



# Revised Training Module & Manual

For  
Designing and Implementing Training Program for Increasing  
Women's Participation in the Agro-Processing Sector in Bangladesh  
Under  
**Bangladesh Regional Connectivity Project-1**  
Ministry of Commerce, Government of the People's Republic of Bangladesh  
(Contract No. BRCP-1/MOC/SD-18)



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**31<sup>st</sup> August 2020**

## CONTENTS

### Contents

### Pages

<b>Training Module</b>		04
5-Day Long Training Programme for Increasing Women’s Participation in the Agro-Processing Sector in Bangladesh		
<b>Training Manual</b>		10
<i>Thematic Area-A: Training Course Introduction and Pre-harvest Management of Fruits and Vegetables</i>		<b>10</b>
Topic A-1	Introduction of course objectives and training plan	10
Topic A-2	Standard for Good Agricultural Practices (GAP): Fruits and Vegetables	12
Topic A-3	Pre-harvest and harvest factors affecting the post-harvest behaviour of fruits and vegetables	20
<i>Thematic Area-B: Primary Processing (Post-harvest Handling of Fresh commodities)</i>		<b>25</b>
Topic B-1	Harvesting, postharvest handling, packaging, transportation and storage of fruits and vegetables	25
Topic B-2	Cold chain management for fruits and vegetables	40
<i>Thematic Area-C: Secondary Processing (Processing into Shelf-Stable Products)</i>		<b>49</b>
Topic C-1	Secondary processing technologies for fruits and vegetables focusing intermediate and shelf-stable processed products	49
<i>Thematic Area-D: Food Safety and Quality Assurance of Fresh and Processed Commodities</i>		<b>57</b>
Topic D-1	Quality & Food Safety Assurance and Sanitary & Phyto-Sanitary Standards (SPS) for Fresh Fruit and Vegetables	57
Topic D-2	Quality and Food Safety Assurance for Processed Products Focusing GMP and HACCP	69
<i>Thematic Area-E: Value Chain Development</i>		<b>76</b>
Topic E-1	Topic E-1. a) Understanding of value chain concept, identification of major constraints and their solution and b) Gender Equality as an Underlying Reason to Value Chain Efficiency	76

Topic E-2	Stakeholder Relationship Development: a) Facilitating formation of network/ platform of value chain actors and b) Topic Topic E-2. Application of Information and communications technology (ICT) towards better market access for fresh and processed fruits and vegetables	89
<b><i>Thematic Area-F: Market Development</i></b>		<b>100</b>
Topic F-1	Various ways to domestic market access and marketing for fruits and vegetables, contract farming and group-based marketing	100
Topic F-2	Orientation to International Trade Centre (ITC) market analysis methodology towards assessing export market potentialities of fresh and processed fruits and vegetables	114
Topic F-3	Procedure of export marketing and export growth of fresh and processed fruits and vegetables	123
<b><i>Thematic Area-G: Entrepreneurship Development</i></b>		<b>132</b>
Topic G-1	Introduction to Development of Business Plans (Appraisal), Procedure and Government Regulations for Starting-up Agro-processing firms, product development and productivity improvement	132
Topic G-2	Soft skills/ Business skills: communication, negotiation, time-management, leadership, sales and customer relationship	145
Topic G-3	Cost-Benefit Analysis for an Agri-business enterprise related to fresh fruits and vegetables	162

# Training Module

## 5-Day Long Training Programme for Increasing Women's Participation in the Agro-Processing Sector in Bangladesh

Time	Contents/Activities	Media/ Materials
<b>Day-1</b>		
9:00-9:30	Registration and opening session	
<b>Thematic Area-A: Training Course Introduction and Pre-harvest Management of Fruits and Vegetables</b>		
9:30 – 10:00	<b>Topic A-1. Introduction of course objectives and training plan</b>	
	<p><b>Learning Objective:</b></p> <ol style="list-style-type: none"> <li>1. To introduce course objectives and the training plan to the participants</li> <li>2. The participants will be aware on the course content and overall benefit of the training course</li> </ol> <p><b>General training conditions:</b> Open learning atmosphere; asking questions and active participation</p> <p><b>Message:</b> Introduce the training plan, objectives, and yourself! Use this introduction round to give the participants more information about the training!</p> <p><b>Hints for the trainer:</b> Note the expectations of the participants. Ensure that they are realistic according to the course outline and attempt to ensure that these are met during the course. Keep the list until the last day. This is to be shown again to confirm that participants' expectations have been met.</p>	Power Point Presentation, Training Manual
10.00 – 11.00	<b>Topic A-2. Standard for Good Agricultural Practices (GAP): Fruits and Vegetables</b>	
	<p><b>Learning Objectives:</b></p> <ol style="list-style-type: none"> <li>1. The participants will be familiar on the standard for good agricultural practices (gap) for fruits and vegetables</li> <li>2. They will be aware on the food safety aspects for fruits and vegetables production that are to be dealt during application of good agricultural practices</li> </ol>	Power Point Presentation, Training Manual
11.00 – 11.30	<b>Tea Break</b>	
11.30 – 12.00	Discussion on Topic A-2.	
12.00 – 13.00	<b>Topic A-3. Pre-harvest and harvest factors affecting the post-harvest behaviour of fruits and vegetables</b>	



	<b>Learning Objective:</b> <ol style="list-style-type: none"> <li>1. The participants will be familiar on pre-harvest and harvest factors that are affecting the post-harvest behaviour of fruits and vegetables</li> <li>2. They will be aware on how the pre-harvest factors are responsible for the qualitative diversity of fruits and vegetables</li> </ol>	Power Point Presentation, Training Manual
13.00 – 13.30	Discussion on Topic A-3.	
13.30 – 14.15	<b>Lunch and Prayer</b>	
<b>Thematic Area-B: Primary Processing (Post-harvest Handling of Fresh commodities)</b>		
<b>14.15 – 15.15</b>	<b>Topic B-1. Harvesting, postharvest handling, packaging, transportation and storage of fruits and vegetables</b>	
	<b>Learning Objective:</b> This lesson has been designed to improve the knowledge level and skill of the trainees on the following areas: <ol style="list-style-type: none"> <li>1. Importance of postharvest management practices of fresh vegetables.</li> <li>2. Best practices of post-harvest management of fresh vegetable and fruits</li> <li>3. Reducing quantitative and qualitative post-harvest loss of fresh vegetable and fruits and increase profitability</li> <li>4. Retaining quality of fresh fruits and vegetable at postharvest level</li> </ol>	Power Point Presentation, Training Manual
15.15 – 17.00	<b>Practical Session on Post-harvest Handling of Fresh commodities</b>	Plastic crate/ Carton, sorting-grading facilities, Board papers/ marker pen/ board stand
<b>Day-2</b>		
8.30-9.00	<b>First day recap</b>	
9:00 – 10:00	<b>Topic B-2. Cold chain management for fruits and vegetables</b>	
	<b>Learning Objective:</b> The participants will be familiar on the following aspects: <ol style="list-style-type: none"> <li>1. Increasing shelf-life of fruits and vegetables through cold chain management practices</li> <li>2. Diverse practices of cold chain management of fresh vegetable and fruits</li> <li>3. Reducing quantitative and qualitative post-harvest loss of fresh vegetable and fruits and increase profitability</li> </ol>	Power Point Presentation, Training Manual

	4. Retaining freshness and quality of fresh fruits and vegetable at postharvest level	
10.00 – 10.30	Discussion on Topic B-2.	
<b>Thematic Area-C: Secondary Processing (Processing into Shelf-Stable Products)</b>		
10.30 – 11.30	<b>Topic C-1. Secondary processing technologies for fruits and vegetables focusing intermediate and shelf-stable processed products</b>	
	<p>Learning Objective:</p> <p>The participants will be aware on:</p> <ol style="list-style-type: none"> <li>1. The principles and methods of preservation of fruits and vegetable through processing in to shelf-stable products</li> <li>2. How to preserve green fruits through steeping preservation method and successive processing the preserved fruits into diverse products</li> </ol>	Power Point Presentation, Training Manual
11.30 – 11.45	<b>Tea Break</b>	
11.45 – 12.15	Discussion on Topic C-1.	
<b>Thematic Area-D: Food Safety and Quality Assurance of Fresh and Processed Commodities</b>		
12.15 – 13.15	<b>Topic D-1. Quality &amp; Food Safety Assurance and Sanitary &amp; Phyto-Sanitary Standards (SPS) for Fresh Fruit and Vegetables</b>	
	<p>Learning Objective:</p> <p>The participants will be aware on:</p> <ol style="list-style-type: none"> <li>1. How to maintain food safety and quality of fresh fruits and vegetables at post-harvest level</li> <li>2. Sanitary and Phyto-sanitary standards required for exporting/importing fresh fruit and vegetables</li> <li>3. Traceability for fresh fruit and vegetables</li> </ol>	Power Point Presentation, Training Manual
13.15 – 14.00	<b>Lunch and Prayer</b>	
14.00 – 15.30	<b>Practical Session on quality and food safety assurance for exporting/importing fresh fruit and vegetables</b>	Board papers/ marker pen/ board stand
15.30 – 16.30	<b>Topic D-2. Quality and Food Safety Assurance for Processed Products Focusing GMP and HACCP</b>	
	<p>Learning Objective:</p> <p>The participants will be knowledgeable on:</p> <ol style="list-style-type: none"> <li>1. How to maintain food safety and quality of processed products from fruits and vegetables</li> <li>2. Compliance on GMP and HACCP for processed fruits and vegetables</li> </ol>	Power Point Presentation, Training Manual
16.30 – 17.00	Discussion on Topic D-2.	
<b>Day-3</b>		

8.30-9.00	<b>Second day recap</b>	
<b>Thematic Area-E: Value Chain Development</b>		
<b>9:00 – 10:00</b>	<b>Topic E-1. a) Understanding of value chain concept, identification of major constraints and their solution and b) Gender Equality as an Underlying Reason to Value Chain Efficiency</b>	
	<b>Learning Objectives:</b> The trainees will be able: <ol style="list-style-type: none"> <li>1. To learn the concept of value chain</li> <li>2. How to Identify value chain constraints of fruits and vegetables</li> <li>3. To Improve their knowledge level on resolving major value chain related constraints</li> <li>4. To know how the gender equality could be the underlying reason to value chain efficiency</li> </ol>	Power Point Presentation, Training Manual
10.00 – 11.00	<b>Practical Session/Group Exercise on identification of major constraints in agro-processing value chains and their solution</b>	Board papers/ marker pen/ board stand
11.00 – 11.15	<b>Tea Break</b>	
<b>11.15 – 12.15</b>	<b>Topic E-2. Stakeholder Relationship Development: a) Facilitating formation of network/ platform of value chain actors and b) Application of Information and communications technology (ICT) towards better market access for fresh and processed fruits and vegetables</b>	
	<b>Learning Objectives:</b> This lesson has been designed to improve knowledge level and skill of the trainees on networking and market access. Specifically, it will improve their capacity on the following areas: <ol style="list-style-type: none"> <li>1. Developing relationship among the value chain actors</li> <li>2. Networking among the value chain actors for improving market access of fresh and processed fruits and vegetables</li> <li>3. Use of ICT tools in relation to networking towards marketing of fresh and processed fruits and vegetables</li> <li>4. Networking among the stakeholders</li> </ol>	Power Point Presentation, Training Manual
12.15 – 12.45	Discussion on Topic E-2.	
12.45 – 13.30	<b>Lunch and Prayer</b>	
<b>Thematic Area-F: Market Development</b>		
<b>13.30 – 14.30</b>	<b>Topic F-1. Various ways to domestic market access and marketing for fruits and vegetables, contract farming and group-based marketing</b>	
	<b>Learning Objectives:</b> The participants will be familiar on the following issues: <ol style="list-style-type: none"> <li>1. Various indirect and direct market access and marketing of fruits and vegetables.</li> <li>2. Market access through contract farming and group marketing</li> </ol>	Power Point Presentation, Training Manual

14.30 – 15.00	Discussion on Topic F-1.	
15.00 – 16.30	<b>Topic F-2. Orientation to International Trade Centre (ITC) market analysis methodology towards assessing export market potentialities of fresh and processed fruits and vegetables</b>	
	<b>Learning Objectives:</b> The participants will be aware on: <ol style="list-style-type: none"> <li>1. International Trade Centre (ITC) market analysis methodology</li> <li>2. How to use the ITC Market Analysis Tool for finding out the potential market and buyers of fresh and processed fruits and vegetables</li> </ol>	Power Point Presentation, Training Manual
16.30 – 17.00	Discussion on Topic F-2.	
<b>Day-4</b>		
8:00 – 17:00	<b>Field/Factory/Pack house visit to observe the relevant practical operations/ participation in relevant hands on training</b>	
<b>Day-5</b>		
8.30-9.00	<b>Fourth day (field visit) recap</b>	
9:00 – 10:00	<b>Topic F-3. Procedure of export marketing and export growth of fresh and processed fruits and vegetables</b>	
	<b>Learning Objectives:</b> The participants will be able to increase their knowledge level on: <ol style="list-style-type: none"> <li>1. Step by step procedure of export marketing and export growth of fresh and processed fruits and vegetables</li> <li>2. Export growth of fruits, vegetables and other agro-processed products in Bangladesh</li> </ol>	Power Point Presentation, Training Manual
10.00 – 10.30	Discussion on Topic F-3.	
<b>Thematic Area-G: Entrepreneurship Development</b>		
10.30 – 11.30	<b>Topic G-1. Introduction to Development of Business Plans (Appraisal), Procedure and Government Regulations for Starting-up Agro-processing firms, product development and productivity improvement</b>	
	<b>Learning Objectives:</b> The participants will be familiar on: <ol style="list-style-type: none"> <li>1. The process of preparing a business plan</li> <li>2. The procedure for Starting-up Agro-processing firms.</li> <li>3. The Government Regulations for Starting-up Agro-processing firms.</li> <li>4. Product development and productivity improvement</li> </ol>	Power Point Presentation, Training Manual
11.30 – 11.45	<b>Tea Break</b>	
11.45 – 12.15	Discussion on Topic G-1.	



<b>12.15 – 13.15</b>	<b>Topic G-2. Soft skills/ Business skills: communication, negotiation, time-management, leadership, sales and customer relationship</b>	
	<b>Learning Objectives:</b> The participants will be aware on: <ol style="list-style-type: none"> <li>1. Importance of soft skill for improving performance of business</li> <li>2. Practical steps to improve the skill of communication, negotiation skill, time management, leadership qualities, sales and customer relationship</li> </ol>	Power Point Presentation, Training Manual
<b>13.15 – 14.00</b>	<b>Lunch and Prayer</b>	
<b>14.00 – 14.30</b>	Discussion on Topic G-2.	
<b>14.30 – 15.30</b>	<b>Topic G-3. Cost-Benefit Analysis for an Agri-business enterprise related to fresh fruits and vegetables</b>	
	<b>Learning Objectives:</b> This lesson is designed to improve the trainees’ knowledge and skill for running business cost effectively and ways of enhancing profitability. Specifically, they will be able to: <ol style="list-style-type: none"> <li>1. Know the steps of estimating costs and benefits of an agri-business enterprise</li> <li>2. Analyse profitability of an agri-business enterprise</li> </ol>	Power Point Presentation, Training Manual
<b>15.30 – 17.00</b>	<b>Practical Session/Group Exercise on Cost-Benefit Analysis for an Agri-business enterprise related to fresh fruits and vegetables</b>	Board papers/ marker pen/ board stand

*N.B.*

1. Discussion has not been provided at the course introduction session
2. Time for the tea break has been provided half an hour at the 1<sup>st</sup> day only as it is the inaugural break
3. Discussion has not been provided at the lessons dealing with the practical operation/ group exercises

# Training Manual

## Thematic Area-A: Training Course Introduction and Pre-harvest Management of Fruits and Vegetables

*Topic- A1*

### Introduction of Course Objectives and Training Plan

#### Learning Objective

- To introduce course objectives and the training plan to participants
- Objectives of the Training Course:  
The basic objective of this training course to enhance women's role in the agro-processing sub-sector and its export.
- More specifically, after this course, the participants will be able to be aware on:
  - a) Good Agricultural Practices for Selected Fruits and Vegetables
  - b) Preharvest factors affecting postharvest management of fruits and vegetables
  - c) Harvesting, postharvest handling, packaging, transportation and storage of fruits and vegetables
  - d) Selected secondary processing technologies for fruits and vegetables focusing intermediate and shelf-stable processed products having market potentiality
  - e) Quality and food safety assurance (including Sanitary and Phyto-sanitary standards) for exporting/importing fresh fruit and vegetables
  - f) Quality and food safety assurance for processed products focusing GMP, HACCP and Food Safety Management System (FSMS)
  - g) Value chain concept, identification of major constraints and their solution
  - h) Stakeholder Relationship Development: a) Facilitating formation of network/ platform of value chain actors and b) Application of Information and communications technology (ICT) towards better market access for fresh and processed fruits and vegetables
  - i) Various ways to domestic market access and marketing for fruits and vegetables, contract farming and group-based marketing
  - j) International Trade Centre (ITC) market analysis methodology for assessing export market potentialities of fresh and processed fruits and vegetable
  - k) Steps of export marketing and export market potentialities for selected fresh and processed fruits and vegetables
  - l) Development of business plans (appraisal) and facilitating access to finance, regulations on government procedure for starting-up agro-processing firms, product development and productivity improvement
  - m) Soft skills/ Business skills: communication, negotiation, time-management, leadership, sales and customer relationship
  - n) Cost-Benefit Analysis for an Agri-business enterprise related to fresh fruits and vegetables
  - o) Field/Factory/ Pack house Visit to observe the relevant practical operations/ participation in relevant hands on training

### General training conditions

- Open learning atmosphere; asking questions and active participation both in theoretical, practical and hands on training in field level working conditions
- All participants to introduce the person next to them. They need to know themselves about their present role, time spent with business lending and expectations of the course. Allow an introduction of on average half a minute per person.

### Training Plan:

- Start with the introduction of the training course
- There will be detailed theoretical presentations on aspects stated above. The theoretical presentations in 4 sessions followed by discussions and a practical /group exercise session on important topics will be held on daily at the first 4 days. However, discussion has not been provided during the theoretical lessons dealing with the practical operation/ group exercises, as there is vast scope to discuss during the practical/group works.
- Trainings will conclude by receiving formal feedback from participants.
- **A day-long practical session** will be held on the 5<sup>th</sup> day of the training course while experiential, or hands-on training will be offered with several more effective techniques for teaching the entrepreneurs with the outlines:
  - Practical session could be arranged through visiting by the trainees at a nearby pack house or processing centre for fruits and vegetables while the trainees will observe the practical operations such as harvesting, pre-cooling, sorting, grating, packaging, transportation, storage and processing.
  - However, this opportunity may not be available everywhere in the country, in that case the trainees will visit in a nearby farmers' field and practically perform the above postharvest operations at the downstream value chain.
  - During practical session, postharvest loss, food safety, quality assurance, traceability, environmental aspects along with the basic technical issues will be demonstrated to the trainees.

### Message to the trainers

- Introduce the training plan, objectives, and yourself! Use this introduction round to give the participants more information about the training!
- Note the expectations of the participants. Ensure that they are realistic according to the course outline and attempt to ensure that these are met during the course. Keep the list until the last day. This is to be shown again to confirm that participants' expectations have been met.

## **Standard for Good Agricultural Practices (GAP): Fruits and Vegetables**

### **1. Objective**

The fundamental objective of lay down this standard is to strengthen Good Agricultural Practices (GAP) for fruits and vegetables in countries. The challenges currently being faced by most countries include the absence of standards for good practices in the farming sector. Most of the food safety standards are focused on end products, whether mandatory technical standards or voluntary standards.

### **2. Scope**

This standard specifies the requirements of GAP with respect to all types of fresh fruits and vegetables covering activities such as production, harvesting and post-harvest handling of farm produce and pack house operations for produce either for sale for direct human consumption or to be used for further processing by the food industry.

The standard may be used for all types of production systems, namely conventional production systems where produce are grown in the soil and hydroponic systems where produce are grown in inert media. Production may occur in the open or in a protected environment.

High-risk products such as sprouts and minimally processed produce such as cut fruits and vegetables are not covered by this standard. The standard does not provide any basis for certification of organic products or GMO free products, but these products can also be certified as GAP compliant in cases where GAP requirements are implemented. In some countries the regulatory policy does not permit cultivation of GM crops and therefore this aspect needs to be addressed accordingly.

This standard further categorizes the criteria/requirements, based on their importance, as “critical”, “major” or “minor”.

### **3. Structure of the Standard**

**3.1** This standard specifies the requirements, in the form of five modules, to be met with respect to GAP in the farms producing fruits and vegetables. The first four modules are stand-alone modules and may be implemented depending upon the objective to be met, namely food safety, environmental management, produce quality, and worker health, safety and welfare. A fifth module is on general requirements that need to be met by farm (single or as group) in addition to the four modules. It also contains criteria for internal control system for farms that seek to apply for recognition as a group or group certification. Each of the four modules can be used alone or in combination with other modules. This enables the progressive implementation of GAP module by module based on individual country/producer priorities.

**3.2** Each module is designed as a complete section enumerating criteria/requirements for control that need to be implemented on a farm, whether a single unit or a group of farms coming under a common group with internal management. The module also gives a checklist in the form of a table that contains the verification indicator for each of the criteria or a checkpoint and can be used by the producer for self-checking or for checking by the auditor. This also includes a column allowing for comments.

**3.3** The criteria/requirements have been categorized, based on their importance, as “critical”, “major” or “minor” as explained below:

- i. “Critical” requirements – these are required to maintain the integrity of the produce and failing to adhere to these may result in a serious food safety incident resulting from a breach in food safety and product integrity.
- ii. “Major” requirements – these are mandatory and must be followed.
- iii. “Minor” requirements – these are important but may not be essential depending upon the produce category.

*Compliance criteria:*

Critical – 100 percent compliance shall be compulsory. Major – 90 percent compliance shall be compulsory. Minor – 50 percent compliance shall be compulsory.

The term “shall” is used in this document to indicate those provisions that are mandatory, i.e. those that are categorized as “critical” or “major”. The term “should” is used in this document either for provisions that are categorized as “minor” or to indicate recognized means of meeting the requirements of the standard.

## **4. Food Safety Module (FSM)**

The purpose of this module is to minimize harmful effects of production and post-production practices on the safety of the produce. The good agricultural practices for controlling food safety hazards are grouped into eleven elements (4.1–4.11).

