

**NATIONAL AGRICULTURAL INNOVATION PROJECT
COMPONENT-II (MANGO AND GUAVA)
NAVSARI AGRICULTURAL UNIVERSITY, NAVSARI**



A Value Chain on Mango and Guava for Domestic and Export Market

➤ **PROJECT DETAILS:**

- ✓ **Component Code** : **NAIP- 2 (PCS)**
- ✓ **Code of Proposal** : **NAIP- 204501**
- ✓ **Date of Start** : **March, 2009**
- ✓ **Planned Duration** : **June, 2012. Extended up to March, 2013**
- ✓ **Lead Consortium** : **Central Institute for Sub-Tropical Horticulture (CISH), Lucknow, U.P.**

➤ **Consortium Partners:**

- ✓ **Navsari Agricultural University, Navsari, Gujarat,**
- ✓ **Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu,**
- ✓ **Andhra Pradesh Horticulture University, Tedepalliguen, A.P.**

➤ **Private Industry:**

- ✓ **BAIF Development Research Foundation, Pune.**

➤ **Associate Partners with NAU, Navsari:**

- ✓ **M/s. Gujarat Agro Industries Corporation Limited, Ashram Road, Ahmedabad**
- ✓ **M/s. Amalsad Seva Sahakari Mandali, Amalsad, Navsari**
- ✓ **M/s. Patson Food Pvt. Ltd. N.H. No - 8, Navsari**
- ✓ **M/s. Deep Frozen Foods, Gandeva, Navsari**

- **Address of the Consortium Partner NAU:**
Co-PI, NAIP-II (Mango and Guava)
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Website: (URL for NAU) :[www.nau.in/NAIP-II\(M&G\).pdf](http://www.nau.in/NAIP-II(M&G).pdf)

- **Name of Co-PI and Associated Scientists at NAU, Navsari :**
- ✓ Er. Parag Pandit, Assistant Professor (Post Harvest Technology), NAU, Navsari
 - ✓ Dr. B. N. Patel, Associate Directorate of Research, NAU, Navsari
 - ✓ Dr. N. I. Shah, Associate Research Scientist (Horticulture), NAU, Paria

➤ **INTRODUCTION:**

Gujarat is one of the major mango growing states occupying an area of 1, 09,600 ha under mango cultivation with production of 9,30,100 T and productivity 8.5 T/Ha in 2007-08. The share of mango in total fruit production of Gujarat is 15.9%. Gujarat is contributing 6.7% share in the total production of Indian mango. The South Gujarat is known for commercial cultivation of prime Indian export mango varieties 'Kesar'. In this region, about 75000 ha area is under fruit crops yielding more than 2.87 lakh MT of mango which is contributing 30.85% of state production. The average price of unripe mango fruit during the year 2007-08 in the Surat market is 1280.50 Rs/Qtl. The total post harvest loss in this fruit is amounting to about 13.6 crores annually from the South Gujarat only (Indian Horticulture Database- 2009). The production belt of Guava is very small in South Gujarat and it is limited to only one taluka of Bharuch district, but Allahabad Safeda guava fruit from this region is famous for its sweet taste in all around Gujarat. Although several advanced technologies have been developed for mango and guava, the extent of their

adoption and correct method of implementation is very poor. Technologies such as canopy modification in old and senile mango and guava orchards, judicious water and nutrient management to increase the productivity and scientific methods for harvesting and post harvest management like pre-cooling, sorting, grading, packaging and marketing have not yet been adopted by a large majority of mango and guava growers. Similarly farm mechanization in production and harvesting of mango and guava orchard is present need. In case of processing except mango pulp canning and pickling, no other products are being processed. The process industry waste is also not utilized adequately and so it is generating unhygienic condition in the plant. The intervention is needed in each steps of entire value chain of mango and guava from management as well research point of view. This project proposal, therefore, aims at developing appropriate environment friendly production systems for quality production of mango and guava, using scientifically developed protocols for judging proper maturity of fruits, harvesting methods, post harvest management practices such as pre-cooling, sorting, grading, packaging, transport and marketing. Efforts will also be made to ensure tying up of producers with processors and entrepreneurship development for promotion of processing which is quite meager, in respect of mango and guava at present. This will result in enhanced gains to the producer in terms of enhanced yield, quality fruits, higher income, employment generation, development of value added products, etc.

➤ **OBJECTIVES:**

- ✓ Enhancing productivity and quality of mango and guava through good agricultural practices.
- ✓ Reducing post-harvest losses, enhancing shelf life through scientific pre and post harvest management practices.
- ✓ Strengthening of processing of mango and guava through entrepreneurship development and tying up with processors.
- ✓ Facilitating the producers in getting domestic and international market access for their produce by creating market linkages.

PROJECT AREA:

- **Total Project Area: For Kesar Mango-40 Hector** (80 Farmers)
 - ✓ **Navsari:** Navsari, Gandevi, Vansda, Jalalpore and Chikhali.
 - ✓ **Valsad:** Valsad, Dharmpur, Umargam, Pardi.

