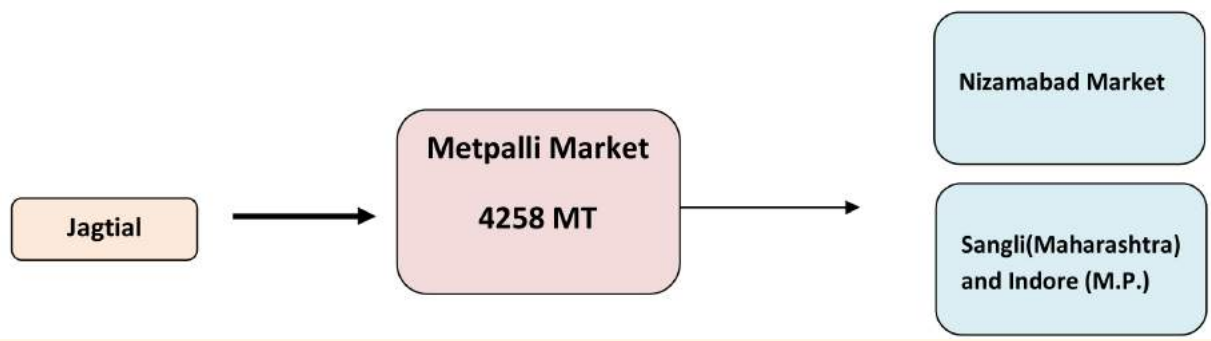


Fig 19: Movement of turmeric into and out of Metpally Market.

Source: Field study 2017

Turmeric Grades observed in Local Markets

Based on the discussions with traders and visual observation of traded lots in Nizamabad market (in colloquial terms), the following grades of turmeric have been listed. This informal grading is used by local traders for assessment of material and transacting with regional traders.

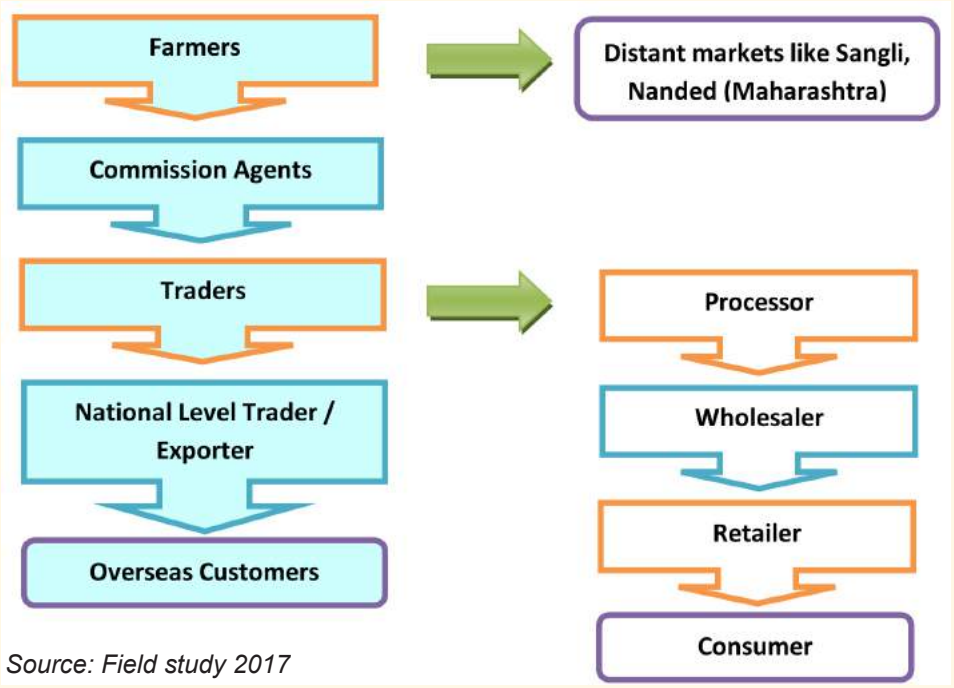
1. Kaadi or finger: This is the preferred grade and fetches higher price than bulb.
2. Gola or bulb: This grade fetches slightly lower price than finger and is preferred for powder making.
3. Thonda is a bold (full fill) finger usually of 3 inches or more length. This grade is usually exported to Japan and European markets after polishing twice (sequential).
4. Mukda is a 'g- shaped' bulb with finger intact. This grade is preferred by consumers in local markets and is available less quantity compared to bulb and finger
5. Chura is small chips of turmeric that fetches lowest price

Assessing quality in the markets: 'Kesar thod' is a characteristic parameter used by traders to assess the quality of turmeric wherein turmeric finger (kaadi) should be dry and snap with a sharp twang and the core of the turmeric should be of yellowish orange similar to saffron (kesar). This grade of finger with bold fill and double polishing are preferred for exports to Japan followed by lesser fill to European markets.

Marketing Channels

Farmers usually market dry turmeric at regulated markets through commission agents, however, wet/fresh turmeric trading was prevalent in some markets like Metpally. The traders in Metpally, in turn used to boil, dry the turmeric into dry turmeric to be sold in Nizamabad market. However this trade practice is not present currently due to government interventions.

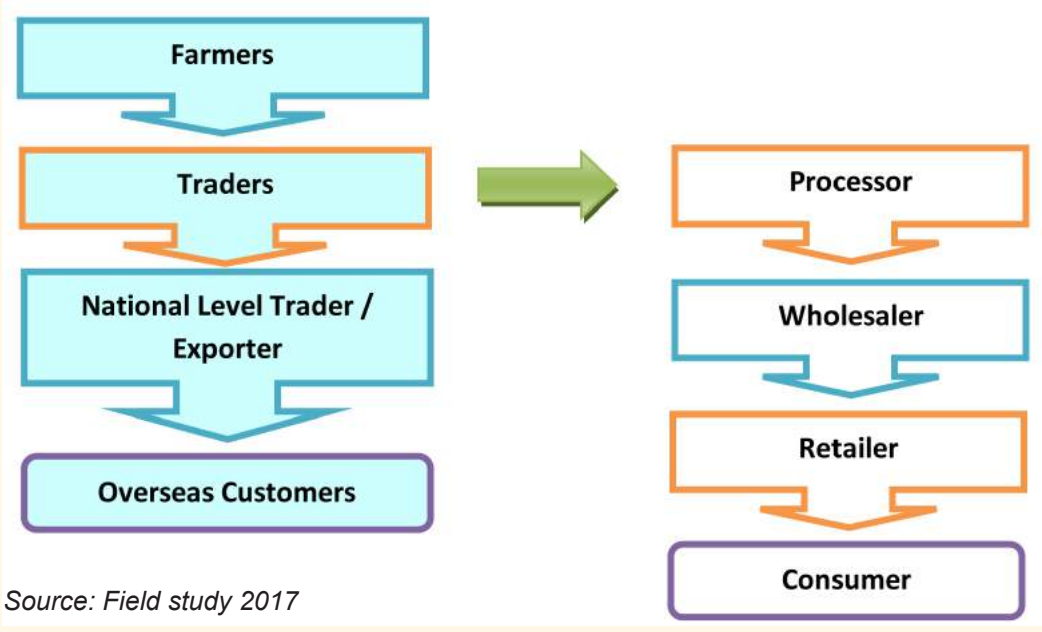
There are some distinct marketing channels observed in most districts and the most common presented below. This type of marketing channel is observed in Nizamabad, Karimnagar and Warangal (Enumamula Market).



Source: Field study 2017

Fig 20: Marketing Channel of Turmeric in Telangana State

In some markets like Kesamudram, Mahbubabad (Warangal district), farmers directly trade with the traders without the involvement of commission agents.



Source: Field study 2017

Fig 21: Marketing Channel of Turmeric in Kesamudram market, Mahbubabad district.