### **4.1 Site history and management**

- i. Site history shall be assessed to identify the risks of contamination to crops grown, from the previous use of chemical and/or biological hazards on the site or on adjoining sites and the risks shall be documented. (Major)
- ii. Where significant risks are identified, the site shall not be used for production of fresh produce without first taking some action to manage the risks. (Critical)
- iii. If remedial action is required to manage any risk, a monitoring programme shall be put in place to make sure that contamination of the produce does not occur and records of monitoring shall be maintained. (Critical)

### **4.2 Planting material (Propagation material)**

- i. If planting material is produced on the farm, a record shall be kept of any fertilizers and/or chemicals used and the reason for usage. The records shall cover the treatments with dates, trade name, and active ingredient, name of operator, method of application, dosages and reason for its use. (Major)
- ii. A document that guarantees seed quality (free from injurious pests, diseases, virus, etc.) shall be on the farm. A record/certificate of seed quality shall be kept stating variety purity, variety name, batch number and seed vendor. (Major)
- iii. The planting material shall be free of visible signs of pest and disease. In case of in-house propagation, only quality rootstock and scion material shall be used. Alternatively, propagation



- material shall be sourced from a certified nursery (government / private nurseries / agricultural institutions / accredited tissue culture laboratories). (Major)
- iv. If seeds are treated with additives/pesticides (fungicides, insecticides, biocides and/or others), these shall be approved additives/pesticides. The treatment shall be done as per recommended technologies. (Major)
  - v. If planting material is obtained from another farm or nursery, the name of the farm and date of supply shall be recorded. (Major)
  - vi. Varieties known to be toxic to humans shall not be grown. (Major)

### **4.3 Genetically modified organisms (GMO)**

- i. Planting or trials with GM crops shall be done if permitted by the applicable legislation in the country. (Critical)
- ii. If a producer is growing GM crops, as permitted by the country's legislation, this shall be documented. (Critical)
- iii. The producer shall inform clients about the status of the product with respect to GMOs. (Critical)
- iv. A written plan shall be available for handling GM material (crops and trials), setting out strategies to minimize contamination hazards (such as accidental mixing of adjacent non-GM crops) and maintain product integrity. (Critical)
- v. The producer shall inform clients about the status of the product with respect to GMOs. (Critical)
- vi. A written plan shall be available for handling GM material (crops and trials), setting out strategies to minimize contamination hazards (such as accidental mixing of adjacent non-GM crops) and maintain product integrity. (Critical)
- vii. GM crops shall be stored separately from other crops before dispatches to avoid adventitious mixing. (Critical)

### **4.4 Fertilizers and soil additives (Plant nutrient management and fertilizer use)**

- i. Assessment of the chemical and biological risks related to fertilizers and soil additives used for each crop grown shall be carried out and records of any significant hazards identified shall be maintained. (Major)
- ii. If any significant hazards are identified, measures shall be taken to minimize the risk of contamination to produce. (Critical)
- iii. Application of fertilizers and soil additives should be based upon soil analysis and/or recommendations of National Soil Service Centre/technically competent personnel/ institutions/ authorities or based on own experience. (Minor)
- iv. Fertilizers and soil additives should be selected and applied so as to minimize the risk of heavy metal contamination to produce. (Minor)
- v. Fertilizers and soil additives should be applied through recommended application practices at appropriate stages of crop growth. (Minor)
- vi. Untreated organic materials shall not be applied where significant risk of contaminating produce is identified. If organic materials are treated on-farm, the method of application, date and duration of treatment shall be recorded. If organic material is obtained from outside the farm and there is a significant risk identified, documents shall be available from the supplier to show that the material has been treated to minimize the risk of contamination to produce. (Major)
- vii. Untreated human sewage shall not to be used for production of fresh produce. (Critical)

- viii. The facilities for storage, mixing and loading of fertilizer/soil additives and for composting of organic material shall be located and constructed and maintained in a manner to minimize the risk of contamination to production sites and water sources. (Major)
- ix. Records shall be maintained for fertilizers and soil additives detailing the source, product name, date and quantity obtained and also for the application detailing the date, name of product, rate and method of application and name of the operators. (Major)
- x. The inorganic and organic fertilizers shall be stored separately from harvested farm produce. (Major)

#### **4.5 Water (Irrigation/Fertigation)**

- i. The water available for irrigation/fertigation shall be free from harmful contaminants. (Major)
- ii. Assessment of the source of water used for irrigation, application of chemicals or handling, washing, treating the produce or cleaning and sanitation should be done at least annually to minimize the risks of chemical and biological contamination and records shall be kept. (Minor)
- iii. Where water testing is required to assess the risk of contamination, tests shall be conducted at a frequency appropriate to the conditions impacting the water supply and records shall be maintained. (Critical)
- iv. Where a significant risk is identified, either a safe alternative water source shall be used or the water treated before use. (Major)
- v. Untreated sewage water shall not be used during production or for post-harvest handling. Where treated water is permitted, the water quality shall comply with applicable national regulations. (Critical)
- vi. The farmer should maintain irrigation equipment as per manufacturer's guidelines/ manual. (Minor)
- vii. The farmer shall employ adequate measures to prevent the flow of water into the fields from undesirable sources such as municipal landfill areas, hospital and industry waste dump areas, etc. (Major)

#### **4.6 Chemicals (Plant protection products or other agro and non-agrochemicals)**

Chemicals used on the farm can be categorized as agro-chemicals that are applied on the farm or produce such as fertilizers, pesticides, seed treatment material, plant growth regulators and additives, and non-agrochemicals such as grease, fuels and oils that are required for other purposes. The requirements for chemicals are:

- i. Only pesticides permitted under a country's regulations shall be used. (Critical)
- ii. Chemicals shall be purchased only from registered/licensed suppliers. (Major)
- iii. Mixing of two or more chemicals should not be done, unless recommended by technically competent personnel/institutions/authorities. (Minor)
- iv. The dosage as recommended by competent authorities shall be applied and excess chemicals shall not be used. (Major)
- v. Surplus chemicals shall be disposed of in a manner to avoid contamination to the produce. (Major)
- vi. Withholding periods for the interval between chemical application and harvest shall be maintained as per the pre harvest interval mentioned on the label. (Major)
- vii. Equipment for applying chemicals shall be maintained in working condition and checked for effective operation by a technically competent person. (Major)
- viii. Equipment shall be washed properly after every use and washing water shall be disposed of in a manner to avoid contamination to produce. (Major)

- ix. Chemicals should be stored in a well-lit, sound and secure structure, which is located and constructed to minimize the risk of contaminating produce and equipped with notices and emergency facilities in the event of a chemical spill. (Minor)
- x. Liquid chemicals shall not be stored on shelves above powders. (Major)
- xi. Chemicals shall be stored in the original container with a legible label and according to label directions; if chemicals are transferred to another container, the container shall be clearly marked with the name of the chemicals, the dosage to be used and the withholding period. (Major)
- xii. Empty chemical containers shall not be reused and shall be collected in a secure place and properly disposed of according to the country's regulations and in a manner to avoid contamination of produce and the environment. (Major)
- xiii. Obsolete or expired chemicals shall be clearly identified and kept in a secure place till disposal. These shall be disposed of through official collection channels or in legal off-site areas. (Major)
- xiv. A record of chemicals obtained should be maintained, detailing the chemicals used, name of the supplier, date and quantity obtained, date of manufacture and expiry. (Minor)
- xv. A record of application for each crop shall be maintained giving details of chemical, reason for application, treatment location, dosage, method, date of application and name of operator. (Major)
- xvi. A record of chemicals held in storage shall be maintained detailing chemical name, date and quantities procured and date of complete use or disposal. (Major)
- xvii. If chemical residues in excess of maximum residue limits (MRL) are detected in the market where the product is traded or exported, the marketing of the product shall cease and the cause of contamination shall be investigated. Corrective actions shall be taken to prevent recurrence and a record kept of the incident and the actions taken. (Major)
- xviii. Non-agrochemicals shall be handled, stored and disposed of in a manner to avoid any risks to food safety. (Major)
- xix. Integrated Pest Management (IPM), if implemented, shall require careful consideration of available pest control techniques and the subsequent integration of appropriate measures to discourage the development of pest populations, while keeping the use of plant protection chemicals at minimal level. (Major)

#### **4.7 Harvesting and handling produce**

- i. Harvested produce shall not be placed directly on the soil, or on the floor of the handling, packing or storage areas. (Major)

##### ***Equipment, containers and materials***

- ii. Equipment, containers and materials that come in contact with produce shall be made of material that will not contaminate the produce and is easy to clean. (Major)
- iii. The containers used for storage of chemicals, waste, and other dangerous substances shall be clearly identified and not be used to hold or store produce. (Major)
- iv. Equipment and containers shall be regularly maintained to minimize contamination of produce and shall be kept in areas separate from chemicals, fertilizers and soil additives to avoid cross contamination. (Major)
- v. Equipment, containers and material shall be checked for soundness and cleanliness before use and cleaned, repaired or discarded as required. (Major).
- vi. The producer shall, at least once a year or as per the legal requirements of the country, have his measuring devices calibrated for ensuring correctness of measurement. (Major)

### ***Buildings and structures***

- vii. Buildings and structures used for growing, packing, handling and storage of produce shall be constructed and maintained to minimize the risk of contaminating produce. (Major)
- viii. Grease, oil, fuel and farm machinery should be segregated from handling, packing and storage areas to prevent contamination of produce. (Minor)
- ix. Sewage, waste disposal and drainage systems shall be constructed so as to minimize the risk of contaminating the production site and the water supply. (Major)
- x. Lights in the packinghouse or store should be shatter proof or protected with a shatterproof cover. (Minor)
- xi. Where equipment and tools that may be sources of physical hazards are located in the same building as handling, packing and storage areas, these should be isolated by a physical barrier or not used during the handling and packing of produce. (Minor)

### ***Cleaning and sanitation***

- xii. Equipment, tools, containers and materials that may be sources of contamination of produce should be identified and regularly cleaned and sanitized. (Minor)
- xiii. Appropriate cleaning and sanitation chemicals should be selected to minimize the risk of these chemicals contaminating produce. (Minor)

### ***Animal and pest control***

- xiv. Household and farm animals should be kept out of the production site (especially where crops are grown in or close to the ground. and around handling, packing and storage areas. (Minor)
- xv. Measures shall be taken to prevent the presence of pests in and around handling, packing and storage areas. (Major)
- xvi. Baits and traps used for pest control shall be located and maintained to minimize the risk of contaminating produce. The location of bait traps shall be recorded. (Major)

### ***Personal hygiene***

- xvii. Workers shall be trained in personal hygiene practices and training records kept. (Major)
- xviii. Written instructions on personal hygiene should be provided to workers and displayed in prominent locations. (Minor)
- xix. Toilets and hand washing facilities shall be available to workers and maintained in a hygienic condition. (Major)
- xx. Sewage shall be disposed of in a manner that minimizes of direct or indirect contamination to produce. (Major)

### ***Produce treatment***

- xxi. The quality of the water applied to the edible parts of produce shall be equivalent to that of drinking water. (Major)
- xxii. Chemicals applied for post-harvest and waxes shall follow the same practices as under the chemical section and shall comply with instructions and recommendations from competent authorities. (Critical)
- xxiii. Specific test on produce should be included if required by an importing country. (Minor)

### ***Storage and transport***

- xxiv. Produce shall be stored and transported separately from goods that are potential sources of chemical, biological or physical contamination. (Major)
- xxv. Produce should be stored in cool places and overloading should be avoided. Produce should be covered to reduce moisture loss during transportation. (Minor).
- xxvi. Containers filled with produce shall not be placed in direct contact with soil, where there is a significant risk of contaminating produce from soil. Pallets, if used, shall be checked for cleanliness, chemical spills, foreign objects and pest infestation and rejected if there is any risk of contaminating produce. (Major)
- xxvii. Vehicles used for transporting produce shall be kept clean and maintained in good condition. These shall be checked before loading for cleanliness, chemical spills, foreign objects and pest infestation. (Major)

### **4.8 Traceability and recall**

- i. Production sites shall be identified by a name or code and recorded on a site map. (Major)
- ii. Packed produce shall be clearly marked with name and identification to enable traceability of the produce to the farm or site where the produce is grown. (Major)
- iii. A record detailing the date of delivery and destination of each produce consignment should be maintained. (Minor)
- iv. Where produce is identified as contaminated or potentially contaminated, it shall be isolated, but if such identification is made after the produce is sold the buyers or consumers shall be notified immediately. (Critical)
- v. The cause of contamination shall be investigated and corrective action taken to prevent its recurrence and a record kept of the incident and the action taken. (Major)

### **4.9 Training**

- i. The farmers and workers shall be given sufficient training in the areas of responsibility relevant to GAP and records of training shall be kept. Some of the aspects that need to be included in any training are:
  - a. the proper purchase, handling, storage and use of chemicals, including labelling requirements, selection of chemicals or bio-pesticides, which are approved and recommended by the competent authorities for the crops grown (Major);
  - b. the application of suitable Integrated Pest Management and avoidance of use of inorganic chemicals (Major);
  - c. information and updates on the maximum residue limits (MRL) as specified in the national regulations, Codex standards or the importing country's standards where the produce is to be traded (Minor);
  - d. checking that chemicals are used correctly and before shelf-life/expiry date. (Minor); and
  - e. importance of testing for chemical residues at a frequency required by customers or the market and the method of drawing of samples for testing. (Major).
- ii. The training needs shall be reviewed once a year.

### **4.10 Documents and records**

- i. Records of GAP shall be kept for two years or more in accordance with statutory requirements, if any, or business requirements. (Major)
- ii. Obsolete (out-of-date) documents shall be discarded and only current versions shall be in use. (Major)



#### **4.11 Review of practices**

- i. A review to be carried out at least once a year to identify new or emerging risks related to food safety and actions to correct any deficiencies identified and corrective actions taken. (Major)
- ii. A record of the review undertaken and corrective action taken shall be kept. (Major)

### **OPTIONAL REQUIREMENTS**

#### **4.12 Fertilizers and soil additives (Plant nutrient management and fertilizer use)**

- i. Documents should be made available to demonstrate that application of fertilizers/nutrients (organic or inorganic) is done by a competent/ trained person. (Minor)
- ii. Records should be made available to demonstrate that the types and dosages of fertilizers/nutrients are in tune with the soil test – crop response studies and/or recommendations of National Soil Service Centre/ National Research Centre (NRC)/other approved organizations for the crop. (Minor)
- iii. A record indicating competence of producer(s) should be maintained to demonstrate their competence and knowledge in determining types and dosages of fertilizers in case advisers are absent. (Minor)
- iv. A competent qualified adviser should make the recommendations on the type and quantity of fertilizers/nutrient being used. (Major)

#### **4.13 Chemicals (Plant protection products or other agro and non- agrochemicals)**

- i. It should be ensured that chemicals are applied correctly by testing produce (in an accredited laboratory) for chemical residues at a predetermined frequency in line with the competent authority requirement of the country where the produce is traded. (Minor)
- ii. Records for technical authorization of all chemicals applied along with their quantities should be maintained. (Minor)
- iii. A documented procedure should be available for correct handling and filling (as stated on the label) when mixing plant protection chemicals. (Minor)
- iv. The application of such formulations should be economically justified and have minimal adverse impact on the environment. (Minor)

### **Reference**

1. *FAO, 2016. A Scheme and Training Manual for Good Agricultural Practices for Fruits and Vegetables. Volume 1: The scheme - standard and implementation infrastructure. Food and Agricultural Organization of the United Nations, FAO Regional Office for Asia and the Pacific, Bangkok.*

## **Pre-Harvest and Harvest Factors Affecting the Post-Harvest Behaviour of Fruits and Vegetables**

### **1. Introduction**

Fruits and vegetables are very important food commodities all over the world. Fresh fruits and vegetables are perishable and highly prone to huge post-harvest losses because they are composed of living tissues. These tissues must be kept alive and in good health throughout the process of marketing. These are composed of thousands of living cells which require care and maintenance. There are many factors involved in selecting the fruits and vegetables varieties for processing. Although high visual quality is desirable for most processing methods, the composition of fruits and vegetables in relation to flavors, texture, color and nutritional value is of paramount importance. The factors affecting quality of fruits and vegetables at their postharvest level can be classified largely into two groups, i.e. (a) Pre-harvest factors, and (b) Harvest factors.

### **2. Pre-Harvest Factors**

**2.1 Genetic / variety** – Varieties with shorter shelf-lives are generally prone to higher post-harvest losses. Varieties with thick peel, high firmness, low respiration rate and low ethylene production rates would usually have longer storage life. The cultivars that have ability to withstand the rigors of marketing and distribution will have lesser losses after harvest. Varieties with resistance to low temperature disorders and/or decay-causing pathogens can be stored well for longer duration with minimum storage losses. Hence, while growing horticultural crops, one must choose such varieties that inherently have got good quality and storage potential in addition to the high yield and pest resistance potential.

**2.2 Light** – light regulates several physiological processes like chlorophyll synthesis, phototropism, respiration and stomatal opening. The duration, intensity and quality of light affect the quality of fruits and vegetables at harvest. Most of the produce needs high light intensity (3000-8000 f.c.). Absorption of red light (625-700 nm) through pigments, phytochrome, is essential for carbohydrates synthesis which determines the shelf life of the produce.

Citrus and mango fruits produced in full sun generally had a thinner skin, a lower weight, low juice content and lower acidity but a higher TSS. And citrus fruits grown in the shade may be less susceptible to chilling injury when subsequently stored in cold storage.

In tomatoes, leaf shading of fruits produced a deeper red colour during the ripening than in the case of those exposed to light. The side of the fruit that have been exposed to sun will generally firmer than the non-exposed side. In general, the lower the light intensity the lower the ascorbic acid content of plant tissues. In leafy vegetables, leaves are larger and thinner under condition of low light intensity.

**2.3 Temperature** – all type of physiological and biochemical process related to plant growth and yield are influenced by the temperature. The higher temperature during field conditions decreases life and quality of the produce. At high temperature, stored carbohydrates of fruits, vegetables and flowers are quickly depleted during respiration and plant respire at the faster rate. The produce which is having higher amount of stored carbohydrates show

longer storage/vase life. For example- high temperature during fruiting season of tomato leads to quick ripening of fruits on and off the plant. Orange grown in the tropics tend to have higher sugars and TSS than those grown sub tropics. However, tropical grown oranges tend to be green in colour and peel less easily and it is due to the lower diurnal temperature that occurs in the tropics.

**2.4 Humidity** – High humidity during growing season results in thin rind and increased size in some horticultural produce and this produce is more prone to high incidence of disease during post-harvest period. Humid atmosphere may cause the development of fungal and bacterial diseases, which damages produce during storage and transport. Damaged produce remove water very quickly and emit a larger concentration of ethylene than healthy ones. Low humidity may cause browning of leaf edge on plants with thin leaves or leaflets. High humidity can maintain the water – borne pollutants in a condition so that they can be more easily absorbed through the cuticles or stomata. Reduced transpiration leads to calcium and other elemental deficiency. High humidity reduces the color and TSS and increases acidity in citrus, grapes, tomato, etc. but it is needed for better quality of banana, litchi, and pineapple.

**2.5 Mineral nutrition** – balanced application of all nutrient elements is necessary for the maintaining growth and development of the plants. The application of fertilizers to crops influences their post-harvest respiration rate. Excess or deficiency of certain elements can affect crop quality and its post-harvest life. Numerous physiological disorders are also associated with mineral deficiencies which ultimately lead to post harvest losses.

**Nitrogen** - High nitrogen fertilization reduces while moderate to high potassium improves post-harvest life and quality of anthurium, cut flowers and many horticultural produces. Application of potassium in water melon tend to decrease the post-harvest respiration. High levels on nitrogen tend to decrease flavor, TSS, firmness and color of the fruit and in stone fruits it increases physiological disorders and decrease fruit colour.

Generally, crops that have high levels of nitrogen typically have poorer keeping qualities than those with lower levels as. High nitrogen increases fruit respiration, faster tissue deterioration thereby reducing their storage life.

**Phosphorous** - Application of phosphorous minimizes weight loss, sprouting and rotting in bulb crops compared with lesser application. Phosphorous nutrition can alter the post-harvest physiology of some produce by affecting membrane lipid chemistry, membrane integrity and respiratory metabolism. The respiration rate of low-phosphorous fruits will be higher than that of high phosphorous fruits during storage.

**Potassium** - potassic fertilizers improves keeping quality, its deficiency can bring about abnormal ripening of fruits and vegetables. Potassium helps in reducing some physiological storage disorders, e.g. superficial rind pitting in oranges.

**Calcium**- the storage potential of the fruits is largely dependent on the level of calcium and it is associated with produce texture. The higher level of nitrogen, phosphorus and magnesium and low levels of potassium and boron lead to the calcium deficiency in fruits and reduce its storage life. Reduction in calcium uptake causes lateral stem breakage of poinsettia. Calcium treatment delays ripening, senescence, reduces susceptibility to chilling injury, increase firmness and reduces decay subsequent to storage in avocados and improves the quality. Increase firmness of many fruits e.g. apple, mango, guava, tomato etc. and check physiological disorders in many fruits.

Physiological disorders of storage organs related to low calcium content of the tissue are

- Bitter pit in apples
- Cork spot in pears
- Blossom end rot in tomato
- Tip burn in lettuce and hollow heart in potato etc.
- Red blotch of lemons

Zinc is known to act as vehicle for carrying ions across tissue and increase calcium content of the fruit. Adequate supply of boron improves the mobility of calcium in the leaves and the fruits and subsequently increases fruit firmness, TSS, organic acids and reduce the incidence of the drought spot, bitter pit and cracking disorders. And impart diseases resistance. The incorporation of 4% calcium into proto pectin of middle lamella form bond with the cellulose of the cell wall and thus delayed softening in fruits. Infused calcium inhibits the internal browning, retarded respiration, and reduced the metabolism of endogenous substrates. Post climacteric respiration of apple decreased as peel calcium level increased from 400 to 1300 ppm. Calcium may reduce the endogenous substrate catabolism by limiting the diffusion of substrate from vacuole to the respiratory enzymes in the cytoplasm (limited membrane permeability).

**2.6 Water Relation and Irrigation** – stress due to excessive or inadequate water in the medium reduce the longevity of the produce. Crop like carnation require 850 to 1200 g of water to produce one gram of dry matter. In general, <5 % of water absorbed in the plant system is utilized for the development of different plant components. Moisture stress increases the rate of transpiration over the rate of absorption and irregular irrigation/ moisture regime leads fruits/vegetable cracking (potato and pomegranate cracking). Higher level of moisture stress affects both yield and quality by decreasing cell enlargement. Crops which have higher moisture content generally have poorer storage characteristics. An example of this is the hybrid onions, which tend to give high yield of bulbs with low dry matter content but which have only a very short storage life. If fully matured banana harvested soon after rainfall or irrigation the fruit can easily split during handling operations, allowing micro-organism infection and post-harvest rotting. Orange is too turgid at harvest (early morning) the flavodeo/oil gland in the skin can be ruptured during harvesting, releasing phenolic compounds and causes oleocellosis or oil spotting (green spot on the yellow / orange coloured citrus fruit after degreening).

Quailing – ‘harvested produce is kept in the basket for few hours in the field before being transported to pack house, this will allow the produce to loosen little moisture’. Some growers have practice of harvesting lettuce in the late in the morning/ early afternoon because when they are too turgid the leaves are soft and more susceptible to bruising.

In green leafy vegetables, too much rain or irrigation can result in the leaves becoming harder and brittle, which can make them more susceptible to damage and decay during handling and transport.

Mango hot water treatment is better if there is delay of 48 hr. between harvest and treatment and resulted better efficiency of hot water in disease control.

Generally, crops that have higher moisture content or low dry matter content have poorer storage characteristics. Keeping quality of bulb crops like onion and garlic will be poor if irrigation is not stopped before three weeks of harvesting.

## 2.7 Canopy Manipulation

**A. Fruit thinning** – increases fruit size but reduces total yield. It helps in obtaining better quality produce.

**B. Fruit position in the tree** – Fruits which are exposed to high light environment possesses higher TSS, acidity, fruit size, aroma, and shelf life compared to which lies inside the canopy. Hence better training system should be practiced to circulate optimum light and air. e.g.: Grapes, Mango.

**C. Girdling** - increases the fruit size and advance and synchronized fruit maturity in peach and nectarines. Increases fruitfulness in many fruit tree species.

**2.8 Rainfall** - Rainfall affects water supply to the plant and influences the composition of the harvested plant part. This affects its susceptibility to mechanical damage and decay during subsequent harvesting and handling operations. On the other hand, excess water supply to plants results in cracking of fruits such as cherries, plums, grapes, dates, litchi, limes, lemon, tomato, sweet potato, tomatoes etc. If root and bulb crops are harvested during heavy rainfall, the storage losses will be higher.

**2.9 Seasons / Day and Day Length**– seasonal fluctuation and time of the day at harvest will greatly affects the postharvest quality of the produce. Synthesis of higher amount of carbohydrates during the day time and its utilization through translocation and respiration in the night is responsible for the variation in the longevity of the cut flowers. Roses and tuberose have been found to show longer keeping quality in the winter season under ambient condition than in the summer seasons. Generally, produce harvested early in the morning or in the evening hours exhibits longer post-harvest life than produce harvested during hot time of the day.

Day length - If long days onion (temperate) grown during short day (tropics) condition it leads to very poor storage quality.

**2.10 Carbon dioxide** - quality planting material, early flowering, more flowering, increased yield and rapid crop growth and development at higher level of CO<sub>2</sub>. Production of chrysanthemum under green house at 1000 – 2000 ppm of CO<sub>2</sub> showed an increase in stem length, fresh weight, leaf no. and longevity of cut flowers.

**2.11 Pest and Diseases** – infection by fungi, bacteria, mites and insects reduces the longevity as well as consumer acceptability. Tissue damage caused by them show wilting and produce ethylene leads to early senescence. Vascular diseases/stem rot /root rot of floral crops hinder the transport, affects the post-harvest life and quality. The potato tuber moth may infest tubers during growth if they are exposed above the soil and subsequently in the storage. Pre-harvest application of systemic fungicides prevents quiescence like anthracnose of mango, papaya, crown rot of banana stem end rot in citrus, etc. pre-harvest application of chitosan reduced the post-harvest fungal rot and maintains the keeping quality of strawberry.



### 3. Harvest factors

- 3.1 Maturity at harvest:** Maturity at harvest is the most important determinant of storage life and final produced quality. Immature produced are high susceptible to shrivelling and mechanical damage are of inferior quality. Hence, fruits and vegetables are harvest at proper stage of maturity. Many leafy vegetables and immature fruits-vegetables (such as cucumbers, sweet corn, green beans peas and okras), attain optimum eating-quality prior to reaching to full maturity. This often results in delayed harvest and consequently in producer of low quality.
- 3.2 Harvest time:** Quality depends on timing the harvest correctly for most vegetables. Size, flavor, tenderness, texture and color can all be influenced by harvest timing. snap bean must reach a certain sieve size, summer squash and cucumbers must be harvested within a narrow size range melon must be reach an acceptable sugar content tomatoes to be shipped must be harvested at “mature green” or as “breaker” but usually no post the “pink stages” tomatoes for direct sales can be harvested when ripe. Cabbage winter squash pumpkin peppers have a wider harvest window.
- 3.3 Harvest methods:** The methods of harvesting (hand vs. mechanical) can be significantly impact up on the composition and post-harvest quality of fruits and vegetables. Mechanical injuries (such as brushing, surface abrasions and cuts) can accelerate loss of water and vitamin C resulting in all increased susceptibility to decay-causing pathogens. Most fresh fruits and vegetables and all flowers are harvested by hand. Root crops (such as carrot, onion, potato and sweet potato) and some commodities destined for processing (such as processing tomatoes) are mechanically harvested.

#### Reference:

- i. <http://ecoursesonline.iasri.res.in/mod/page/view.php?id=16333>
- ii. Ramjan, M. and Ansari, M. T. 2018. Factors affecting of fruits, vegetables and its quality. *Journal of Medicinal Plants Studies* 2018; 6(6): 16-18

## Thematic Area-B: Primary Processing (Post-harvest Handling of Fresh commodities)

### *Topic B-1.*

#### **Harvesting, postharvest handling, packaging, transportation and storage of fruits and vegetables**

##### **Post-harvest management of fruits and vegetables**

The aim of the post-harvest management of fruits and vegetables is to minimise loss and quality deterioration and manage risks of fresh produces after harvest, thereby providing greater returns and benefit to all parties.

- **Post-harvest** refers to the period following harvest. Post-harvest handling links production and marketing. Post-harvest handling and treatment affect the final quality of a product.
- **Post-harvest management** operates through the value chain. Key objectives of post-harvest management are to eliminate losses and waste as products move from the field to the fork.
- **Postharvest technology** involves all treatments or processes that occur from time of harvesting until the foodstuff reaches the final consumer, which considers ways to minimize losses during postharvest period.

