CEE
Centre for Environment Education

Towards Green and Socially-Sound Recovery
in Rural and Farm Sector

CASE STUDY OF TOMATO FARMERS IN SALAWADE VILLAGE IN BHOR BLOCK, DIST. PUNE, MAHARASHTRA

Photo : Baswant Jagdhane

ABOUT US

Centre for Environment Education (CEE) was established in 1984 as a Centre of Excellence of the Ministry of Environment and Forests, Government of India. As a national institution, CEE's mandate is to promote environmental awareness nationwide.

CEE develops innovative programmes and educational material and builds capacity in the field of Education for Sustainable Development (ESD). It is committed to ensuring that Environmental Education (EE) leads to action for sustainable development. It undertakes field projects that demonstrate and validate the role education can play in sustainable development.

With partners including State Governments, Foundations and Corporates through CSR funding, CEE has undertaken projects in rural and urban development, waste management, biodiversity conservation, quality improvement in school education, marine conservation and others. Working with the government, CEE has made significant contributions to international negotiations in the area of ESD.

ACKNOWLEDGMENTS

Our sincere thanks to our partners: Mr. Shantaram Pandere and Ms. Mangal Khinwasara (Lok Paryay, Aurangabad), Mr. Mahesh Patankar (MP Ensystems, Mumbai), Mr. Manish Rajanakar, Mr. Patiram Tumsare, Ms. Shalu Kolhe & Mr. Nandlal Meshram (Foundation for Economic and Ecological Development) for their domain expertise and facilitation, and Mr. Ravi Thombade, Ms. Vijaya Padekar, Mr. Shripad Konde, Mr. Eknath Bagul and Mr. Appasaheb Ghadage for community level data collection in the different clusters across Maharashtra and Mr. Subodh Kumar for Bihar.

We would also like to express our gratitude towards the Forest Department, Kalsubai Harishchandragad Wildlife Sanctuary, Govt. of Maharashtra; PO, Aurangabad, Tribal Development Department; DFO Aurangabad, Fisheries Department, Dr. Ramchandra Sabale; Mr. Kiran Auti, Gramoorja Solutions Pvt. Ltd., Pune, Mr. Nitin Ingale from Maharashtra. From Gujarat viz. Agriculture Department, Jasdan, APMC Jasdan, APMC Gondal, Agriculture University, Junagadh; Agriculture University, Anand; Agriculture University, Navsari; Mr. Pradip Kalariya and Mr. Dhaval Singh; Rajkot Dairy and TinyTech. From Bihar viz. Director, Banana Research Institute, Goraul, Dist. Vaishali, ATMA Hajipur, Dist. Vaishali; ATMA Muzaffarpur, KVK, Saraiya, Dist. Muzaffarpur, and KVK Hariharpur, Dist. Vaishali; Fisheries Department & Horticulture Department of Muzaffarpur and Vaishali districts; Sudha Cooperative Milk Society, Muzaffarpur; National Research Centre on Litchi, Mushahari, Muzaffarpur. Last but not the least, all the study participants, number of farmers, forest dwelling community members, fisherfolks, entrepreneurs, academicians, whose direct and indirect contributions made these multi-state, multi-commodity/livelihoods studies possible.

Editorial team: Satish Awate, Sanskriti Menon
Coordination: Navneet Wadkar, Satish Awate
Comments: Madhavi Joshi
Design: Ashok Thorave
Copyediting and Proofreading: Shweta Venkatesh

PROJECT TEAM

Overall Lead and Maharashtra: Sanskriti Menon, Satish Awate, Navneet Wadkar, Baswant Vithabai Babarao, Puja Shelkande
Bihar: Preeti R. Kanaujia, Neeraj Pal, Vipin Verma, Subhodh Kumar
Gujarat: Suman Rathod, Kurshid Alam, Nitin Agravat

INTRODUCTION

Tomato *(Solanum lycopersicum)* is an important but highly perishable vegetable. Huge post-harvest losses in tomatoes occur due to falls in prices and inadequate storage facilities, which brings substantial losses to the farmers. India is the world's second largest tomato producer after China but processes only 0.7 per cent of its production. This impacts farmers by way of high post-harvest losses and low returns during periods of excess supply in the market.

APPROACH

1. The GHG emission for agriculture inputs and outputs supply chain inventories and primary processing (sorting, grading, storing) was calculated using the Cool Farm Tool (CFT). The data required for the Cool Farm Tool was collected using the GHG emission data collection tool.
2. To study the value chain of tomatoes both primary and secondary data were collected by interviewing various value chain intermediaries such as farmers, transporters, traders, and APMC commission agents and using datasets from the Centre for Monitoring Indian Economy (CMIE) and APMCs.

STUDY AREA

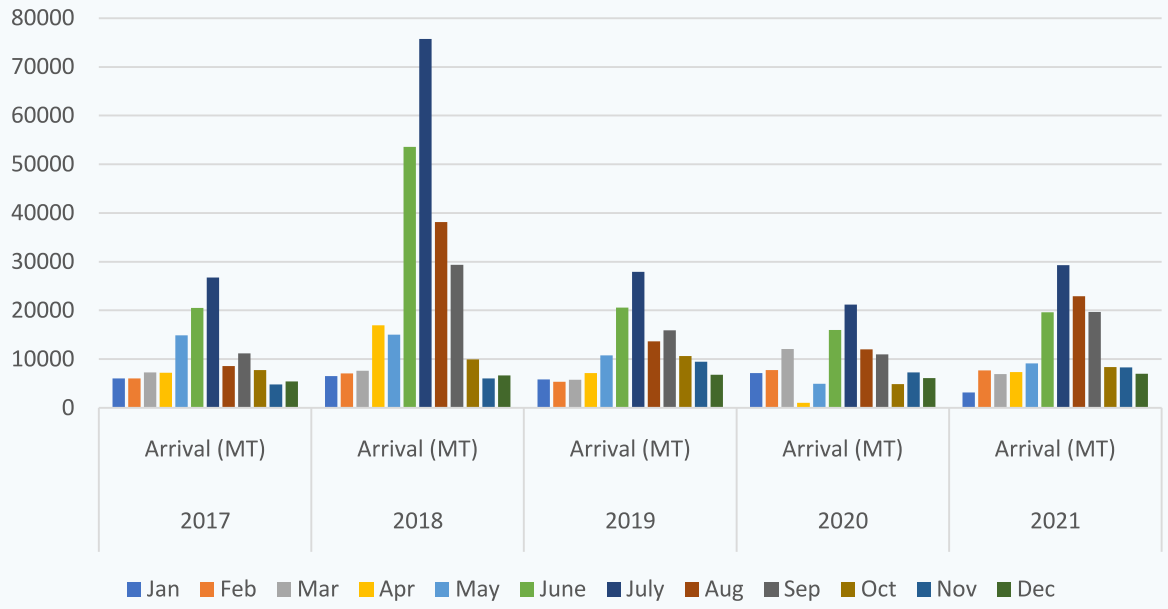
The study village Salawade is situated in Bhor taluka, Pune district, Maharashtra, on the bank of the Shivaganga river. People in this village largely depend on agriculture for their livelihood. Tomato and rice (Indrayani) are the popular crops in this region. The total geographical area of the village is 473.16 ha out of which 350 ha is agricultural land. Around 150 ha land is irrigated while 200 ha land is rainfed agriculture. 69.2 per cent of the population are marginal farmers and 24.2 per cent are small farmers.