In some parts of Nirmal (part of old Adilabad district) and Metpally (part of old Karimnagar district), local aggregators scout for small quantities of turmeric usually from small farmers or from farmers who are left with quantities uneconomical to transport, towards the end of season. These aggregators are small traders who in turn sell the collected turmeric to traders in Nizamabad market.

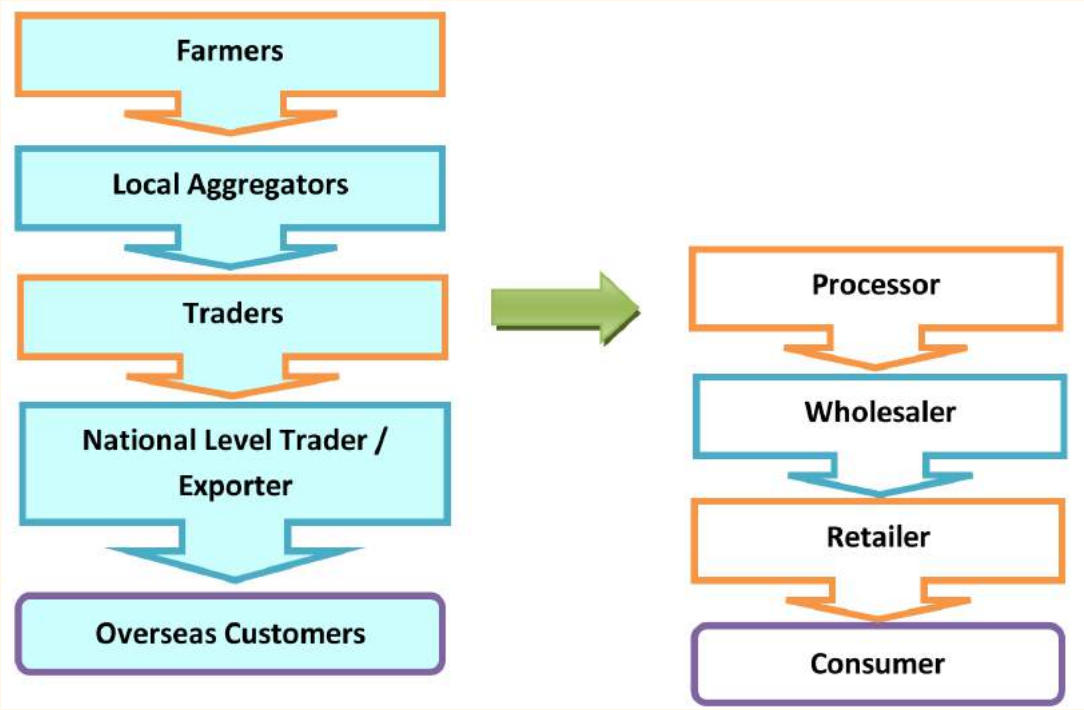


Fig 22: Marketing Channel of Turmeric in parts of Nirmal and Metpally markets

Source: Field study 2017

Domestic and Regional Markets

The domestic market is the major market for turmeric including the southern states. Turmeric grown in Telangana finds major market in Maharashtra, Gujarat, Madhya Pradesh and Uttar Pradesh, further goes to Delhi, Punjab and Haryana for consumption as powder. Besides the local produce, several brands of turmeric powder are available in these market centres which are processed in the regional markets.

End Markets

Apart from the regional markets, turmeric from Telangana gets exported to three major global destinations. The first grade finger material (double polished, more than 3” and bold fill) is exported to Japan and the next best quality material is exported to European markets. The remaining finger grade material is exported to Middle East countries where it is primarily used in leather and meat industry. The remaining material consisting of bulb, finger and broken pieces (chura) is used in local powder mills by small, unorganized players.

6

CHAPTER

CONSTRAINTS AND SUGGESTED INTERVENTIONS

As part of the study, based on interactions with various stakeholders, the following constraints are presented with possible interventions.

Table 20: Constraints and Suggested Interventions in Turmeric Cultivation

S.No.	Nature of Issue	Constraint	Suggested interventions
1	**Crop Production related**		
	i. Tank silt application	In Warangal area, tank silt application is low due to non availability and high transport cost.	In Warangal area tank silt application may be popularised as a soil conditioning mechanism.
	ii. FYM application	FYM/Poultry manure application is leading to high cost of cultivation and at times has to be procured from distant locations.	The good practice of FYM application has to be encouraged by developing a mechanism to make FYM / Vermicompost available in nearby places.
	iii. Soil Structure	In Nizamabad belt and Warangal districts, red chalka soils and sandy loams dominate turmeric cultivation which have poor soil properties.	Repeated application of tank silt and manure has resulted in apparent clay loam texture in the top soil.
	iv. Seed material	No promising variety has replaced the Duggirala and the local varieties which are a mixture of several varieties. The cost of seedlings through portray technology is very high and there is no planting machinery.	Almost the entire seed used in Nizamabad belt is of Duggirala origin, locally referred to as erra gunturu. In Mahbubabad, there is no specificity in the seed material as the stock appears to be a mix of Duggirala, Tekurpet and desi variety (local cultivar) sourced 3-4 decades ago. There is a scope for seed replacement with a better performing variety. There is a need to develop low cost plant material with appropriate machinery.
	v. Introduction of new varieties	Varieties like Salem, Rajapuri, Roma, Suroma, Pratibha have been tried and found to be inferior to Duggirala (Erragunturu) in terms of dry turmeric yield and resistance to pests and diseses.	Varieties to be introduced should be tested for yield performance (dry turmeric) which is a major criterion for acceptance by farmers. At the same time, curcumin content is to be validated in field conditions.

S.No.	Nature of Issue	Constraint	Suggested interventions
vi.	Varietal preferences of farmers	Farmers prefer varieties which yield high dry turmeric with good fill and texture. Farmers feel that no introduced variety could match the performance of Duggirala Red.	In Nizamabad belt, 7 months crop is preferred against 9 months crop in Mahbubabad to allow for subsequent short duration crops like gingelly, bajra subsequently. Research on short duration varieties is needed.
vii.	Curcumin content	Currently curcumin content does not play any role in price determination, as such farmers prefer varieties with higher dry turmeric yield alone.	There is a need to develop awareness on curcumin based price determination by maintaining purity of lots. Before introducing high curcumin cultivars, there is a need to test the cultivars in farmers' field at least for 2 years.
viii.	Land Preparation	The recent introduction of raised bed method has not been received well by the farmers due to 1. Lack of proper bed making implements 2. Current bed maker results in two rows resulting in lower plant population and yields 3. Current bed width of 120 cm renders using drip laterals insufficient given the low water holding capacity of soils 4. There is no machinery to take up sowing simultaneously during bed making. 5. Farmers contend that beds become flat after initial rains, requiring sowing by manual labour, increasing the cost. 6. In areas where drip is not used, cultivation on raised beds is not possible with surface irrigation.	Turmeric Research Station Kammarpalle has tried four row bed raiser but it needs extensive field trials to be recommended to farmers. Turmeric Research Station Kammarpalle is working on four row bed raiser with a provision for irrigation channel between second and third row, enabling bed method for farmers using surface irrigation. More trials are required before adoption at farmers' level.
ix.	Seed Treatment	Seed treatment is being practiced by less than 15% of the farmers as they find no respite from rhizome shoot fly and rhizome rot even after seed treatment. Further, labour constraint also adds to non adoption of this practice.	Effective control measures for root borne diseases and rhizome shoot fly need to be developed.
x.	Bulb as seed material	Farmers believe that vertically split bulb as seed material did not provide encouraging results	There is a need to revisit this recommendation.

