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Centre for Environment Education

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

CASE STUDY OF GUAVA FARMERS IN VINCHHIYA BLOCK, DIST. RAJKOT, GUJARAT

Photo : Navneet Wadkar

ABOUT US

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INTRODUCTION

Guava is an important food crop in India due to its hardy nature. It requires little care and input. Around 3,07,000 ha of land across India is under guava cultivation and overall production is around 4,516 thousand MT. Guava is well-adapted in almost all states and is principally produced in Maharashtra, Bihar, Uttar Pradesh, Andhra Pradesh, Madhya Pradesh, Rajasthan, Gujarat, Karnataka and Tamil Nadu. There is around 14.33 thousand ha of land in Gujarat under guava cultivation and the total production of the state is 175.33 thousand MT. The changing climate in the region is making guava trees susceptible to poor growing seasons, pest and fungal attacks. Emerging pests and diseases are increasing wastage at the farmgate and overuse of pesticides is reducing the export potential of this fruit crop. Climate change-induced temperature fluctuations during the flowering and fruit setting stages affect the production and quality of the produce. The adapted temperature range of guava is 15-30°C. The temperature change stops the growth of the fruit (Fischer & Melgarejo, 2021). The fruit is highly perishable and the recent disruption of the value chain due to the COVID-19 pandemic-induced lockdown led to a high amount of wastage of guavas at the farmgate. Therefore, this study was conducted to assess the impact of COVID-19 on guava farming and to understand the value chains of the guava production system. The aim was also to assess the possibilities of green and socially-sound recovery strategies.

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 guava, 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.

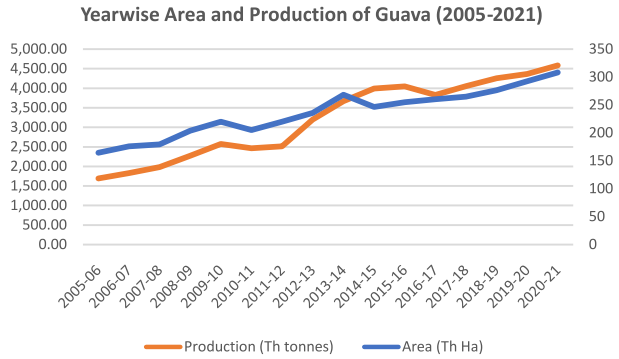
STUDY AREA

Sanali village is in the Vinchhiya block of Rajkot district of Gujarat, located 81 km to the east of the district headquarters in Rajkot. As per the 2010-11 census, the population of the village is 2,481, of which 1,233 i.e., 49.7 per cent are female. People in this cluster are largely dependent on agriculture and allied sectors for livelihood. Groundnut and cotton, along with guava and vegetables, are the major crops.

Photo : Navneet Wadkar

Production system at national, state and district levels

1. In India, the area under cultivation of guava has increased from 164.2 thousand hectares in the year 2005-06 to 308.1 thousand hectares in 2020-21. The overall increase in area under production is 87.6 per cent. Similarly, the total production of guava in the year 2005-06 was 1,691 thousand tonnes which has increased to 4,582 thousand tonnes in the year 2021. The overall increase in production is 170.9 per cent (CMIE, 2022).
2. The average yield of guava in India has increased from 10.2 MT/ha in 2005-06 to 14.8 MT/ha in 2020-21 and it is higher than the yield in other countries (CMIE, 2022).



3. In India, Uttar Pradesh is the state with the highest guava production, but Uttar Pradesh state has the lowest yield of 7.90 MT/ha (Statista, 2022). Guava is also grown in Bihar, Andhra Pradesh and West Bengal.
4. Gujarat state has a guava yield of 7.20 MT/ha. There is around 14.33 thousand ha of land in Gujarat under guava cultivation and the total production of the state is 175.33 thousand MT. Within Gujarat, Ahmedabad, Rajkot and Amreli are the highest-producing districts (Directorate of Economics Statistics, 2021).