Photo : Baswant Vithabai Babarao

PRODUCTION SYSTEM AT THE NATIONAL, STATE, AND AT THE PUNE DISTRICT LEVEL

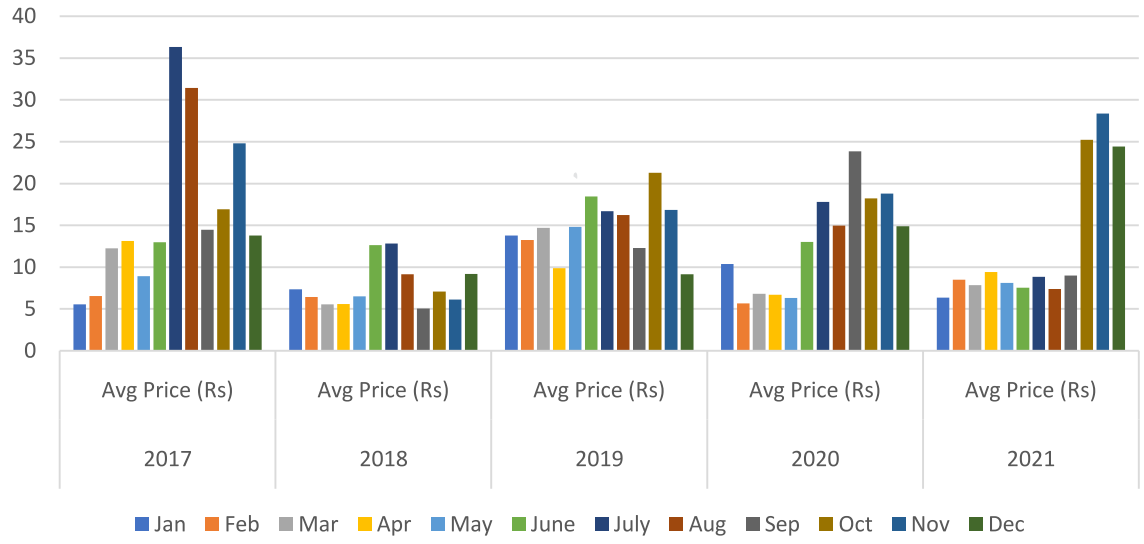
1. In India, the area under cultivation of tomatoes has increased by 36.8 per cent in the past fifteen years and the production of tomatoes has increased by 111.2 per cent (Directorate of Economics Statistics, 2021).
2. The average yield of tomatoes in India has increased from 18.2 MT/ha in 2005-06 to 24.3 MT/ha in 2020-21 (Directorate of Economics Statistics, 2021) but it is lower than other high-production countries. The tomato yield of China is 56.2 MT/ha while that of the USA is 90.3 MT/ha.
3. In India, Madhya Pradesh, Andhra Pradesh, Karnataka, Gujarat and West Bengal are the largest tomato-producing states in terms of quantity.
4. Maharashtra state has 56,600 ha under tomato cultivation and has produced 11,89,800 MT of tomatoes. Andhra Pradesh state has the highest yield of 41.9 MT/ha and Maharashtra has a productivity of 21 MT/ha (CMIE, 2022). Within Maharashtra, Nashik, Pune, Nagpur and Gadchiroli are the highest tomato-producing districts (Madhumurthy & Sundaramoorthy, 2018).
5. The month-wise arrival of tomatoes in various APMC markets of Pune is high during the months of June, July, August and September. During the pre COVID-19 years, the arrival of tomatoes in the APMC markets was high compared to post COVID-19 years. There is no specific trend in the prices of tomatoes in the APMC markets of Pune and prices are fluctuating throughout the year.

Month-wise average arrival of tomatoes in market-yards: Gultekadi, Moshi, Pimpri, Khadki, Manjri APMCs of Pune (2017-2021)



Source: (Directorate of Marketing & Inspection, 2021)

Month-wise average price of tomatoes in market-yards: Gultekadi, Moshi, Pimpri, Khadki, Manjri APMCs of Pune (2017-2021)



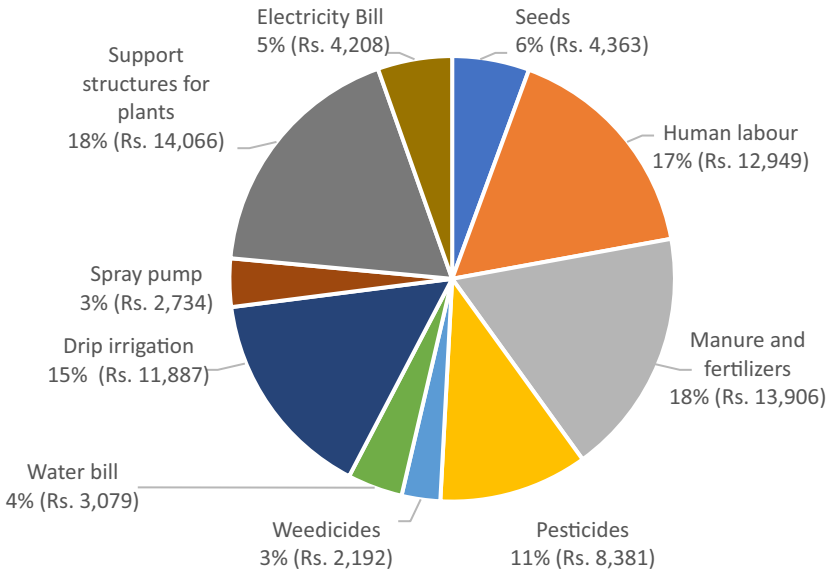
Source: (Directorate of Marketing & Inspection, 2021)