S.No.	Nature of Issue	Constraint	Suggested interventions
	xi. One budded seed material	Farmers complained that one budded seed material resulted in poor establishment.	Farmers attempted two budded material and could reduce the seed material requirement to 3Q instead of normal 10Q.
	xii. Weeding	Manual weeding is the prevalent practice with initial chemical weed control. Shortage of labour and higher wages adding to cost of cultivation.	High density planting with 6”x6” spacing is observed in some parts of the state. Suitable implements for use on raised bed are needed.
	xiii. Drip Irrigation	Currently laterals are being provided for 120 cm wide raised beds which farmers find insufficient for two rows of turmeric.	Three / Four row sowing should be encouraged to compensate for less population.
	xiv. Digging and Harvesting	In Mahbubabad, digging is done using bullock drawn ploughs whereas in Nizamabad belt, digging is done manually using ‘konki’ (hand implement) Leaf cutting is observed in areas where crop is harvested after seven months, as in the case of Nizamabad belt. In Mahbubabad area, leaf is burnt after full maturity. Farmers find leaf cutting followed by digging labour intensive and costly.	There is a need to develop tractor drawn harvesting implements similar to that of onion and potato.
	xv. Separation of rhizomes and cleaning	Involves manual labour which is in short supply and is adding to higher cost of cultivation.	Further an inbuilt mechanism may be developed to clean and separate the rhizome into bulb and finger.
2	**Primary Processing related**		
	i. Boiling	Firewood based steam boilers are being used in Nizamabad belt whereas boiling in pans (kadai) is practised in Mahbubabad. This process requires huge amount of firewood and boiling is not uniform	Electric steam boilers need to be made available to reduce dependence on firewood.
	ii. Drying	Currently boiled turmeric is being dried on mud floors and drying yards (concrete). There is a chance of discoloration and moisture absorption during this stage.	Drying yards on community basis can be provided for small holders.

S.No.	Nature of Issue	Constraint	Suggested interventions
		Under MIDH, tarpaulin sheets are being supplied on subsidy basis to farmers by State Horticulture Dept. However, farmers feel that the moisture escaping settles on tarpaulin sheets and results in mold formation on turmeric.	An inbuilt mechanism through which boiling and drying can be done is needed to avoid high manual labour involvement.
	iii. Polishing	Farmers are practising single polishing using mechanical polishers in Nizamabad belt whereas such a practice is not prevalent in Mahbubabad.	More number of polishing facilities which can achieve superior polishing with less wastage will fetch better price for farmers.
3	**Market and Marketing related**		
	i. Information asymmetry	Farmers feel that there is information asymmetry in the markets despite the advent of eNAM platform. There is no broad based participation of traders from all parts of the country which is suspected for the collusion of local traders in keeping the prices down.	Product specifications for turmeric should be provided in the market along with probable range of prices. This may help farmers adopt grading as a post harvest operation for better price realization.
	ii. Continuous closure of market during holidays	During the months of March-April, there are instances wherein the market is closed for 4-5 consecutive days due to public holidays which results in turmeric arrivals in huge quantities, once the market resumes. This is also believed to be a reason for depression of prices citing high supply and low demand by traders.	Alternate marketing mechanism may be developed by providing compensatory holidays for market functionaries during busy season. This might help in continuous participation of traders during harvesting season.
	iii. Role of Commission Agents	Farmers depend on commission agents for various purposes including short term financial needs and as a guarantor for income after a trade is settled at the market. The role of commission agent might see a reduction with higher trades settled through eNAM platform. The absence of commission agent is not a desirable feature of market as it has been observed in Kesamudram market, where traders shut shop leaving the farmers in distress.	There is a need to broad base eNAM platform and regulate the charges levied by commission agents.

S.No.	Nature of Issue	Constraint	Suggested interventions
	iv. Inconsistent product quality	Farmers market turmeric as bulb and finger without adhering to any specific quality standards. Most farmers sell single polished product. Double polished product with better lustre may help in higher price realization.	Awareness, training and exposure visits on grading and quality standards can be provided.
4	**Secondary Processing related**		
	i. Lack of secondary processing in turmeric growing areas	Most of the turmeric grown in Telangana State is either getting traded in other states for powder purpose or sent to powdering mills in Hyderabad. There is no local industry as a standalone turmeric powdering unit is not viable.	Powdering mills need to be established for chilli, turmeric and coriander in major turmeric belts to improve value addition at local level and benefits to farmers involved in secondary processing.
	ii. Lack of curcumin and oleoresin extraction plants	Currently high curcumin varieties are not available.	High curcumin varieties need to be field tested and promoted to attract processors.
5	**Finance and Risk mitigation related**		
	Access to finance and insurance	The current scale of finance is not in line with the actual cost of production. Farmers believe that there is lack of transparency in insurance premium payment as no receipt is being provided. Farmers feel insurance is money wasted as in the past there were droughts and no sum was paid for loss of yields.	Scale of finance for turmeric should be based on realistic cost of production. The terms of crop insurance should take into consideration the transparency related issues.
6	**Governance related**		
	Collectives of turmeric farmers	Currently there are no FPOs in the study area which can collectively leverage their strength for production, marketing and processing.	Turmeric FPOs with a view to create additional employment opportunities to be nurtured.
	Extension gaps	Shortage of extension staff is hampering transfer of technology	ICT solutions should be explored to make up for staff shortage

Prioritization of Interventions

Improvements in turmeric cultivation and value addition would require many interventions involving various stakeholders and diverse teams. The following interventions have been grouped into short term, medium term and long term depending on the urgency and relevance in the field. These interventions have made to this list based on the need expressed by turmeric farmers and to some extent by traders and processors.

Short term Interventions

1. Drip irrigation is a necessary condition for raised bed method of planting. Most turmeric farmers in Mahbubabad district are yet to adopt drip irrigation.
2. Demonstration of advantages in raised method of planting, single/double bud seed material is needed to improve adoption. Farmers have certain apprehensions about these practices.
3. Protray method is a promising technology which can reduce the quantum of seed material required provided the cost per plant is brought down.
4. Integrated boiling and drying units need to develop to reduce time period between harvesting and marketing of produce.
5. The current scale of finance is not in line with the actual cost of production. Primary processing at farmers' end should also be considered in cost of production and scale of finance should be enhanced accordingly.
6. Insurance is a significant hidden cost, particularly for turmeric farmers availing finance through banks. A mechanism has to be developed to provide a receipt for the amount deducted towards premium payment.
7. As of now turmeric is covered under Mandal Insurance Unit Scheme, there is a need to bring it under Village Insurance Unit Scheme for effective utilization of the scheme.

Medium term Interventions

1. Seed material replacement with improved varieties is a priority and should be taken up with an action plan of 4-5 years through a cluster approach.
2. Varieties with high curcmin content without compromising on dry turmeric yield are in demand and need to be introduced through extensive field trials.
3. Produce with high curcumin content should be provided premium and a pricing mechanism should be developed to encourage cultivation of such varieties.
4. Quick test for estimation of curcumin is required in major turmeric markets to enhance interest of trader participation for such material. Lot wise curcumin results provided through eNAM will enhance nationwide trader participation and higher price realization to farmers.
5. Linkages between processors and farmers cultivating turmeric varieties with high curcumin content should be developed.
6. Establishment of cold storage units in identified clusters, to a certain extent, reduce distress sale.
7. Development of Spice Park in Nizamabad District

Long term Interventions

1. Development of varieties with high curcumin content and dry turmeric yields
2. Encouraging investors for establishing curcumin/oleoresin extraction plants with a view to tap the potential of improved varieties with high curcumin content.

Proposed Action Plan under MIDH

As envisaged in the norms of MIDH, cluster groups need to be promoted to increase the effectiveness of programmes implemented to enhance the value chain of turmeric in Telangana state. Under the study conducted, four clusters have been identified as shown in Table No.13 and the action plan proposed is to be implemented in these clusters.

Immediate intervention required:

Revision of cost norms: As per the existing MIDH guidelines, unit cost (cost norms) adopted for various components applicable to turmeric needs to be enhanced commensurate to actual cost of cultivation.

Action plan proposed as per the MIDH guidelines for enhancement of value chain of Turmeric in Telangana State is given below.