##### **The importance of post-harvest management**

- Appropriate post-harvest handling practices are needed to maintain the quality of freshly harvested produce, thereby reducing loss, extending shelf life and providing greater returns and benefit to all parties.

##### **Apply appropriate post-harvest techniques for fruits and vegetables**

Post-harvest begins immediately after the harvest of vegetables and fruits. Harvesting removes the product from its water and nutrient resources, which causes stress and results in damage.

- Being living organs, fruits and vegetables continue to respire even after harvesting when they have a limited source of food reserves.
- In addition to degradation of respiratory substrates, a number of changes in taste, colour, flavour, texture and appearance take place in the harvested commodities which make them unacceptable for consumption by the consumers if these are not handled properly.
- Postharvest techniques are integrated from farm to market. Selecting the correct techniques for each process will depend on the circumstances and available technology.

##### **Post-harvest handling of fresh vegetable and fruits**

**Perishable** fruits and vegetables have soft tissues and are vulnerable to injury. Due to their high moisture content and respiration rate, perishable crops have relatively short post-harvest life, a few hours to a few days.

Usually farmers get reduced farm-gate price due to post-harvest loss. The traders also incur losses due to post-harvest losses. There is thus great incentive to minimise post-harvest losses.

Post-harvest losses in perishable crops can result from:

- Physical, chemical and biological factors that affect the safety of the food;
- Mechanical and physical damage;
- Physiological deterioration;
- Pests; and
- Rot.

**Food loss** refers to the measurable decrease of food quantity or quality as a result of changes in a food product and could be unfit for human consumption.

**Damage** is the visible sign of deterioration. Damage can be partial. Damage restricts the use of a product, whereas loss makes its use impossible.

**Quality** is the degree to which a product meets specific standards in terms of its intended use. The following factors contribute to quality of a product:

- Appearance relates to visual factors such as size, shape, colour, and defects and decay.
- Texture includes firmness, crispness, juiciness, mealiness and toughness. The desirable feel or texture varies by commodity and intended use.
- Flavour - a subtle combination of taste and aroma – includes sweetness and sourness.
- Nutritional quality. Fresh fruits and vegetables are sources of vitamins, minerals and dietary fibre.
- **Quantitative loss** refers to loss of physical substance. This means a reduction in weight and volume that can be assessed and measured (Figure 1).

**Post-harvest handling practices** for fruits and vegetables aim to minimize losses throughout the supply chain. Reducing post-harvest losses will increase the returns to the businesses and sustainability of the supply chain as a whole. The type of commodity and the perishability of the produce influence the post-harvest programme and practices to be applied.

Typical stages and processes of post-harvest handling for perishable crops include:

- Harvesting;
- Field handling;
- Packing house operations (e.g. cleaning, trimming, sorting/grading, commodity treatments shelf life extension like pre-cooling and curing, for disease and insect pest control, fruit ripening, etc.);
- Packaging,
- Storage;
- Transport; and
- Market handling.

Major causes of post-harvest quality deterioration in horticultural crops are high transpiration and respiration rates, and pre-harvest contamination with pathogenic microbes.

- **Transpiration** is the process of water movement through a plant and its evaporation from aerial parts, such as from leaves, stems and flowers.
- **Respiration** is the process by which plants convert the sugars back into energy for growth and other life processes (metabolic processes).

Transpiration and respiration are aggravated by exposing harvested produce to high temperatures, low relative humidity and/or windy conditions.

Loss is not only the result of reduction of food and water but also caused by physical, chemical and biological contaminations. Fruit and vegetables are food to microorganisms causing product spoilage and human illness. It is therefore important to try to keep products clean and safe from pesticide and food borne pathogen contaminations.

Examples of quality loss and causes: over-ripening, yellowing, shrivelling and/or rotting in tomato, chilli, yardlong bean, bitter melon, cucumber and eggplant; wilting, yellowing and/or rotting in Chinese cabbage; bacterial soft rot and wilting of outer leaves in cabbage (Figure 1).



Figure 1: Examples of quality loss in different types of produce

Further loss is incurred by handling produce incorrectly once it has been harvested. This is illustrated in the picture below.



Figure 2. Improper handling causes post-harvest losses (Source of Image: Sheel, 2014)

## Packinghouse operations

### PACKINGHOUSE

In many situations it is necessary to establish a specific site for packing operations.

## Need for a packinghouse

The site for the packing operations may simply be the provision of a portable or temporary shelter in the field adjacent to the harvesting area to protect the produce and workers from the weather during field handling. This is of considerable importance for produce harvested in hot, sunny conditions where exposure to the weather for only a few hours can markedly accelerate senescence or in rainy periods where the chance of microbial infection is greatly enhanced if the produce becomes wet.

- The packinghouse is a facility to prepare produce for markets. Activities include cleaning, sorting/grading, commodity treatments, and packing.
- Packinghouse operations and flows vary with type of produce and market. In the simplest operation, produce is delivered in picking containers, immediately after harvest, directly to the packers. The packers then sort, grade, size and pack the produce directly into appropriate transport containers.
- The workers must be knowledgeable regarding produce defects, grade and size requirements, and packing methods.

Table 1: Operations at Packing house

PRODUCT	ACTIVITY
Tomato, chilli, cucumber, bitter gourd and yard long bean	Cleaning -> sorting -> chlorine wash ->air drying -> grading -> packing
Eggplant	Cleaning -> sorting -> chlorine wash ->airdrying -> packing
Cabbages and Chinese kale	Cleaning -> sorting -> bacterial soft rot control or chlorine wash->airdrying -> sizing -> packing
Cabbages for supermarkets:	Produce arrival recording -> wrapper leaf removal, butt trimming and lime application for soft rot control -> plastic film packing-> crating -> pre-cooling and storage



The complexity of packing house operations increase, as market requirements for quality and uniform grading become more demanding in case of exporting fresh produce. The standards of the required building will also increase along with more sophisticated equipment and a larger and more skilled work force.

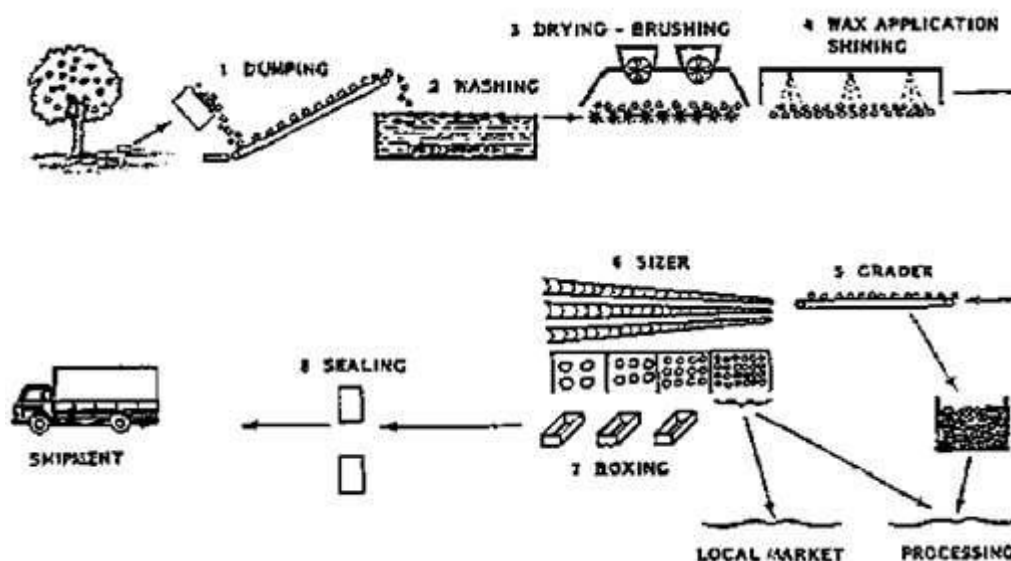


Figure 3. Handling operations in a packinghouse

### *Cleaning*

- Trimming, for example the fruit stem of eggplant and the stem end of cabbage and Chinese cabbage; Trimming improves the appearance of the produce and removes over-mature or damaged outer leaves and sections that are contaminated with micro-organisms;
- Removing leaves, for example wrapper leaves in cabbage, leaving 3-4 leaves for protection, and damaged and yellowed leaves in Chinese cabbage;
- Wiping tomato, bitter gourd, cucumber, and eggplant with a clean soft cloth;
- Washing the produce to remove soil and other debris.
- While cleaning, cull out damaged, diseased, off-shaped and off-sized produce.

### *Sorting/Grading*

- Sorting/grading preserves produce quality by preventing microbial contamination and ethylene effects; this facilitates marketing, and significantly increasing income (by as much as 40-60%).
- Sort the produce to remove defective products, get uniform size, shape and colour, separate vegetables by grades and detect disease
- Sorted produce is classified according to grades or classes based on size, maturity and appearance as dictated by markets.
- Sorters/graders must be skilful and attentive. Ensure good worker hygiene
- **Grade standards** specify product quality factors and characteristics for marketing purposes. Grade A products would be expected to achieve a higher price than Grade B products.

### *Practical and effective commodity treatments*

**Ethylene** is responsible for the changes in texture, softening, colour, and other processes involved in ripening. It can be produced when plants are injured, either mechanically or by disease. Ethylene can play a role in post-harvest programmes. For example, ethylene gas is used commercially to ripen tomatoes, bananas, pears, and a few other fruits post-harvest.

**Washing** during preparation for market can improve the postharvest quality of many types of vegetables. The primary purposes of washing are to remove soil, grit, and other debris from the vegetables, eliminate undesirable microbial contaminants, and clean/sanitise wounds incurred during the harvesting process. Vegetable surfaces, and at times the internal tissues, can also be contaminated by human pathogens (bacteria, viruses, nematodes, and protozoans). These may derive from the use of uncomposted animal manures or contaminated irrigation and wash-water. Wash-water must be from a clean source or treated appropriately if recycled.

- In tomato, washing in 2% bicarbonate (20 grams baking soda per litre of water) could reduce storage rot by 4-33%.
- In eggplant, washing in 100-200 ppm chlorine (mixing 4-8 tablespoons of commercial bleach, 5.25% sodium hypochlorite or NaOCl per gallon of water) for 1-3 minutes sanitizes produce and could minimize microbial decay.
- **Cabbage soft rot control:** Bacterial soft rot is the most serious problem in hot-humid climates. Bacterial soft rot could be reduced 24-37% by applying alum, lime paste or guava leaf extract on the butt end of cabbage.
- 10% alum (10 grams alum in 100 ml water),
- lime paste (mixing lime powder and water at 1:1) or
- guava leaf extract (mixing pure extract and water at 1:1)



Figure 4. Applying lime, alum or guava leaf extract to control soft rot

### *Packing*

Suitable packages and handling techniques can reduce the amount of damage to which fresh produce is exposed during marketing. Packaging should protect produce from damage and serve as

an effective handling unit. The design of the packaging and the strength of the materials used are important factors. It is also important to pack produce neatly and not over-pack the container.

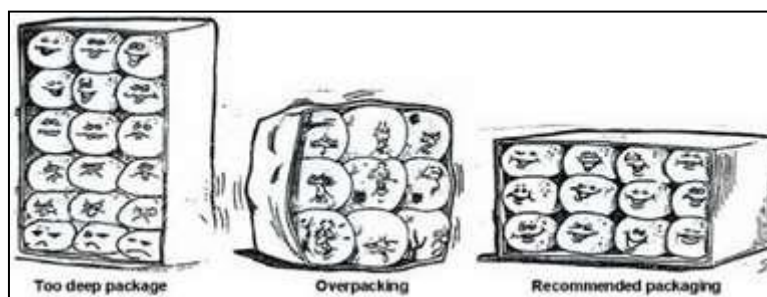


Figure 5. Optimal Packaging

- Packaging used for fruit and vegetables includes bamboo baskets, plastic baskets and crates, wooden crates with inner cardboard sides; carton and foam boxes.
- Protective packaging includes the use of liners and cushion (newsprint), individual wraps, vents in carton boxes to minimize heat build-up.

The steps involved in package selection are:

- Understand the need of the commodity, particularly in terms of physical protection;
- Select the packaging material that will economically satisfy the above needs; and
- Select a package that offers the greatest protection to produce and is acceptable to the intended market.
- It should be easily transported when empty and occupy less space than when full



Figure 6 Pallets at Packinghouse



Figure 7 Packaging damaged in transport

Other packaging measures and considerations:

- Use clean containers.
- Ensure that unused packing materials are stored properly.
- Ensure that packaging has the necessary stacking strength, including under moist cold room conditions if required
- If packed products are handled manually, keep the weight of containers at a reasonable level (e.g. <40 kg).
- Fill a package to capacity. Do not under-pack (more vibration damage) or over-pack (more compression damage).
- Do not mix produce at different stages of ripening in the same container.
- Immobilize produce in the container.
- Secure package by proper binding or strapping.

- Pack and stack in a cool place.
- Observe care when handling packages.

### Cooling and storage

- Cooling is the foundation of produce quality protection as it slows physiological processes and microbial growth. Every degree of reduction from ambient temperature increases storage life. So, every form of cooling is beneficial even if not optimum (e.g. avoiding sun exposure, harvesting at cooler times of the day, or using the cool night air).
- **Pre-cooling** is rapid removal of product heat, usually in a cold store.
- **Hydro-cooling** (dipping in cold water) alone or together with ice packing can be done without the use of expensive equipment.



Figure 8: A simple hydro-cooler for vegetables and fruit developed at FAVRI, Vietnam, and its effect on reducing tomato chill injury (brown spots) in 10°C storage

### *Ice packing and ice bottle techniques*

- **Ice packing and ice bottle techniques** for vegetable storage and transport are able to reduce temperature to 20-25°C from 35-40°C in packs of produce sealed in the afternoon and transported the following morning.



Figure 9: Ice packing of leafy vegetables in Laos



Our next lecture will give details of application of cool chain for post-harvest handling of fresh vegetables and fruits.

### Transportation

- Produce to be transported must be stacked in ways that minimize physical damage, and the load must be secured.
- Temperature management is critical during long distance transport. Ideally, transport vehicles should be well insulated to maintain cool environments for pre-cooled commodities and well ventilated to allow air movement through the produce.
- An open air vehicle can be loaded in such a way that air can pass through the load, and provide some cooling of the produce as the vehicle moves. Travelling during the night and early morning can reduce the heat load on an open vehicle.

Whatever the mode of transport is used the principle of transportation are the same:

- Loading and unloading should be as careful as possible;
- Transit time should be as short as possible;
- The product should be well protected in relation to its suitability to physical injuries;
- Overheating should not be permitted;
- Water losses by the produce should be restricted to the minimum;
- Whenever possible the transport vehicle should not stop under the sun and the produce protected with a cover; and
- Providing shelter from sun and rain at loading and unloading areas.

Useful guidelines for loading in the transport are the following:

- Loads must be stacked to enable proper air circulation to carry away heat from the produce itself as well as incoming heat from the atmosphere and off the road.
- Load the package tightly to reduce movement and make best use of space;
- Distribute weight evenly;
- Only stack to a load height which the lower container can withstand the weight without crushing or damaging the content;
- Use rope whenever needed to avoid shaking of the containers on the higher side. If the container shakes most probably the content will get bruised; and
- Cover the top boxes with tarpaulin to avoid sun damages and overheating to the produce. The cover will, also, reduce shaking of the containers.

### Handling in the market

Perishable produce should be handled with care at its destination. The number of handling steps should be minimised, and the lowest feasible temperature maintained.

**Storage:** Produce that is stored before sale should be housed in clean, well-insulated storage rooms. Markets and retailers may handle and store a variety of commodities simultaneously and it is important to not mix products with different temperature requirements, or store ethylene sensitive commodities near ethylene generating commodities.

Several small ripening rooms may be more useful than a single large room for small scale handlers, since the amount of product handled at destination may vary from time to time. In this case, flow through systems can be designed to allow the use of one or more rooms at the same time.

**Sorting:** Before produce is sold to the consumer, the handler may wish to sort for quality, or at least to discard any damaged or decayed produce in order to give the product more market appeal. If

ripeness or maturity is non-uniform, sorting at destination can provide the seller with a higher price for the better quality produce and neater presentation.

## HARVEST AND POST-HARVEST HANDLING FOR SELECTED FRUITS AND VEGETABLES

### 1. Mango

#### Harvesting

**Harvesting maturity.** Mangoes normally reach maturity in 4 to 5 months after flowering. When the Large fruits turned into a yellowish-pink colour on the tree, then all the fruits of the same size or larger are ready and have to be picked. Harvesting must be repeated when the remaining fruits, which in the meantime have grown in size, start colouring.



**Harvesting method.** When harvesting by hand from the ground is not possible the picker should use a long pole with a cutting blade and a small bag under the blade which holds only a few fruits. For bigger trees the pickers should climb the branches with cotton or fiber bags that they fill and lower to the ground. Optimum picking should be done with shears and cutting the stem 1 to 2 cm away from the fruit. This technique permits the reduction of latex exudation and staining of the skin and the entrance of fungus diseases.

Unfortunately many pickers harvest mangoes by simply knocking them from the tree, dropping or throwing to the ground; this causes bruises, punctures and cracks and later the fruits spoil. When low fruits are harvested with clippers, it is desirable to leave approx. 1 to 2 cm of stem to avoid the spurt of the milky sap that exudes if initially the stem is cut close.

**Field assembly.** Place the field crates with no more than two to three layers of fruits (separating each layer with sponges to avoid bruises and scratches) and baskets with liners in a sheltered or shaded area of the field or under the shade of the tree. Exposure to the sun of fruits with stains provoked by the latex may be corrosive for the skin. After harvest, latex should be allowed to drain away from the fruit by placing the mangoes with the stem downward on grass below the tree, cutting the stem 1 to 2 cm away from the fruit.

When quality of the harvested fruits is very good, in field selection, grading, sizing and packing can be done. Fruits should be freed from debris, and cleaned of soil and eventual leaked latex separated with a clean and soft cloth.

#### Post-harvest

**Treatments:** Wash/clean the fruits or use a clean soft cloth if latex stains and/or residues of chemical treatments are present on the surface of the fruit.

In Bangladesh, it is a habit at the beginning of the harvesting season to artificially ripen mangoes. In the north of the country mangoes are picked at a quite green stage to avoid bird damage and reduce damage during long transport of badly packed produce, on roads which are in a bad condition. On arrival in the final market dealers layer them with paddy straw, covered with plastic and allow for ripening, which will take place within 5 to 7 days at 15 to 20° Celsius.

In developed countries ripening of mangoes prior to shipment is conducted in ripening rooms with controlled atmosphere, temperature and humidity. Treatments with chemicals (such as ethephon) are used in a air tight rooms for 24 hour at 20 to 25o C and 90 - 95% of relative humidity and an adequate

air circulation. The treatment causes green mangoes to develop full color in 7 to 10 days, depending on the degree of maturity, whereas untreated fruits require 10 to 15 days.

**Selection/Grading:** Select out all immature, ripe, damaged, scarred or otherwise damaged fruits. In accordance with quality specifications required by the purchaser fruits should be graded in each carton according to variety, size and maturity.

**Packaging.** Mangoes for export or sophisticated internal markets such as supermarkets should be packed in cardboard boxes in single layer and the stem end facing downward or slightly on one side to avoid the latex contamination and with separators Ventilation holes are recommended to improve air circulation.

### Storage

Mangoes ripen within 4 to 6 days, after harvest at the mature green stage. The ripe fruits have a shelf life of 2 to 4 days. Storage at 10 to 12°C and 85 to 90 % of relative humidity, will maintain fruits in acceptable conditions for up to 4 weeks and fruits will then ripen satisfactorily at higher temperature. These conditions will however depend on the variety, maturity at harvest and time of harvest.

### Post-harvest losses

- Chilling injuries. Storage below 10°C for a few days will result in this damage.
- Anthracnose. Consists of small, black, circular spots on the skin which increases with the ripening of the fruits. Post-harvest applications of specific fungicides (imazalil or thiabendazole) may assist in disease control. Dipping in hot water (at 50°C for 5-10 minutes, depending from the fruit size in combination with the fungicide) is also utilized.

## 2. Banana

### Harvesting

**Harvesting maturity:** When bananas are to be sent to distant urban markets they are best harvested in hard mature but unripe green state, which reduces the risk of deterioration during transport.

**Harvesting method:** The method of harvesting will depend on the height of the plant. Low-growing varieties can be harvested by cutting through the bunch stalk about 30 to 35 cm above the top by hand. With taller varieties, the stem of the plant will be partly cut through to bring the bunch down within the harvester's reach, and then the bunch stalk can be cut through. Harvested bunches are best carried on a foam-padded tray to reduce damage during carrying.

**Field assembly:** It is customary in most banana-growing countries to transport the fruit to market on the bunch. This practice injures the fruit during handling and transport, and it is not recommended. Bananas for urban markets will suffer less damage and look better if they are de-handled and packed in suitable boxes.



### Post-harvest

**Selection and grading:** Bananas which are very immature and small, badly damaged or decaying should be discarded. Size and quality grading will depend on the demands of the market. In the more sophisticated urban markets (e.g. supermarkets), size-graded and good-looking fruit may command a higher price.

**Packing:** All harvested bananas should be kept dry and in the shade before and after packing. Packing is best done in or as near to the field as possible. There must be facilities for keeping the fruit and packaging dry.

As soon as the hands of bananas are cut from the stem, they should be laid, curved side uppermost, across the midribs of fresh banana leaves. This will prevent latex from the cut crown contaminating the fruit. Latex flow should stop in 12-15 minutes, after which the banana may be packed into wooden or, preferably, cardboard boxes, which can be of the slotted or telescopic type. Whole hands of bananas can be divided into clusters of four or more fruit which can be packed more compactly to give a greater weight of fruit per box.

The hands or clusters should be packed in the boxes with the curved side uppermost, making sure that the crowns of the upper hands do not damage the bananas underneath. Boxes should be full but not over-packed, otherwise the bananas will be damaged because the fruit itself and not the walls of the boxes will be supporting the upper boxes of the stack.

**Post-harvest treatments** .No special post-harvest treatments should be necessary for bananas sold locally or for those which will be sold to consumers in urban markets within four or five days. If sales are to be delayed for a greater time and the fruit sold in a ripening condition, it may be necessary to wash and then dip or spray them with a fungicide before packing.

### **Storage**

Bananas have a very short post-harvest life at ambient conditions. This is four to ten days when mature green and two to four days when ripe. Both green and ripe bananas are sensitive to cold and are damaged by temperatures less than 13o Celsius.

### **Ripening**

Bananas harvested in the mature green stage will normally ripen under the local ambient conditions in which they are grown, but some types will not develop their full ripe skin color.

## **3. Pineapple**

**Harvesting maturity:** Harvesting should be started when the base of the fruit has changed from green to yellow or light brown. An acceptable quality may also develop before color changes may occur.

**Harvesting method and handling:** Fruits are harvested manually by cutting the stalk using a sharp knife or twisting the fruits from the stalk. The harvested fruits are put inside gunny bags, bamboo or other kind of baskets or field crates and sent to the collecting point for grading. Grading and packing can also be done in the field itself. Fruits, after separation of broken and heavily diseased or defective ones, are graded according to size and stage of ripeness and packed in single layer cardboard boxes, on their side.



**Storage:** The fruits should be stored, depending from the variety, at 7 to 13° C (45 to 55 ° F), 85-95% Relative Humidity for up to 24 weeks. However it is advisable to store pineapples for no more than 4-6 weeks, because the fruit is chilling injury sensitive, like most of the tropical fruits.



#### 4. Leafy vegetables and immature flower heads

Include cabbage, Chinese cabbage, kale, rape, mustard, broccoli, spinach beet, spinach, lettuce, celery, green onions, etc.

##### Harvesting

**Harvesting maturity:** All are harvested in the immature state before the plant has developed to the point of seed production. The older parts of these commodities become fibrous or woody.

**Harvesting method:** The parts of the plant harvested vary with the crop:

- Cabbage, Chinese cabbage, lettuce, and green onions form more or less compact heads; the entire head is harvested at one time;
- Kale, rape, mustard, young shoots, with or without immature flower heads, are picked by hand-breaking; can usually be harvested over a period of time as long as new shoots continue to develop; and
- Beet and spinach are harvested as individual young leaves; sometimes young shoots of spinach are harvested; harvesting is repeated as new leaves continue to develop.



Those crops forming a head, such as cabbage, are cut with a sharp knife. Young shoots and leaves are broken off by hand. Green onions are either pulled by hand or dug from the soil. They should be harvested under dry conditions when soil can be readily shaken from the roots. The roots are then trimmed with a sharp knife.

**Field assembly:** All these commodities are damaged easily if subjected to pressure. They should be packed loosely in field containers, which must not be overfilled or the produce will be damaged when the containers are stacked. The harvested produce must be kept free from contamination by soil. Leafy vegetables and immature flower heads deteriorate very quickly after harvest because they lose water fast and produce a great deal of heat. The following care is necessary to keep losses to a minimum:

- They must be packed loosely in well-ventilated plastic field containers; if they are piled in a tight mass, the heat they generate cannot escape.
- They must be kept in the shade and not exposed to direct sunlight.
- They must not be exposed to drying winds or they will lose water quickly and become wilted and soft; at the same time there must be enough ventilation to disperse the natural build-up of heat.
- There must be the shortest possible delay between harvest and sale or consumption because leafy commodities have a very short post-harvest life under ambient conditions.

##### Post-harvest

**Selection, grading and handling:** All produce which is damaged, decaying wilted or infested by insects or other pests must be discarded. Size-grading is not normally necessary for local and internal marketing. Size-grading may be needed to supply supermarkets.