Photo : Anand Pagare

Key findings from the Salawade cluster study

1. The tomato is a kharif (monsoon) crop in this cluster. There is a regular demand for tomatoes in the nearby markets of Pune, Mumbai and Belagavi. Farmers grow intercrops such as chickpea, jute, common bean, groundnut and pumpkin. Tomato farming is considered profitable by farmers compared to other crops.
2. *Namdhari 1068, Rasika* and *Kaustubh* are the major varieties of tomatoes grown in the village. About 56.6 per cent farmers sow *Namdhari* 1068 variety.
3. The average cost of tomato production by the farmers in Salawade was Rs. 77,665 per acre. Out of the total cost, the major costs are the cost of constructing supporting structures for the plants which accounts for 18.1 per cent, manure and fertilizer application accounts for 17.9 per cent and labour cost accounts for 16.5 per cent of the total expenses.

Distribution of input costs per acre in tomato farming (Rs. 77,665 per acre)



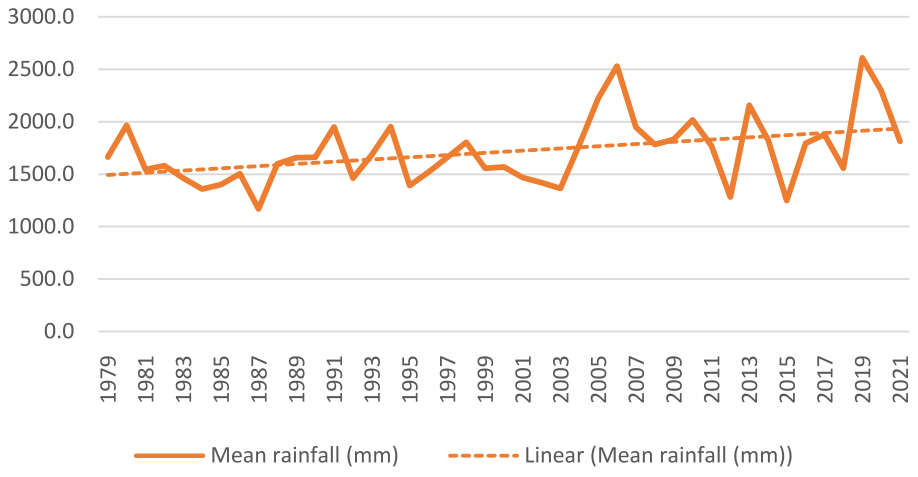
4. During the COVID-19 pandemic-induced lockdown, the supply chain of agriculture inputs was also impacted. The inputs such as fertilizers, seeds, pesticides were available in village, but farmers had to spend extra money to purchase them. The labour availability was not an issue during COVID-19, as most of the farmers rely on household labour.

Extra money spent by farmers on agriculture inputs during the COVID-19 pandemic-induced lockdown

Particulars	Fertilizers (Kg)	Seeds (Packet)	Pesticides (Unit)	Labour (Daily wages)
No. of farmers impacted (%)	41 (77.3)	42 (79.2)	51 (96.2)	3 (5.7)
Average extra amount spent	96.3	120.7	135.3	116.7

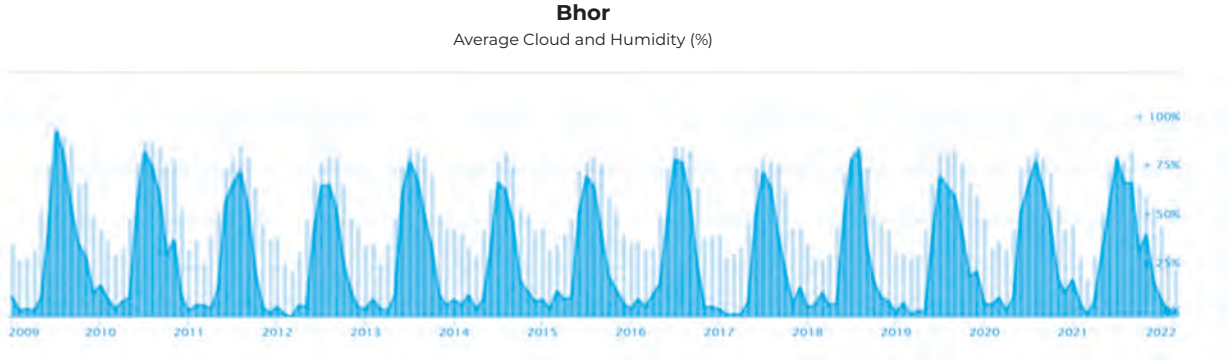
5. Out of 53 tomato farmers in the village, only one farmer had conducted soil testing of the farmland. Out of all the tomato farmers, 32.1 per cent farmers use only inorganic/synthetic fertilizers while the remaining 67.9 per cent farmers use a mix of inorganic/synthetic and organic fertilizers.
6. The common diseases and pest attacks that occur on tomato fruits and plants are tomato fruit borer, white fly, bacterial wilt and late blight. In Salawade village, farmers are experiencing climate change-related extreme events. The monsoon being delayed and spread across the months of September, October and November as well as the increase in average rainfall and number of cloudy days have created favourable conditions for pests and diseases.

Monthly Average rainfall (mm) in Bhor block



Source: Meteoblue, 2022

Number of cloudy days in Bhor block



Source: Worldweatheronline, 2020

7. For irrigating tomato farms, farmers are dependent on rain water in the months of June, July and August. For the remainder months, the main source of irrigation in the village is well water. 73.6 per cent farmers use flood irrigation methods while the remaining 26.4 per cent use drip irrigation. In terms of water use, the water use efficiency of drip, sprinkler and flood irrigation systems are 90-95 per cent, 80-85 per cent and 60-70 per cent respectively. Drip and sprinkler systems potentially increase the productivity of the crop by 30-90 per cent (Narayanamoorthy, 2021). Though farmers are aware of the benefits of drip and sprinkler irrigation systems, these systems are cost intensive and hence, farmers are unwilling to adopt them.
8. On an average, tomato farmers spent Rs. 10,025 on energy usage in the fields. Major expenses comprise the electricity bill of water pumps and fuel consumption of tractors. The total seasonal emission from in-field energy use for tomato farming is equivalent to 111.8 MT CO_2e from 47.3 acres of tomato farms in Salawade village.