For Allahabad Safeda Guava:

- **Total Project Area: 10 Hector** (20 Farmers),
 - ✓ **Bharuch:** Ankaleswar.

PROJECT ACTIVITY:

A. Enhancing productivity and quality of mango and guava through good agricultural practices.

- Selection of target farmers for the purpose and benchmark survey
- Centre opening and light pruning in existing orchards of mango and guava
- Water application during critical periods
- Integrated nutrient management based on soil and leaf nutrient analysis
- Use of chemicals for regular bearing in mango
- Management of insect -pests and diseases using environment friendly molecules and bio-agents.
- Pesticide residue analysis in fresh mango and guava fruits
- Field days and training of farmers/stakeholders for timely and correct orchard management practices

B. Reducing post-harvest losses, enhancing shelf life through scientific pre and post harvest management practices.

- Pre-harvest bagging of mango fruits
- Harvesting at proper maturity and use of harvesting tools
- Ripening of mango fruits using ethrel
- Pre-cooling of mangoes
- Sorting and grading of fruits
- Packaging in CFB Boxes/plastic crates.

- Training of farmers/stakeholders in on-farm handling, pre and post harvest management practices

C. Strengthening of processing of mango and guava through entrepreneurship development and tying up with processors.

- Practical training of stakeholders/processors for processing of fruits into mango pulp, dehydrated mango powder and others; guava products like guava pulp, dehydrated ripe guava powder, etc and development of by-products from mango peel and mango stones.
- Tying up of mango and guava growers with processing industries for processing of produce into mango and guava products.

D. Facilitating the producers in getting domestic and international market access for their produce by creating market linkages.

- Strengthening of market linkages by organizing buyers-growers meet/interaction.
- Tying up of producers with the market agencies in the country and exporters.

EXPECTED OUTPUT AND OUTCOME OF PROJECT:

➤ **Output:**

- ✓ Increase in mango yield by 25-30 % and that of guava by 40-50 % coupled with quality improvement of fruits from the existing orchards due to enhanced water and fertilizer use efficiency, better light penetration, enhanced orchard efficiency, effective disease and insect pest management.
- ✓ Availability of safe/residue free mango and guava fruits for domestic and export market.
- ✓ Availability of uniformly ripe fruits with better shelf life for consumption and processing.
- ✓ Enhanced level of mango and guava processing into various value added products like mango pulp, mango bar, *amchoor*, dehydrated mango powder and others; guava products like guava pulp,

dehydrated ripe guava powder, guava cider, etc and development of by-products from mango peel and mango stones

- ✓ Availability of trained manpower in scientific production, protection and processing of mango and guava.
- ✓ Increased profitability to the mango and guava producers through better access to markets.

➤ **Outcome:**

- ✓ Increase in farmers' income and socio-economic status of mango and guava farmers.
- ✓ Increased export of mango and guava due to better quality fruits and earning foreign exchange, thereby benefiting different agencies involved in the value chain.
- ✓ Enhancement in capacity utilization of processing industries.
- ✓ Enhanced processing level will ensure nutritional security to the people and will avoid market gluts during peak seasons of fruit production.
- ✓ Generation of employment opportunities in Horticulture and Processing sector.

MAJOR INNOVATIONS AND ACHIEVEMENTS OF PROJECT

(From 01.04.09 to 31.06.12)

Process/ Product/Technology Developed

S. No.	(Process/Product/Technology Developed)
1	Technology for Frozen mango pulp
2	Ready to eat pickle made from the unripe and fallen mango fruit
3	Technology for mango bar processing
4	Technology for mango pulp canning
5	Technology for spray drying of ripe mango and guava powder production
6	Technology for ripe mango slices dehydration
7	Guava fruit pulp storage using freezing technology
8	Technology for the guava bar production
9	Guava flavour tea bags

10	Technology for mango kernel oil extraction
11	Technology for mango papad preparation
12	Pre-harvest bagging of mango and guava fruits by news paper
13	Centre opening of dense mango orchard.
14	Light pruning of guava orchard
15	Tractor Trolley Mounted Hydraulic Platform
16	Tractor mounted power sprayer
17	Foliar application of boron and zinc on guava
18	Ripening of mango by ethaphone as well as ethylene gas
19	Specially designed CFB boxes for Kesar mango fruit in 2, 3, 5 and 10 kg capacity

Publications:

A. Research papers in peer reviewed journals:

S. No.	Authors, Title of the paper, Name of Journal, Year, Vol. & Page No.
1.	Bhalerao P. P. and Pandit P. S. Study on pre-cooling treatments for extending ripening in Mango cv. Kesar. <i>International Journal of Processing and Post Harvest Technology</i> , 2010; 1 (2): 111-113.
2.	Pandit, P. S. A study on fruit ripening. <i>International Journal of Processing and Post Harvest Technology</i> , 2011; 2 (1): 64-70.