**Post-harvest treatment:** It is essential to keep these commodities free from contamination by soil or decaying plant material. Do not wash them. Washing them may remove gross soil contamination, but it will also spread any decay through the whole bulk and result in heavy losses. Shading the produce and keeping it in a moist atmosphere helps to keep it cool, reduces water loss, and delays wilting and yellowing of leaves.

Chemical treatments to control decay are not acceptable because they are not very effective and they leave high residue levels because of the characteristic high surface area of these products in relation to their volume.

**Packaging.** For local rural markets traditional containers are likely to remain in use. It is important, however, that containers should not be too large to be carried by one person. Rough handling of heavy packages results in damage to produce. Packaging of leafy vegetables and immature flower heads for urban markets will vary with the type of commodity.

The following are examples:

- Cabbages: woven sacks, net bags or field crates of 20-25 kg capacity are suitable.
- Lettuce: one layer wooden plastic crates or ventilated cardboard boxes each containing 24 heads of lettuce.
- Green onions: normally tied in bunches by the grower; they are best transported in small wooden crates holding 10-15 kg.
- Spinach: crisp, brittle and easily broken by rough handling; they are best packed loosely in cardboard, wooden or plastic field boxes of 5-10 kg capacity; over-packing will cause crushing of leaves and bruising and rapid discoloration of stems.
- Kale, rape and leafy brassicas: may be tied in bunches or packed loose; they can be marketed in nets, cardboard or wooden or plastic field crates of 5-10 kg capacity.

## Storage

Leafy vegetables and immature flower heads have a very short post-harvest shelf-life, especially under ambient conditions. Even under refrigeration most remain in good condition only up to two weeks. Ideally, they should reach the consumer within two days of harvest.

## 5. Tomatoes

### Harvesting

**Harvesting maturity:** If tomatoes are to be used in the ripe condition, they should be picked at the earliest when they are at least mature green. Immature tomatoes do not ripen after harvest. Tomatoes have reached the mature-green condition when they are fully rounded and have changed from dark to medium or light green, and the skin develops a waxy gloss. As ripening is initiated, the fruit shows a pale pink or yellow tinge, which develops through a definite pink to full red. Most tomatoes are harvested at the early ripening or pink stage, depending on market preference and the time they take to reach the retailer. Tomatoes to be consumed immediately can be harvested when fully ripe.



**Harvesting:** Tomatoes are best harvested into plastic buckets (pails) and transferred if necessary to plastic field crates holding not more than 20 to 25 kg weight.

### Post-harvest

**Selection and grading:** All decaying, damaged, undersized and sunburned tomatoes should be discarded. Size-grading for the local market is normally done by retailers. Internal urban markets, including supermarkets, may have differential prices for size grades as against un-graded fruit.

**Post-harvest treatments:** Only those tomatoes which are in good condition are marketed, there should be no need for any post-harvest treatments. Tomatoes are normally harvested at maturity and ripen naturally.

**Packaging:** For local markets tomatoes can be packed in baskets or other traditional containers assuring careful handling, i.e. rigid enough to protect the contents from being crushed. For urban markets cardboard telescopic boxes or wooden or plastic trays/crates with capacities of not more than 20 kg, should be used. Size-graded tomatoes can be pattern-packed in 2 layers for green produce and one layer for ripe red produce to make best use of the box.

### **Storage**

Tomatoes have a relatively poor storage capability. Green mature fruit can be held for up to two weeks at 18-20° C and 90-95% Relative Humidity, but for less time under ambient tropical temperatures. Fully ripe tomatoes have only 4 to 7 days' storage life, at 13-15° C and 90-95% Relative Humidity.

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## Cold Chain Management of Fruits and Vegetables

### 1. Introduction

Refrigeration has been the principal known method of successful storage of fresh fruits and vegetables to retain their freshness and flavour. Cold storage is meant to preserve the perishable commodities of food items for a longer period with retention of the original colour, flavour and taste. The farmers in Bangladesh confront poor access to marketing information and prevalence of cheating in markets. Most of farmers are poor; have to depend on the middlemen to sell what they cultivate. Sadly, at the end of the day, they cannot fetch even the cost of production, let alone a little profit. As a result, many of them are gradually opting for small trades in local markets or 'haats' for a livelihood. On the other hand, there is a high demand of farm fresh quality fruits and vegetables especially at the levels of exporters, superstores and agro-processors where, cold chain management system can contribute to retain the commodities in better condition with extended shelf-life, simultaneously the postharvest loss of the commodities can be reduced to a greater extent. The cold storage facilities are the prime infrastructural component for perishable commodities. These are essential for extending the shelf life, period of marketing, avoiding glut, reducing transport bottlenecks during peak period of production and maintenance of quality of produce. Besides the role of stabilizing market prices and evenly distributing both on demand basis and time basis, the multipurpose cold storage industry renders other advantages and benefits to both the farmers and the consumers. It is therefore necessary that multipurpose cold storages are to be constructed in major producing areas as well as consuming centers. The development of this industry in Bangladesh has therefore, an important role to play in reducing the wastages of the perishable commodities and thus providing remunerative prices to the growers.

### 2. Cold Storage System

#### 2.1 Small-Scale Cold Storage

A Small-Scale Hub-and-Spoke Model Cold Storage having the capacity of 50MT occupying a chamber with the dimension of 32'L X 32'B X 10.5'H is shown in Figure- 1. Cold storage rooms

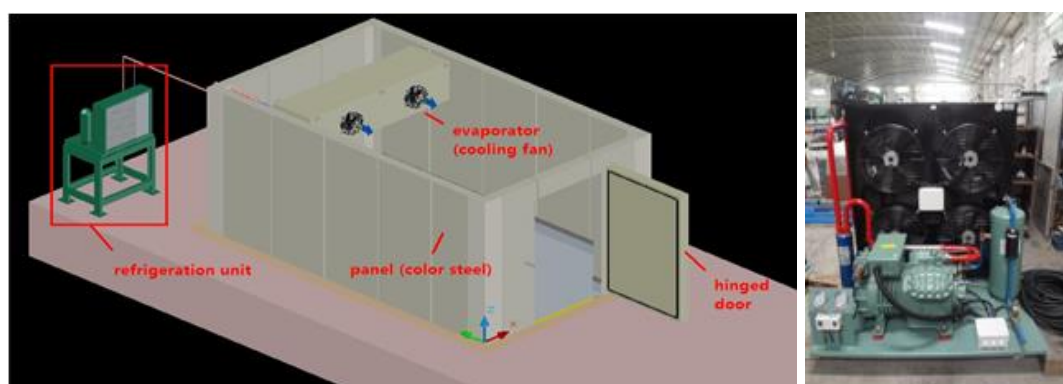


Figure. 1. Cold room assembled well (Left), Refrigeration System (Right)

are made of Poly Urethane Foam (PUF) having density of 40+/-2 Kg/ cubic m. Flooring is either bare slab and concrete or aluminium chequered with ply wood. Cladding of the PUF is with 0.5/ 0.6 mm pre-painted galvanized iron (PPGI). Any other cladding viz. SS, aluminium can also be provided.

The mode of operation of the small-scale cold storage are described here:

The cold storage model will be treated as a small unit of this business model for storing horticultural commodities. In a specific place, more than one unit may be established as per the availability of the horticultural commodity where the existing source of the commodities is basically for export. The model assumes mainly to store the horticultural commodities for 43 cycles (batch) per year with the assumption of 7 days storage per batch with 300 days working per year. The hub-and-spoke model will be basically linked with a stand-alone CoolBot model (like Figure 11) from where it will collect the commodities and keep for short term storage. This model will conduct business basically with the stand-alone model but it will have the opportunity to collect the horticultural commodities from the surrounding farmers' field. Working conditions of the model are shown in Table 1:

Table 1. Working conditions of the Hub-and-Spoke Model-1

1. Max. Ambient temp.	+50°C
2. Relative humidity	95%
3. Power supply	380V/3Phase/50Hz
4. Refrigerant	R22 (R404a)
5. Compressor type	Semi-hermetic piston compressor
6. Evaporating tempt.	-5°C
7. Cooling system	air cooled
8. Inside temp.	0°C to 4°C

The facilities in a cold chain are composed of pre-coolers, packing houses and cold storage rooms and trucks for transport.

- Pre-coolers - to remove field heat rapidly right after harvest to acquire desired conditions.
- Packing houses- prepare the vegetables by trimming and cleaning, sorting defective products.
- Cold storages- to maintain vegetables at high quality as produced.
- Refrigerated trucks/container vans – to collect to transport them.

## **2.2 Evaporative Cold Storage**

### **2.2.1 Zero Energy Evaporative Cooler**

#### **2.2.1.1 Principles of Zero Energy Evaporative Cooler**

Principle of ZEEC depends on cooling by evaporation. As water evaporates it has a considerable cooling effect and faster the rate of evaporation greater the cooling rate of evaporation and ultimately greater the cooling. Evaporative cooling occurs when air is not already saturated with water, passes over a wet surface. Water evaporates into air raising its humidity and at the same time cooling is occurred at the surroundings. Efficiency of evaporative cooler depends on humidity of the surrounding air. Very dry and low humid air can absorb a lot of moisture and hence considerable cooling occurs. In extreme case of air that is saturated no evaporation can take place and no cooling occurs. Based on this principle of direct evaporative cooling, ZEEC has been developed. The main advantages of this on-farm low cost cooling technology are: i) It



Figure 2. Zero Energy Evaporative Cooler

does not require any electricity or power to operate and ii) Materials required like bricks, sand, bamboo etc. available easily and cheaply.

### 2.2.1.2 Method of Fabrication

ZEEC is a double brick-wall structure (Figure 2), the cavity is filled with sand and walls of the chamber are soaked in water. Even unskilled labour can build the chamber, as it does not require any specialized skill.

Table 1. Cost of Fabrication of ZEEC

Items	Total (Taka)
Brick, 500 No. @ Taka 2.50 per brick	1,250.00
Sand, 1000 kg	400.00
Cement, 3 bags, @ Taka 490 per bag	1,470.00

Cool chambers can reduce temperature by 5-15 °C depending on the temperature and humidity of air and maintain high humidity of about 95% that can increase shelf life and retain quality of horticultural produce (Sheel, 2012). Small and marginal farmers can store perishable commodities for about a week after harvest for better price.

It does not require any specialized skill. Cool chambers can reduce

temperature by 5-15 °C depending on the temperature and humidity of air and maintain high humidity of about

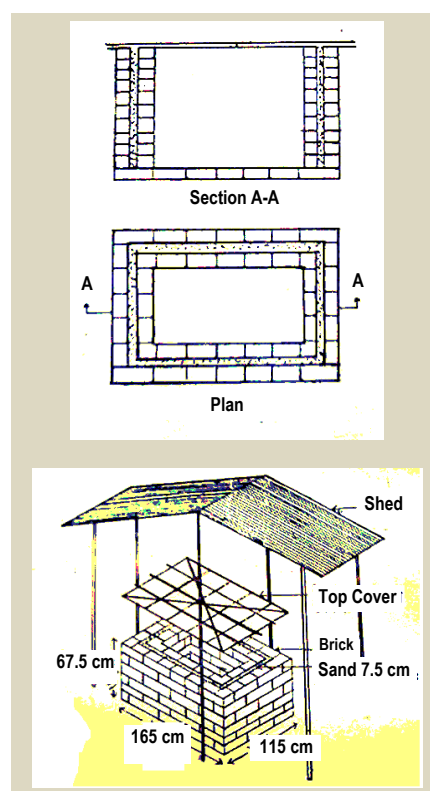


Figure.3. Isometric View of Zero Energy Evaporative Cooler

To fabricate a ZEEC the required materials are: i) Highly porous brick (3<sup>rd</sup> class brick)-300 No. ii) Cement-2 Sacks and iii) Sand, gunny bag and bamboo sleeper (cost of fabrication is presented in Table-1).

The following methodology is used to fabricate the cooler:

- The isometric view of the cooler is presented in Figure 2. According to the dimensions specified in the figure, the cool chamber is fabricated with cheap quality highly porous bricks and river bed sand.
- The floor is made with a single layer of bricks, the side walls with a double layer of bricks, the space (7.5 cm) between the bricks being filled with sand. The chamber prepared thus, is used for storage of commodities.



- iii. The brick and sand are soaked in water till they are saturated.
- iv. The top of the storage space is covered with wet gunny cloth fitted with a structure made with bamboo sleeper according to Figure-3.
- v. The cooler may be installed in a shed having sufficient aeration facilities. If there is no room available in existing shed, a low-cost thatched shed may be prepared for the cooler.

### 2.2.1.3 Method of Operation

The ZEEC can be installed in farmers' field, assembly and retail markets at village level. The sand layer of ZEEC will be soaked with water sufficiently. Once the cooler is saturated with water, sprinkling of water once in the morning and once in the evening is enough to maintain the temperature and humidity. It is better to set a drip system containing a plastic container as water reservoir and a plastic flexible pipe having sufficient number of nozzles fitted with it in certain interval. Once the container is filled in with water, the nozzle will discharge water drop by drop to the sand layer and thus the sand layer will be soaked continuously according to the rate of evaporation of water. Dripping can be controlled by adjusting the connection tap attached with the water reservoir. Nine plastic crates having capacity of 15-20 kg of fruits/vegetables will be placed in 3 layers keeping 3 crates in each layer. Before storing the commodities, these should be properly sorted and graded and washed (where necessary). Fruits/vegetables will be placed in the crates with or without packing with perforated polythene depending on the nature of the commodities.



Figure 4 ZEEC with cover

ZEEC can be installed profitably where the fruits, vegetables and cut flowers are held temporarily. The materials required for the cooler is cheap and available at the rural level and the fabrication method is also easy. If the ZEEC is properly fabricated and actually adopted, availability of nutritious fruits and vegetables will be increased through reduction of postharvest loss as well as farmers/traders will get better price.

### 2.2.2 Evaporatively Cooled Room

An evaporatively cooled (EC) room (3x3x3m. size) was developed in India (Figure 5) for on-farm storage of fruits and vegetables.

- The summer temperature inside the EC room was 5-8 °C lower than that inside the ordinary room and winter temperature was 5-8 °C higher than that inside the ordinary room.
- Compared on the basis of 10% physiological loss in weight (PLW) the shelf life inside the room was 34 days for early kinnow, 23 days for late kinnow, 11 days for cauliflower and 4 days for spinach as compared to 21, 11, 5 and 2 days respectively in an ordinary room at the same time.
- The cost of the chamber is Rs. 75000 (BDT Around 90,000) and capacity is 2 MT.



Figure 5. Evaporatively Cooled Room

### 2.2.3 CIPHET Evaporative Cooled Storage Structure

**CIPHET** Evaporatively Cooled Structure (ECS) maintains a moderate low temperature and sufficiently high relative humidity for short term storage of fresh fruits and vegetables (Figure 6).

- Advantages
  - Low level consumption of electricity
  - Less initial investment
  - Negligible maintenance cost
- Features
  - Special design of roof, orientation
  - Uses wetted pad as cooling medium
  - 20°C below the outside temperature
  - An ECS of about 5 -7 MT storage capacity may cost about Rs. 1.5 – 1.8 lakh (BDT 1.8 - 2.16 Lakh)



Figure 6. Evaporatively Cooled Structure (ECS)

## 3. Cold Transportation System

### 3.1 Mobile Cool Chamber

- The insulated box was designed such that it could hold 8 plastic crates of size 540x360x295 mm in two layers of four each (Figure 7).
- Capacity of storage was 100 kg of fruits with 80% filling of each plastic crates with ice packaging
- Costs around Rs. 18,000-20,000/- (BDT 21,160 -24000/-)
- Low cost unit saves the fruits from exposure to sunlight and preserves the quality.



Figure 7. Mobile Cool Chamber

### 3.2 Refrigerated transport

A mobile refrigeration unit (Figure 8) is mounted on top for cooling the solution of ethylene glycol and salt stored in the jacket of insulated box.

- This solution is cooled to sub-zero temperature by running the refrigeration unit by plugging to power source for 8-10 hours before use.
- The refrigerated transport vehicle can lower the product temperature up to 5 °C.
- The wattage of compressor is 0.65 kW.



Figure 8. A mobile refrigeration unit

### 3.3 Transportation with Ice Packaging Using Insulated Styrofoam Box

Ice packaging using insulated Styrofoam Box could be used for the fruits and vegetables that are usually not affected with chilling injury at too low temperature. Plastic bottles containing ice is wrapped with paper followed by placed among the layers of the fruits to be packed. The package finally would be covered with cover and tightened with plastic tape (as in Figure 9).





Figure 9. Ice packaging of Fruits and Vegetables

### 3.4 Refer Track

Reefer trucks (Figure 10) with the following specification are available in the country for transporting fruits and vegetables:

- To maintain cool-chain, while transporting your fresh produce/product .
- To ensure proper quality .
- To store your produce/product in appropriate temperature (+ 15°C to -25°C)
- Capacity 3-4 MT .
- Auto humidity control of fresh produce: up to 99%



Figure 10. Reefer Truck

## 4. Techno-Economic Feasibility Study on Establishing Small Scale Multipurpose Cold Storage and Cold Chain Management System using CoolBot technology

The key features of the Techno-Economic Feasibility Study on establishment of the small-scale cold chain management are as follows (Sheel 2015):

- 4.1 Name of the Project:** Establishing small scale multipurpose cold storage and cold chain management system using CoolBot technology.
- 4.2 Location of the Project:** The project is proposed to be located at the major fruit and vegetable growing upazilas of the country. The land area for the project will be situated adjacent to highway and at or closure to the assembly market for fruits and vegetables. All infrastructural facilities like power, water and commercial facilities should be available at the proposed project site.

**4.3 Brief Description of the Project:** The proposed project envisages establishment of a small scale multipurpose short-term/ transit cold storage (MPCS) with marketing facilities maintaining cold chain management up to the exporters' end at the airport and superstore retailers' shop. The horticultural produces is assumed to be stored in the MPCS up to maximum 3 days. The total production capacity of the plant is 2850 MT fruits and vegetables per year at 100% capacity utilization with working 300 days per year. The project will also produce 48 MT of compost per year. The MPCS comprises i) complete cold chain (CCC) management of 1800 MT fruits and vegetables per year and ii) supply chain management of 1050 MT fruits and vegetables maintaining pre-cooling and using crates packaging (PCP) as transport package only. The MPCS will comprise two CoolBot cold storages each of having capacity of 9 MT.



**Figure 11. (Upper) CoolBot cold storage, (lower) CoolBot device connected to indoor unit of a room air cooler** (Image Source: USAID Horticulture Project, RARS, BARI, Jessore)

**4.4 Market Feasibility:** There is huge demand of fresh and superior quality fruits and vegetables at the levels of exporters, domestic superstores and agro-processing enterprises. With this prevailing marketing opportunities, the project will sell its whole amount to these sectors maintaining proper cold chain management.

**4.5 Sources of Raw Materials:** All the quality horticultural crops may be produced through contract farming/ group farming following improved and safe production practices. The project shall not purchase any raw materials from abroad. A considerable amount of horticultural crops will be marketed through purchasing the commodities from the farmers paying them superior price, as a result the growers will find their market as well as more profit and hence, they will be encouraged to grow more crops.

**4.6 Machinery and Equipment:** The project will be run by the machinery available in the country. After comprehensive scrutiny and in-depth field survey and as per the best and suitable price offer, the price of the machinery stands at Tk. 44.5 Lac. The machinery in detailed is shown below:

Machinery	Requirement of Power (kW/hr)	Total Price Tk. In ('000')
CoolBot Cold Storage Machinery, 2 No.	7	2000
Hydro cooler, Capacity 1 MT/hr, 1 No.	10	650
Pack house Machinery/Equipment (1 Set)	1	500
Lab Equipment (1 Set)		100

Diesel Generator, 30kVA, 1 No.		500
Deep Tube well	2	500
Miscellaneous	1	200
<b>Total</b>	<b>21</b>	<b>4450</b>

**CoolBot technology for small scale cold rooms:** A small-scale option is to use a modified room air conditioner, a method originally developed by Boyett and Rohrbach in 1993. The control system of the unit is modified to allow it to produce low air temperatures without building up ice on the evaporator coil. The cost of installation of a CoolBot technology for a 15ft W X 12ft B X 10.5ft H small scale cold rooms having capacity of 9 MT fruits/vegetables is around BDT 10.00 Lac only. The Coolbot technology utilizes a 1.5 Ton capacity air conditioning unit to create a cold room capable of around 2°C temperature.

In the system, the ice restricts airflow and stops cooling. Recently a company has developed an easily installed controller that prevents ice build-up but does not require modifying the control system of the air conditioner (Cool-bot, Store It Cold, LLC, <http://storeitcold.com>). It was observed that, the room air conditioner and Cool-bot control system costs about 90% less than the commercial refrigeration system. The control system is designed so that any moisture condensed on the refrigeration coils is returned to the cold room air and the system will like cause less product moisture loss than the commercial refrigeration system. However, this type of cold storage technology has been started to work in the country (Figure 1).

**4.7 Transport:** The project will require refer van and other transports for carrying raw materials from the farmers' premises/assembly market to the MPCS and the commodities to the points where the products will be exported and superstores. The project will require two refer vans which will be used only to transport the commodities from MPCS to the places of exporter and superstores. The project is assumed to be run initially by hiring the vehicles.

#### 4.8 Building and Other Civil Cost

The civil construction of the proposed project includes 3000 sqft built area with high quality roofing with adequate civil-structure. The construction includes two cold storage chambers, dispatch dock, pre-cooling room, ante room, toilet and change room, sorting, grading, washing, weighing and packaging room, waste disposal room, receiving dock, packaging material store room, laboratory, office room and rest house. The total cost of the construction has been estimated at Tk. 45.00 Lac including electrification, sanitation, drainage etc. The floor plan of the building is shown in figure 12.

#### 4.9 Cost of the Project

Summary cost of the project is as follows:

Items	Total in BDT '000'
Land and Land Development	1700
Civil & Other Works	4500
Machinery, Equipments & Vehicles	4820
Preliminary expenses	1620
Furniture & Fixture and Crates	1400
Contingencies	135

Working Capital Margin	1189
<b>Total Cost of the Project</b>	<b>15364</b>

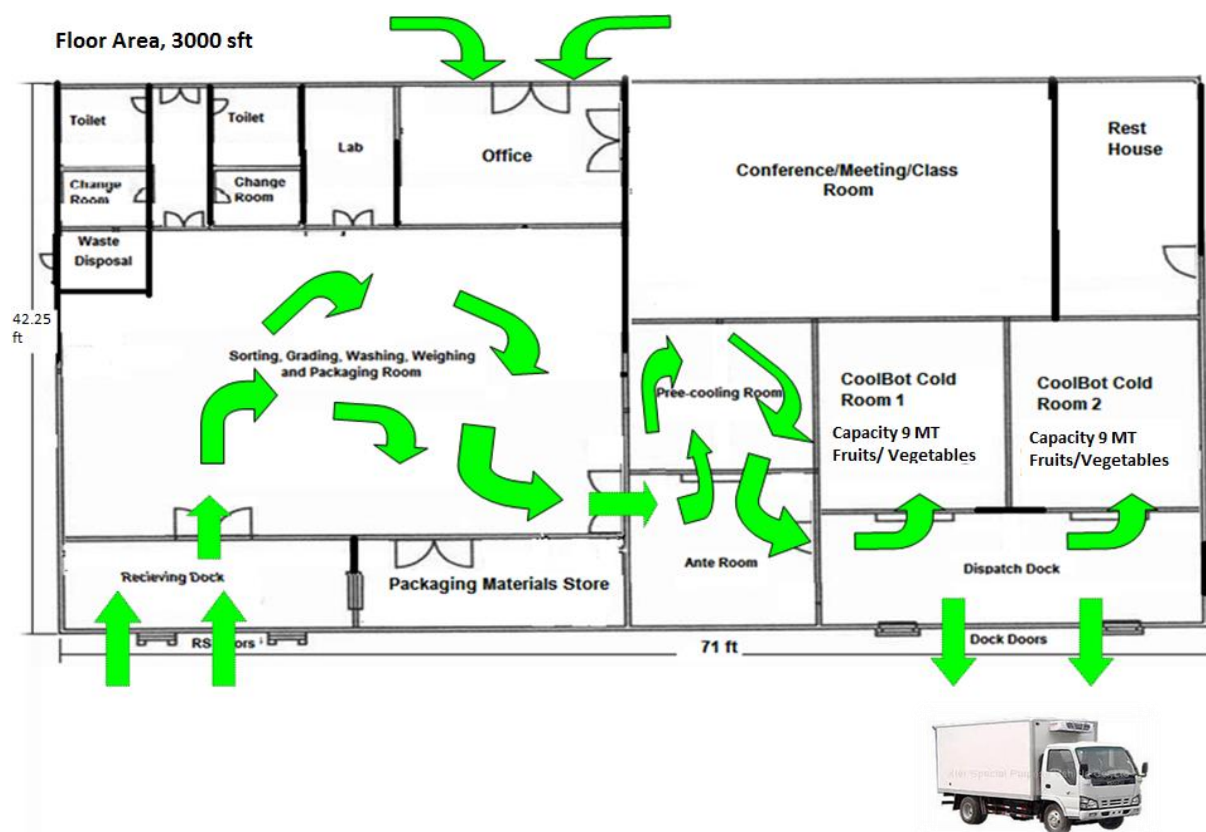


Figure 12. Floor Pan of Small Scale Multipurpose Short-Term/Transit Cold Storage (MPCS)

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## **Thematic Area-C: Secondary Processing (Processing into Shelf-Stable Products)**

### *Topic-C1*

#### **Secondary processing technologies for fruits and vegetables focusing intermediate and shelf-stable processed products**

##### **1. Introduction**

The perishable fruits and vegetables are available as seasonal surpluses during certain parts of the year in different regions and are wasted in large quantities due to absence of facilities and know-how for proper handling, distribution, marketing and storage. Furthermore, massive amounts of the perishable fruits and vegetables, produced during a particular season result in a glut in the market and become scarce during other seasons. Neither can they all be consumed in fresh condition nor sold at economically viable prices. In developing countries agriculture is the mainstay of the economy. As such, it should be no surprise that agricultural industries and related activities can account for a considerable proportion of their output. Of the various types of activities that can be termed as agriculturally based, fruit and vegetable processing are among the most important. Therefore, fruit and vegetable processing has been engaging the attention of planners and policy makers as it can contribute to the economic development of rural population. The utilization of resources both material and human is one of the ways of improving the economic status of family.