Energy consumption and expenses on energy in tomato farming

	No. of farmers (%)	Avg. fuel consumption (lit.)	Avg. expenses (Rs.)	Percent of total energy expenses
Water pump	53 (100)	Not Applicable (Electricity)	4208	41.9
Tractor	53 (100)	39.0	3666	36.6
Four-wheeler	17 (32.1)	16.1	1723	17.2
Two-wheeler	46 (86.8)	4.0	428	4.3
		Total	**10025**	**100**

9. As per collected data in the year 2021, a total of 538 MT of tomatoes was produced in Salawade village with an average productivity of 10.4 MT/acre. Out of the total percentage of tomato farmers, 54.7 per cent i.e., 29 farmers have productivity of less than the average productivity of the village while the remaining 45.3 per cent farmers have productivity higher than the average productivity of the village.

Photo : Anand Pagare

10. As per previous studies, the average tomato productivity of Maharashtra is 8.9 MT/acre which means the average productivity of Salawade village is above that of state and country levels (Madhumurthy & Sundaramoorthy, 2018).

Average Tomato Yield at World, India, Maharashtra and Salawade village levels

World	India	Maharashtra	Salawade village
22.8 MT/acre	9.8 MT/acre	8.9 MT/acre	10.42 MT/acre

11. The tomatoes are usually graded into three grades based on their size. The grade-1 tomatoes fetch a higher price and their production is highest (68%) compared to the other two grades.

Grade-wise production and price received for tomatoes in Salawade village

Tomato Grade	Average Production in MT (%)	Grade-wise average price (Rs.) in the year 2020-21
Grade-1	365.8 (68)	26
Grade-2	102.2 (19)	13
Grade-3	70.0 (13)	9

12. Factors such as pest attacks, untimely rain, sorting and packing, and fall in market price result in loss of production and income. The below table presents data on produce spoilage due to various causes.

Quantity of tomatoes wasted at the farmgate due to various reasons

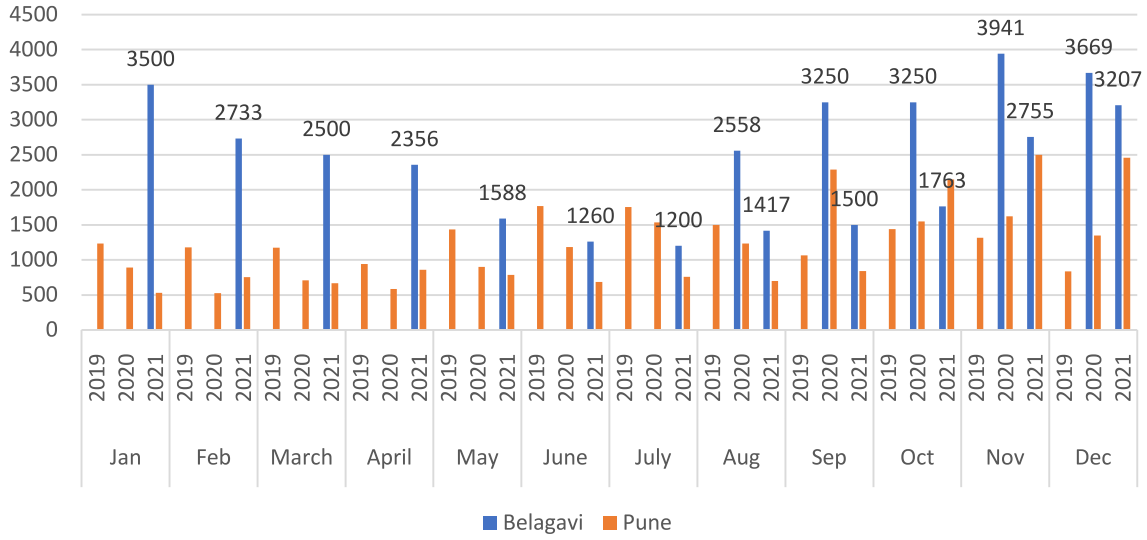
Reason for spoilage	No. of farmers reported (%)	Quantity spoiled in MT (%)
Pest attack	53 (100)	5.7 (13.6)
Untimely rain	53 (100)	15.4 (36.8)
Sorting and packing	53 (100)	3.3 (7.9)
Fall in market price	34 (64.2)	17.4 (41.6)
	Total	41.8 (7.8% of total produce)

Heaps of discarded tomatoes in Salawade village due to market price fall in November 2022

Photo : Baswant Vithabai Babarao

13. The sorted and graded tomatoes are usually sold in the Pune APMC market which is at a distance of 35 km and in the Belagavi APMC market at a distance of 350 km. The transportation cost is charged per crate the and cost of transport to the Pune APMC market is Rs. 35 per crate (approximately 25 kg tomatoes per crate) and to Belagavi is Rs. 105 per crate. The cost of transport of tomatoes to the Belagavi APMC market is almost three times the cost of transport to the Pune APMC market. Farmers usually sell the tomatoes in the Pune APMC market and when the price of tomatoes in the Pune APMC market crashes in the months of November, December, and January, they sell it in the Belagavi APMC market. A larger proportion of grade-1 tomatoes are sold to the Pune APMC market while the Belagavi APMC market is preferred for grade-2 and grade-3 tomatoes. The average price of all grades of tomatoes received by farmers from Salawade village in year 2020-21 in the Pune APMC market was Rs. 21.32/ kg while in the Belagavi APMC market was Rs. 27.7/kg Though the net profit farmers get in the Belagavi APMC market is high, overall demand for tomatoes in this market is very less compared to the Pune APMC market.