S. No.	Component	Proposed physical units	Pattern of Assistance
1	**Research and Development (R&D)**		
1.1	Selection of suitable varieties with high dry yield and high extractable curcumin content from among the released varieties shall be field tested through adaptive trials in farmer's field in different soils.	One unit	100% to public sector (Project based)
1.2	Demonstration plots shall be laid out in farmers' fields for popularizing seed treatment, raised bed method, micro irrigation, variety, plant population and economic efficiency of liquid fertilizers and mechanisation.	One units in each production cluster (1*4=4)	75 % assistance(implemented in farmers' field)
1.3	Develop suitable farm machinery for making raised beds, planting and digging should be developed by involving innovative farmers.	-	100% subsidy
1.4	a) Establishment of Tissue Culture lab at State Horticulture University OR b) Strengthening of existing lab	(Pattern of assistance- 100% to public sector)	a) Unit cost Rs. 250.00lakhs/unit b) Unit cost Rs.20 lakhs/ unit

2	**Production and Productivity Enhancement**		
2.1	Production and Distribution of Planting material:	Cluster-1 Morthad-Armoor-Nandipet-Velpur 2250ha	
a.	Development of four seed production clusters(Since there is no HYV identified for growing in this area, Duggirala Red – Selection from Duggirala having 4.5 % curcumin will be multiplied)	Cluster-2 Korutla-Jagtial-Ibrahimpatnam: 1700ha	35% subsidy on cost of production of seed material shall be provided to the beneficiaries
		Cluster-3 Mamda-Laxmanchanda: 700ha	
		Cluster-4 Kesamudram-Nellikuduru:950ha	
b.	Establishment of small Protray nurseries of 1.0ha	Eight in each production cluster (8*4=32)	Rs.15.00 lakhs/ha 50% subsidy
3	**Promotion of Integrated Nutrient Management(INM) and Integrated Pest Management (IPM)**		
3.1	Establishment of Plant Health Clinic near to Nizamabad, Nirmal and Jagtial production cluster	One unit	Unit cost: Rs. 25.00lakhs Pattern of assistance: 100% to public sector
3.2	Supply bio capsules developed by Indian Institute of Spices Research for control of rhizome rot.	5% of production cluster area 1. Nizamabad cluster-790ha 2. Jagtial Cluster-820ha 3. Nirmal Cluster-440ha 4. Kesamudram cluster-360ha	Unit cost: Rs.2000/ha Pattern of assistance: 30% of cost subject to a maximum of Rs 1200/ ha limited to 4.00 ha/ beneficiary (Or) 75% subsidy whichever is less
4	**Organic Farming**		
4.1	Adoption of organic farming (Programme to be linked with certification)	50 ha group in each cluster	Unit cost- Rs.20,000/ha. 50 % of cost limited to Rs.10,000/ha for a maximum of 4 ha/ beneficiary , spread over a period of 3 years involving assistance of Rs.4000/ha in first year and Rs.3000/ha each in 2nd and 3rd year

	Organic certification	Project based	Rs. 5 Lakh for a cluster of 50 ha which will include Rs.1.50 lakh in first year, Rs. 1.50 lakh in 2nd year and Rs. 2 Lakh in 3rd year.
4.2	Establishment of Vermicompost units (organic input production)		
	Individual beneficiaries	Four units in each production cluster (4*4=16)	Unit cost-Rs. 1.0 lakh Pattern of assistance: 50%
	Community basis or Commercial lines	One unit in Kesamudram cluster	For Community basis or Commercial lines - size of the unit should be at least 15 times to the existing size i.e. 301X81X2.51 to produce 200MT of compost per annum to make the unit viable
5	**Horticulture Mechanization**		
5.1	Machinery for bed making	Thirty units in each of Nizamabad, Jagtial and Nirmal clusters (30*3=90) Twenty units in Kesamudram cluster (Total = 90+20=110)	Assistance of Rs. 0.15 lakhs/unit
5.2	Planting Machinery	Five units in each of Nizamabad, Jagtial and Nirmal clusters Two Units in Kesamudram cluster	Assistance of Rs. 0.15 lakhs/unit
5.3	Steam Boilers	Twenty units each in Nizamabad, Jagtial and Nirmalclusters (20*3=60) Ten units in Kesamudram cluster (Total = 60+10=70)	Assistance of Rs. 0.15 lakhs/unit
5.4	Small polishing units	Twenty units in each production cluster (4*20=80)	Unit cost – Rs. 2.50 Lakhs. Assistance @ 40%, ie Rs. 1.00 lakhs/unit

5.5	Import of new machines & tools for horticulture for demonstration purpose (Public sector)- Electric Boilers / Solar Tunnel Dryers / Integrated Boiling and Drying Units	One unit	Unit cost limited to Rs. 50.00 lakhs 100% subsidy to public sector
6	**Technology Dissemination through Front Line Demonstration**		
6.1	Front Line Demonstrations (Project based)	Five units each in Nizamabad, Jagtial, Nirmal and Kesamudram production clusters	75% subsidy-Upper limit for assistance is Rs. 25,000,00/- per each project
7	**Integrated Post Harvest Management**		
7.1	Development of spice park - Integrated facilities for post harvest operations like cleaning, grading, drying, value addition, packaging and warehouse to help in better marketing and price realisation of the produce.	One unit (Project based)	100 % assistance for public sector
7.2	Establishment of three cold storage units of 5000MT capacity	1. Morthad-Kammarpalle in Nizamabad Cluster 2. Nirmal in Nirmal cluster 3. Kesamudram in Kesamudram cluster	Pattern of subsidy: Rs 8,000/MT, (max 5,000 MT capacity) Credit linked back-ended subsidy @ 35% of the cost of project in general areas per beneficiary.
7.3	Primary Processing Unit (Polishing Unit)	One unit in Kesamudram cluster	
8	**Creation of Market Infrastructure**		
8.1	Strengthening of Quality control lab for estimation of curcumin content	One unit at Warangal AMC market yard	• Unit cost: Rs. 200lakhs • Pattern of assistance: 100% to public sector

9	**Human Resource Development**		
9.1	Trainings to farmers within the state (to be conducted yearly)	5 training in each at Nizamabad, Jagtial and Nirmal clusters 8 trainings in Kesamudram cluster	Rs. 1000/- per farmer(25 farmers per training) 100% subsidy
9.2	Trainings to farmers outside the state(to be conducted yearly)	One training in each of Nizamabad, Jagtial and Nirmal clusters. Three trainings in Kesamudram cluster	Actual project cost 100% subsidy
9.3	Exposure visits to farmers outside the state(to be conducted yearly)	One Exposure visit in each of Nizamabad, Jagtialand Nirmal clusters Two Exposure visits in Kesamudram clusters	Actual project cost 100% subsidy
9.4	Formation of Farmers Producer Organizations	Three units in each of Nizamabad and Jagtial production clusters(3*2=6) One unit in each of Mahbubabad and Nirmal production clusters(1*2=2) (Total-6+2= 8)	Rs. 2.00 lakhs per unit 100% subsidy
10	**Mission Management**		
10.1	Organization of Exhibitions a. district level b. state level	Four One	Rs. 2.00 lakhs Rs. 3.00 lakhs 100% subsidy

Optimization of Cost of Cultivation: At present cost of cultivation of wet turmeric in Telangana is Rs. 2.16 Lakhs/Ha. This needs to be taken into consideration while fixing the norms for assistance on unit cost basis under seed production and other components.