##### **2. Principles of Food Preservation**

Freshly prepared products are highly attractive in appearance and possess good taste and aroma, but deteriorate rapidly if kept for some time. This is on account of several reasons such as. fermentation caused by moulds, yeasts and bacteria, enzymes present in the product may affect the colour and flavour adversely, e.g. apple juice turns brown due to the activity of oxidative enzymes in it, chemicals present in the pulp/juice may react with one another and spoil its taste and aroma, air coming in contact with the product, may react with the glucosidal materials present in it and render the product bitter, e.g., Navel orange and sweet lime juices often turn bitter when they are exposed to air even for a short time. and traces of metal from the equipment may get into the product and spoil its taste and aroma. In preservation of foods by various methods, the following principles are involved:

###### **a) Prevention or delay of microbial decomposition:**

- (a) by keeping out microorganisms (asepsis);
- (b) by removal of microorganisms, e.g., by filtration;
- (c) by hindering the growth and activity of microorganisms, e.g., by low temperature, drying, anaerobic conditions, chemicals or antibiotics; and
- (d) by killing the microorganisms, e.g., by heat or radiation.

###### **b) Prevention or delay of self-decomposition of the food:**

- (a) by destruction or inactivation of enzymes, e.g., by blanching;
- (b) by prevention or delay of chemical reactions, e.g., prevention of oxidation by means of an antioxidant.

###### **c) Prevention of damage by insects, animals, mechanical causes, etc.**

To retain the natural taste and aroma of a product, it is necessary to preserve it soon after preparation, without allowing it to stand for any length of time.



### 3. Methods of Food Preservation

Various methods of preservation are employed and each of them has its own merits. The important methods generally used are as under:

#### a) Asepsis (Absence of infection)

Asepsis means preventing the entry of microorganisms. Maintaining of general cleanliness while, picking, grading, packing and transporting of fruits and vegetables increases their keeping quality and the products prepared from them will be of superior quality. Washing or wiping of the fruits and vegetables before processing should be strictly followed as dust particles adhering to the raw material contain microorganisms and by doing so the number of organisms can be reduced considerably.

#### b) Preservation by High Temperature

Coagulation of proteins and inactivation of their metabolic enzymes by the application of heat leads to the destruction of microorganisms present in foods. Further, heating can also inactivate the enzymes present in the food. Heating food to high temperatures can, therefore, help to preserve it. The specific treatment varies with:

#### c) Preservation by Low Temperature

Microbial growth and enzyme reactions are retarded in foods stored at low temperatures. The lower the temperature, the greater the retardation. Low temperatures can be produced by (i) cellar storage (about 15°C), (ii) refrigeration or chilling (0 to 5°C), and (iii) freezing (-18 to -40°C).

(i) Cellar storage (about 15°C): The temperature in cellars (under- ground rooms) where surplus food is stored in many villages is usually not much below that of the outside air and is seldom lower than 15°C. It is not low enough to prevent the action of many spoilage organisms or of plant enzymes. Decomposition is, however, slowed down considerably. Root crops, potatoes, onions, apples and similar foods can be stored for limited periods during the winter months.

(ii) Refrigeration or chilling (0 to 5°C): Chilling temperatures are obtained and maintained by means of ice or mechanical refrigeration. Fruits, vegetables and their products can be preserved for a few days to many weeks when kept at this temperature. The best storage temperature for many foods is slightly above 0°C but this varies with the product and is fairly specific to it. Besides temperature, the relative humidity and the composition of the air can affect the preservation of the food. Commercial cold storages with proper ventilation and automatic control of temperature are now used throughout the country (mostly in cities) for the storage of semi-perishable foods such as potatoes and apples. This has made such foods available throughout the year and has also stabilized their prices.

(iii) Freezing (-18 to -40°C): Freezing method is the most harmless method of food preservation. Microbial growth is inhibited and the rate of chemical reactions is slowed down at low temperatures. In commercial frozen storage the activity of meat enzymes is stopped while plant foods have to be blanched before freezing to avoid undesirable quality changes. At temperatures below the freezing point of water (-18 to -40°C) growth of microorganisms and enzyme activity are reduced to a minimum. Most perishable foods can be preserved for several months if the temperature is brought down quickly (quick freezing) and the food kept at these temperatures. Foods can be quick frozen in about 90 minutes or less by: (i) placing them in contact with the coil through which the refrigerant flows, (ii) blast freezing in which cold air is blown across the food, and (iii) dipping in liquid nitrogen.

Quick frozen foods maintain their quality and freshness when they are thawed (brought to room temperature) because only very small ice crystals are formed when foods are frozen in this manner. Many microorganisms can survive this treatment and become active and spoil the food if it is kept at higher temperatures. Frozen foods should, therefore, always be kept at temperatures, below -5°C. Enzymes in certain vegetables can continue to act even after being quick frozen and so such vegetables have to be given a mild heat treatment called blanching (above 80°C) before they are frozen to prevent development of off-flavours.

The best way of preserving pure fruit juice is by freezing. Properly frozen juice retains its freshness, colour and aroma for a long time. This method is particularly useful in the case of juices whose flavour is adversely affected by heating. The juice is first deaerated and the vacuum filled with nitrogen gas. It is then transferred into containers which are hermetically sealed and frozen. Moulds are sometimes not affected by this technique. Juice can be kept in good condition for a long time in frozen form at -12 to -17°C by excluding air. It is defrosted before consumption.

#### **d) Preservation by Chemicals**

Microbial spoilage of food products is also controlled by using chemical preservatives which do not include salt, sugar, acetic acid, oils, alcohols, etc., but only microbial antagonists. The inhibitory action of preservatives is due to their interfering with the mechanism of cell division, permeability of cell membrane and activity of enzymes.

According to the British Food and Drug Act of 1928 a "preservative" is any substance which is capable of inhibiting, retarding or arresting the process of fermentation, acidification or other decomposition of food, but does not include common salt (sodium chloride), saltpetre (sodium or potassium nitrate), sugar, acetic acid or vinegar, alcohol or potable spirits, spices, essential oil or any other substance added to the food by the process of curing known as smoking. The two important chemical preservatives permitted in many countries are :

- (i) sulphur dioxide (including sulphites), and
- (ii) benzoic acid (include benzoates)

#### **e) Preservation by Drying**

Microorganisms need moisture to grow so when the concentration of water in the food is brought down below a certain level, they are unable to grow. Moisture can be removed by the application of heat as in sun-drying or by mechanical drying (dehydration). Sun-drying is the most popular and oldest method of preservation. In these days, mechanical drying has replaced sun-drying. This is a more rapid process as artificial heat under controlled conditions of temperature, humidity and air flow is provided and fruits and vegetables, e.g., green peas, cauliflower, mango, mahua, etc., are dried to such an extent that the microorganisms present in them fail to survive. In this method, juices are preserved in the form of powder.

*Vacuum Frying Technology:* For decades, consumers have desired deep fat fried products because of their unique flavor- texture combination, ranging from potato chips, French fries, doughnuts, extruded snacks, fish sticks, and the traditional-fried chicken products. Frying is one of the oldest and most popular cooking methods in existence. Frying in vacuum condition is a new technology that can be used to improve the quality of fried foods because it is working in low temperatures and use the minimum oxygen content. Deep-fat frying is a method to produce dried food where an edible fat heated above the boiling of water serves as the heat transfer medium, fat also migrates into the food, providing nutrients and flavour. These conditions lead to high heat transfer rates, rapid cooking, browning, texture, and flavour development. Therefore, deep-fat frying is often selected as a method for creating unique flavors, colors, and textures in processed fried foods. However, surface darkening and many adverse reactions take place during deep-fat frying because of high temperature. Due to the pressure lowering, the boiling points both of the fat and moisture in the foods are lowered. Vacuum frying is an alternative technique to improve the quality of dehydrated food.

#### **f) Preservation by Carbonation**

Carbonation is the process of dissolving sufficient carbon dioxide in water or beverage so that the product when served gives off the gas as fine bubbles and has a characteristic taste. Carbonation adds

to the life of a beverage and contributes in some measure to its tang. Fruit juice beverages are generally bottled with carbon dioxide content varying from 1 to 8 g per litre. Though this concentration is much lower than that required for complete inhibition of microbial activity (14.6 g/litre), it is sufficient for supplementing the effect of acidity on pathogenic bacteria. Another advantage of carbonation is the removal of air thus creating an anaerobic condition, which reduces the oxidation of ascorbic acid and prevents browning.

#### **g) Preservation by Sugar**

Syrups containing 66 per cent or more of sugar do not ferment. Sugar absorbs most of the available water with the result that there is very little water for the growth of microorganisms hence their multiplication is inhibited, and even those already present die out gradually. Dry sugar does not ferment. Thus, sugar acts as a preservative by osmosis and not as a true poison for microorganisms. Fruit syrup, jam, jelly, marmalade, preserve, candy, crystallized fruit and glazed fruit are preserved by sugar.

#### **h) Preservation by Fermentation**

Decomposition of carbohydrates by microorganisms or enzymes is called 'fermentation'. This is one of the oldest methods of preservation. By this method, foods are preserved by the alcohol or organic acid formed by microbial action. The keeping quality of alcoholic beverages, vinegars and fermented pickles depends upon the presence of alcohol, acetic acid and lactic acid, respectively. Care should be taken to seal the fermented products from air to avoid further unwanted or secondary fermentation. Wines, beers, vinegar, fermented drinks, fermented pickles, etc., are prepared by these processes.

#### **i) Preservation by salt**

Salt at a concentration of 15 to 25 per cent is sufficient to preserve most products. It inhibits enzymatic browning and discoloration and also acts as an antioxidant. Salt in the form of brine is used for canning and pickling of vegetables which contain very little sugar and hence sufficient lactic acid cannot be formed by fermentation to act as preservative. It exerts its preservative action by (i) causing high osmotic pressure resulting in the plasmolysis of microbial cell! (ii) Dehydrating food as well as microorganisms by drawing out and tying up the moisture by ion hydration, (iii) ionizing to yield the chloride ion which is harmful to microorganisms, (iv) reducing the solubility of oxygen in water, sensitizing the cells against carbon dioxide, and interfering with the action of proteolytic enzymes.

#### **j) Preservation by Acids**

Low acid foods are spoilt rapidly. Highly acidic environment inhibits the growth of food spoilage organisms. Lowering the pH of certain foods by anaerobic fermentation, action on carbohydrates producing lactic acid is one of the methods of food preservation. The same spoilage inhibitory effects can be produced by acidic additives such as vinegar or citric acid. Nutrient losses through fermentation are small. In fact, in certain cases, the nutrient levels are increased, particularly through microbial vitamin and protein synthesis. Acids are added to or allowed to form in foods to preserve them. Acetic (vinegar), citric (lime juice) and lactic acids are commonly used for preservation. About 2 per cent acetic acid prevents spoilage of many products. Onions are bottled in vinegar with a little salt. Vinegar is also added to pickles, chutneys, sauces and ketchups. Citric acid is added to many fruit squashes, jams and jellies to increase the acidity and prevent mould growth.

**k) Preservation by Oil and Spices** A layer of oil on the surface of any food produces anaerobic conditions which prevent the growth of moulds and yeasts. Thus, pickles in which enough oil is added to form a layer at the top can be preserved for long periods. Spices like turmeric, pepper, and



asafoetida have little bacteriostatic effect and their ability to prevent the growth of other microorganisms is questionable. Their primary function is to impart their characteristic flavour to the food.

### **l) Preservation by Irradiation**

Sterilization of food by ionizing radiations is a recently developed method of preservation which has not yet gained general acceptance. The unacceptable flavour of some irradiated foods and the fear that radioactivity might be induced in such food has come in the way of its greater use. The harmful effects on the human body of radiation from nuclear explosions have given rise to such apprehension in the minds of many people.

### **m) Preservation by combination of two or more methods**

Fruits and vegetables can be well preserved using the combination of the two or more methods. A good example of such kind of method is preserving green fruits in a steeping solution where green fruits can be preserved using the combination of salt, acid and chemical.

**Steeping Preservation of Green Fruits:** Green fruits like green mango, olive, golden apple, aonla etc. can be preserved up to 9-12 months in ambient condition by this method. These fruits will be available year-round which, will be utilized as the raw material for preparation of pickles, chutneys etc. Also, by introducing this cheap method of preservation of the fruits, the farmers will get an easy way for disposal of the fruit commodity.

#### *Objective(s)*

- i. Utilization of the preserved fruits into pickle and chutney or some other products
- ii. To reduce post-harvest loss of the perishable agricultural produces
- iii. To generate income by supplying the preserved fruits to the pickle and chutney manufacturing factories.



Fig. 1. Steeping preserved green fruit in plastic drums

#### *Materials Required*

- i. Plastic drum/container with tight able lead
- ii. Adhesive tape (Masking tape)
- iii. Glacial acetic acid
- iv. Potassium metabisulphite (KMS)
- v. Salt

### *Methodology for preserving green fruits*

- i. Sound fruits are selected, washed them with clean water, (for medium or large size mangoes, seeds are removed and the fruit flesh is made into 4 to 8 slices).
- ii. A steeping solution containing 8.0 per cent salt, 1.25 per cent glacial acetic acid and 0.1 per cent potassium metabisulphite (KMS) is prepared (for preparation of 1kg solution, 80 gm salt, 12.5 gm glacial acetic acid and 1 gm potassium metabisulphite (KMS) are mixed with 906.5 gm clean water)
- iii. The plastic drum/ container is properly washed with cleaned water and sterilized with hot water.
- iv. The fruits/slices are kept in the cleaned and sterilized plastic container and the steeping solution is added over the slices (for 1kg fruits, approximately 1.5 kg of steeping solution is required).
- v. The filled in container is then closed with the lead tightly and the junction area of the container and lead is covered with adhesive tape so that the container becomes properly airtight.
- vi. The container is stored in a cool place.
- vii. Before using the fruits preserved in steeping solution, the fruits should be washed with clean water and soaked at hot water (at about 80°C) for 3 minutes.

## **4. Selected Low-Cost Processing Technologies**

### **a) Chutneys**

A good quality chutney should be palatable and appetizing. Mango chutney is an important food product exported from India to many countries. Apple and apricot chutneys are also very popular in the country. The method of preparation of chutney is similar to that for jam except that spices, vinegar and salt are added. The fruits/vegetables are peeled, sliced or grated, or cut into small pieces and cooked in water until they become sufficiently soft. The quality of chutney depends to a large extent on its cooking which should be done for a long time at a temperature below the boiling point. To ensure proper thickening, cooking is done without a lid even though this results in some loss of volatile oils from the spices. Chopped onion and garlic are added at the start to mellow their strong flavours. Spices are coarsely powdered before adding. Vinegar extract of spices may be used instead of whole spices. Spice and vinegar are added just before the final stage of cooking, because prolonged boiling causes loss of some of the essential oils of spices and of vinegar by volatilization. In mango and apricot sweet chutneys, where vinegar is used in large quantity, the amount of sugar added may be reduced, because vinegar itself acts as a preservative. These chutneys are cooked to the consistency of jam to avoid fermentation.

### **b) Pickles**

The preservation of food in common salt or in vinegar is known as pickling. It is one of the most ancient methods of preserving fruits and vegetables. Pickles are good appetizers and add to the palatability of a meal. They stimulate the flow of gastric juice and thus help in digestion. Several kinds of pickles are sold in the Indian market. Mango pickle ranks first followed by cauliflower, onion, turnip and lime pickles. These are commonly made in homes as well as commercially

manufactured and exported. Fruits are generally preserved in sweetened and spiced vinegar, while vegetables are preserved in salt.

**Preparation of pickle from steeping preserved fruits:** Pickle can be prepared from steeping preserved fruits according to the following formulation:

*Ingredients:*

Sl. No.	Item	Quantity (gm)
1	Half dried fruit slices	1000
2	Sugar	150
3	Mustard oil	650
4	Turmeric Powder	8
5	Red chili powder	35
6	White Mustard	20
7	Fennel	12
8	Aniseed	5
9	Cumin	4
10	Black Pepper	1
11	Unripe Fruit Pulp	300
12	Ginger	100
13	Garlic	20
14	Acetic Acid	20
15	Salt	45
16	Black Cumin	8
17	Fennel	10
18	Aniseed	8
19	Mustard (Red)	8

*Equipment*

- i. Blender/ Mortar & Pestle
- ii. Utensils

*Methodology*

- i. The fruit slices preserved in steeping solution, will be washed with clean water and soaked at hot water (at about 80°C) for 3 minutes.
- ii. Turmeric is mixed with the fruits/ fruit slices properly 50 gm turmeric is mixed with 1Kg of slices) and partially dried on a net rack (a rack made with wooden or bamboo frame whose top will be covered with a nylon net). The slices will be dried up to 50% of its original weight so that 50% weight will be lost due to removal of moisture from the slices.
- iii. All the materials are weighed according the ingredients.

- iv. The spices as stated at ingredient no. 6-10 are fried as usually and powdered with a spice grinder/mortar and pestle and all these spice powder except white mustard powder are mixed together and kept in a pot. The spices as stated at ingredient no. 16-19 which will be used as it is are fried lightly.
- v. Ginger, garlic and green mango are peeled and blended in a blender or made into pulp with mortar and pestle.
- vi. Turmeric and red chili powder are mixed with the mixture of ginger, garlic and green mango pulps and mixed properly to make into a paste.
- vii. Mustard oil is heated and the half-dried fruits/ fruit slices are fried lightly, separated from oil and put in a pot. The paste of ginger, garlic and fruit pulps, turmeric and red chili powder are then fried in the oil left after frying half dried slices. Then the fried half dried slices and sugar are added to the mass. The lightly fried spices as stated at ingredient no. 16-19 are added and then the mustard powder is added to it. Then gradually, fennel, aniseed, cumin, black pepper powder and salt are added and mixed properly. At last, acetic acid is added and mixed properly. The pickle is removed from the furnace while the pleasant flavour is come out from the pickle.
- viii. Pickle is filled in sterilized glass jars (previously sterilized in boiling water for about 20 to 30 min.) and capped airtight with sterilized cap. Pickles are stored in warm places for about 15 days for ageing. After ageing the product will be palatable.

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## Thematic Area-D: Food Safety and Quality Assurance of Fresh and Processed Commodities

*Topic D-1.*

### Quality & Food Safety Assurance and Sanitary & Phyto-Sanitary Standards (SPS) for Fresh Fruit and Vegetables

#### 1. Quality & Food Safety Assurance for Fresh Fruit and Vegetables

##### 1.1 Quality assurance

##### 1.1.1 The Concept of Quality in the Horticultural Sector

Quality is like art, everybody praises it, “everybody recognizes it, but each one has its own understanding of what it is”. Objectively, quality is the aptitude of a good (product) or service to satisfy the needs of its users. ISO Standard 8402:1987 defines quality as “The totality of features and characteristics of a product or service that bears its ability to satisfy stated or implied needs”. This definition implies “consumer’s satisfaction”, fulfilling their needs and expectations, in an organization committed to continuous improvement and effectiveness. The five important words associated with quality are then:

**Aptitude, Satisfaction, Need, User and Continuous Improvement:** It is therefore essential when producing quality products to know who will be the user(s) of the product and what are the specific and constantly changing needs to be addressed. For agri-food products, quality may be regarded as a complex characteristic of foods that determines its value and acceptability by consumers (22nd Regional FAO Conference for Europe, Oporto, 2000). Quality components for foods are related to:

Characteristics of the food:

- hygienic quality and safety
- nutritional quality
- organoleptic quality

Use or service quality:

- convenience (easy to use)
- conservation

Psychosocial or subjective quality:

- satisfaction, pleasure

These characteristics define the options to satisfy implicit or explicit needs. Explicit needs are those conforming to the declared needs of an objective user. Explicit need is the right of a consumer to choose the product rewarding his senses (smell, taste, sight, touch and ear).

Quality attributes for a product that fulfils needs and expectations of consumers (and other actors in the chain) belong to two main categories: attributes relating directly to the product, called “**product attributes**”, and attributes relating to production and processing, called “**process attributes**”. The

first include those relating to taste, appearance, texture, consistency, smell, safety and some functional characteristics, such as post-harvest life and convenience. “process attributes” on the other hand, include among others, organic production, GMOs, environmental concerns and origin.

Therefore, as long as product quality is defined according to the needs of its user, it will remain strongly influenced by the principles, values, culture, ethics and religious values of individuals. Altogether, consumers may choose products not only by “product attributes”, but also by “process attributes” involving the way in which they are produced and processed: origin, environmental impact of production practices, etc. Consumers may pay a higher price for products conforming to these requirements or attributes.

### **1.1.2 Applying the Principles of Post-Harvest Management to Maintain the Quality and Safety of Fresh Fruits and Vegetables**

Quality assurance of horticultural produce allows customers access to products satisfying their expectations. Quality assurance and safety of horticultural produce starts at the very moment when varieties fulfilling the consumers expectations and those of other actors in the chain are selected according to taste, nutritional value, texture, post-harvest life, perishability rate, etc.

The adequate post-harvest handling of fresh fruits and vegetables must account for the cultural, economic, technological, environmental and administrative context of the target market. On the other hand, the objectives of efficient post-harvest processes and of quality improvement and safety programmes must conform to the needs of the actors along the product handling sequence. Any action plan must incorporate and direct this multiplicity of objectives in such a way that the requisites of all involved are considered. Objectives of post-harvest technologies for products include:

- maintaining the quality and safety to fulfil the needs of the intended market;
- creating and capturing market opportunities;
- adding value and increasing income and profit;
- satisfying the customer;
- reducing costs and making processing more efficient.

These objectives can be addressed at a:

- country and governmental level;
- regional level;
- local level;
- company level (farm, trader, exporter, services, etc.).

As a result of these objectives, country and local projects and programs may result, and/or specific company directed action plans and projects for a product or a group of products.

Maintaining and enhancing quality of fresh fruits and vegetables entails:

- knowing the order of magnitude of problems likely to occur (losses in quality and quantity), their causes and opportunities to differentiate a product to comply with the requirements of a particular market;
- finding solutions to problems and available technologies to secure already identified market opportunities;
- assessing the impact of simple changes in product handling;
- training and involving the people responsible for these changes;

- identifying problems requiring more detailed research.

## **1.2 Food Safety Assurance**

### **1.2.1 The Concept of Food Safety**

Food safety may be defined as the assurance that food will not cause harm to the consumer when it is prepared or eaten according to its intended use. This guarantee means reducing risks that may result from the production and handling of produce.

Public concern about food safety has increased dramatically in the last years as a result of food-borne diseases. The World Health Organization (WHO, 1999) estimates in the hundreds of millions the number of people suffering from diseases resulting from contaminated food or water. Even if reporting this data is difficult, statistics show that both in developed and developing countries, food-borne diseases are rising (resulting from more trustable reporting of data and occurrence). In developed countries, more than 30 percent of the population suffers every year from food-borne diseases, with 70 percent of worldwide diarrhoea resulting from biological contamination of foods. Contaminated food is also responsible for cholera, which together with various types of diarrhoea, contributes significantly to malnutrition problems.

Risks associated to chemical contaminated foods, such as pesticide residues, although less dramatic and immediate in their outcome, are a permanent concern for customers. With enhanced awareness of the presence of pesticides in fresh fruits and vegetables resulting in occasional intoxications, their long-term effect is important. Agrochemical intoxication of workers and infants is a risk associated with their use, with scientific evidence pointing to other direct and indirect risks. Pesticides residues, throughout the food chain, resulted in reduced pelican and eagle populations. Toxicological research shows pesticides to be responsible for cancer and birth defects and for damaging the interphase between the nervous, endocrine, reproductive and immunological system in mammals.

#### **1.2.1.1 Objectives of Food Safety Assurance Programs**

Strategies to assure quality and safety rely on guaranteeing and certifying, with processing and production standards, the attributes produce must conform to. This entails verifying that the standards' provisions are met and conformance made apparent through marks, labels or certifications.

Public and private strategies addressing risk of contamination and their controls may differ from country to country. Public strategies usually direct institutional efforts and regulations to both locally produced and imported foods. For fruits and vegetables, National Codex Committees strive to align national regulations with Codex recommended codes of practice. These codes rely on implementing GAPs, GHPs and GMPs to prevent and control contamination hazards in primary production and post-harvest handling by using the hazard analysis approach. The objectives of safety assurance programs are to:

- protect local consumers assuring the safety of fruits and vegetables produced and traded;
- enhance confidence of foreign markets on safety of locally produced products;
- assure the acceptance in target markets of the exporters' national programs and/or protocols;
- increase the offer of safe foods;
- differentiate between private companies assuring safety of their offers.

These objectives apply nationally, regionally, locally, for a group of producers/exporters or at the company level (farm, trading company, service company, etc.) and result in programs, national/local projects, action plans and projects that meet specific company needs for a product or group of products. Implementing quality assurance programs means:

- knowing the hazards, and their causes, associated to production and post-harvest handling of produce;
- understanding that safety assurance is a shared responsibility under the chain approach.