Monthly average price of tomatoes in years 2019, 2020 and 2021 in the Belagavi and Pune APMC markets



Source: AGMARKNET, 2020 (Data points are not available for Belagavi market for 2019 and Jan 2020 to July 2020)

14. The average price of tomatoes in the Belagavi APMC market for the year 2019 is not available. However, the average prices of tomatoes in the years 2020 (during the COVID-19 induced lockdown) and 2021 are Rs. 3,334 and Rs. 2,148 per quintals respectively (Rs. 33.3 and Rs. 21.5 per kilogram). On the other hand, the average prices of tomatoes in the Pune APMC market in the years 2019, 2020 and 2021 were Rs. 1,303, Rs. 1,197 and Rs. 1,104 per quintal (Rs. 13, Rs. 12 and Rs. 11 per kilogram). The average price in Belagavi was approximately three times higher during 2020 and two times higher in 2021.
15. As transportation service is available in the village, the cost of transport was not impacted during the COVID-19 induced lockdown.
16. The net profit for Salawade farmers at the Belagavi APMC market is 52 per cent of that at Pune APMC markets. The total arrival of tomatoes as an indicator of demand in the Belagavi APMC market is much lesser compared to the Pune APMC. The GHG emissions attributed to the transport of tomatoes from Salawade village to the Pune APMC Market in 12 MT Medium Duty Vehicle (MDV) is 17.8 kg CO_2e for Pune and 188.5 kg CO_2e for the Belagavi APMC market.

GHG emissions during transportation of tomatoes to Pune and Belagavi APMC markets

APMC Market	Average price (Rs/kg)	Cost of Transport (Rs/kg)	Net Profit (Rs/kg)	GHG Emission kg CO_2/one trips of MDV (One way)	GHG Emission kg CO_2/two trips of MDV (Two way)
Pune	21.32	1.4	3.37	17.8	35.6
Belagavi	27.70	4	6.95	188.5	377.0

Quantity arrival and price of tomatoes in various districts near the cluster in the year 2021

17. As per the price data received from farmers, the average price of tomatoes across months and of different grades of tomatoes in the year 2020-21 in the Pune and Belagavi APMC markets were Rs. 2,132 and Rs. 2,770 respectively for a quintal of tomatoes. Therefore, overall farmers earned a net profit of Rs. 337.3 and Rs. 695.3 per quintal in the total profit in the Pune and Belagavi APMC markets respectively. Therefore, the total profit in the Pune and Belagavi APMC markets is 18.8 per cent and 33.5 per cent respectively over the cost of production (excluding family labour and land rent cost).

Farmer's Net Income	Pune	Belagavi
The average cost of cultivation[1] (Rs/acre)	77665	77665
Average yield (q/acre)	52.03	52.03
The total cost of production (Rs/q)	1492.7	1492.7
Cost of the transportation-Pune and Belagavi APMC markets (Rs/q)	140	420
APMC market expenses[2] (Rs/q)	162	162
Total price received in Pune and Belagavi APMC markets (Rs/q)	2132	2770
Net profit (Rs/q)	337.3	695.3
Profit percentage	**18.8%**	**33.5%**

18. During the COVID-19 pandemic-induced lockdown, 62.2 per cent farmers could not sell the entirety of their produce. 88.9 MT extra tomatoes, which is equivalent to 21 per cent of average production, got wasted at the farmgate due to a fall in demand through existing market channels during the COVID-19 pandemic. As farmers could not sell tomatoes in the APMCs, they sold their produce in the local market of Nasarapur, sometimes even at the throwaway price of Rs. 2 per kilogram. at times. The average annual price received from the APMCs during the COVID-19 pandemic-induced lockdown period was 18 per cent lesser than the normal price. The average price received during COVID-19 lockdown period was Rs. 18.3 as against the normal average price of Rs. 24.5.

19. The total emission due to various activities at pre-production, production and post-production levels of tomato farming in Salawade village in the form of carbon dioxide equivalent is as follows:

GHG Emissions from tomato farming in Salawade

Total Emission	Emission per acre	Average emission per kg
96.02 MT Co_2e	1805.2 kg Co_2e	0.37 kg CO_2e

GHG Emission from tomato farming as per land holding in Salawade

Sr No	Landholding (acre)	Total Emission (MT CO_2e)	Emission per acre (kg CO_2e)	Average emission per kg of tomato (kg Co_2e)
1	Up to 2	36.80	1679.1	0.32
2	2 – 4	39.70	1753.1	0.37
3	More than 4	19.53	2994.9	0.42

[1]This includes the cost of seeds, human labour, manure and fertilizers, pesticides, weedicides, water bill, drip irrigation, spray pump, supporting structures for plants, electricity bill. It does not include value of labour work of farmers and their family members and land rent cost.

[2]Weighing, porting, APMC tax

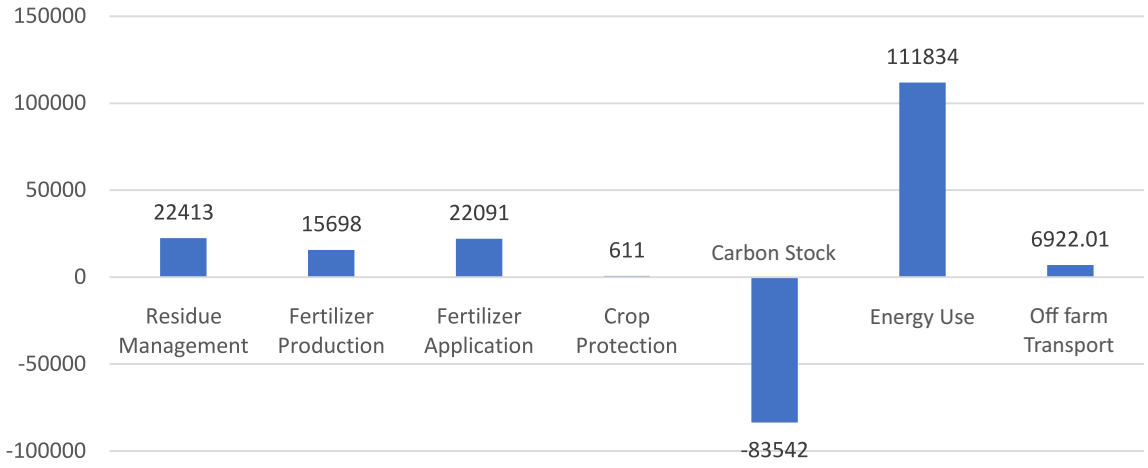
20. Marginal farmers who own land up to 2 acres and small farmers who own land of 2-4 acres have an almost equal amount of emission per acre and an almost equal average emission per kilogram tomato. The emission per acre and average emission for one kilogram of tomatoes is slightly higher for small farmers. The big farmers who own land of more than 4 acres have the highest amount of emission per acre and per kilogram of tomato production.