ANNEXURES

Annexure: I Turmeric Crop insurance details in Telangana State from 2008 to 20014

Amount in Rs in Cr, Area in Ha

Year	Sum Insured	Number of Farmers - insured	Area Insured	Net Premium Payable	Net Premium Subsidy	Gross Premium	Claim Amount	Number of Farmers benefited
2008	25.04	8820	12672	1.43	0.13	1.56	0.62	4452
2009	81.33	22341	25958	4.90	0.43	5.33	1.42	7023
2010	52.81	13791	13108	2.90	0.27	3.17	2.80	6764
2011	56.38	14235	15346	3.41	0.31	3.72	4.36	7091
2012	81.69	16887	15102	3.83	0.38	4.21	0.00	0
2013	69.68	12728	10558	3.49	0.33	3.82	6.31	5878
2014	51.09	6708	5462	1.16	0.11	1.28	0.00	0
Total	418.01	95510	98205	21.13	1.96	23.09	15.50	31208

Source: AIC of India Ltd, Hyderabad

Annexure: II Turmeric Crop insurance details in Nizamabad district from 2008 to 20014

Amount in Rs in Cr, Area in Ha

Year	Sum Insured	Number of Farmers insured	Area Insured	Net Premium Payable	Net Premium Subsidy	Gross Premium	Claim Amount	Number of Farmers benefited
2008	13.1	3313	4264	0.8	0.1	0.8	0	0
2009	62.0	13501	17252	3.7	0.3	4.1	0.0	0
2010	35.6	6764	8024	2.0	0.2	2.1	2.8	6764
2011	35.4	7094	6965	2.2	0.2	2.3	4.4	7091
2012	48.8	7637	8305	2.3	0.2	2.5	0.0	0
2013	40.1	5878	6042	2.0	0.2	2.2	6.3	5878
2014	47.7	6048	5028	1.1	0.1	1.2	0.0	0
Total	282.6	50235	55879	14.0	1.3	15.3	13.5	19733

Source: AIC of India Ltd, Hyderabad

Annexure: III Turmeric Crop insurance details in Karimnagar district from 2008 to 20014

Amount in Rs in Cr, Area in Ha

Year	Sum Insured	Number of Farmers insured	Area Insured	Net Premium Payable	Net Premium Subsidy	Gross Premium	Claim Amount	Number of Farmers benefited
2008	2.71	1055	1003	0.16	0.01	0.17	0.00	0
2009	3.63	1242	1061	0.22	0.02	0.24	0.94	1242
2010	5.45	1641	1032	0.30	0.03	0.33	0.00	0
2011	7.42	2426	2666	0.45	0.04	0.49	0.00	0
2012	12.16	3746	3024	0.57	0.06	0.63	0.00	0
2013	7.43	1643	1142	0.37	0.04	0.41	0.00	0
2014	2.28	455	323	0.05	0.01	0.06	0.00	0
Total	41.07	12208	10251	2.11	0.20	2.31	0.94	1242

Source: AIC of India Ltd, Hyderabad

Annexure: IV Turmeric Crop insurance details in Adilabad district from 2008 to 20014

Amount in Rs in Cr, Area in Ha

Year	Sum Insured	Number of Farmers insured	Area Insured	Net Premium Payable	Net Premium Subsidy	Gross Premium	Claim Amount	Number of Farmers benefited
2008	8.61	4098	6945.99	0.49	0.05	0.54	0.60	4098
2009	12.64	5781	6685.1	0.75	0.07	0.83	0.48	5781
2010	9.26	4080	3330.37	0.51	0.05	0.56	0.00	0
2011	13.60	4715	5715.7	0.82	0.08	0.90	0.00	0
2012	15.01	4078	2907.96	0.70	0.07	0.77	0.00	0
2013	16.46	3781	2509.6	0.83	0.07	0.91	0.00	0
2014	0.58	124	70.51	0.01	0.00	0.01	0.00	0
Total	76.15	26657	28165.23	4.11	0.40	4.51	1.08	9879

Source: AIC of India Ltd, Hyderabad

Annexure: V Turmeric Crop insurance details in Warangal district from 2008 to 20014

Amount in Rs in Cr, Area in Ha

Year	Sum Insured	Number of Farmers insured	Area Insured	Net Premium Payable	Net Premium Subsidy	Gross Premium	Claim Amount	Number of Farmers benefited
2008	0.59	354	458	0.03	0.00	0.04	0.02	354
2009	3.09	1817	961	0.18	0.02	0.20	0.00	0
2010	2.53	1306	722	0.14	0.01	0.15	0.00	0
2011	0.00	0	0	0.00	0.00	0.00	0.00	0
2012	5.72	1426	864	0.27	0.03	0.30	0.00	0
2013	5.72	1426	864	0.27	0.03	0.30	0.00	0
2014	0.52	81	41	0.01	0.00	0.01	0.00	0
Total	18.18	6410	3909	0.91	0.09	1.00	0.02	354

Source: AIC of India Ltd, Hyderabad

Annexure-VI: Characteristics of different prominent varieties of turmeric

S. No	Variety	Yield (t/ha)	Crop Duration	Dry recovery (%)	Curcumin (%)	Oleoresin (%)	Essential oil (%)
1	Suvarna	17.4	200	20.0	4.3	13.5	7.0
2	Suguna	29.3	190	12.0	7.3	13.5	6.0
3	Sudharshan	28.8	190	12.0	5.3	15.0	7.0
4	IISR Prabha	37.5	195	19.5	6.5	15.0	6.5
5	IISR Prathibha	39.1	188	18.5	6.2	16.2	6.2
6	Roma	20.7	250	31.0	9.3	13.2	4.2
7	Suroma	20.0	255	26.0	9.3	13.1	4.4
8	Ranga	29.0	250	24.8	6.3	13.5	4.4
9	Rasmi	31.3	240	23.0	6.4	13.4	4.4
10	Rajendra Sonia	42.0	225	18.0	8.4	-	5.0
11	IISR Alleppey Supreme	35.4	210	19.3	6.0	16.0	4.0
12	IISR Kedaram	34.5	210	18.9	5.5	13.6	3.0
13	Duggirala red	32.0	240	17.6	4.5	14.6	4.0

Source: Turmeric Research Station, Kammarpalle

Annexure-VII: Variations in fresh yield of different cultivars in different locations in India

Fresh yield per plant (g) of 11 turmeric cultivars at 10 environments during 2008-2011.											
	Environments										
Cultivars	**Barapani**	**Coimbatore**	**Kumarganj**	**Kolasib**	**Kozhikode**	**Chintapalli**	**Dholi**	**Pundibari**	**Raigarh**	**Jagtial**	**Mean**
Mega turmeric	464.11c	382.17bc	231.12bc	437.00a	455.83cd	401.18b	555.56c	285.15cd	148.08de	319.78bc	367.99BC
IISR Alleppy Supreme	391.11de	412.00a	227.67c	345.89bc	394.86de	291.44c	386.67d	246.73ef	113.81f	280.33d	309.05D
IISR Kedaram	383.67de	350.56ef	228.23c	327.89bc	367.33ef	317.07bc	393.33d	348.92ab	105.26f	341.78ab	316.40D
IISR Prathiba	357.78de	360.44dc	206.67e	379.33b	493.06bc	275.91c	405.56d	252.80de	121.64ef	282.33d	313.55D
BSR-2	672.89a	402.11ab	251.34a	281.22ef	490.74bc	404.22b	530.00c	254.81de	195.46bc	312.00bc	379.48B
Suranjana	502.22c	292.22g	200.00e	351.00bc	560.61b	365.33bc	516.67c	382.90a	262.89a	332.33ab	376.62B
Rajendra Sonia	407.22d	355.11e	216.52d	297.11de	657.86a	394.11b	1040.00a	265.87cd	166.81cd	330.56ab	413.12A
Roma	558.89b	393.44ab	236.63b	326.78cd	347.25ef	500.96a	518.89c	307.87bc	126.18ef	310.56cd	362.75BC
Rasmi	315.56f	391.22ab	203.23e	246.89f	302.67f	370.11bc	510.00c	299.92ef	114.51f	372.78a	312.69D
Narendra Turmeric-1	515.89bc	328.44f	246.41a	377.11bc	658.89a	338.96bc	698.89b	296.70cd	216.99b	363.39ab	404.17A
Duggriala Red	352.17ef	368.22cd	236.38b	362.67bc	510.69bc	339.89bc	550.00c	232.85f	189.22bc	366.00ab	350.81C
Mean	447.41C	366.90D	225.84G	339.35E	476.35B	363.56D	555.05A	288.59F	160.08H	328.35E	355.14
CV%	**12.59**	**7.68**	**2.62**	**18.16**	**17.07**	**28.27**	**15.61**	**18.52**	**23.28**	**18.49**	