#### **1.2.1.2 Safety hazards for fresh fruits and vegetables**

The production chain for fresh fruits and vegetables has several links: production, harvesting, post-harvest treatments, packaging, transport and storage, each with its own contamination hazards and, depending on size of operations, of production and of processing systems in use. Safety assurance programs identify these hazards throughout the entire produce production and handling chain.

Three different types of hazards can be associated to product safety: **biological**, **chemical** and **physical**. Different methods or practices allow for the dissemination of hazards in the production and handling stages:

##### *Primary production and harvest*

- The environment as contaminant.
- Agricultural inputs (water, soil, organic and chemical fertilizers, etc.).
- Inadequate handling of agro-supplements (mixtures, storage, dosage, etc.).
- People and animals.
- Inappropriate facilities.
- Contaminated tools.
- Production methods, crop-seed quality protection methods, planting distances, fertilizing, irrigation, pests and disease
- controls, shrub management, etc.

##### *Post-harvest handling*

- Inadequate facilities.
- Unsuitable packaging.
- Inadequate/contaminated equipment (storage rooms, grading equipment, etc.).
- People and animals.
- Inputs for post-harvesting (washing water, waxes, etc.).

### **1.2.2 Programs for Food Safety Assurance of Fresh Fruits and Vegetables**

Programs for quality assurance of fresh fruits and vegetables concentrate in identifying hazards, prioritizing their importance according to the risks represented for produce safety and identifying appropriate prevention and control practices.

#### **1.2.2.1 Prerequisite programs**

Include Good Agricultural Practices, Good Manufacturing Practices and Good Hygienic Practices. These are the back-bone for quality assurance and safety programs.



#### **a) Good Agricultural Practices**

Include practices improving conventional production and produce handling methods - starting from the selection of the soil to be cultivated - and activities related to production and handling of produce in the field, always stressing SAFETY. Practices also aim at reducing negative impacts of production systems on the environment, fauna, flora and workers' health. GAP in primary production, relies on hazard identification and detection of appropriate prevention and control practices. Specifically for a farm or a production system, Best Practices should be identified within the Good Practice options as those more suitable for production conditions and the environment in the area and in the farm. Standard for Good Agricultural Practices (GAP) for Fruits and Vegetables has been described in detailed under topic A-2.

#### **b) Good Manufacturing Practices**

Include practices preventing and controlling post-harvest hazards affecting produce safety and having minimum effect on workers and the environment.

From the chain standpoint, hazard prevention and control in stages previous to production and harvest of produce using GAP are essential to assure success of implementing Good Manufacturing Practices programs. The objective is to ensure that safe raw materials go into the packaging plants with assured safety resulting from using Best Practices in post-harvest handling. Enforcing GMP programs supposes identifying associated hazards in post-harvest handling and suitable preventive and control practices.

#### **c) Good Hygienic Practices**

Include all those measures and conditions required to prevent and control produce contamination hazards, mainly biological. In practical terms, the implementation of GAP and GMP (at primary and post-harvest stages) already include all recommendations regarding hygiene practices to produce and handle safe products. (Reference reading: Code of Hygienic Practices for Fresh Fruits and Vegetables).

#### **d) Good Practices as programs for safety assurance of fresh fruits and vegetables**

Good Practices, as seen from safety assurance programs for fresh fruits and vegetables imply:

- knowing the product's potential contamination hazards in production and handling;
- prioritizing these dangers (define risk);
- determining prevention and control procedures for each operation (implementing GAP and GMP), for identified and prioritized hazards;
- applying support procedures, standardized sanitary operating procedures (SSOP) and product recall procedures;
- traceability: consumers tracking and information procedures;
- continuous training to different chain players;
- keeping a record and documentation system.

#### **e) Standard Operating Procedures (SOPs)**

A written, detailed and accessible description for use by personnel explains how each operation in the flow diagram is performed, including cleaning and maintenance procedures. All are known as SOPs.

Operating programs for sanitation and maintenance are put in place to assure that maintenance and sanitation (cleaning) of facilities, tools and equipment, as well as pests' control and waste handling, are efficiently and appropriately done. These programs include:

- i. Procedures and methods for cleaning and disinfection: Cleaning, hygiene and disinfection programs, should be designed considering existing facilities where product production and adaptation is completed, as well as sanitation facilities, offices, equipment, tools, etc., are available. Cleaning programs must include name of responsible person, working schedules, chemicals and concentrations used for cleaning (equipment and facilities), temperature requirements, cleaning and sanitizing procedures, etc.
- ii. Non-contaminating products and chemically and microbiologically acceptable water, properly used, must be employed.
- iii. Pests' control: Pests are a serious threat affecting safety and life of foods and result in quality losses and increasing chances of food-borne diseases. Programs precluding access, infestation and monitoring for their appearance and eradication are necessary preventive measures.
- iv. Waste handling or management: Appropriate measures should be taken to remove and store waste and trash produced; these should be absent from areas where fruits and vegetables are handled and stored or from working zones and outlying areas.
- v. Monitoring: Procedures checking the efficiency of the maintenance sanitizing systems should be applied and sampling of outlying areas; areas in contact with produce should be implemented and examined regularly to reflect possible changing conditions.
- vi. Recall procedures: Efficient procedures should be used, allowing for the complete and fast recall from the market of fruits and vegetables showing safety hazards. Until a decision is taken, recalled products should be kept under surveillance to be either destroyed, not used for human consumption or declared safe.
- vii. Training: To assure the proper implementation of preventive and control measures for identified hazards, the commitment of personnel involved in the process is required as they are responsible for compliance. Success highly depends on the understanding by each of the players in the chain of specifics of food safety and their role in its maintenance. Therefore, training programs aimed at enhancing awareness of the proper application of practices along the processes are essential and should encompass all actors playing a direct role in production (producers, packing and transport personnel, etc.) and those supporting the chain (technicians, extension workers, researchers, etc.).
- viii. Training programs must be periodically updated to ensure that all players are aware of all procedures to maintain safety of fresh fruits and vegetables. It is therefore necessary to articulate efforts between research institutions and the private sector (producers, packing and transport personnel, etc.) to ensure that all are aware of advances in product safety.

#### **f) Traceability: consumers' tracking and information procedures**

Traceability is the capacity to identify a product origin: where it was produced, inputs received, tracking post-harvest handling, and through appropriate records, following it along the supply chain. These records must be kept for some time (two years) as proof of its history. In quality and safety assurance programs, traceability allows proving conformance to specific standards.

Traceability, more than just being a label identifying production, origin and price, is a system promoting customer confidence and useful to settle quality and safety disputes

To allow for efficiency, traceability schemes rely on an adequate coordination of the many actors in the production and post-harvest handling chain. Proper information must flow easily from link to link, enabling the adoption of actions resulting in safe handling and storage. Consumers should also have this information available to ensure maintaining the required hygienic and use aptitudes.

#### **g) Personnel hygiene**

This is covered by Recommended International Code of Practice, General Principles of Foods Hygiene and in the Code of Hygiene for Fresh Fruits and Vegetables. Personnel may become a safety risk for fresh fruits and vegetables if they have inadequate personal cleanliness, if they suffer from or carry diseases or have an inadequate personal behavior. Training programs and other measures to avoid contact between produce and personnel representing a safety risk must be enforced. Strategies to improve personal cleanliness (protective clothing, hand washing) and practices promoting adequate behavior at work forbidding eating, smoking or spitting should also be adopted to safe-guard safety. These strategies and procedures are usually covered in the general hygiene protocols available in the company/plant.

### **1.2.2.2 Hazards Analysis and Critical Control Points System (HACCP)**

#### **a) Concept**

**What is it?** Is a control and systematic recording methodology, originating at the USA food processing company Pills-bury and in the North American Space Administration (NASA) to prevent food contamination in space flights and to avoid the effects of astronauts suffering food poisoning in a space mission. With time, the system evolved into a useful tool for the food processing industry, substituting the old-fashioned quality control systems relying on end product inspection and testing and destroying defective products; for quality assurance procedures where processing and production is adjusted along the way to avoid defective products by anticipation and adoption of prevention and control measures. HACCP performs a detailed analysis of the whole production system to identify physical, chemical and biological hazards and those points where control measures should be applied to minimize or reduce risks to acceptable levels. Steps taken to minimize risks should be properly registered and kept as proof of actions adopted.

**Advantages.** HACCP is applied to food safety management and uses a methodology to identify and control critical points in food handling, to prevent safety problems. It is science-based and applies a systematic approach, identifying specific hazards and measures for their control to ensure food safety.

**Foundations of HACCP.** HACCP is based on hazard analysis, a series of logical steps to identify and provide answers to potential problems. Hazard analysis is the process of data gathering and evaluation on hazards associated to a particular food and of deciding which are significant and should be approached with a safety assurance program. HACCP consists of:

- analysis of potential hazards in production and post-harvest handling; · identification of the points where the hazard can take place;
- establishment of the critical points for product safety;
- establishment of effective controls to minimize hazards;

- establishment of a system to monitor critical points;
- review of hazards, hazard analysis, critical points and follow-up records.

Hazard analysis can be simple or very complex depending on the safety assurance program enforced. Sometimes safety programs in primary production and post-harvest result in voluminous records supporting the HACCP system. However, these programs, depending on the scale of primary operations and the producers' resources, must concentrate in applying good practices backed up only by essential records.

## **b) Establishing a HACCP system**

Prior to applying the HACCP system, prerequisite programs (GAP, GMP, GHP, training programs, traceability, standardized sanitary programs, etc.) should be in place. Establishing a HACCP program relies on the application of the seven HACCP principles:

- Identify the hazards.
- Establish the critical control points (CCPs).
- Establish critical limits (CL) for each CCP.
- Establish a system to monitor control of the CCP.
- Establish the corrective action to be taken when monitoring indicates that a particular CCP is not under control.
- Establish procedures for verification to confirm the HACCP system is working effectively.
- Establish documentation concerning all procedures and records appropriate to these principles and their application.

Applying these seven principles requires the following 12 steps:

- Step 1. Assemble the HACCP team.
- Step 2. Product description.
- Step 3. Identify intended use of product.
- Step 4. Establish a flow diagram.
- Step 5. On-site confirmation of flow diagram.
- Step 6. List all potential hazards, conduct a hazard analysis and consider any measures to control identified hazards.
- Step 7. Establish CCP.
- Step 8. Establish critical limits for each CCP.
- Step 9. Establish a monitoring system for each CCP.
- Step 10. Establish corrective actions.
- Step 11. Establish verification procedures.
- Step 12. Establish documentation and record keeping.

Steps 1 to 5 are preliminary to the plan, steps 6 to 8 apply the 7 principles and define the plan and steps 9 to 12 support the implementation.

A detailed description of each step can be found in A training manual on food hygiene and the Hazard Analysis and Critical Control Point (HACCP) system, FAO, 2002.

Difficulties defining critical control points and critical limits make HACCP not mandatory for the primary sector.

A critical control point as defined in the HACCP system is a phase in the process where an essential control may be applied to prevent or eliminate a hazard or to reduce this hazard to acceptable levels.

In primary production, for instance, it is not possible to establish just one control ensuring hazard elimination. Internationally, mechanisms establishing barriers along the chain to prevent and control were attempted. These controls, or good practices, together with proactive control and record keeping strive to keep out of the food chain hazards such as physical, chemical and biological contaminants.

For fresh fruits and vegetables, it is also difficult to establish an acceptable level for biological contaminants and efforts are directed to have pathogen free fresh foods. Relatively few steps during processing are addressed at reducing or eliminating biological contamination in already contaminated foods; measures aim at preventing hazards as a result of GAP, GMP and GHP in place.

In post-harvesting, some handling procedures may reduce the occurrence of pathogens: cooling temperatures, thermal processing, irradiation and water sanitizing procedures. But, except for irradiation, there is no guarantee of hazard reduction to acceptable levels, or elimination. New technologies, difficult to access for small producers, are currently being tried.

These constraints should be considered by producers contemplating adoption of a HACCP system. They should always remember that hazard reducing actions (biological in particular) are more preventive than established CCPs.

In any case the systematic approach involved in HACCP (steps in logical sequence, hazard analysis and control points) is valuable to apply safety assurance programs for fresh fruits and vegetables.

## **2. Sanitary and Phytosanitary (SPS) Agreement**

### **2.1 Overview of Sanitary and Phytosanitary (SPS) Agreement**

#### **2.1.1 Introduction**

The Sanitary and Phytosanitary (SPS) Measures Agreement deals with risks to human, animal and plant health and the requirements on products that were declared by the Technical Barriers to Trade (TBT) Agreement. There are three intergovernmental mechanisms of setting the standards by which the health of people, animals and plants are protected. These are:

- Codex Alimentarius Commissions (CAC), which sets sanitary and technical standards for food safety including: food standards for commodities; codes of hygienic or technological practice; limits for pesticide residues in foods; and standards for contaminants and food additives.
- Office International des Epizooties (OIE), which deals with animal health and zoonosis and sets sanitary standards for the international movement of animals and animal products.
- International Plant Protection Convention (IPPC), which provides phytosanitary standards on how to prevent the spread and introduction of pests of plants and plant products.

The Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement) is one of the multilateral trade agreements, which all members of the World Trade Organization (WTO) are committed to observe. As the membership of the WTO grows, the principles embodied in the SPS Agreement are becoming de facto international rules governing the domestic and foreign trade of foods, feeds and other agricultural commodities. The compliance with the obligations of the SPS Agreement as well as the exercise of rights accorded by the Agreement are a key to ensuring food safety and animal and plant health in all countries, while promoting free trade and development.

The Uruguay Round of the Multilateral Trade Negotiations was successfully concluded in 1994. In January 1995, the WTO was established with its headquarters located in Geneva, Switzerland, replacing the Secretariat of the GATT (General Agreement on Tariffs and Trade). Although the long-standing framework of the GATT continues to exist in the form of GATT 1994, the WTO has seen a number of new rules added and the coordination mechanisms reinforced. The SPS Agreement is one of the new elements in the WTO system and constitutes a part of the package of multilateral agreements, which WTO members are required to comply with. The SPS Agreement has its root in the Technical Barriers to Trade (TBT) Agreement established by the Tokyo Round, as a pluri-lateral agreement. The SPS Agreement can also be considered as complementing Article XX (b) of the GATT 1947, which allows contracting parties to apply measures “necessary to protect human, animal or plant life or health”. While this article was open to a range of different interpretations, the SPS Agreement has brought about, for the first time, more concrete and specific rules based on scientific approaches in this area.

### 2.1.2 Overview of the SPS Agreement

The SPS Agreement covers food safety, animal life and health as well as plant life and health, in accordance with its scope and objectives found in the Preamble and Article 1. The Article 2 sets out basic rights and obligations of WTO members with regard to sanitary and phytosanitary measures: these measures should be applied only to the extent necessary; measures should be based on scientific principles and not maintained without sufficient scientific evidence; and no arbitrary or unjustified discrimination is allowed, etc. Below are some of the principal provisions of the Agreement.

**Harmonization:** The Article 3 of the SPS Agreement encourages WTO members to harmonize their national measures with international standards, guidelines and recommendations. The standards and related texts adopted by the Codex Alimentarius Commission (CAC), the International Plant Protection Convention (IPPC) and the Office International des Epizooties (OIE) are recognized under the SPS Agreement as international benchmarks within the fields of food safety, plant life and health and animal life and health, respectively. Country measures conforming to international standards are “deemed necessary” and “consistent with the SPS Agreement”. Stricter measures can be applied only when there is scientific justification or when a higher level of sanitary or phytosanitary protection is chosen by the member.

**Equivalence:** The Article 4 of the SPS Agreement emphasizes the notion of equivalence. WTO members have to accept different measures providing the same level of health protection against risks of disease or contamination, even if they are less sophisticated than those used by them. Steps to be taken to promote recognition of equivalence have been identified in “Decision on the Implementation of Article 4 of the Agreement on the Application of Sanitary and Phytosanitary Measures” (G/SPS/19), effective on 24 October 2001.

**Risk Assessment:** The Article 5 of the SPS Agreement underscores the importance of risk assessment as the scientific basis for sanitary and phytosanitary measures. It also identifies factors that need to be taken into account when determining the member’s appropriate level of protection (ALOP) from sanitary and phytosanitary risks. Consistency is a key principle when applying an ALOP so as to avoid arbitrary or unjustifiable distinctions and discriminations. Provisional measures can however be applied by a member when relevant scientific evidence is insufficient on a condition that additional information is sought for a more objective risk assessment and reviewing the measure. WTO members have a right to request an explanation to another member applying a measure constraining trade or not based on international standards.

**Adaptation to Regional Conditions:** The Article 6 of the SPS Agreement requires a WTO member’s sanitary and phytosanitary measures to be adapted to the characteristics of the area from which the

product originated and to which the product is destined. In so doing they should recognize pest- or disease-free areas as well as areas of low pest or disease prevalence.

**Transparency:** The Article 7 of the SPS Agreement refers to transparency as an important tool for the effective operation of the Agreement. In accordance with the Annex B of the Agreement, WTO members need to ensure the publication of their regulations, the establishment of Enquiry Points and the adherence to the notification procedures. Information exchange taking place between delegations during the sessions of the SPS Committee also contributes to ensuring transparency.

**Technical Assistance:** The Article 9 of the SPS Agreement encourages WTO members to facilitate the provision of technical assistance, either directly from a member to another, or through international organizations. Technical assistance should particularly address the need of exporting, especially developing, countries. This important subject will further be discussed in some of the following sections in this paper.

**Special and Differential Treatment:** Under the Article 10 of the SPS Agreement, WTO members need to take account of the special needs of developing countries, in particular least-developed countries. Longer time-frames for compliance should be accorded to the products of interest to developing countries if phased introduction of measures is possible. The SPS Committee, upon request, can accord specified, time-limited exceptions from obligations, although no member has formally made such a request so far. The same Article also encourages active participation of developing countries in the work of so-called “three sisters” (CAC, IPPC and OIE).

## 2.2 SPS Measures at Agriculture Sector in Bangladesh

Bangladesh became a signatory to FAO, International Plant Protection Commission with the commitment of formulating rules and regulations to prevent the spread of destructive plant pests and diseases. The SPS Agreement dealt with all aspects of phytosanitary measures that may directly or indirectly affect trade. The IPPC should cover at least the same issues as the SPS Agreement. As trade is global it was considered essential that standards are international rather than regional. The Uruguay Round Agreement recognizes the right of the member countries to adopt measure to protect human, animal or plant life. In Bangladesh, numerous harmful organisms threaten plant production. It is important to combat all plant disorders already present in the country. SPS measures include all relevant laws, decrees, regulation requirements and procedures, inter alia, and product criteria processes and production method, testing, inspection, certification, and approval procedures, treatments and methods or risk assessment.

SPS measures include all relevant laws, decrees, regulations and requirements associated with the transport of animals or plants. In Bangladesh, Ministry of Agriculture (MoA), Ministry of Fisheries and Livestock (MoFL), Ministry of Food (MoF), Ministry of Health and Family Planning (MoHFP) and Bangladesh Standard and Testing Institution (BSTI) deals with the SPS measures. Bangladesh considers SPS measures both for import and export of agricultural products. We import many items including food grains, agricultural plants and plant products, veterinary drugs, additives, pesticides, etc. The activities and present status regarding SPS measures of relevant sectors of Bangladesh are interpreted below in brief.

Bangladesh being an agricultural country has to import a huge quantity of seeds and other plant and plant products. Annually on an average 1.5 million MT of plants and plant products are imported for which plant quarantine inspection are needed. Sometimes to ensure phytosanitary measure plant quarantine treatment are adopted. Similarly, different types of plants and plant products are also exported to other countries of the world. Annually, on an average 3.5 million MT of agricultural commodities, mainly raw jute and jute products, handicrafts, vegetables, fruits are inspected for the purpose of export for which Phytosanitary Certificates are issued. Basically, plant quarantine is a



preventive measure; it is a front of defense against the introduction of plants pests destructive to agricultural crops.

Bangladesh became a signatory to IPPC in 1974. It also became a member of the Asia and Pacific Plant Protection Commission in 1978. Bangladesh is committed to strengthen plant quarantine services and enhance regional cooperation among other member countries in the field of plant quarantine. The existing plant quarantine legislation known as “Destructive Insects and Pest Rules, 1966 (Plant Quarantine)” amended in July 1989.

**SPS-related Services at National Level:** The MoA is responsible for execution and implementation of the national and international plant quarantine legislations and agreements. At present sixteen “plant quarantine stations” are functioning in different entry points of the country. Important plant quarantine stations are at Headquarter, Zia International Airport, Shah Amanat Airport, Chittagong Seaport, Mongla Seaport, Benapole Land Check Posts.

**Method Practiced in Bangladesh to Issue Phytosanitary Certificate for Export:** A Phytosanitary Certificate of Exportation must accompany plants and plants products. Certification is made as follows:

- a) An exporter of plant and plant products submits application in prescribed form to the Director or Plant Quarantine Officer concerned. The application is submitted at least a day before exportation for perishable items and 15 days before the date of the exportation for nonperishable items for proper inspection and treatment (if required) and certification.
- b) If the plant or plant product is found, upon inspection to be free from injurious insect and plants diseases, a Phytosanitary Certificate is issued by the Director or Plant Quarantine Officer.
- c) No Phytosanitary Certificate is issued for any plant or plant products mixed with other plants or plant products, which are infested or infected.
- d) No Phytosanitary Certificate is issued for any plant or plant products, intended for shipment to a country in which its entrance is absolutely prohibited.
- e) All risks or damages of any kind associated with, or resulting from fumigation or other treatment are borne by the exporter.

Perishable items leave national territory within 24 hours of the time issue of the Phytosanitary Certificate and nonperishable item must have left national territory within 15 days of the time issue of the Phytosanitary Certificate.

**Phytosanitary Certificate for Imported Plant and Plant Products:** A Phytosanitary Certificate shall accompany all plants and plant products from the country of origin. Persons who import any plant or plant products shall submit the Phytosanitary Certificate to the Plant Quarantine Officer for his perusal and record.

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## **Quality and Food Safety Assurance for Processed Products from Fruits and Vegetables Focusing GMP and HACCP**

### **1. Managing Quality Assurance in the Fruits and Vegetables Processing Industries**

When a new enterprise is established it is necessary to both standardise the quality of fruit, vegetable and allied produces and their products and also ensure that they are safe to eat. The owner should work with the staff to go through each stage of processing, from purchase of raw materials and ingredients to the consumption of the final product, to identify where factors exist that could influence either product quality or safety and to then devise procedures that control those factors. This is known as developing a Quality Assurance System.

In order to improve and control product quality it is essential to fully understand the meaning of the term quality. A common definition is "achieving agreed customer expectations or specifications". In other words, the customer defines the quality criteria needed in a product. To meet this standard the manufacturer puts in a Quality Control System to ensure that the product meets these criteria on a routine basis.

Implementation of this system starts with processors deciding which focus to address first: improvements to product quality or improvements to product safety. They then examine every stage in the process to find where improvements can be made. If safety is the main reason for doing an analysis, the aim is to draw attention to potential risks and then develop measures to monitor and control the risks so that they do not become a hazard.

#### **1.1 Hygiene and Sanitation**

Laws relating to food production premises and the staff who handle foods are among the most widely enforced in most developing countries. There are numerous examples of prosecutions by Food Inspectors from Ministries of Health or other enforcement authorities and in some cases, enforced closure of the business for failure to comply with these laws. Guidelines on the design and construction of premises and hygiene of operators should therefore be consulted before submitting a new processing facility for inspection and certification.

These guidelines should be rigorously enforced in routine production to ensure that safe, high quality products are produced. In summary the laws which are concerned with the following aspects of health, hygiene and sanitation should be followed strictly:

- processing that is carried out in unsanitary conditions
- or where food is exposed to the risk of contamination
- equipment (which must be able to be cleaned and kept clean)
- persons handling food and their responsibilities to protect it from contamination
- building design and construction including water supplies,
- drainage, toilet facilities, wash-hand basins, provision of first aid facilities, places to store clothing, facilities for washing food and equipment, lighting, ventilation, protection against infestation by rats and insects and removal of wastes.

## 1.2 Good Manufacturing Practice (GMP) and Standard Operating Procedure (SOP)

**Good Manufacturing Practices (GMP)** are the practices required in order to conform to the guidelines recommended by agencies that control authorization and licensing for manufacture and sale of food, drug products, and active pharmaceutical products. These guidelines provide minimum requirements that a pharmaceutical or a food product manufacturer must meet to assure that the products are of high quality and do not pose any risk to the consumer or public.

Good Manufacturing Practice guidelines provide guidance for manufacturing, testing, and quality assurance in order to ensure that a food or drug product is safe for human consumption. Many countries have legislated that food and pharmaceutical and medical device manufacturers follow GMP procedures and create their own GMP guidelines that correspond with their legislation.

All guidelines follow a few basic principles:

- Manufacturing facilities must maintain a clean and hygienic manufacturing area.
- Controlled environmental conditions in order to prevent cross contamination of food or drug product from adulterants that may render the product unsafe for human consumption.
- Manufacturing processes are clearly defined and controlled. All critical processes are validated to ensure consistency and compliance with specifications.
- Manufacturing processes are controlled, and any changes to the process are evaluated. Changes that affect the quality of the drug are validated as necessary.
- Instructions and procedures are written in clear and unambiguous language. (Good Documentation Practices)
- Operators are trained to carry out and document procedures.
- Cross contamination with unlabeled major allergens is prevented.
- Records are made, manually or by instruments, during manufacture that demonstrate that all the steps required by the defined procedures and instructions were in fact taken and that the quantity and quality of the food or drug was as expected. Deviations are investigated and documented.
- Records of manufacture (including distribution) that enable the complete history of a batch to be traced are retained in a comprehensible and accessible form.
- The distribution of the food or drugs minimizes any risk to their quality.
- A system is available for recalling any batch from sale or supply.
- Complaints about marketed products are examined, the causes of quality defects are investigated, and appropriate measures are taken with respect to the defective products and to prevent recurrence.