Key highlights of the study cluster

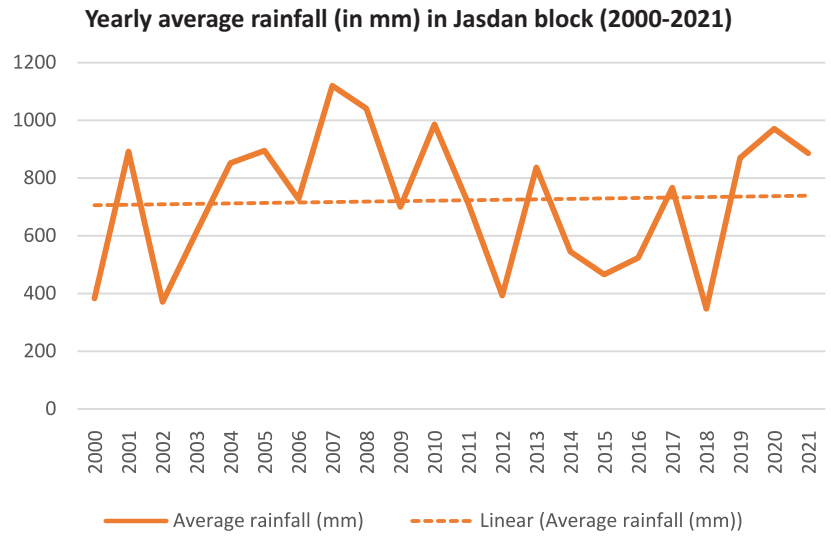
1. Overall, data from 28 guava farmers was collected. Out of the total surveyed farmers, 14 per cent were marginal farmers (less than 1 ha land), 28 per cent were small farmers (1-2 ha land), 28 per cent were semi-medium farmers (2-4 ha land) and 30 per cent were big farmers.
2. The guava farmers from the sample own a total of 200.5 acres of land of which 75 acres are under guava cultivation. Initially, there were only five to seven farmers who were cultivating guava. However, after the introduction of the *Anjiriya* and *Arka Kiran* varieties from Andhra Pradesh, the area under guava cultivation suddenly increased in the region. Since then, more farmers have been growing guava. The main reasons for shifting from traditional crops of groundnut and cotton to guava were pink-worm attacks on the cotton crop leading to loss of cotton crop. The guava crop has a relatively lower cost of production, it requires a one-time investment, the crop is hardy, the local weather and soil are suitable and there is a higher demand for guava.
3. Initially to promote the plantation of guava in the region, guava saplings were provided by the government and farmers had to bear the cost of land preparation for sapling plantation.
4. The varieties *Anjiriya, Arka Kiran* and *Taiwan Pink* are the most preferred in this cluster. Out of a total sample of 28 guava farmers, 21 farmers have trees of the *Anjiriya* variety, two farmers have *Arka Kiran*, four have *Taiwan Pink* and one farmer has *Desi Jumkadi* in their farms. Most of the farmers prefer the *Anjiriya* variety as it fetches a higher profit.


Photo : Navneet Wadkar

5. The *Anjiriya* variety is preferred for its taste and colour, *Arka Kiran* gets a high price while the *Taiwan Pink* requires fewer inputs. The average per acre production of *Anjiriya* is 300 quintals, of *Arka Kiran* is 350-400 quintals and of *Taiwan Pink* is 350 quintals.
6. Out of a total sample of 28 guava farmers, only three farmers have conducted soil testing and applied the inputs of fertilizers to some extent as recommended by the experts. It is observed that soil tests are generally not being done by the farmers in the study area.
7. The common diseases and pest attacks that occur on guava trees and fruits are fruit fly, caterpillar, whitefly, mosquito bug, mealy bug, fruit borer, aphids, mites and thrips. In the study cluster, farmers are experiencing climate change-related extreme events. The rainfall in the Jasdan block has been very erratic in recent years. In some years, there is above-normal rainfall, and in some the rainfall is deficient. The overall cloudy days have increased and there is the usual delay in monsoon arrival. This has created favourable conditions for pests and diseases. The common pesticides used for pest management are *Pyrellin* (Pyrethrins+rotenone), *Thiodan, Endosulfan* and *Seven* (carbaryl).

Guava varieties, average productivity and characteristics

Varieties	Preferences	Production per acre (quintal)	Space	Reason for the given preference
Anjiriya	First	300	15x15, 15x12	Taste, and market demand
Arka Kiran	Second	350-400	18x15, 18x18	Highest price
Taiwan Pink	Third	350	10x10	Low cost of production



8. The guava farmers spent an average of Rs. 10,126 per year on energy usage in the field and out of total expenses, major expenses are the electricity bills. The expenditure on fuel required for tractors and vehicles is very minimum. The total seasonal emission from in-field energy use for guava farming of farmers in the selected sample is 469.9 MT CO_2e. None of the farmers have installed solar pumps for irrigation purposes. Apart from these expenses, major expenses are renting tractors or bullockcarts.