Mean in the same column and row followed by a common letter are not significantly different at P≤0.01 by DMRT Different capital letter(s) indicate significant difference between environments and between cultivars

Source: AICRPS [1]

[1] *Genotype by environment interaction effects on yield and curcumin in turmeric (Curcuma longa L.) Industrial Crops and Products 53 (2014) 358– 364*

Annexure-VIII: Variations in Curing (%) of different cultivars in different locations in India

Curing (%)of 11 turmeric cultivars at five environments during 2010-2011.						
	Environments					
Cultivars	Barapani	Coimbatore	Kumarganj	Kolasib	Kozhikode	Mean
Mega turmeric	22	20.49cd	18.80e	23.00bc	18.71a	20.60B
IISR Alleppy Supreme	17.47	21.83a	23.20cd	21.63c	18.30a	20.49B
IISR Kedaram	21.83	21.12bc	24.60bc	25.67a	17.60a	22.16A
IISR Prathiba	18.33	21.62ab	25.00ab	24.63ab	19.27a	21.77A
BSR-2	17.37	21.46ab	18.60e	21.17c	12.70b	18.26C
Suranjana	15.1	20.28de	24.30bc	17.30d	16.75a	18.75C
Rajendra Sonia	13.43	14.70g	21.90d	13.47e	11.21b	14.94E
Roma	19.87	16.47f	26.40a	24.77ab	18.74a	21.25AB
Rasmi	20.07	16.20f	24.30bc	24.17ab	18.45a	20.63B
Narendra Turmeric-1	12.7	19.77e	24.10bc	12.23e	11.81b	16.12D
Duggriala Red	17.77	15.23g	16.90f	21.70c	17.25a	17.77C
Mean	17.82D	19.39C	23.12A	20.80B	16.35E	19.34
CV%	28.01	2.15	4.28	6	13.4	

Mean in the same column and row followed by a common letter are not significantly different at P≤0.01 by DMRT
Different capital letter(s) indicate significant difference between environments and between cultivars
Source: AICRPS

Annexure-IX: Variations in Curcumin content and yield of different varieties in different locations in India

Cultivars	Locations				
	Barapani	Coimbatore	Kumarganj	Kolasib	Kozhikode
Mega turmeric	7.2a	5.3b	4.2cd	5.5	3.7cd
IISR Alleppy Supreme	6.3c	3.0g	4.7bc	5.4	3.6d
IISR Kedaram	6.4bc	5.0d	4.5cd	5.4	4.2bc
IISR Prathiba	6.9ab	2.9g	4.2cd	5.2	4.6ab
BSR-2	3.7f	3.7f	3.8d	5.8	4.1cd
Suranjana	5.1d	5.2bc	4.8bc	5.5	3.8 cd
Rajendra Sonia	6.2c	5.1cd	4.8bc	6.1	4.1bc
Roma	6.8ab	5.1cd	5.3ab	5.3	3.7cd
Rasmi	5.0de	5.0d	3.8d	5.3	5.3a
Narendra Turmeric-1	6.2c	6.2a	5.6a	6.0	5.0ab
Duggriala Red	4.5e	4.1e	4.5cd	5.6	3.8cd

Mean in the same column and row followed by a common letter are not significantly different at P≤0.01 by DMRT.
Different capital letter(s) indicate significant difference between environments and between cultivars
Source: AICRPS

Annexure-X: Stability analyses for curing (%), curcumin and dry yield of 11 turmeric cultivars grown at 5 environments during 2010-2011.

Cultivars	Curcumin (%)			Curing (%)			Dry yield (t/ha)		
	Mean	b	Sd^2	Mean	b	Sd^2	Mean	b	Sd^2
Mega turmeric	5.18	1.71	0.40**	20.6	0.06	4.11**	7.82	1.08	1.37
IISR Alleppy Supreme	4.6	1.61	0.53**	20.49	0.89	1.18	6.89	0.99	1.49
IISR Kedaram	5.09	1.13	0.05	22.16	1.16	2.14	7.24	0.92	1.4
IISR Prathiba	4.75	1.51	1.20**	21.77	1.16	0.95	7.29	1.15	1.29
BSR-2	4.22	0.48	0.90**	18.26	0.94	9.25**	7.69	1.46	3.75*
Suranjana	4.87	0.69	0.23**	18.75	1.12	6.89**	5.99	0.66	-0.16
Rajendra Sonia	5.26	1.22	-0.006	14.94	1.41	5.90**	4.99	0.75	0.6
Roma	5.27	1.3	0.41**	21.25	1.4	7.27**	6.59	1.17	2.86*
Rasmi	4.87	0.2	0.46**	20.63	1.1	6.71**	5.16	1.08	1.23
Narendra Turmeric-1	5.78	0.49	0.11	16.12	1.54	21.55**	6.75	0.64	9.22*
Duggriala Red	4.49	0.66	0.24**	17.77	0.24	6.48**	5.19	1	0.27
Mean	4.94			19.34			6.51		

Significant from 1.0 (for b) at P< 0.01 or P< 0.05 probability level indicates unstable cultivars.
Significant from regression value (for Sd2) at P <0.01 or P <0.05 probability level indicates unstable cultivars.
Source: AICRPS

Annexure-XI: Turmeric Markets in Telangana

S. No	District	A.M.C	Market	Functional/Non Functional
1	Jagtial	Gollapalli	Gollapalli	Functional
2	Jagtial	Jagtial	Jagtial	Functional
3	Jagtial	Metpally	Metpally	Functional
4	Jagtial	Korutla	Korutla	Seasonal
5	Jagtial	Raikal	Raikal	Seasonal
6	Karimnagar	Huzurabad	Elkaturthy	Seasonal
7	Mahabubabad	Kesamudram	Kesamudram	Functional
8	Mahabubabad	Mahabubabad	Mahabubabad	Functional
9	Nirmal	Bhainsa	Bhainsa	Seasonal
10	Nirmal	Khanapur	Khanpur	Seasonal
11	Nizamabad	Nizamabad	Nizamabad	Functional
12	Warangal Urban	Warangal	Warangal	Functional
13	Sanga Reddy	Sadasivpet	Sadasivapet	Functional
14	Vikarabad	Basheerabad	Basheerabad	NA
15	Vikarabad	Dharur	Dharur	Functional
16	Vikarabad	Marpally	Marpally	Seasonal
17	Vikarabad	Pargi	Pargi	Functional
18	Vikarabad	Tandur	Tandur	Functional
19	Vikarabad	Vikarabad	Vikarabad	Functional
20	Khammam	Khammam	Khammam	Functional

NA-Not Available
Source: http://tsmarketing.in/CommoditywiseImpMarkets.aspx
http://tsmarketing.in/Functional_Non_Functional_AMCs_List.aspx

Annexure-XII: List of Respondents

Date of FGD:		13.07.2017
Village: Morthad	Mandal:Morthad	District: Nizamabad
S.No	**Name of the Respondent (Farmer)**	**Mobile**
1.	Sri.Ollem Santosh	9440898945
2.	Sri.Bonagiri Ganganna	9603322587
3.	Sri.Muska Ramesh	9542640608
4.	Sri.Sama Srinivas	9440728156
5.	Sri.Yelala Srinivas Reddy (Y.Sri)	9948819838
6.	Sri.Mutym Reddy	9441163665
7.	Sri.K. Linga Reddy	9985224459
8.	Sri.Dadine Pedda Mohan	9492792199
9.	Sri.Sunil Kumar	9440707388
10.	Sri.Gopidi Satya Narayana	9440004356
11.	Sri.D. Naveen (Sarpanch Marthur)	9948953195
12.	Sri.N. Ashok	9100930868
13.	Sri.P. Sudhakar	9490404983
14.	Sri.B. Naresh	8297070353
15.	Sri.T. Mohan	9640583905
16.	Sri.B. Anjaiah	9948946675
17.	Sri.Y. Mohan Reddy	-

contd...