B. Books/ Book chapters/Abstracts/Popular articles, Brochures, etc.:

S. No.	Authors, Title of the papers Name of Book/ Seminar/ Proceedings/Journal, Publisher, Year, Page No.
Books	
1.	Pandit, P. S., Patel, B. N., Shah N. I., Bhalerao, P. P. and Modi, P. (2012). "Ambama Vaignanik Kheti Dvara Nikaslakshi Utpadan ane Mulyavrudhi". Pub.: Navbharat Sahitya Mandir, Ahmebadab. Ed. -1. ISBN No.-978-81-8440-674-0.
2.	Pandit, P. S., Shah N. I., Patel, B. N., Modi, P. and Bhalerao, P. P. (2012). "Jamrukhma Vaignanik Kheti Padhati ane Mulyarudhi". Pub.: Navsari Agricultural University, Navsari.
3.	Pandit, P. S., Prajapati, P. P., Bhalerao, P. P. and Modi, P. (2012). "Value Addition in Mango Through Processing". Pub.: Navsari Agricultural University, Navsari.
Abstracts	
1.	Pandit, P. S., Patel, B. N. and Bhalerao, P. P. Comparative study of high volume fine particle sprayer with traditional power sprayer. Abstract presented in 2 nd National Workshop of Indian Blacksmithy Forum on "Agriculture Tools and Traditional Blacksmithy: Present trends and Future Prospects" held at A. T. R. C., Bardoli (Gujarat) during 20-22 Jan., 2011. pp. 45.
2.	Pandit, P. S., Shah, N. I. and Patel, P. R. Use of Tractor Trolley Mounted Hydraulic Platform for Mango Orchard Management. Abstract presented in 2 nd National Workshop of Indian Blacksmithy Forum on "Agriculture Tools and Traditional Blacksmithy: Present trends and Future Prospects" held at A. T. R. C., Bardoli (Gujarat) during 20-22 Jan., 2011. pp. 46.

3.	N. N. Chaudhari, N. I. Shah and R. G. Patel. Storage of mango fruits cv. Kesar treated with calcium chloride after harvesting at different maturity stages. <i>(in)</i> Global Conference on “Augmenting Production and Utilization of Mango : Biotic and Abiotic Stresses” organized by the Society for Development of Subtropical Horticulture, Central Institute for Subtropical Horticulture (ICAR), Lucknow in partnership with the International Society for Horticultural Sciences (ISHS), Belgium at Lucknow during 21-24 June, 2011. pp. 84.
4.	N. N. Chaudhari, N. I. Shah, N. R. Sondarva and R. G. Patel. Influence of hormones on fruit retention, early maturity and quality of mango cv. Kesar. <i>(in)</i> Global Conference on “Augmenting Production and Utilization of Mango : Biotic and Abiotic Stresses” organized by the Society for Development of Subtropical Horticulture, Central Institute for Subtropical Horticulture (ICAR), Lucknow in partnership with the International Society for Horticultural Sciences (ISHS), Belgium at Lucknow during 21-24 June, 2011. pp. 89.
5.	C.R. Patel and N.I. Shah. Effect of mulching on yield and quality of mango cv. Kesar. <i>(in)</i> Global Conference on “Augmenting Production and Utilization of Mango : Biotic and Abiotic Stresses” organized by the Society for Development of Subtropical Horticulture, Central Institute for Subtropical Horticulture (ICAR), Lucknow in partnership with the International Society for Horticultural Sciences (ISHS), Belgium at Lucknow during 21-24 June, 2011. pp. 88.
6.	C.R. Patel, U.P. Joshi, B.T. Patel, B. S. Rathod and R.R. Patel. Micro irrigation in mango nursery- a revolution. <i>(in)</i> Global Conference on “Augmenting Production and Utilization of Mango : Biotic and Abiotic Stresses” organized by the Society for Development of Subtropical Horticulture, Central Institute for Subtropical Horticulture (ICAR), Lucknow in partnership with the International Society for Horticultural Sciences (ISHS), Belgium at Lucknow during 21- 24 June, 2011. pp. 89.
7.	Sharma, H., Ghoghari, P.D. and Kalaria, G.B. Evaluation of mango germplasm against powdery mildew incited by <i>Oidium mangiferae</i> berthed. <i>(in)</i> Global Conference on “Augmenting Production and Utilization of Mango : Biotic and Abiotic Stresses” organized by the Society for Development of Subtropical Horticulture, Central Institute for Subtropical Horticulture (ICAR), Lucknow in partnership with the International Society for Horticultural Sciences (ISHS), Belgium at Lucknow during 21-24 June, 2011. pp. 26.
8.	Sharma, H., Kalaria, G.B. and Ghoghari, P.D. Bio-efficacy of different fungicides for management of mango powdery mildew in South Gujarat. <i>(in)</i> Global Conference on “Augmenting Production and Utilization of Mango : Biotic and Abiotic Stresses” organized by the Society for Development of Subtropical Horticulture, Central Institute for Subtropical Horticulture (ICAR), Lucknow in partnership with the International Society for Horticultural Sciences (ISHS), Belgium at Lucknow during 21-24 June, 2011. pp. 118.
9.	Kalaria, G.B., Ghoghari, P.D. and Sharma, H. Estimation of avoidable losses in mango due to mango hopper, <i>Amritodes Atkinsoni</i> Lethier under South Gujarat. <i>(in)</i> Global Conference on “Augmenting Production and Utilization of Mango : Biotic and Abiotic Stresses” organized by the Society for Development of Subtropical Horticulture, Central Institute for Subtropical Horticulture (ICAR), Lucknow in partnership with the International Society for Horticultural Sciences (ISHS), Belgium at Lucknow during 21-24 June, 2011. pp. 119.
10.	P. K. Modi, S. Pushpraj, P. P. Bhalerao, L. R. Verma and P. S. Pandit. Recent initiatives to enhance shelf life of fruits. Abstract presented in National Seminar on New Frontiers and Future Challenges in Horticultural Crops (NFFCHG) held at College of Agriculture, Punjab Agricultural University, Ludhiana on 15-17 th March, 2012. pp. 207.