Energy consumption and expenses on energy in guava farming

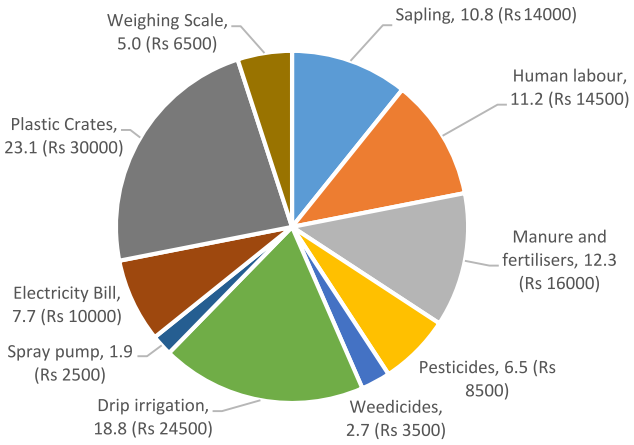
	Avg. fuel consumption (lit.)	Avg. expenses (Rs.)	Total energy expenses (%)
Water pump	Not Applicable (Electricity)	8296	81.9
Tractor	7	700	6.9
Four-wheeler	6	600	5.9
Two-wheeler	5.3	530	5.3
	Total	**10126**	**100**

9. As the guava plant is a less water-intensive crop and requires only soil moisture to grow, it can be grown on drip irrigation systems. However, most of the farmers are using the flood irrigation method. Out of the total surveyed farmers, 82.1 per cent of farmers are irrigating their land from wells and 53.6 per cent are extracting water from both borewells and wells, 7.1 per cent use agriculture ponds and the remaining 3.6 per cent use streams. Only 27 per cent of farmers are using drip irrigation.

10. The average productivity of guava in the study cluster is 305 quintals per acre. The guava production starts one year after plantation and initially, the productivity is 7-8 quintals per acre. In the following years, the production increases gradually and ultimately it reaches a maximum productivity of 305 quintals per acre by fifth year. The orchard gives peak-level production for the following 10-12 years.

11. The average cost of guava production of the farmers in the study cluster was Rs. 1,30,000 per acre. Out of the total cost, major costs are the plastic crates which account for 23.1 per cent, drip irrigation accounting for 18.8 per cent and saplings for 10.8 per cent. This cost includes both one-time costs and recurring costs. The fixed cost includes the cost of a sapling, drip irrigation, spray pump, plastic crates and weighing scale. The fixed cost converted to a yearly payable amount is Rs. 15,132. The yearly recurring cost of guava farming is Rs. 52,500 which includes the cost of labour, fertilizer, pesticides, weedicides and electricity bills. Therefore, the yearly cost of production of guava is Rs. 67,632.

Distribution of input cost per acre of guava farming



Fixed cost converted to yearly recurring cost (8-year duration at an interest rate of 12 per cent)

Heads of expenses	Total expenses	Monthly expenses	Total yearly payable amount
Sapling cost investment	14000	228	2736
Drip irrigation installation	24500	398	4776
Spray pump	2500	41	492
Plastic crates (200 nos.)	30000	488	5856
Weighing scale	6500	106	1272
Total	**77500**		**15132**

12. The guava farmers usually employ labour to harvest the fruits. While harvesting the fruit, special care needs to be taken and for that purpose, labourers skilled in harvesting are required. The labourer picks fruits which are shiny and about to ripen. The sorting and grading are done on the same day and fruits are categorized into three grades.

Wastage of guava produce due to fall in price

Photo : Navneet Wadkar

Grade-wise characteristics and production

Type of grades	Grade-wise production (MT)	Characteristics
Grade 1	16.6	Big and shiny
Grade 2	9.6	Normal size and stained
Grade 3	4.3	Small, overripe

13. Out of the total production of guava, 16.6 MT is of grade-1, 9.6 MT is of grade-2 and 4.3 MT is of grade-3. Grade-1 variety is a big-sized, clean and shiny fruit.