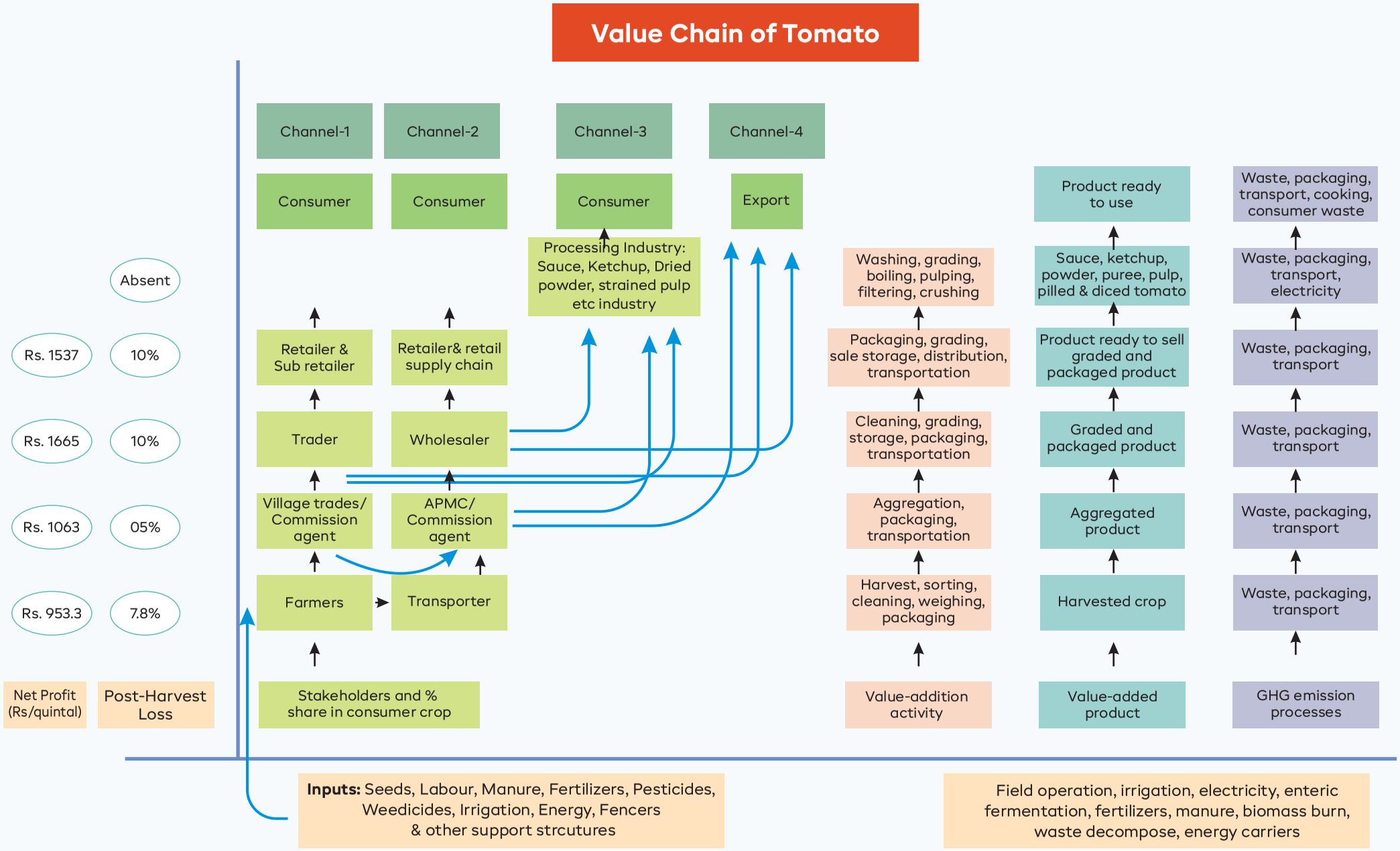
GHG Emission from tomato farming as per land holding in Salawade

Sr. No.	Sources	Up to 2 acre		2 - 4 acre		More than 4 acre	
		Per acre of tomato	Per Kg of tomato	Per acre of tomato	Per Kg of tomato	Per acre of tomato	Per Kg of tomato
1	Residue Management	316.3	0.077	423.0	0.06	914.1	0.099
2	Fertilizer Production	357.5	0.041	381.1	0.04	388.4	0.047
3	Fertilizer Application	327.3	0.071	473.8	0.056	420.7	0.053
4	Crop Protection	12.57	0.002	12.78	0.002	11.81	0.002
5	Carbon Stock	-1197.5	-0.46	-1397.9	-0.28	-1839.4	-0.48
6	Energy Use (Field)	2696.9	0.58	2288.5	0.32	3393.8	0.308
7	Off-farm Transport	161.7	0.02	141.5	0.02	229.9	0.02

21. If we analyse the data of greenhouse gas emissions from various activities related to tomato farming, the energy use in the field such as electricity consumption for water pumps and use of tractors for ploughing produces the highest amount of greenhouse gases.