Date of FGD:		14.07.2017
Village: Armoor	Mandal: Armoor	District: Nizamabad
S.No	Name of the Respondent (Farmer)	Mobile
1.	Sri.Katipally Venkat Reddy	9949494777
2.	Sri.Vanela Chinna Narsaiah	9912972279
3.	Sri.Yeruga Ramesh	9553269686
4.	Sri.Magidi Rajeshwar	9553669927
5.	Sri.Macherla Gangaram	9010449888
6.	Sri.Puppala Rajesh	9912095900
7.	Sri.Gaddam Bhumanna	9959264688
8.	Sri.Macherla Ganga Reddy	9010449888
9.	Sri.Gajareddy Ramesh	9705606688
10.	Sri.Vegour Gangaram	9032763359
11.	Sri.Aliver Sudhakar	7794821100
12.	Sri.Gaddam Narayana	9010270054
13.	Sri.Gaddam Narayana	9949115811
14.	Sri.Nakkala Ramulu	9494842727
15.	Sri.Gaddam Venkat Reddy	9951256386
16.	Sri.Gadereddy Chinna Gangaram	9030738720
17.	Sri.Macherla Lingareddy	9948979224
18.	Sri.Essapally Bajanna	9912972892
19.	Sri.Thathi Ashok	9030922421
20.	Sri.Chikamuku Rajanna	9666924536

contd...

Date of FGD:		14.07.2017
Village: Donkeshwar	Mandal: Nandepet	District: Nizamabad
S.No	Name of the Respondent (Farmer)	Mobile
1.	Sri.Bonla Bhima Reddy	-
2.	Sri.Bonla Ganga Reddy	-
3.	Sri.Kallem Pedda Gangareddy	-
4.	Sri.Naikadi Gangadhar	-
5.	Sri.Velgor Nadpi Gangaram	-
6.	Sri.Bosi Mekela Gangasagar	-
7.	Sri.Barla Pedda Sai Reddy	-
8.	Sri.Goka Srinivas Reddy	-
9.	Sri.Gangasaram Mahesh Reddy	-
10.	Sri.Koppala Bojendar	-
11.	Sri.Mamidi Bojareddy	-
12.	K Sri.andala Rajanna	-
13.	Sri.Barla Pedda Sai Reddy	-

contd...

Date of FGD:		18.07.2017
Village: Inugurthy Mandal: Kesamudram District: Mahabubabad		
S.No	Name of the Respondent (Farmer)	Mobile
1.	Sri.P. Sanjeeva Reddy	9908144475
2.	Sri.P. Devendar Reddy	9133546120
3.	Sri.J. Desh Naik	9866169943
4.	Sri.Karra Narsimhareddy	9701813066
5.	Sri.G. Venkanna	9666197819
6.	Sri.P. Ravindar Rao	9494280255
7.	Sri.P. Mahabab Reddy	9949452797
8.	Sri.Parupati Narsimha Reddy	9490596200
9.	Sri.Parupati Yaraju Reddy	9491531309
10.	Sri.Pothula Venkateshwarlu	8978560510
11.	Sri.Odala Sadanandam	9441634245
12.	Sri.Odala Yakanna	9848630667

contd...

Date of FGD:		18.07.2017
Village: Chinamupparam Mandal: Nallikuduru District: Mahabubabad		
S.No	Name of the Respondent (Farmer)	Mobile
1.	Sri.Gayapu Jayapal Reddy	9951245932
2.	Sri.Kalepu Nethaji	9951101049
3.	Sri.Gude Ugender	8985636977
4.	Sri.RupiReddy Gopala Reddy	9963992798
5.	Sri.Morapaka Veeraiah	9490116737
6.	Sri.Tuppathi Veeranna	9908552261
7.	Sri.Soma Ashok	9652373955
8.	Sri.Bomoth Bojya	9989219970
9.	Sri.Koder Lakshmi Narayana	9704296106

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Date of FGD:		21.07.2017
Village: Koritikal	Mandal: Mamda	District: Nirmal
S.No	**Name of the Respondent (Farmer)**	**Mobile**
1.	Sri.Alepi Chinna Linga Reddy	9666886668
2.	Sri.Eluri Raja Reddy	9704024087
3.	Sri.Kuntula Peddanna	7036761645
4.	Sri.Eddhandi Rajareddy	9603609499
5.	Sri.Bheema Reddy	9885553131
6.	Sri.Naeddyrsa R	7799665979
7.	Sri.M. Rajeshwar	9948868649
8.	Sri.NarsaReddy	9505130055
9.	Sri.S. LingaReddy	9010199260
10.	Sri.P.Raju	9010454678
11.	Sri.G.Ganga Reddy	9666888600
12.	Sri.Eluri Bangaru Reddy	8096397206
13.	Sri.Devulla Srinivas	9640082083
14.	Sri.Syed Bari	9989641131
15.	Sri.Devella Prabhakar	9705208792

contd...

Date of FGD:		22.07.2017
Village: Laxmanchanda	Mandal: Laxmanchanda	District: Nirmal
S.No	**Name of the Respondent (Farmer)**	**Mobile**
1.	Sri. Narayana, Sarpanch	9666240372
2.	Sri.Sunkari Ellanna	-
3.	Sri.A.Ramreddy	9440708625
4.	Sri.Kummari Chinnolla Narsaiah	9666282578
5.	Sri.Sangem Rajeswar	9666384683
6.	Sri.Sida Linganna	9505961549
7.	Sri.K.Gandhi Reddy	8790389488
8.	Sri.Osa Ravi	9908099367
9.	Sri.Appali Sankar	9010735510
10.	Sri.Anumal Rajeswar	7729083244
11.	Sri.Kuna Pothanna	9705690981
12.	Sri.Talakkola Chinna Muthanna	-
13.	Sri.Bodla Praveen	-
14.	Sri.Sunkari Chinna Gangayya	
15.	Sri.S. Mutyham Reddy	9505021613
16.	Sri.Bojja Chitti	-
17.	Sri.Osa Rajanna	9441339339
18.	Sri.Adlu RajaReddy	-
19.	Sri.Golla Erranna	-
20.	Sri.Gaddam Chinarajanna	-
21.	Sri.Bojja Ganganna	-
22.	Sri.Sangem Ganganna	-

contd...