Variety	Price received for Grade-1 (Rs/kg)	Price received for Grade-2 (Rs/kg)	Price received for Grade-3 (Rs/kg)
Anjiriya	17	10	2
Arka Kiran	25	15	6
Taiwan	32	17	2

14. There are various reasons such as pest attacks, untimely rain, fall in market price, delay in transport and shortage of labour which lead to spoilage of the guavas at the farmgate. In a study sample of guava farmers, a total of 14.5 MT of guava was spoiled at the farmgate due to these various reasons.

Reason	Quantity Spoiled (MT)	Percentage (%)
Pest attack	6.56	45.3
Untimely rain	3.93	27.2
Fall in market price	2.87	19.8
Sorting and grading	1.12	7.7
Total	**14.5**	**100**

15. Guava crop is generally sold in the Gondal APMC market. The demand for guava is high and farmers receive good prices in this market. The market is approximately 85 km from the study cluster. Another market is the Rajkot APMC which is at a 75 km distance from the cluster. The average transportation cost is Rs. 1 per kg. The proportion of produce sold in these markets and prices received are as follows:

APMC Market	Grade-1		Grade-2		Grade-3	
	Per cent of total production sold	Price	Per cent of total production sold	Price	Per cent of total production sold	Price
Gondal Market	50.7	25	24.3	18	17.9	9
Rajkot Market	7.1	23	0	15	0	0

16. As per the price data received from farmers, the average price of guava across months and of different grades of guava in the year 2020-21 in the Gondal APMC markets was Rs. 2,000 for a quintal of guava. Therefore, farmers overall earned a net profit of Rs. 1,326.4 per quintal in the Gondal APMC market.

Farmer's Net Income	Price received (Rs.)
The average cost of cultivation[1] (Rs/acre)	67632
Average yield (q/acre)	120
Total cost of production (Rs/q)	563.2
Cost of transportation-Gondal and Rajkot APMC markets (Rs/q)	100
APMC market expenses (Rs/q)	10
Average price received in Gondal and Rajkot APMC markets (Rs/q)	2000
Net profit (Rs/q)	1326.4

17. During the COVID-19 induced lockdown, guava farmers largely suffered due to the unavailability of harvesting labour. Around 67.8 per cent of farmers could not get labour during the lockdown. Therefore, a large amount of the guava produce was spoilt at the farmgate. Agriculture inputs such as fertilizers, and pesticides were also not available as the supply chain of these inputs was disrupted. Around 71.4 per cent of farmers were unable to obtain fertilizers and pesticides on time.

GHG Emission from Guava Farming

1. The total emission due to various activities at the pre-production, production and post-production levels of guava farming in the Rajkot cluster in the form of carbon dioxide equivalent is as follows:

GHG Emissions from guava farming

Total Emission	Emission per acre	Average emission per kg
504.3 MT CO_2e	6009.4 kg CO_2e	1.07 kg CO_2e

2. The marginal farmers who own land up to 3 acres produce less emission per acre and average emission per kilogram of guava produced. The average emission per acre and average emission per kilogram of guava of a small farmer who owns land of 3-6 acres and of a big farmer who owns land of more than 6 acres are higher are almost equivalent.

GHG Emission from guava farming as per land holding

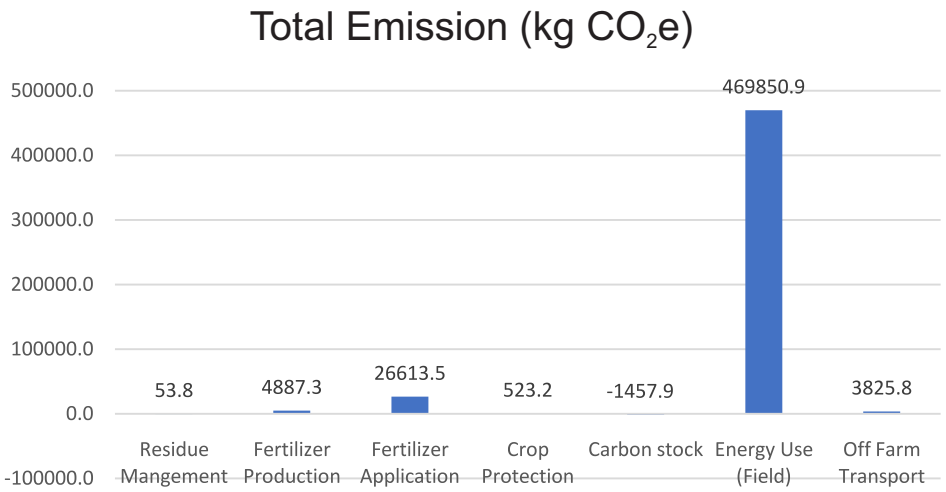
Sr. No.	Landholding (acre)	Total emission (MT CO_2e)	Emission per acre (kg CO_2e)	Average emission per kg of guava (kg CO_2e)
1	Up to 3	34.01	4908.0	0.976
2	3 – 6	202.27	6356.5	1.652
3	More than 6	268.01	6165.9	1.576