Practices are recommended with the goal of safeguarding the health of consumers and patients as well as producing good quality food, medicine, medical devices, or active pharmaceutical products. GMP guidelines are not prescriptive instructions on how to manufacture products. They are a series of general principles that must be observed during manufacturing.

**Standard Operating Procedure (SOP)** is a set of written instructions that document a food manufacturer's routine or repetitive activity. Specific to food manufacturing plants, the term SOP is commonly applied to production, manufacturing and support area processes, jobs or activities. SOP is core to any food manufacturer's food safety/Hazard Analysis and Critical Control Points (HACCP) plan are the facility's prerequisite programs. The foundation of each prerequisite program is its corresponding SOP.

### 1.3 Safety of Products (Hazard Analysis Critical Control Point (HACCP))

Although fruit and vegetable products have a lower risk of food poisoning than for example meat and dairy products, they can still become contaminated with potentially hazardous materials and quality assurance should be an essential component of production planning. In most developing countries, the requirement to produce safe foods in a hygienic way is part of the law and there are serious penalties for those who contravene hygiene and food safety legislation.

The safety of fruit, vegetable and allied products can be assured by implementation of a management method known as the *Hazard Analysis Critical Control Point* (HACCP) system. This is designed to prevent problems from arising, rather than curing them. In essence, the process of implementing HACCP systems involves the following stages:

- identify potential hazards
- assess the level of risk
- design and implement procedures for monitoring and controlling hazards
- apply corrective action in a process
- train all staff in implementation of the procedures
- develop appropriate reporting procedures.

This is especially true when an entrepreneur establishes a system for the first time. This type of assistance is also increasingly seen as a vital service that can be provided by Manufacturers' Associations. Where an analysis of food safety is required, the stages identified above are implemented as follows:

***Identify potential hazards and assess the level of risk:*** the processing stages are written out as a Process Chart and ways in which contaminants could enter the food are identified. A selection of different types of contaminant is shown in Table 1.

**Table 1. Some types of contaminants in foods**

Types of contaminant	Examples
Microbial	Bacteria, moulds, yeasts, viruses
Biological	Hair, excreta, bone splinters
Chemical	Pesticide residues, detergents
Physical	Bolts from machinery, stones, glass

Up to 95% of customer complaints in countries where these have been monitored, are related to contamination by physical, chemical or biological sources. Microbial contamination is therefore a small part of the risk, but in low-acid foods, the risk of serious food poisoning means that proportionately greater attention is given to this source.

During development of a safety system, emphasis should be placed on:

- sources of contamination
- methods of contamination
- effect of the process on levels of contamination
- probability of micro-organisms surviving the process and growing in the product.

It is better to first select the most important type of hazard for a particular product and do the study for this. Potentially less important hazards can then be examined later and added to the quality assurance plan. Following identification of hazards, the effect of processing conditions on

contaminating micro-organisms is then assessed. This should include all parts of the process, from the purchase of raw materials and ingredients to storage and consumption of the final product.

***Design and implement monitoring and control procedures:*** Once the ranges of potential hazards are identified, control methods can then be developed to prevent contamination. Some parts of a process have greater effect on product safety than others do. Where an error at a particular stage could have an important effect on safety, controls are put in place at these stages. These are known as *Critical Control Points* (or CCPs). A 'Decision Tree' can be used to help decide on the CCPs. Target limits and tolerances are decided for each CCP.

***Train staff to implement procedures:*** Staff is trained to operate the quality assurance methods. They should also know the limits that are placed on any variation from the specified methods, so that everyone involved in the process understands his or her responsibilities.

***Develop reporting procedures:*** Methods for monitoring quality assurance procedures are designed, together with a plan of what should be done if the tolerances are exceeded. It should be clear who has the authority to make decisions and who is responsible for checking that a corrective action was properly done.

## **2. Quality Assurance of Products through using Proper Postharvest Management Techniques for Fruits, Vegetables and Allied Produce**

When a producer wishes to ensure the quality of products, it is necessary to identify where losses in quality are likely to occur and then find methods to control the process and to improve the product. If for example, a problem is due to poor quality raw materials or ingredients, this should be discussed with suppliers and if necessary, the processor should introduce appropriate testing methods with tolerance limits that are agreed with the supplier. If a problem is due to a processing condition, such as the time or temperature of heating, the process control is improved by better staff training, use of thermometers etc. All changes should be monitored to make sure that they are effective and details of the changes should be recorded in a Production Workbook. Such procedures are intended to control the parts of the process that significantly affect product quality and therefore help the processor to employ staff where they are most effective.

***Raw Materials and Ingredients:*** The main quality factors associated with fruit products are the characteristic flavour and colour of the fruit, vegetables and allied produce, the absence of contamination, and in some products, a characteristic texture. However, few quality characteristics of fruit, vegetables and allied products can be measured objectively and fewer still can be measured by machines.

Fruit, vegetables and allied produce should be harvested carefully by cutting them from the tree or plant. With fruits, it is important to leave the stem in place to reduce the risk of infection by moulds and yeasts through an open stem hole.

Bad practices at harvest cause many problems for the processor later on, but the processor often has no control over harvesting methods and the farmers do not understand the processors' requirements. In this situation, it is therefore advantageous for the processor to work with farmers to improve the quality of raw materials. Examples of ways that processors can do this are as follows:

- handlers should be asked to cut their fingernails to prevent them puncturing fruits
- in tropical climates, fruits and vegetables should be cooled after harvest to remove some of the 'field heat' and stored in a cool place or covered with wet sacks

- any damaged pieces should be removed from the bulk as they will lead to rapid spoilage of surrounding foods before processing starts
- fruit, vegetables and allied produces should not be thrown into piles. They should be filled into crates that are small enough to be carried and not dragged along the ground
- crates should not be over-filled as this crushes the commodities if boxes are stacked. Ideally, fruit, vegetables and allied produces should be packed into stackable crates which prevent crushing.

The first inspection of raw materials may therefore take place as they arrive at the processing unit. The inspection should check that the fruit, vegetables and allied produces are suitable for processing and reject those that are not. This normally includes a check on the following characteristics:

- maturity (over-ripe or under-ripe)
- colour
- size or shape (for some products)
- visible mould or rots
- serious bruising or cuts
- presence of soil, large amounts of leaves or other materials.

The percentage of rejects should be monitored as this is an important factor in calculating the true cost of useable raw material.

At this stage in processing, careful inspection by properly trained staff is an important method of maintaining product quality and saving time and money later in the process. It should be remembered that *poor quality raw materials produce poor quality final products*.

***Quality Assurance Procedures in A Typical Fruit, Vegetable and Allied Produces Processing Enterprise:*** A summary of the quality assurance procedures for a typical fruit and vegetable process is shown in Table 2.

Table 2. Summary of quality assurance procedures during postharvest management and processing

Stage	Process Activity	Control Point
Raw material harvest	Liaison with farmers, pick fruit, vegetables and allied produces and load it into crates or purchase from markets.	Specifications of fruit, vegetables and allied produces quality required. Training of pickers and handlers to minimize damage to the commodities. Use of correctly designed boxes. Rejection of damaged or rotten fruit, vegetables and allied produces.
Raw material transport	Transport in crates to processing unit.	Control of fruit, vegetables and allied produces temperature by use of water, shade or covers. Correct stacking and handling to minimize damage. Reduce delays and minimize journey time.
Raw material inspection and preparation	Record amount and quality of fruit, vegetables and allied produces received. Sort the commodity, wash and peel/slice as required for the specific product.	Setting of acceptable standards for incoming fruit, vegetables and allied produces. Training in correct sorting, preparation and recording procedures and management to ensure procedures are implemented. Accurate slicing to required sized pieces. Operator hygiene and plant hygiene. Water chlorination. Regular disposal of waste.

Ingredient formulation/ batch preparation	Weigh and mix ingredients.	Training in accurate weighing and keeping records of ingredients used.
Processing	Part-processing if fruit, vegetables and allied produces are to be stored for later use. Heating, drying, pickling etc. to make the required product.	Preparation of processing schedules and training of operators to ensure: - control of temperature and time of heating or drying, - correct amounts of ingredients added at the correct time in the process. Establish standards for operator hygiene and schedules for cleaning of equipment and processing room.
Packaging	Fill product into packages, seal and label. Pack into distribution boxes.	Establish specifications for package quality (especially glass containers), labels and fill-weights. Implement inspection, check-weighing and recording procedures

### 3. Personal Hygiene and Cleaning

Together, a manager and processing staff should apply the HACCP approach to identify all areas of potential hazard in the production of a food and then develop a cleaning plan and personal hygiene rules that ensure safe preparation of the product. The manager should monitor the plan and make sure that all staff are trained and know their own responsibilities. Similarly, it is important that staff are not penalised for having an infection, otherwise they will hide a problem in order to be paid. If staff report a stomach illness or skin infection, they should be transferred to other jobs that do not put them in direct contact with the product. The manager should also provide proper cleaning materials and equipment and allow adequate time for cleaning machinery and processing areas after production has finished.

Cleaning schedules should be drawn up when specific areas of hazard have been identified in a process or in the building. All areas need attention but some carry a greater risk than others. Each worker should know their cleaning responsibilities within a cleaning plan and the manager should take overall responsibility to ensure that cleaning is done to the correct standard and that a cleaning schedule record is maintained.

### 4. Record keeping

There are sets of basic records that should be kept by the owner of a small fruit and vegetable processing unit. Accurate information is essential and this means that staff who are required to collect information should know its value and why it is being collected. This should be part of the induction and training when new staff learn their job.

**Production records:** The main reasons for production records are to ensure that quality assurance procedures are in place and operating satisfactorily and to record the use of ingredients and amounts of stock. When raw materials are processed, each batch should be recorded in an *Incoming Materials Test Book*. The same layout can be used for recording incoming batches of ingredients and packaging materials, some of which also require inspection on arrival.

Records should also be kept of the amount and type of raw materials and ingredients that are used and the important processing conditions (e.g. drying times, heating times and temperatures etc.) to ensure that operators mix together the same ingredients in every batch and process them in the same way each time.



Each batch of food should be given a Batch Number which is recorded in stock control books, processing logbooks and product sales records. The batch numbers should be correlated with the product code numbers that are printed on labels or outer cartons. This allows the processor to trace any subsequent faults in a batch of product back to the process or to the raw materials.

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## Thematic Area-E: Value Chain Development

### Topic E-1.

#### E-1. a) Understanding of value chain concept, identification of major constraints and their solution

##### 1. Concept of Value Chain

##### A. Value Chain Basics

##### Porter's Value Chain

- The Value Chain concept was developed and popularized in 1985 by Michael Porter, in “Competitive Advantage,” a seminal work on the implementation of competitive strategy to achieve superior business performance.
- Porter defined ‘**value**’ as the amount buyers are willing to pay for what a firm provides, and he conceived the “value chain” as the combination of nine generic value-added activities operating within a firm – activities that work together to provide value to customers.
- Porter linked up the value chains between firms to form what he called a **Value System**; however, in the present era of greater outsourcing and collaboration the linkage between multiple firms’ value creating processes has more commonly become called the “**value chain**.”
- As this name implies, the primary focus in value chains is on the benefits that accrue to customers, the interdependent processes that generate value, and the resulting demand and funds flows that are created. Effective value chains generate profits.

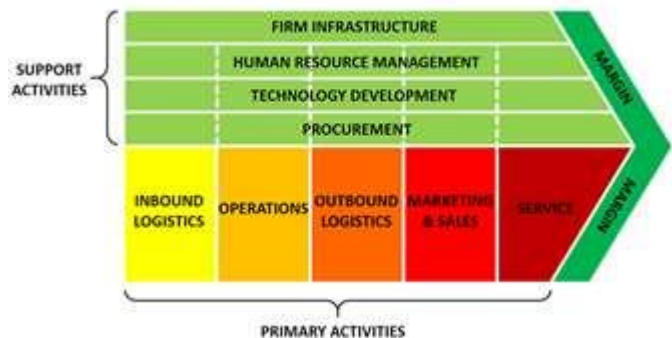


Figure 1 Porter's Value Chain

##### Definition of Value Chain (Present Era)

A value chain includes the full range of **actors and activities** that are required to bring a product or service from its conception to its end markets/consumer.

- Actors include input suppliers, producers, processors, traders, distributors, wholesalers, and retailers that provide services required to get the product to the final consumer.

## Difference between Value Chain and Supply Chain

In common phrasing, a supply chain and a value chain are **complementary views** of an extended enterprise with integrated business processes enabling the flows of products and services in one direction, and of value as represented by demand and cash flow in the other.

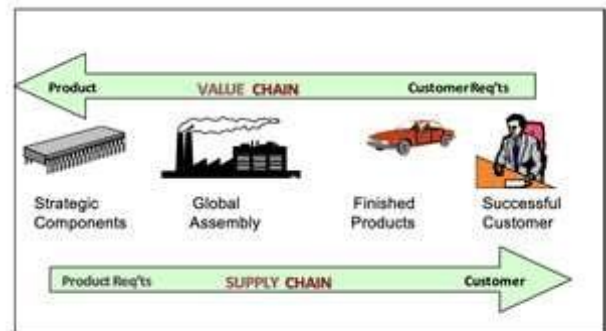
However, difference is reflected on the following points:

- **Value** flows from the person (or institution) that is the recipient of resources, the customer. This is a key difference between a value chain and a supply chain where flow is in opposite directions.

Order fulfillment value chain as a pictorial of the comparison:

- In “Lean Thinking” by Womack and Jones, the first Lean Principle was “defining value from the customer’s perspective.” From this come two critical factors that need to be clarified when strategizing the creation of value:

- Who is the customer?
- What do they value?



A Comparison of a Value Chain with a Supply Chain

Figure 2 . A Comparison with a value chain and supply chain

- When we talk about supply chains, however, we usually talk about a downstream flow of goods and supplies from the source to the customer. Value flows the other way. The customer is the source of value, and value flows from the customer, in the form of demand, to the supplier.
- That flow of demand, sometimes referred to as a “demand chain”, is manifested in the flows of orders and cash that parallel the flow of value, and flow in the opposite direction to the flow of supply.

The primary difference between a supply chain and a value chain is a fundamental shift in focus from the supply base to the customer.

- Supply chains focus upstream on integrating supplier and producer processes, improving efficiency and reducing waste,
- Value chains focus downstream, on creating value in the eyes of the customer.



Figure 3. Upstream and downstream value Chain

## B. Value Chain Approach

### Definition: Value Chain Approach

- A method of achieving economic growth and reducing poverty that focuses on linking micro and small enterprises (MSEs) including small-scale farmers into local, regional and/or global value chains, while ensuring an enabling environment and access to the resources needed to take advantage of and benefit from these market opportunities.

- By transforming MSEs' relationships with buyers up the chain and input suppliers down the chain, as well as with financial and business development service providers, the approach ensures that the poor are included in economic growth strategies.

**Value Chain Approach** Is comprised of models, principles, tools and terminology.

## Value Chain as Market System

### Market System

A market system consists of a value chain, its service providers, and the enabling environment in which value chain actors and service providers operate. It is a system because all actors are interconnected and mutually dependent, as they interact within an enabling environment.

### Value Chain Actor

An actor is a general term for individuals, groups of individuals or businesses operating within a value chain.



Figure 4. Market System

### Service Providers

Service Providers include Sector-specific service providers and Cross cutting service providers. The inter-relationships among all of the actors, shown here, are key to value chain growth and increasing competitiveness.

### Sector-specific Service Provider

Some services are tied to one particular sector: for example, crop sprayers exemplify sector-specific services in agriculture, while product design may be important to the handicraft sector.

### Cross-cutting Service Provider

**Financial SP:** Financial service providers include formal sources of financing, such as, banks, microfinance institutions, as well as informal sources of financing such as traders, family members, and actors throughout the value chain.

**Technological SP:** These include services such as transportation, technology and mobile phone services. Providers of these services often serve multiple sectors, although they might have specialized products and services for a given market or industry.

### **Business Enabling Environment (BEE)**

- Formal—laws, regulations, policies, international trade agreements and market standards
- Informal—norms, customs and codes of conduct
- Public infrastructure and services—roads, education, health services, electricity, etc.

A healthy, appropriately skilled workforce,

Reliable access to water, energy and ICT,

Cost-effective transportation from production site to market

## **C. Key Elements of the VC Approach**

In the value chain approach we:

- Take a market system perspective.
- Look to end markets to define opportunities and risks.
- Address underlying constraints, not symptoms.
- Facilitate ongoing improvement.

### **Market System Perspective**

Understanding the market system includes looking at the:

- Firms that operate within a value chain (VC Actor)
- Support markets that provide technical, business and financial services (Service Providers)
- Business environment in which the value chain operates (BEE)

### **End Markets**

The final consumers of a product that determine the characteristics—including price, quality, quantity, and timing—of a successful product or service. An end market is where the end-user is located, meaning the individual or organization for whom the product or service has been created, and who is not expected to resell that product or service. For example, creating a consumer product may entail many transactions between various value chain actors, but the end market is where the product becomes available for purchase by the consumer. For a business-related product or service, the end market is where the sale occurs to the organization that will use the product or service in its own operations. The terms destination market, target market and final market are often used interchangeably with end market.

### **Address underlying constraints, not symptoms of these constraints.**

Value chain actors may face many constraints:

- Access to resources or services
- Lack of knowledge or skills
- Lack of price premiums for quality, etc.

It is important to ask why these constraints exist. Are they symptoms of an underlying problem?

### **Facilitate Ongoing Improvements**

- Facilitation involves intervening in a way that stimulates changes in value chains or market systems, while avoiding taking a direct role in the system.
- For example, facilitators may encourage private sector companies to supply inputs to target

beneficiaries, rather than providing those inputs directly.

Facilitate ongoing improvements:

- Catalyze performance improvements among actors without becoming part of the chain
- Avoid project activities that directly intervene in the market systems
- Avoid creating donor dependence
- Prepare actors for future challenges

## **2. MAJOR CONSTRAINTS OF VALUE CHAINS OF FRUITS AND VEGETABLES IN BANGLADESH AND SOLUTIONS TO OVERCOME THEM**

### **A. MAJOR CONSTRAINTS OF VALUE CHAINS OF FRUITS AND VEGETABLES**

#### **Low productivity and lack of knowledge on post-harvest management**

It revealed from value chain studies that producers are suffering from low productivity, low quality of inputs (mainly seeds and fertilizers). Productivity of vegetables and fruits are low compared to China and India. Farmers often lack of knowledge good agricultural practices (GAP) and of appropriate post harvest management (Cleaning, sorting, grading, packaging, storage, transportation, etc.) and suffers from lack of improved transportation system.

The growers as well as market intermediaries suffers from high post harvest loss of perishable produce for poor post harvest handling and transportation and lack of cool chain and storage facilities.

#### **Limited market access of the smallholder farmers**

Market access for farmers is commonly limited by transportation, infrastructure and quality standards. Most farmers do not possess the transportation means to access markets beyond the local farmers market. Furthermore, a lack of post-harvest technologies and infrastructure, e.g. cooling facilities, leads to inconsistent quality of their produce and post-harvest losses. These obstacles limit their ability to build and maintain direct partnerships with large traders or exporters who require consistent quality and quantity. Hence, their contact with agricultural market participants beyond their region is limited and farmers are often unaware of market prices and consumer demand outside their region. As a result, the farmers have to cope with the high price volatility of the local market and low prices in harvest-season due to oversupply.

#### **Smallholder value chains**

The current smallholder value chains are often complex and long, leaving farmers with very little control and profit. Most commonly, small-scale traders travel through the villages and buy the farmers produce, often at very low prices due to the lack of buyer-competition at the local farmers market.

Furthermore, the farmers often supply unprocessed produce that marks the very beginning of the value chain for the respective products. Even rudimentary processing such as washing and grading is often done later in the supply chain and the added value left to other participants. As a result, farmers are only a very small part in the agricultural produce supply chain and therefore have limited

bargaining power and value creation. This leaves them with low prices that are often dictated by the traders instead of bargained.

### High post-harvest loss

Post-harvest losses of vegetables and fruits are substantial which is around 30% (Figure 6). There is substantial scope to increase **productivity and profitability** by reducing post-harvest losses, increasing the shelf-life of perishable commodities and adding value through processing of **fresh produces** into finished or semi-finished products, packaging in appropriate containers, proper storage and exports.

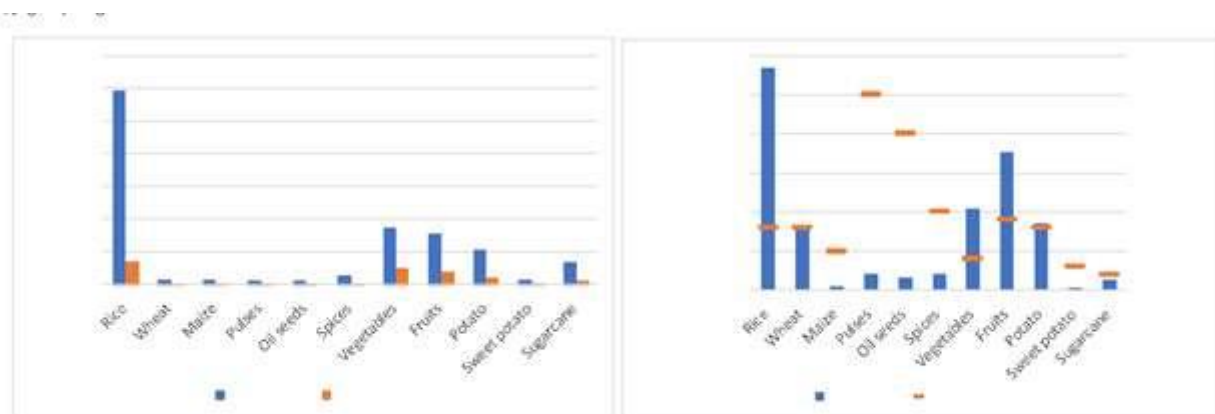


Figure 5. Post-harvest losses of major crops

### Inadequate market infrastructure and poor transportation facilities

Rising income, urbanization, liberalized trade, advancing technology-all are driving up the demand for high-value fresh and processed agricultural products. This development requires quality and timely delivery of products to the consumers, which poses particular challenge to smallholders. The performance of marketing is often hampered by poor transport facilities and inadequate market infrastructure, increasing transaction costs and price volatility. There are insufficient well equipped wholesale markets. Inferior communication and transport condition and inadequate financial and information service also contribute to poor distribution of perishable food.

Improved market infrastructure can reduce the cost of food and uncertainty of supply thus improving the food security of the country. In spite of a substantial expansion of road communications over the past years, existing roads, railways and waterways, particularly in rural areas, remain insufficient which has a negative impact on the growth of perishable high value products. Besides road networks, attention is needed to improve waterways by re-excavating rivers and canals. Rail transport facilities fall short of requirement and need to be expanded and improved for transporting agricultural products at cheaper rates. Farmers from the char lands and other remote areas suffer especially due to inadequate transports.

### Inadequate agro-processing industries

Many opportunities and challenges face **small and medium enterprises (SMEs)** in food processing and related activities due to the impact of a new competitive environment on scale, minimum quality, and the perspectives for non-traditional products.

The scope for processing agricultural products to add value to them is considerable and could help further develop the agricultural sector in Bangladesh. This could also help reduce wastage, especially



of perishable foods, which would translate into savings of water and soil resources and help reduce carbon emissions. Adequate focus on the agro-processing sector to strengthen the links between agriculture and industry is thus critical. Although there has been a significant expansion of agro-processing industries -there are currently about 700 food processing industries across the country- there is still a gap between requirements and supply and support is needed for further expansion.

Traditionally, fruits and vegetables are also processed at household level, mostly by women. But a lack of capital and knowledge on food quality and safety issues prevents these activities from being carried on a larger scale and for commercial purposes. From a strategic point of view, where possible, policies should be directed at increasing the capacity of traditional actors.

### **Lack of market/price information to the producers and intermediaries**

Lack of market information results in low prices and thereby low returns for farmers and traders. Indeed, for lack of knowledge on the market situation, farmers as well as intermediaries cannot bargain with their sellers/buyers who are better equipped with marketing information on equal terms.

### **Lack of food safety knowledge**

Bangladesh faces significant problems with food contamination through poor handling practices, and deliberate adulteration for the purpose of fraud (extension of shelf life, passing off cheaper ingredients as expensive ones, etc). The National Food Safety Laboratory revealed the presence of high residues of banned pesticides and chemical preservatives in fresh produce on the Dhaka markets. Not only does this impact the health of the population, but it also affects the exportability of Bangladeshi agricultural produces. The Government faces the challenge of creating a satisfactory food control system backed by inspections, of improving practices among food producers and handlers, as well as of building the awareness of consumers. As food products move through every stage of the supply chain, it is crucial to extend training to all stakeholders in order to ensure quality and safety of food along the way ‘from the field to the table’.



Figure 6. Highlights of various food safety issues prevailing in each link in the value chain

### **Lack of easy credit to smallholders and market intermediaries**

Credit play an important role in value chain development and it is believed that expansion of credit programs has beneficial effects on agricultural production and income of small farmers and traders. It is also key to poverty alleviation, livelihood diversification and increasing the business skills of

small farmers and traders. Institutional credit and agricultural production are positively related and suggesting the need to expand agricultural credit disbursement particularly to SMES.