Popular Articles	
1.	Pandit P.S., Chhatrola A.S. and Patel R.G. <i>Jamfal ma export ne lagta mapdand</i> (Gujarati). <i>Krushvi Govidhya</i> (Gujarati), April-2010, pp. 22-23.
2.	Bhalerao P. P. Ultra High Density Plantation-A New Approach in Mango Production. <i>Agro-bios Newsletter</i> . 2011. IX (10): 19-21.
3.	Patel, B. N., Shah N. I., Pandit, P. S., Bhalerao, P. P. and Modi, P. Meadow Orchard: <i>Jamrukhma Ghanisth Vavetar padhati</i> (Gujarati). <i>Khetini Vat</i> , April-2012, Issue-7. pp-38-39.
4.	Patel, B. N., Shah N. I., Pandit, P. S., Bhalerao, P. P. and Modi, P. <i>Ambama Ghanisth Vavetar Padhati ane Canopy Management</i> , <i>Krushijivan</i> May-2012, 10 (523): 13-16.
5.	Shah, N. I., Patel, C. R., Bhalerao, P. P. <i>Ambama chatni (pruning) ane kelavani (training)</i> . West Zone KVK Agro-fair under RKVY, Agro-forestry & High-tech Horticulture seminar at Vyara, NAU, Navsari, Feb.-2012, pp. 71-74.

Media Products Developed/Disseminated

S. No.	CD, Bulletins, Brochures, etc. (Year wise)
CD's	
1.	Production technology of mango (2011)
2.	Pest and disease management in mango (2011)
3.	Post harvest management and value addition in mango (2011)
Folders	
1.	Pandit P. S., Desai, C. S. Patel, J. M. and Desai P. R. (2009). Post Harvest Management of Mango and Guava Fruits.
2.	Pandit P. S., Desai, C. S. Patel, J. M. and Desai P. R. (2009). Value Addition through the Processing of Mango and Guava.
3.	Pandit P. S., Desai, C. S. Patel, J. M. and Desai P. R. (2009). Scientific Production Practices and Pest-Diseases Management in Guava.
4.	Patel B. N., Shah N. I., Pandit P. S., Bhalerao P. P. and Desai P. R. (2010). Scientific Production Practices in Mango.
5.	Patel B. N., Shah N. I., Pandit P. S., Bhalerao P. P. and Desai P. R. (2010). Insect, Pest and Diseases Management in Mango.
6.	Patel B. N., Shah N. I., Pandit P. S., Bhalerao P. P. and Modi, P. K. (2012). Calendar: Mango working operations throughout year.
7.	Patel B. N., Shah N. I., Pandit P. S., Bhalerao P. P. and Modi, P. K. (2012). Training and Pruning in Mango.
8.	Patel B. N., Shah N. I., Pandit P. S., Bhalerao P. P. and Modi, P. K. (2012). Ultra-high Density Plantation System in Mango.
9.	Patel B. N., Shah N. I., Pandit P. S., Modi P. K. and Bhalerao P. P. (2012). Meadow Orchard Planting Method in Guava (Gujarati Language).
10.	Patel B. N., Shah N. I., Pandit P. S., Bhalerao P. P. and Modi, P. K. (2012). Meadow Orchard Planting Method in Guava (English Language).
Handouts	
1.	Patel, B. N., Pandit, P. S., Bhalerao P. P. and Modi, P. (2011). Meadow orchard planting system in guava.
2.	Patel, B. N., Pandit, P. S., Bhalerao P. P. and Modi, P. (2012). Rejuvenation in old guava orchard.