Total Emissions (kg CO_2e) for tomato production in Salawade

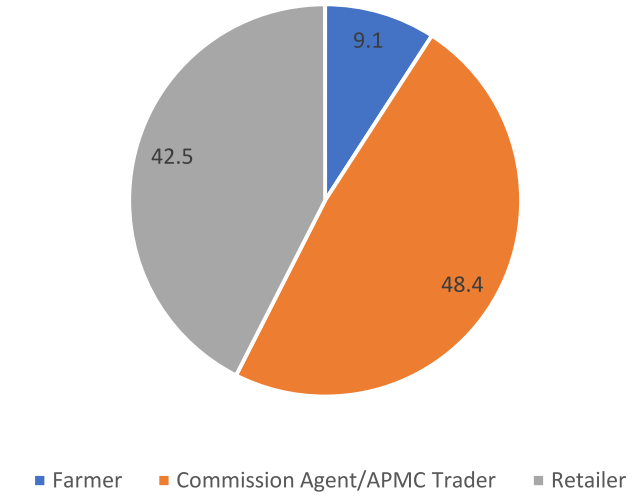



Value Chain of Tomato
Channel-1
Channel-2
Channel-3
Channel-4
Consumer
Consumer
Consumer
Export
Processing Industry: Sauce, Ketchup, Dried powder, strained pulp etc industry
Retailer & Sub retailer
Retailer& retail supply chain
Trader
Wholesaler
Village trades/ Commission agent
APMC/ Commission agent
Farmers
Transporter
Absent
Rs. 1537
10%
Rs. 1665
10%
Rs. 1063
05%
Rs. 953.3
7.8%
Net Profit (Rs/quintal)
Post-Harvest Loss
Stakeholders and % share in consumer crop
Washing, grading, boiling, pulping, filtering, crushing
Packaging, grading, sale storage, distribution, transportation
Cleaning, grading, storage, packaging, transportation
Aggregation, packaging, transportation
Harvest, sorting, cleaning, weighing, packaging
Value-addition activity
Product ready to use
Sauce, ketchup, powder, puree, pulp, pilled & diced tomato
Product ready to sell graded and packaged product
Graded and packaged product
Aggregated product
Harvested crop
Value-added product
Waste, packaging, transport, cooking, consumer waste
Waste, packaging, transport, electricity
Waste, packaging, transport
Waste, packaging, transport
Waste, packaging, transport
Waste, packaging, transport
GHG emission processes
Inputs: Seeds, Labour, Manure, Fertilizers, Pesticides, Weedicides, Irrigation, Energy, Fencers & other support strcutures
Field operation, irrigation, electricity, enteric fermentation, fertilizers, manure, biomass burn, waste decompose, energy carriers

22. The overall value chain of tomatoes mainly comprises agriculture input suppliers, producers/farmers, commission agents, traders, wholesalers, retailers, exporters, processors and consumers. The net profit for various supply chain intermediaries is calculated using the cost of production/value addition, net selling price, and losses at each stage. The expenses are highest at the farmer's level (Rs. 1,492.7 per quintal) while the APMC traders and retailers incur the lowest expenses. The farmers receive the lowest net profit of Rs. 455.3 per quintal while the APMC traders receive the highest net profit from the sale of tomatoes. Out of the total net profit from the sale of tomatoes, 9.6 per cent goes to the farmers, 22.5 per cent goes to the traders, 35.3 per cent goes to the APMC traders and 32.6 per cent goes to the retailers. Retailers also take the risk of spoilage due to various reasons.

Supply chain intermediaries	Cost of Production and marketing-related expenses (Rs/q)	Selling price (Rs/q)	Net Profit (Rs/q)
Farmer	1794.7	2132	337.3
Commission Agent/APMC Trader	116[3]	4031	1783
Retailer	119[4]	5696.8	1566.8

Percentage share of stakeholders of supply chain in net profit from sale of tomatoes



[3]NHRDF. (2017). Value Chain Study of Tomato of Karnal, Haryana. https://midh.gov.in/VCS Reports/[18]-Tomato Value Chain Karnal Haryana.pdf
[4]Cost of labour, transport, market taxes and rent for shop

Recommendations

Tomato yield in India is among the lowest in the world and within India, Maharashtra is the lowest-yielding state. There are several factors such as the variety of seeds, water availability, the status of soil, fertilizer application, weather conditions, pest attacks, etc. that impact the yield of tomatoes. A long term, comprehensive and participatory assessment of the production system looking at soil fertility, productivity level, planning of production cycle and promotion of climate-resilient varieties of tomatoes is needed to enhance productivity. Bringing cluster productivity to the level of global average would mean over 100 per cent yield and a corresponding earning enhancement.

Sustainable soil and production management

An accessible soil testing lab can encourage more farmers to test the soil and to adopt a scientific application of fertilizers. This will reduce the cost of fertilizers as well as GHG emissions due to the excess application of fertilizers. This will also reduce GHG emissions from fertilizer production and fertilizer application which is 15.7 MT CO_2e and 22.1 MT CO_2e respectively.

- **Organic inputs:** A clear plan towards a phase-wise increase of organic inputs in tomato farming can reduce dependency on inorganic inputs. This needs to be considerate of continuous soil monitoring, organic input manufacturing and distribution at scale in order to overcome limitations of individual farm-based input production.
- **Protective Farming**
  - Groundwater monitoring and conservation actions
  - Soil moisture conservation needs promotion using a range of mulching techniques
  - Protection from untimely rains and extreme climate events is a challenge. Polyhouses are costly with 2 inch SS pipe-based polyhouses costing between Rs. 30-40 Lakh per acre. Also, areas such as the ones in this study cluster are prone to the impacts from cyclonic events in the Arabian Sea which cause serious damage to polyhouses. This is a complex challenge which can be tackled through studies of structural quality, low cost alternatives, government subsidies and an effective insurance system.

Case Story: Benefits of scientific application of fertilizers

Anil Shinde and Shyamrao Shinde are progressive farmers in Salawade village. They collectively own 2.5 acres of land and grow tomatoes and strawberries. Three years ago, they realized that the overall productivity of tomatoes and strawberries is decreasing and therefore they decided to test the soil in order to know the status of the macro and micronutrients present in it. The soil testing report indicated a high content of potash and calcium and a deficiency of zinc and boron. Therefore, as per the information in the soil health card, they changed the method and type of application they had adopted.

It resulted in an overall increase in productivity of crops as well as saved expenses on fertilizers. They saved approximately Rs. 5,000 by the correct application of fertilizers. The productivity of tomatoes has been increased by 100 per cent and that of strawberries by 25 per cent.

Integrated Pack House and Processing Unit

In India, presently around 40 lakh tonnes of fruits and vegetables are produced. Out of this, around 30-40 per cent produce gets wasted, resulting in loss of around 92 thousand crore rupees (Kumar, 2016; Ministry of Agriculture and Farmers Welfare, 2017). Therefore the small integrated pack house and processing unit can lead to reduction in post-harvest losses and better price realization. Currently, due to lack of planning and formal contracting towards procurements, challenges in supply and correspondingly, in price and capacity occur for processing units located at a distance. Such a well-planned integrated unit could provide facilities like a collection centre, as well as centres for cleaning, washing, sorting, packaging, cold storage, and marketing. The processing unit (solar dryer and pulping unit) can process grade-2 and grade-3 tomatoes throughout the season and also procure surplus tomatoes during bumper production which will help farmers to get a better price for their produce. The major costs for the operation of the integrated pack house and processing unit are that of electricity and processing equipment. Alternative and cheaper sources of energy and discounted financial mechanisms for processing unit equipment are key for economic viability and competitiveness of pack houses and processing units.