Date of FGD:		25.07.2017
Village: Joginipally	Mandal: Korutla	District:Jagtial
S.No	Name of the Respondent (Farmer)	Mobile
1.	Sri.Kommula Kamalakar Reddy	9866719066
2.	Sri.K.Thirupathi Reddy	9948079877
3.	Sri.Sama Laxma Reddy	9676749142
4.	Sri.Kommula Thirupathi	9848940078
5.	Sri.Balagam Raju	8008252808
6.	Sri.Baddam DevaReddy	9652648288
7.	Sri.Yeleti RamiReddy	9912436363
8.	Sri.Mahipal Reddy	9618399659
9.	Sri.B.Anjaiah	9676748970
10.	Sri.B.Kishan Reddy	9618399659
11.	Sri.J.Raji Reddy	-
12.	Sri.S.Shekhar Reddy	9989728118
13.	Sri.S.Narasa Reddy	9160333711
14.	Sri.A.Nagaraju	9652058265
15.	Sri.B.Nageshwar Reddy	9989142432
16.	Sri.Nalla Santhosh Reddy	9490472357
17.	Sri.Yeleti Linga Reddy	8897763245
18.	Sri.Maru Ravindhar Reddy	9652093241
19.	Sri.Yeleti RamReddy	9703123298
20.	Sri.Yeleti Sudarshan	9652648321
21.	Sri.Yeleti Mohan Reddy	9550955262
22.	Sri.Baddam Ramanujam	9989142339

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Date of FGD:		25.07.2017
Village: Laxmipur Mandal: Jagtial® District: Jagtial		
S.No	Name of the Respondent (Farmer)	Mobile
1.	Sri.A.Laxma Reddy	9951155900
2.	Sri.A.Sudharshan Reddy	9849888361
3.	Sri.M.Bhooma Reddy	9849881181
4.	Sri.A.Satya Reddy	9951342160
5.	Sri.A.Ravi Reddy	9989080982
6.	Sri.M.Sudarshan	9963275402
7.	Sri.G. Gopal Reddy	9866004464
8.	Sri.G. Gangaih	8008821645
9.	Sri.T. Chandra Sekhar Reddy S/o T.G. Reddy	9000525371
10.	Sri.T. Chandra Sekhar Reddy,s/o J. Redddy	9000364631
11.	Sri.G. Rajaiah	9441196367
12.	Sri.M.Thirupathi Reddy	9704943489
13.	Sri.S.RamReddy	9948452429
14.	Sri.P.Srinivas Reddy	9666276319
15.	Sri.P.Sanjeeva Reddy	9705594361
16.	Sri.A.Lingana	9963372503
17.	Sri.P.Thirupathi Reddy	9618297800

contd...

Date of FGD:		25.07.2017
Village: Laxmipur Mandal: Jagtial®		District: Jagtial
S.No	Name of the Respondent (Farmer)	Mobile
18.	Sri.Anugu Balwantha Reddy	9963469419
19.	Sri.Anugu Chandra Prakash	9177300735
20.	Sri.Baddam Thirupathi Reddy	9912433220
21.	Sri.Yeleti Jeevan Reddy	9951259901
22.	Sri.Baddam Goutham Reddy	8332831617
23.	Sri.Kommula Gopal reddy	9959863980
24.	Sri.Kommula Buchi Reddy	9948864537
25.	Sri.Kommula Buchi Reddy	9705161919
26.	Sri.Sama Nageshwar Reddy	9666750999
27.	Sri.Baddam Laxma Reddy	9652648323
28.	Sri.Yeleti Narayana Reddy	9951397985
29	Sri.Baddam Rajesham	9502355620
30	Sri.Baddam Amarendhar	9550624347
31	Sri.Yeleti Jithendhar Reddy	8106467495
32	Sri.A Anandha Reddy	9440024365
33	Sri.Anugu Lingareddy	9676749049

contd...

Date of FGD:		26.07.2017
Village: Ibrahimpatnam	Mandal: Ibrahimpatnam	District: Jagtial
S.No	**Name of the Respondent (Farmer)**	**Mobile**
1.	Sri.Kumbala Raja Reddy	9849493711
2.	Sri.T. Ashok Reddy	9963413666
3.	Sri.Kumbala Lingareddy	9949454833
4.	Sri.Badikinti Muttanna	9949898806
5.	Sri.Sepapanna	9949863419
6.	Sri.Bala Srinu	9502443488
7.	Sri.Nereti Narayana	9989727068
8.	Sri.Odde Rajanna	9949565032
9.	Sri.Anugu Narsha Reddy	9989332987
10.	Sri.Anugu Mahipal	9948008595
11.	Sri.Nuthula Ravi Reddy	9666167999
12.	Sri.S. A. Raju	9949883032
13.	Sri.Kunbala Lingareddy	9948772755
14.	Sri.Nemuri Satya Nayar	9866783377
15.	Sri.G. Rajendhar	9052396118
16.	Sri.Kanthi Prathap	9963257818

contd...

S.No	Name of the Respondent	Address
1.	Mr.Master Shankar	Commission Agent, AMC, Nizamabad
2.	M/S Ketan Uday	Trader, AMC, Nizamabad
3.	Sri.Kamak Kishore Inani	Trader, AMC, Nizamabad
4.	Sri. Jitendra Nagla	Trader and Processor, AMC, Nizamabad
5.	Sri.K.Vinod,	National Bulk Handling Corporation, In-charge, Nizamabad
6.	Sri. K. Chandra Mohan,	Trader and VC, AMC, Warangal
7.	Sri.A Linga Reddy	Commission Agent, AMC, Warangal, Enumamula
8.	Sri.Kumaraswamy	Commission Agent, AMC, Warangal, Enumamula
9.	Sri.Ravi Karani	Trader, AMC, Warangal, Enumamula
10.	M/S Karani Spices	Processor, AMC, Warangal, Enumamula
11.	Sri.Shiva Kumar	Commission Agent, AMC, Metpally
12.	Sri.Vinod Kumar	Commission Agent, AMC, Metpally
13.	M/S Shiva Traders	Trader, AMC, Metpally
14.	M/S Vinod Traders	Trader, AMC, Metpally
15.	Sri Rama Traders	Trader, AMC, Metpally

contd...

List of Officers

S.No	Officer Name	Designation	Contact No
Nizamabad district			
1.	Dr.N. Sunanda Rani	DHSO,Nizamabad	8374449878
2.	Sri. Md.Riyaz	DMO, Nizamabad	7330733145
3.	Sri. Ramarao Naik	Assistant Director of Agrl, Armoor	7288894575
4.	Smt. S.Swarupa Rarni	Secretary, AMC, Nizamabad	7330733143
5.	Sri.Rohit	CLHO, Morthad	9640871430
6.	Sri.M.M. Mahipal	CLH, Armoor	9440660832
7.	Sri.Ch. Vidyasagar	HEO, Armoor	8374449867
8.	Ms.K. Kalyani	AEO ,Nandepet	9177665011
9.	Sri.M. Sudheer	HEO, Nandipet	8374449862
Mahbubabad district			
10.	Sri.K.Suryanarayana	DHSO, Mahaboobabad	8374449066
11.	Ms. Surekha	DMO, Mahbubabad	7330733467
12.	Sri.Ch. Rakesh,	HO, Thorrur	8374449378
13.	Sri. Niranjan Reddy	Secretary, AMC, Kesamudram	7330733495
Warangal district			
14.	Smt.P. Sunitha	DHSO, Warangal	8374449906
15.	Sri. V.Srinivas	Dy. Director of Marketing, Warangal	7330733669
Nirmal district			
16.	Sri.D. Narsaiah	DHSO, Nirmal	8374449481
17.	Sri. P. Srinivas	DMO, Nirmal	7330733458
18.	Smt. Kalyani	HO, Nirmal	8125218074
19.	Sri.Devanna	HEO, Mamda	8374449886

contd...

S.No	Officer Name	Designation	Contact No
Jagtial district			
20.	Sri.J.Pratap Singh	DHSO, Jagityal	8374449364
21.	Sri. D.Prakash	DMO, Jagtial	7330733148
22.	Sri.S.K.Javid Pasha,	CLHO, Metpalli	8374449363
23.	Sri.K.R.Sharma	CLHSO,Metpalli	9704373378
24.	Sri.B.Anvesh	MLHSO,Jagityal	8374449893
25.	Sri.G. Deva Prasad	CLHO, Korutla	8374449368
26.	Sri.A. Anil Kumar,	HEO, Korutla	8374449472
27.	Sri.N. Anil Kumar	HEO, Korutla	8374449894
28.	Ms.A. Srilatha,	HEO, Metpally	8374442344
Office of Commissioner, Dept of Horticulture, Govt. of Telangana			
29.	Sri.K.Venugopal	Assistant Director of Horticulture	8374449095
Turmeric Research Station, SKLTSHU, Kammarpally,Nizamabad district			
30.	Dr. Dr.B.Mahender,	Scientist and Head	9441532072

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