Performance Indicators

S. No.	Indicator	Total No.	
1.	No. of production technologies released and/or adopted	06	
2.	No. of processing technologies released and/or adopted	12	
3.	Number of technologies/products commercialized based on NAIP research	01	
4.	No. of new rural industries/enterprises established/ upgraded	04	
5.	No. of product groups for which quality grades developed and agreed	02	
6.	Total no. of private sector organizations (including NGOs) participating in consortium	06	
7.	No. of farmers involved in consortia activities	100	
8.	Total number of farmers' group developed for marketing and processing	02	
9.	Number of patent/intellectual property protection applications filed based on NAIP research	--	
10.	Number of patents/intellectual property protections granted/published based on NAIP research	--	
11.	Number of scientists trained overseas in the frontier areas of science	--	
12.	Number of scientists trained overseas in consortium-based subject areas	--	
13.	No. of scientists participated in conference/seminar etc. abroad	--	
14.	Success stories	01	
15.	Incremental employment generated (Man-day/year)	Baseline	Final
		150	235
16.	Increase in income of participating households (₹ per annum)	Baseline	Final
	Mango, ₹ /ha	93431	170000
	Guava, ₹ /ha	53275	220000
17.	Number of novel tools/protocols/methodologies developed	3	
18.	Publications		
	Articles in NAAS rated journals	--	
	Articles in other journals	02	
	Book (s)	03	
	Book chapter (s)	--	
	Thesis	05	
	Popular article(s) (English)	01	
	Newspaper article (s)	14	
	Seminar/Symposium/Conference/Workshop Presentation	10	
	Technical bulletin(s)	--	
	Manual(s)	--	
	CDs/Videos	03	
	Popular article(s) in other language	04	
	Folder/Leaflet/Handout	12	
	Report(s)	--	
	Success stories	01	

Picture Illustration of Project Activity:



Demonstration of Tractor Trolley Mounted Hydraulic Platform at *Krushimela* -2010.



Spray dried Kesar mango powder



Quality mango for export



CFB boxes for the Kesar mango for domestic and export requirement developed by NAU



Kesar mango box for export to UK.



Participation of farmers in Kesar mango festival at Delhi and Ahmedabad



Ripening of Kesar mango for domestic market using ethaphone

Ripening of Kesar mango for export to UK using Ethylene gas chamber



Direct Marketing of Kesar Mango

Centre Opening of Kesar Mango Orchard



Application of Paclobutrazol for Regular Bearing of Flowers in Kesar Mango



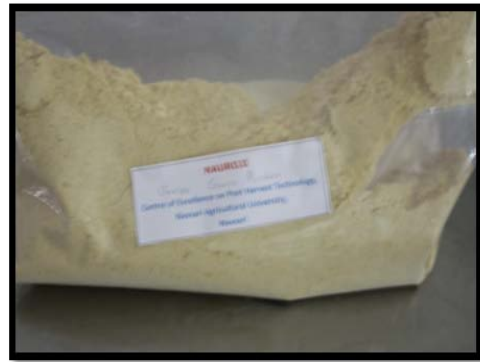
Fruit Bagging in Kesar Mango Orchard



Group of Farmers at "*Umarsadi*" Village for Global GAP Certification in Mango Orchard



Frozen Guava Pulp



Guava Powder



Ready To Eat Mango Pickle From Fallon Mango



Dried Unripe Mango Slices



Spray Drying Unit at N.A.U.



Solvent Oil Extraction Unit at N.A.U.



Dr. A.R. Pathak, Hon. Vice-Chancellor of N.A.U. during Mango Buyer Seller Meet



Actively Participate in *Krishi Mela* and Agro-Fairs



Training on Kesar mango production practices at Valsad and Navsari to the farmer



Progressive Farmers Discussing on Weight Grader during Training of PHM for Mango and Guava



Training Program on Processing of Kesar Mango and Allahabad Safeda Guava



Buyer-Seller Meeting for Kesar Mango and Allahabad Safeda Guava



Demonstration of Tractor Trolley Mounted Hydraulic Platform and Power Sprayer



Training on guava orchard management



Field visit of guava orchard for shoot borer control



Use of Tractor Trolley Mounted Hydraulic Platform by Farmers for spraying and pruning in Mango Orchard



Distribution of Agro-chemicals and Equipments to farmers of Mango & Guava

Recommendations of NAU for the IPDM in Mango

Sr. No.	Time of Spray	Disease/ Insect	Recommended Pesticide/ Fungicide	Quantity 10 lit
1.	End of October or Start of November	Hopper, Shoot Borer, Leaf eating caterpillar & for all the diseases	Fenitrothion 50% EC or Copper Oxychloride 50% WP or Bordeaux mixture	10 ml 40 gm 25 gm
2.	End of November	Hopper, Inflorescence & Shoot Borer, Leaf eating caterpillar & Leaf Blight; Anthracnose	Fenvelrate 20% EC or Lamdacylhelothrin 50EC (+) Carbendezim 50% WP	2.5 ml 60 ml(+) 10 gm
3.	December	Hopper, Inflorescence & Shoot Borer; Powdery mildew	Phosalone 35% EC + Wetable Sulphur 80 %	21 ml + 30 gm
4.	January	Bud Burst Stage (For Pest & Disease)	Phosalone 35 % EC + Dinocap 48 % EC or Triadimefon 80 % EC or Hexaconazole 5 % EC	21 ml + 10 ml 5 ml 10 ml
5.	February	Pea Stage Hopper, Inflorescence & Shoot Borer, Mealy Bug, Scale Insect & Leaf eating caterpillar; Powdery Mildew	Quinalphos 20 % AF + Imidachloprid 17.8 %	25 ml + 5 gm
6.	March	Marble Stage Hopper, Inflorescence & Shoot Borer; Powdery Mildew & other Diseases	Phosalone 35% EC+ Dinocap 48 % EC or Triadimefon 80 % EC or Hexaconazole 5 % EC	21 ml + 10 ml 5 ml 10 ml
7.	April	Stone Formation in Mango Hopper, Inflorescence & Shoot Borer, Mealy Bug, Scale Insect & Leaf eating caterpillar; Anthracnose and Die Back	Quinalphos 20 % AF + Captafol 80% WP or Mencozeb 80 % WP	25 ml + 20 gm 20 gm