Comparison of potential income from processing of different grades

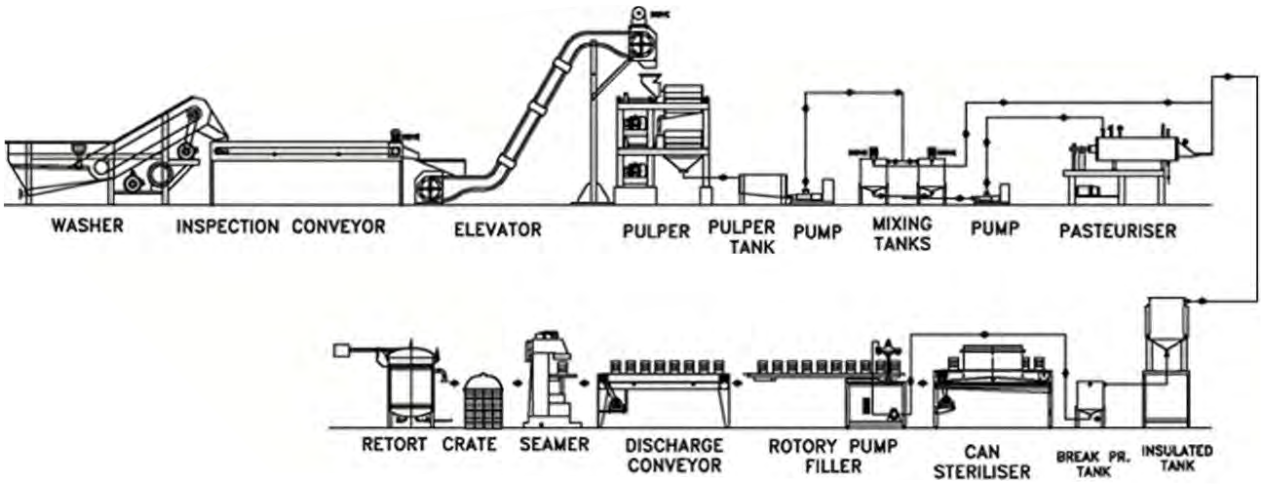
Grade	Productivity (kg/acre)	Gross income through the sale of raw tomatoes (Rs/acre)	Quantity of pulp produced (kg)	Gross income through the sale of processed tomatoes[5]
Grade-1	7086	184236	3437	481180
Grade-2	1980	25740	960	134400
Grade-3	1355	12195	657	91980
Total	10420	222171	5054	707560

Source: (Ministry of MSME, 2019)[5]

If the raw tomatoes are sold in raw form, the gross income of the farmer will be Rs. 2,22,171 per acre. As the net profit is 15.8 per cent, the net profit from an acre of tomato farming will be Rs. 35,103 per acre. If the raw tomatoes are processed, the gross income per acre can potentially increase up to Rs. 7,07,560 per acre. The total capital investment which includes fixed capital and working capital for three months is Rs. 16,75,000 for a processing plant of capacity 0.5 MT/hour. As net profit ratio of the tomato processing unit is 11 per cent, the net profit from the processing of all three grades will be Rs. 77,832 per acre, which is two times higher than the profit when tomatoes are sold in raw form (MSME, n.d.). In another scenario, if only grade-2 and grade-3 are processed (net profit of Rs. 24,902), and grade-1 is sold in raw form (net profit of Rs. 29,109) in the market, the potential profit is Rs. 54,011 which is lesser than the profit earned if all of the tomato produce is processed. The processing business will be more profitable when tomatoes are bought at a cheaper price during a glut period and stored in cold storage for processing at a later date.

[5]Quantity of pulp per kilogram and price of puree

Schematic design of a Tomato Processing Unit



Source: (PTech cited in Knitcon, 2023)

Real time, granular and actionable weather advisories

Delay in monsoon rainfall, increase in average rainfall and number of cloudy days, and decrease in the number of rainfall days have created favourable conditions for pests and diseases as experienced by this cluster. District level weather advisories are ineffective in helping farmers. Cluster-specific real-time advisories are urgently needed to alert the farmers about extreme weather events and recommended actions towards mitigation and adaptation. This entails greater public investments towards creating real time, granular and actionable weather advisories.

APMC Market price information

As APMC market price-related information is not easily accessible to farmers, farmers tend to sell their produce to traders in contact with them. There is a need to create a robust APMC market price discovery mechanism for farmers which will be able to integrate multi-mode information dissemination features considering different levels of farmer abilities in accessing media and technologies.

Promotion of Farmer Producer Company

To address issues ranging from productivity enhancement, reducing spoilage, better marketing and the potential present for the processing industry, it is imperative to have collectivization of producers. A Farmer Producer Company (FPC) is recommended for the collectivization, keeping in view the necessity of an encouraging policy environment. Drawing from wider experience and the situation over the last few years, it is critical to ensure that FPCs are an effective form of collectivization and that economic development in the farm sector is promoted. Investments in areas of social processes, capacity building of Board of Directors and other key functionaries in areas of business planning, marketing and accessing financial and technical resources are some of the ways in which this can be ensured.

REFERENCES

- CMIE. (2022). Crop-wise Area Sown, Production and Yield: Tomatoes. https://commodities.cmie.com/
- Directorate of Economics Statistics. (2021). Agriculture Stastics at a Glance 2021.
- Directorate of Marketing & Inspection. (2021). Agmarknet. Ministry of Agriculture & Farmer's Welfare. http://agmarknet.gov.in/Default.aspx
- Madhumurthy, N., & Sundaramoorthy, M. (2018). A Report on The Study of Tomato Value Chain and its Financing. https://cab.rbi.org.in/docs/Special_Study/A Report on The Study of Tomato Value Chain and its Financing.pdf
- Meteoblue. (2022). Climate Change Bhor. Meteroblue: Weather Close to You. https://www.meteoblue.com/en/weather/historyclimate/change/bhor_india_12519141
- MSME. (n.d.). Tomato Products. http://www.dcmsme.gov.in/old/publications/pmryprof/food/ch24.pdf
- Narayanamoorthy, A. (2021, December 6). Tap drip irrigation to save water. The Hindu Businessline. https://www.thehindubusinessline.com/opinion/tap-drip-irrigation-to-save-water/article27688289.ece

Photo : Baswant Vithabai Babarao

Centre for Environment Education

Pinewood Apartment, S No 233/1/2, Vidhate Colony,
Near Aundh Telephone Exchange, Aundh, Pune 411067

Phone : 020 27298862

care@ceeindia.org www.ceeindia.org