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

GHG Emissions from various activities from guava farming

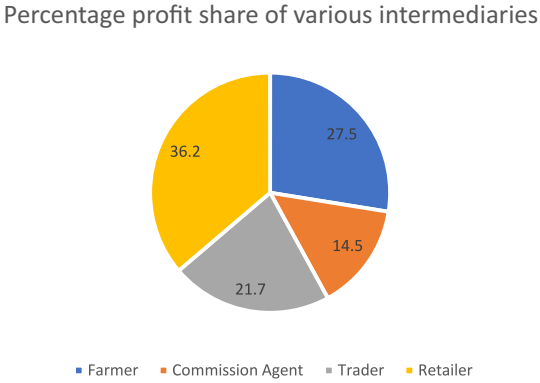
Sr. No.	Sources	Up to 3 acres		3 - 6 acres		More than 6 acres	
		Per acre of guava	Per kg of guava	Per acre of guava	Per kg of guava	Per acre of guava	Per kg of guava
1	Residue management	0.585	0.0001	0.579	0.0001	0.980	0.001
2	Fertilizer production	20.38	0.004	36.40	0.010	96.53	0.025
3	Fertilizer application	361.6	0.078	342.8	0.087	374.41	0.096
4	Crop protection	6.94	0.002	7.47	0.002	6.61	0.002
5	Carbon stock	-20.09	-0.004	-21.34	-0.004	-18.21	-0.005
6	Energy use (field)	4484.4	0.887	5955.9	1.547	5665.3	0.895
7	Off-farm transport	33.63	0.009	36.82	0.009	46.97	0.011

3. If we analyse the data of greenhouse gas emissions from various activities related to guava 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. The emissions from fertilizer application and production are also moderately high.



Value Chain Intermediaries

The guava farmers earn a profit of Rs. 3.8 per kg while other intermediaries such as commission agents, traders and retailers earn a range of profits through the sale of guava. The commission agent earns an average profit of Rs. 2 per kg, the trader of Rs. 3 per kg while the retailer earns Rs. 5 per kg.



RECOMMENDATIONS

1. Introduction of cluster-level guava nursery model using small polyhouse techniques ensuring access to quality and affordable access to saplings by small and marginal farmers.
2. A three-year cluster-based organic guava production programme providing risk coverage until the production system stabilizes will encourage farmers to make the gradual shift towards safe food production
3. Solar-based irrigation pump set with drip irrigation system to be provided to small farmholders. The existing PM-KUSUM scheme for irrigation needs to be revised with additional subsidies that can be given to small farmers and expanding reach.
4. Proper management and pruning skills are required to be imparted through proper training to the guava farmers to increase productivity.
5. Small guava producers need to be collectivized into Farmer Producer Organizations to access better inputs, share the transportation and marketing costs and to be able to negotiate the selling price.
6. Community-based small cold storage to be installed along with the support of subsidies to encourage the guava growers to store the guavas safely for a certain period and avoid wastage during the market glut period and due to extreme and unpredictable weather.
7. A reefer vehicle needs to be introduced in the cluster to transport the guava fruit to potentially distant markets and for export.
8. Solar-based guava processing units should be installed to reduce the loss of grade-2 and grade-3 guava fruits. The processing unit can make guava juice and other value-added products.
9. For the promotion and development of FPCs and organic production, a single window facility to obtain the organic farming certification, FSSAI licence, export licence and *mandi* licence is something necessary

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