Note: i. Avoid spraying of Bordeaux mixture with any insecticide
ii. Avoid the use of Sulphure after flowering of mango

Properties of Packaging Box for Kesar Mango

Designed by NAU, Navsari

Sr. No.	Attributes	Pack Size			
		2 kg	3 kg	5 kg	10 kg
1	Length (cm)	25	36	38	38
2	Breadth (cm)	19	23	23	24
3	Height (cm)	11	13	19	23
4	Volume (cm ³)	5225	10764	16606	20976
5	No. of Holes	24	24	24	24
6	Type of Holes	Elliptical	Elliptical	Elliptical	Elliptical
7	% of opening in total surface area	13.01	21.64	19.57	22.50
8	No. of Ply	3	3	5	5
9	Compressive Strength (kgf/cm ²)	82	135	115	150
10	Stacking Height (cm)	143 (13boxes)	182 (14 boxes)	418 (22 Boxes)	345 (15 Boxes)
11	Stacking Strength (Kgf)	27.3	45	115	150
12	Bursting Strength (kg/cm ²)	6.9	7.7	8.7	7.8
13	Moisture %	1.6	1.6	1.7	1.8
14	GMS (g/m ²)	613.76	573.23	702.54	882.00
15	Weight of Empty Box (gm)	238	414	330	500
16	Safety factor	3	3	1	1

Properties of Single Layer Plastic Crates

Sr. No.	Particular Property	Unit
1	Height	177.8 mm
2	Length	558.8 mm
3	Breadth	361.9 mm
4	Weight	1356.0 g

Protocol for Export of Kesar mango

- The fruits should be harvested at proper maturity i.e. TSS > 8.5 ° Brix and fruit specific gravity 1.01-1.02 with 1cm stalk and brought to the pack house immediately in single layer plastic crates after sorting and mild cleaning.
- As per pack house operations, the fruits are to be desapped, washed, treated with fungicide (0.05% Benomyl preferably) in hot water (50 ±1 °C) followed by sponging and grading on weight basis i.e. 250-300g per fruit.
- The fruits need to be packed in CFB boxes having a bursting strength of more than 7.75kgf/cm² and using a cushioning material preferably the bubble type of plastic or sterile paper savings.
- The fruits should be individually wrapped with Styrofoam net and arranged preferably slightly tilted or slanted in single layers in ventilated CFB boxes,
- Preferably the ventilation in the boxes is covered with insect proof screen of 30 mesh.
- Stacking of the boxes should be on the basis of box strength and specifications of the container. Recommended size of NAU CFB box is 360 mm x 230 mm x 130 mm with staking strength 45 kgf and 21.2% ventilation.
- Proper palletization is required before keeping the boxes in container; fruits are to be precooled at 11 ± 1°C.
- The container temperature from point of loading to point of destination should be kept around 12±1° C with 80-90% R.H, if the fruits are to be stored for around 15-20 days. If the fruits are to be disposed off immediately after reaching the destination on the container temperature may be maintained at 19±1° C with 85-90% R.H.
- The data loggers for temperature and humidity recording should be placed in the container and monitored throughout the transport from point of dispatch to point of delivery.
- If the fruits are to be consumed within the 4-5day of delivery and transported through air cargo at 12-16°C and 80-90% R.H, the naturally ripened fruits should be selected at 80% ripening stage (i.e. TSS > 14 °Brix).
- If fruits are unripe and required ripening, it should be ripen with 100ppm ethylene gas at 24±2°C and 80-90% R.H in closed ripening chamber up 30±4 h and followed by 48h fresh air circulation to get correct ripening stage for transportation in air cargo.
- If mangoes are unripe during export, it is to be ensured that ripening chambers are available at the destination, particularly in temperate region.

Observations to be made before loading/packing at the point of dispatch:

- The calibration of temperature and humidity data logger and its proper installation in container.
- TSS of Kesar mango fruits.
- The physical condition and properties of the boxes.
- The physical condition of the fruits i.e. bruising, disease, pressmarks, surface colour and ripening stage.
- Weight of packed boxes.
- Arrangement of boxes in container.

Observations to be made at the destination:

- Physical conditions of boxes.
- Temperature and Humidity recorded in data logger.
- TSS of Kesar mango.
- If proper ripening is required, ripening treatment facilities and its monitoring and storage.
- Disposal pattern and retailer/consumer acceptability.
- Any other information required at the destination.

THCHNOLOGY DEVELOPED
(Information on technologies/Products commercialized)

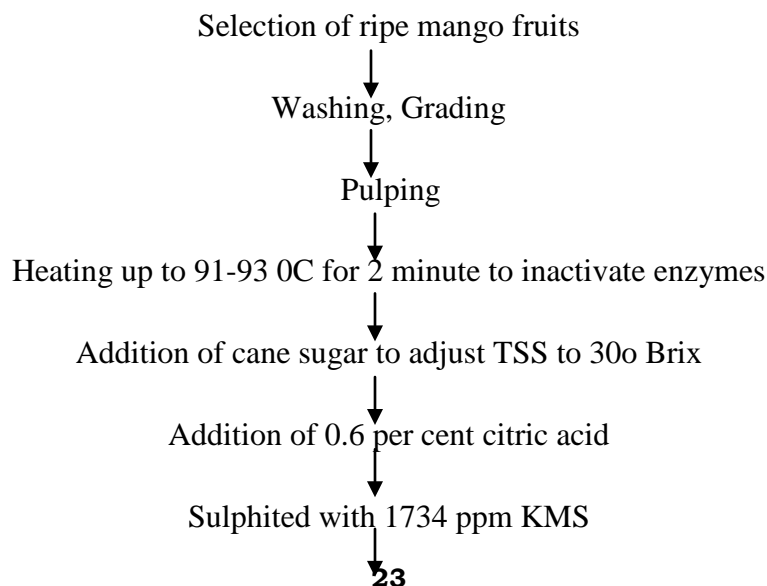
Project Reports for All type of Mango and Guava Processing Technology is available. Some of them are as under.

A. (Mango Bar)

1. Name of Product: Mango Bar
2. Cost of Technology: Rs. 10.00 per kg
3. Date of Commercialization: 01/07/2010
4. Industry which has taken up commercialization:
Deep Fresh Frozen Food Products Ltd., Gandeva.
5. Details of Product:

Healthy and ripe fruits were selected for extraction of the pulp. The pulp was then heated to 91-93⁰ C to inactivate the enzyme. Cane sugar is then added to adjust TSS to 30⁰Brix. Citric acid is then added to the puree to raise the acidity to 0.6%. The blend is sulphited with 1734 ppm KMS. All the blends are spreaded on smeared trays smeared by glycerin/ refined oil at the rate of 9.8 kg/m². These trays are kept in tray drier at 63±2⁰C for 14-15 hr. Dried sheets of each blends are cut into rectangular pieces of 3 x 5” size and packed in polyethylene bags and stored at ambient condition.

FLOW CHART FOR PREPARATION OF MANGO BAR



Spread layer of the blend on the tray smeared with glycerin/ refined oil

Dried in tray drier for 14-15 hr at $63 \pm 2^\circ\text{C}$ at the tray load of 9.8 kg/m^2

Cutting into rectangular piece

Packing in polyethylene bag

Storage at ambient condition

6. Details of Product so far: 500 kg

7. Economics of Technology: Rs. 10.00 per kg

8. Impact of Technology:

Previously they made the frozen mango pulp. By adopting this technology, the utilization of mango and its pulp is increased and fetch good price.

9. Consumer acceptability: Like extremely.



Mango Bar

B. Ripening of Mango

1. Name of Product: Ripening of Mango
2. Cost of Technology: Rs. 0.20 per kg per day
3. Date of Commercialization: 25/05/2010
4. Industry which has taken up commercialization:

Shreeji fruits and Agro Food Processors, Surat

5. Details of Technology:

- ✓ Use of ethrel/ethephon @ 62.5/187.5 m.l./100 lit water for uniform ripening. Dip 100 kg kesar fruits for 5 minutes in the solution at 52° C and it will take 4-5 days for uniform ripening. Same solution can be used for 4 times and thus it will reduce the cost.
- ✓ Use of ethylene gas @ 100 ppm at 11-18 ° C for 24 hrs. and expose fruits in the air upto 48 hrs will also result in uniform ripening.

6. Details of Product so far: 2 T

7. Economics of Technology: Rs. 0.02 per kg per day

8. Impact of Technology:

By adopting this technology, they get good market price due to low competition

9. Consumer acceptability: Preferred Extremely.



Ripening of Kesar mango for export to UK using Ethylene gas chamber

C. (Canning of Mango Pulp)

1. Name of Product: Canning of Mango Pulp
2. Cost of Technology: Rs. 45 per kg
3. Date of Commercialization: 20/06/2010
4. Industry which has taken up commercialization:

M/s. Patson Foods Pvt. Ltd, Navsari

5. Details of Technology:

Select the ripe mango of good quality. Washing, slicing and pulping should be done and pass it through pulper cum finisher and collect it in nitrogen filled tank. Adjust the TSS, acidity and pH of the pulp. Fill the pulp in OTS Can, seal with double seamer machine. Sealed OTS Can is kept in boiling water for 20 minutes and after that immediately cools the OTS Can. The canned pulp can be stored for more than a year and it can be used in RTS beverages, juice, leather, powder etc.

FLOW CHART FOR PREPARATION OF MANGO BAR



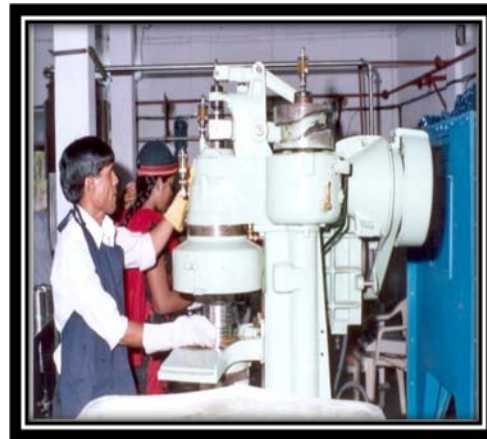
6. Details of Product so far: 4000 T

7. Economics of Technology: Rs. 25 per kg

8. Impact of Technology:

By adopting this technology, they get good market price due to low competition and demand of pulp is throughout the year.

9. Consumer acceptability: Preferred Extremely.



Mango Pulp Can Filling and Seaming Unit



Publications of information about Mango and Guava in News-paper



કેરી ઉપર પેપર બેગ ચઢાવવાની ભલામણ

નવસારી-જલાલપોર કૃષિ યુનિવર્સિટીના આયોજિત શિબિરમાં આજ રોજ મેંડેલોરના કૃષિ વિભાગના અધિકારીઓએ કૅરીના ઉપર પેપર બેગ ચઢાવવાની ભલામણ કરી હતી.

આજ રોજ મેંડેલોરના કૃષિ વિભાગના અધિકારીઓએ કૅરીના ઉપર પેપર બેગ ચઢાવવાની ભલામણ કરી હતી. આજ રોજ મેંડેલોરના કૃષિ વિભાગના અધિકારીઓએ કૅરીના ઉપર પેપર બેગ ચઢાવવાની ભલામણ કરી હતી.



જામફળની વર્ષ દરમિયાન બજારમાં રહેતી માંગ

નવસારી-જલાલપોર કૃષિ યુનિવર્સિટીના આયોજિત શિબિરમાં આજ રોજ મેંડેલોરના કૃષિ વિભાગના અધિકારીઓએ કૅરીના ઉપર પેપર બેગ ચઢાવવાની ભલામણ કરી હતી.



પાંચ વર્ષમાં હેક્ટરદીઠ ૫૦ ટન

નવસારી-જલાલપોર કૃષિ યુનિવર્સિટીના આયોજિત શિબિરમાં આજ રોજ મેંડેલોરના કૃષિ વિભાગના અધિકારીઓએ કૅરીના ઉપર પેપર બેગ ચઢાવવાની ભલામણ કરી હતી.



કેરી ઉતાર્યા પછીનું માવજત

નવસારી-જલાલપોર કૃષિ યુનિવર્સિટીના આયોજિત શિબિરમાં આજ રોજ મેંડેલોરના કૃષિ વિભાગના અધિકારીઓએ કૅરીના ઉપર પેપર બેગ ચઢાવવાની ભલામણ કરી હતી.



શિબિરમાં કેરીના નિકાસલક્ષી પગલાં ઉપર ભાર મુકાયો

નવસારી-જલાલપોર કૃષિ યુનિવર્સિટીના આયોજિત શિબિરમાં આજ રોજ મેંડેલોરના કૃષિ વિભાગના અધિકારીઓએ કૅરીના ઉપર પેપર બેગ ચઢાવવાની ભલામણ કરી હતી.



કૃષિ સમાચાર

નવસારી-જલાલપોર કૃષિ યુનિવર્સિટીના આયોજિત શિબિરમાં આજ રોજ મેંડેલોરના કૃષિ વિભાગના અધિકારીઓએ કૅરીના ઉપર પેપર બેગ ચઢાવવાની ભલામણ કરી હતી.



કેરીને ઈથરેલ દ્વારા પકવવાની વેજાનિક પદ્ધતિ વિકસાવતા કૃષિ તજજ્ઞો રસાયણ આરોગ્યને નુકસાન કરતું નથી

નવસારી-જલાલપોર કૃષિ યુનિવર્સિટીના આયોજિત શિબિરમાં આજ રોજ મેંડેલોરના કૃષિ વિભાગના અધિકારીઓએ કૅરીના ઉપર પેપર બેગ ચઢાવવાની ભલામણ કરી હતી.



છટણી-કેળવણી દ્વારા કેરીનું વધુ ઉત્પાદન મેળવવો

નવસારી-જલાલપોર કૃષિ યુનિવર્સિટીના આયોજિત શિબિરમાં આજ રોજ મેંડેલોરના કૃષિ વિભાગના અધિકારીઓએ કૅરીના ઉપર પેપર બેગ ચઢાવવાની ભલામણ કરી હતી.

Publication of Book, Booklets and Folders