## **B. SOLUTIONS TO OVERCOME VALUE CHAIN CONSTRAINS**

### **Improve market infrastructure, value chain facilities and access**

Both rural and urban agricultural markets lack adequate value addition supporting infrastructures for traders. In the market place, facilities for sorting, grading, packaging and storing agricultural produce are often inadequate. General hygienic and sanitary market conditions-for example- drainage facilities, are also poor. Markets are also found not to be women-friendly. Potential areas for improvement are thus:

- Capacity building of marginal, small and women farmers for contract farming, cooperatives, group marketing and inputs procurement. In order to encourage small and medium scale farmers to grow fruits and vegetables, the government promoted the formation of marketing groups and cooperatives by supporting initiatives through the different Projects and by working together with market actors,. Contract farming constitutes another option to increase market access of small and medium scale farmers. By facilitating the development of supermarkets and other large-scale retail centres that directly engage in agreements with local producers, small farmers can be better integrated into the value chain and the influence of market intermediaries is effectively reduced.
- Capacity development of farmers including marginal, small, and women farmers, entrepreneurs and market intermediaries through training in food quality and safety regulations and requirements and Good Agricultural Practices (GAP) so as to comply with market requirements;
- Improved post-harvest management, value chain improvement and facilitation.
- Facilitation of coordinated, market-based action, harnessing the productive capacity of agriculture to drive food and nutrition security, environmental sustainability and economic opportunity.
- Enhancement of opportunities for participation of poor women for value chain development.

### **Promote agro-processing and value addition**

Agro-processing industry is a group of manufacturing industries that processes raw materials and intermediate products obtained from the agricultural sector. These industries have the advantage of forging backward linkages, boosting agricultural production and enhancing farmers income.

The GoB considers this to be a thrust sector for the economy and has prioritised the development of MSMEs in this sector. As a result, this sector grew at around 7% over the past years. The policy, institutional and infrastructure barriers to agribusiness and agro-processing need to be removed in order to provide a ‘big push’ to agriculture and rural development.

The production and processing of agricultural products is also labour intensive and, therefore, is likely to have a significant favourable impact on employment in rural areas. A number of measures can help

promote MSMEs and community-based enterprises for the development of agro-processing facilities in Bangladesh: tapping the potential for development of youth and women entrepreneurship and developing the knowledge of farmers, traders and GoB on sanitary and phyto-sanitary standards for example.

Local and export markets must be identified and export promotion activities. The role of the private sector as a vital development partner must be recognised and alliances created. A sustainable and viable private sector-led value chain must be developed. Also, strong partnerships with chambers, associations/intermediary organizations, donors and civil society organizations should be encouraged. Public-private partnership are needed to support value chain development projects for fruits, vegetables,. The capacities of the farmers and market actors must be developed.

### **Develop cool chain and storage facilities**

Food losses and waste are substantial in Bangladesh due to a lack of cold chain infrastructure. An efficient cold chain can not only contribute to reducing losses and waste in the quantity and quality of food, but can also improve the efficiency of food supply chains and compliance with food safety and quality standards. Therefore, cold chain development is essential for improving food and nutrition security in Bangladesh. The primary segments of an integrated cold chain include: packing and cooling fresh food products, food processing, cold storage, distribution using refrigerated transport and marketing.

The government can promote the use of cold chain technology, improve logistics, maintenance, services, infrastructure, education and management skills, and create sustainable markets for the design, use and funding of cold chains and reducing tariffs for cool chain equipment. Efforts need to be made to make available refrigerated compartments in trains and other means of transport and refrigerated trucks for transporting agricultural products.

### **Promote supply of safe and nutritious food**

Foodstuffs in Bangladesh are often adulterated in varying degrees in the different stages of supply chain. The food industry currently mostly ignores existing food regulations due to the multiplicity of laws, the non-coordination and overlapping of regulatory bodies, and transparency, autonomy and bureaucracy issues as well as enforcement problems. Therefore, in order to ensure the supply of safe and nutritious foods and guarantee the effective regulation of food systems, the capacity of farmers, market intermediaries and concerned government agencies should be modernized and strengthened.

### **Marketing information**

Marketing information helps farmers and traders plan their marketing strategy and bargain with other parties. More importantly, farmers and traders may be aware of the types and quality of produce being sought by national, regional, and international customers that may aid the nation to earn more from exports. DAM has taken an initiative to develop and disseminate agricultural market information to farmer, traders, policy makers, development agencies and other stakeholders by posting different types of prices on its website, circulating market information, publishing bulletins and reports. This type of initiative needs to be expanded. Net working of market actors are needed for dissemination improved post harvest technology and market information. Successful marketing requires learning new skills, new techniques and new ways of obtaining information.

### **Public private partnership**

Government initiatives and support is required to enhance market access with particular emphasis on small producers and farmers' groups. Besides, sustainable development is needed for growth centres, rural markets, women market centres and Union Parishad complexes.

Government and private sector investments are needed to develop market and value chains; to speed up dissemination of technology; to enhance institutional capabilities to deliver essential services to small farmers, traders and various supply chain actors for developing demand-led value chains and enhancing market linkages of the small and marginal farmers.

### **C. EXERCISE: IDENTIFY VALUE CHAINS CONSTRAINTS OF YOUR BUSINESS AND FIND SOLUTIONS**

**Instruction:** Divide the whole class of trainees into three groups. Then each group should discuss and identify their value chain problems and find solutions.

**Notes:**

**What are the value chain constraints your group identified?**

1.....

2.....

**Solutions identified?**

1.....

2.....

### **E-1. b) Gender Equality as an Underlying Reason to Value Chain Efficiency**

Social and gender relations influence the different activities in the food value chain (i.e. who carries them out, how, where, when and under what conditions) and how resources and benefits are successively allocated among actors. Imbalanced gender relations, due to discriminatory attitudes and practices, result in diverse constraints faced by women and men in accessing and controlling the resources needed to carry out their activities, which influences the efficiency of the food value chain in many ways. For example, rural women are often less involved than men in cooperatives and farmer organizations. As a result, these women have limited access to processing facilities, technologies and markets, which consequently leads to value chain inefficiency.

In addition, despite their important role in food value chains, rural women often face specific constraints in accessing essential productive resources, services and information, and in participating in decision-making. These constraints affect their ability to fully contribute to increasing food value chain efficiency. Nevertheless, there is compelling evidence of the fundamental role of women in food value chains. In the agricultural sector, women comprise around 43 percent of the workforce worldwide (World Farmers' Organization, n.d.). In many regions of the world, they play a primary role in production and post-harvest activities. For example, with respect to staple crops, women are the main actors in drying, threshing, de-husking, shelling, grading and cleaning as well as in the initial processing and storing of the produce. Women also play a pivotal role in post-harvest activities

involving perishable produce, such as fruits and vegetables, dairy and fish. This work, which is typically assigned to women is generally arduous, time-consuming and repetitive, and is often carried out around the home. It generally includes a social component: for example, groundnuts are de-hulled by sitting around the house while interacting with other community members and caring for children. These traditional practices do not always allow for efficient production and high output quality. In addition, women often combine food production activities with household and care tasks. This double or triple role creates time and energy constraints, and can significantly influence food value chain.

Gender relations are also highly relevant in determining the effectiveness of food value chain strategies and interventions. By addressing one or more value chain inefficiencies, most food value chain interventions focus on introducing improved labour- and time-saving technologies and practices to reduce losses and retain quality of the produces. These kinds of interventions, which aim for long-term adoption of technologies and shifts in production behaviours, require that gender relations and the different priorities, preferences and bargaining power of women and men as actors of the food value chain are taken into account. For example, the underlying socio-cultural and economic contexts at large (such as caste/ class systems, socio-cultural habits and gender norms) influence who may or may not engage in a specific activity or what is culturally acceptable within a local context. The differences in men's and women's individual priorities, preferences, needs, knowledge and decision-making power are relevant for the uptake of technological solutions to reduce losses and retain quality of the produces. There is solid evidence of improved technology design that shows how men's and women's preferences and priorities converge in some aspects (security, cost, calibration, accessibility, etc.), but diverge in others, because of the influence of different factors (work burden, mobility, etc.). If women's preferences and needs are not taken into account, the cultural acceptance of proposed solutions, newly introduced technologies and practices aimed at facilitating activities carried out by women are unlikely to be adopted.

In order to be long-lasting and effective, food loss reduction and quality retention policies and interventions should take into consideration from the onset the underlying socio-cultural, institutional and economic dimensions of food value chains and systematically integrate gender equality concerns. By overlooking the importance of gender dynamics and applying a gender-blind approach, food loss reduction and quality retention interventions may be less effective and even exacerbate gender inequalities along the food value chain, which has a counter-effect on the reduction of losses and retention of quality. Reducing gender inequalities in the food value chain will contribute to improving efficiency. Specifically, the following summarized points are to be given more emphasis:

- Socio-cultural and gender relations are significant underlying reasons for food value chain inefficiencies, which in turn directly cause qualitative and quantitative food loss.
- The different productive and social roles of men and women affect their access to and control over assets, knowledge and services, and their participation in productive activities and decision-making. This impacts the efficiency of the food value chain and hence is an underlying reason for postharvest loss.
- Women and men have different needs, constraints and preferences when carrying out their activities along the value chain. These gender concerns are particularly relevant in determining the response of a specific food value chain to food loss reduction and quality retention policies and interventions, and consequently determining their effectiveness and impact.

**Food Value Chain Checklist to address Gender Aspects:** Try to find out as much as possible on the involvement of the food value chain actors, both men and women, in their respective food value chain activities. This information will be key to analyse social and gender related causes for food value chain inefficiency and identify socially acceptable solutions.

<b>Division of labour</b>	<ul style="list-style-type: none"> <li>• Which activities along the food value chain do women predominantly do, which ones do men do?</li> <li>• How are these activities related to/affect women's and men's roles in other productive and domestic activities?</li> <li>• Consider/document/observe the involvement and role of men and women in: <ul style="list-style-type: none"> <li>▪production</li> <li>▪harvesting</li> <li>▪postharvest handling</li> <li>▪storage</li> <li>▪transport</li> <li>▪processing</li> <li>▪marketing (wholesale)</li> <li>▪marketing (retail)</li> </ul> </li> </ul>
<b>Access and control to resources (including production ones)</b>	<p>Consider/document/inquire about the access, ownership and control of men and women in:</p> <ul style="list-style-type: none"> <li>• How well are the food value chain actors prepared and equipped to participate in the respective food value chain activities?</li> <li>• Is the equipment appropriate and used adequately?</li> <li>• Under which conditions do the food value chain actors pursue their respective activities?</li> <li>• Do women and men have equal access to assets and productive resources, which comprise: <ul style="list-style-type: none"> <li>➢ Natural resources capital: land, water, trees, livestock, genetic resources, soil fertility</li> <li>➢ Physical capital: livestock, agricultural and business equipment, crop drying and storage structures, postharvest and food processing tools/supplies, labor saving technologies, houses, consumer durables, jewellery, vehicles and transportation, water supply and sanitation facilities, and communications equipment, mobile phones</li> <li>➢ Human capital: education, skills, knowledge, information, health, nutrition (these are embodied in the labour of individuals)</li> <li>➢ Financial capital: money, savings, credit, and inflows (state transfers and remittances)</li> <li>➢ Social capital: membership in organizations and groups, social and professional networks, mobility, personal freedom</li> <li>➢ Political capital: citizenship, enfranchisement, and effective participation in governance</li> <li>➢ Services: agricultural, financial and health services.</li> </ul> </li> </ul>

<b>Power and Agency</b>	<p>Consider/document the ability and willingness of men and women to make autonomous decisions and transform them into outcomes regarding:</p> <ul style="list-style-type: none"> <li>•productive resources (assets, agricultural services, financial services)</li> <li>•production activities (what to plant or produce, methods, tools, investments, work burden, etc.)</li> <li>•harvesting/postharvest activities (timing, tools, investments, etc.)</li> <li>•how to add value to foods (via processing, packaging, transformation, etc.)</li> <li>•how to transport produce from the farm to the market</li> <li>•how and where to sell (buyers, prices, locations, marketing options, etc.)</li> </ul>
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**Stakeholder Relationship Development: a) Facilitating formation of network/platform of value chain actors and b) Application of Information and communications technology (ICT) towards better market access for fresh and processed fruits and vegetables**

**A. Stakeholder Relationship Development**

One way to help the entrepreneur support business in the challenging and changing market environment of smallholder agriculture is to ensure that all stakeholders are engaged in ways that enhances their cooperation with the entrepreneur.

There is a difference between internal and external stakeholders. Internal stakeholders include employees, customers, suppliers and service providers and financial partners, whereas external stakeholders include the general public, communities and groups and the media. Working with stakeholders refers to your ability to build long-term or ongoing relationships with stakeholders.

**Managing business relationships**

The business relationship management refers to the strategies, processes and behaviours involved in creating and maintaining value-producing relationships between an entrepreneur and all its stakeholders, including: employees (labour), service providers, key partners and financial partners.

**Principles of business relationship management**

Business relationship management is based on the following, underlying principles:

- Acknowledge and actively monitor the concerns of all your stakeholders and take their interests into account when making business decisions;
- Listen to, and communicate openly with your stakeholders about their concerns and contributions;
- Implement processes and modes of behaviour that are sensitive to the concerns, opinions and contributions of each stakeholder;
- Recognize the interdependence of the stakeholders' efforts and try to achieve a fair distribution of the benefits among them; i.e, equal distribution of benefits of an Association of the market actors.
- Cooperate with all stakeholders to ensure that your business risks are minimized; and
- Acknowledge the potential of conflicts between stakeholders and address such conflict (if it does occur) through open communication.

**Steps involved in business relationship management**

The entrepreneur should manage their business relationships by taking the following steps:

***Step 1: Identify all stakeholders***

Be specific and make sure that all stakeholders are identified, including suppliers, employees, distributors, financial partners (e.g. commercial banks) and government agencies and non-government organizations

***Step 2: Define the impact of each relationship***

As the entrepreneur you need to determine how a relationship affects your ability to achieve your goals. By collaborating with role players and stakeholders, you can make significant improvements in operations, production, product quality and financial results and market access.

### ***Step 3: Identify common ground***

As you begin the relationship management process, try to identify what are the common interests and shared goals are between you and the other stakeholder(s) that will facilitate to improve market access of vegetables and fruits.

### ***Step 4: Develop action plans***

Once you have identified all your stakeholders and you are aware of the impact of each of these relationships, you need to prioritize the stakeholders and develop a specific work plan for the most important relationships to start the process.

Communication strategies are particularly important and you should consider communication methods such as regular face-to-face meetings, e-mail updates, Imo/Whats up or other ways of sharing information with stakeholders.

### ***Step 5: Identify measurable results***

Identify indicators that you can use to measure the results and success of your business relationship management effort.

## **B. Facilitating formation of network/platform of value chain actors**

Networking is one of the most essential skills for business people, but it is extremely important for entrepreneurs. Communication and strong presence in the entrepreneurial ecosystem are productive approaches which will help you along your way to building strong relationships with different stakeholders

Business networking events organized around the world bring together groups of entrepreneurs and various stakeholders for, sharing, creating and developing ideas and meeting with potential investors.



Networking is powerful in many different ways meeting many exceptional opportunities can occur if they impress potential investors or business partners.

### **Platform of value chain actors**

The platform of value chain actors is a space for learning and development change. It is a group of individuals (who often represent organizations) with different backgrounds and interests: farmers, traders, food processors, researchers, government officials, etc. The members come together to diagnose problems, identify opportunities and find ways to achieve their goals concerning the value chain promotion. In this context, any value chain approach requires the identification of all relevant stakeholders at all levels of the chain, followed by a systematic analysis to identify opportunities and threats to ensure an equitable distribution of all, especially producers.

Multi-stakeholder platforms (MSPs) can be defined as “bringing together different stakeholders (actors) who have an interest in a problem situation and engaging them in a process of dialogue and collective learning that improves decision-making, action and innovation. The core role of MSPs is to improve coordination and collaboration along the value chain, resulting in more efficient and equitable linkages that benefit those poor who are economically active.

## **Approach**

Governance remains a core concept in the value chain. Governance of value chains integrates the different strategies of stakeholders in terms of access to factors of production and market and the inclusion (equity) of poorest stakeholders.

Governance refers to the mechanisms by which an actor of a value chain determines the parameters within which other actors will operate. Governance responds to pluralistic principles such as democracy, legitimacy, participation, equity, transparency, unity in diversity. The key objectives should be:

- Undertake multi-stakeholder innovation platform processes and value chains analysis by linking agricultural technologies and best practice development to market demand.
- Create linkages with other regional initiatives and programs, to improve information exchange and communication behaviours.

## **Approach of networking of stakeholders**

- Group approach is the most effective ways of networking and communicating with stakeholders. Groups could be farmers organization, traders association, processors association and chamber of commerce, etc.
- Join in your appropriate group/association
- Create a plan with specific goals that you need to achieve.
- Attend regular weekly/monthly meeting of the organization and find solutions for better market access

Online networking for business is a great way to use the power of the internet. You might need networking with the following stakeholders for developing linkages and improving market access for vegetables and fruits:

- ◆ Improved technology sources (eg. University, research centers, seed companies, etc.)
- ◆ Suppliers (inputs, intermediate products, equipment providers)
- ◆ Farmer organizations (cooperatives, associations, groups)
- ◆ Financiers (banks, different market actors)
- ◆ Government agencies: DAE, DAM, SMEF
- ◆ Regulators (issuing licenses, permit, etc.)
- ◆ Chamber of commerce
- ◆ Women chamber of commerce
- ◆ Trade associations
- ◆ Professional associations

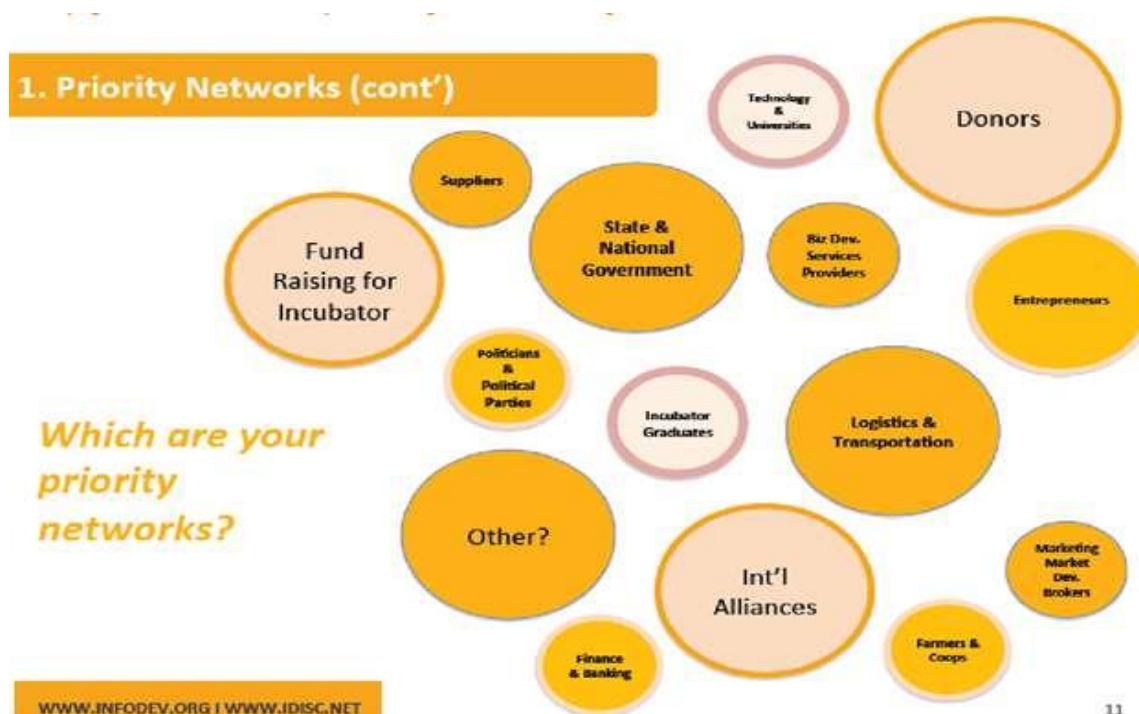
- ◆ International export network, etc.

## C. Application of Information and communications technology (ICT) towards better market access for fresh and processed fruits and vegetables

### 1. Finding Priority Networks

Your business can expand with developing partnership. You may develop partnership with the following agencies:. So you need to find priority networks. Your priority network may include the following:

- Government agencies
- International organizations
- Raw material suppliers
- Value chain membership
- Shipping companies
- Farmers organization
- Trade organizations
- International standards organizations
- Certifying agencies
- Private enterprise partners, etc



11

## 2. The ICT (Information Communication Technologies) Tools for Networking

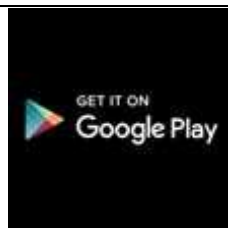
You may use

- Mobile phone
- Laptop with Wifi connection or broadband connection

You can use social communication media for networking. You may open a Google email account for sending emails and business information, videos, photos etc. You may also open and use Face Book account or Linked in account for exchanging your business information. One popular video call app known as Whats App might be useful for your business. You may use this app for calling home and abroad. All these social media communication tools might be useful to complete your daily business activities timely, efficiently and will reduce your operating costs.



Google Chrome [browser](#) is a free program for accessing the World Wide Web and running Web-based applications. You can download it from Google web sit or Google Play store.



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## 3. Hot Spots for Networking

Then you need to find out some hot spot or important web site that might be very useful developing your business and better market access for fresh and processed fruits and vegetables

Some of the agribusiness hot spots could be:

- a) e-agriculture sites
- b) Network of SME entrepreneur
- c) Hortex foundation
- d) BAPA
- e) Chamber of Commerce
- f) International organizations:
  - International Food and Agribusiness Management Association (IFAMA): [www.ifama.org](http://www.ifama.org)
  - Community of Practice of Agribusiness Incubator (infoDev)  
<http://www.idisc.net/WorkGroups/Home.aspx>
  - International Finance Corporation (IFC), Global Agribusiness Program  
[www.ifc.org/ifcext/agribusiness.nsf/content/home](http://www.ifc.org/ifcext/agribusiness.nsf/content/home)
  - Asian Association of Business Incubators (AABI): [www.aabi.info](http://www.aabi.info)
  - Trade Associations (eg New Zealand flower exporters association At [www.nzflowers.com](http://www.nzflowers.com);
  - Farm Equipment Manufacturing Association: [www.farmequip.org](http://www.farmequip.org))

#### **a) e-agriculture sites**

e-Agriculture is helping enhancement of agricultural and rural development through improved information and communication system.

- Quickest dissemination of agricultural information and technology;
- Getting demand driven agricultural suggestions;
- Farmers can get appropriate solution from the concern expert direct from the field;
- Dissemination of Improved agricultural technology for crop production, post-harvest handling and processing;

e-Agriculture has a vast area of coverage such as improved seed, fertilizer, agricultural mechanization, irrigation, pest management, post-harvest handling, marketing, storage, preservation, processing, exporting, credit, research, extension activities, biotechnology, Information management, Association of market actors, climate and weather.

Tools of e-Agriculture in Bangladesh

- Tele-centre/Call center
- Various social communication clubs & hubs;
- Website or portal in Bangla and English;
- E-mail sharing in Bangla and English;
- Mobile Phone- Call/SMS/MMS/ Whats app, Imo, Skype, etc



- Radio broadcast through Medium wave, Short wave, FM band and Community Radio
- Public and Private TV channel through terrestrial and satellite facilities;
- Teleconference/Video conference/Phone in Program/Video chatting;
- Video documentary, audio documentary, agricultural content digitization through online & offline...

Farmer can easily access the info from the nearest telecentre; Can get need based or demand driven information on time; Cost effective and time saving; Marketing channel through a organized network; Can gets all kinds of essential information as they need and desire. e-Agriculture movement is implementing through several mode. Ultimately become social composite communication movement. These are:

**Telecentre based e-Agriculture:** Telecentre in Bangladesh is a physical infrastructure with basic ICT facilities like phone, computers, printer, scanner, internet connectivity, digital camera, webcam, Photocopier, online & offline information, Infotainment inputs etc. in rural set-up. However, the center, along with other common ICT facilities, is disseminating business information for the local businesses and comprehensive information on integrated agriculture.

**Agriculture Information and Communication Centre (AICC):** There are about 20,000 farmers' clubs around the country, working with the welfare of farmers in mind. The latest trend towards union-parishad based information centers by DANIDA and UNDP, community based Agriculture Information and Communication Center (AICC) by AIS a ware house or cooking house of agricultural Information on behalf of Ministry of Agriculture sheds a new light in to the conventional information delivery mechanism. Through AICC, the farmers can actively participate in the farm telecast and farm broadcast programs by mobile phone. Moreover the idea of establishing AICC at the village level has derived from this thinking where demand-led agricultural technologies and information will be available at the door-step of the farmers so that the rural people can get the benefit from it and can develop their livelihood. In the centers they can also learn new agricultural technologies by watching documentary films and videos.

**Important hot spot of e-agriculture:** Agriculture Information Service is providing agriculture information to rural people through their website <http://www.ais.gov.bd> . This website is the only biggest Bangla version website in the country. It includes textual, audio, video, graphics and many other forms of contents. Many other agricultural websites have been developed that could be the sources of online agricultural information. Some of them are

- (i) [www.moa.gov.bd](http://www.moa.gov.bd)
- (ii) [www.dae.gov.bd](http://www.dae.gov.bd)
- (iii) [www.dam.gov.bd](http://www.dam.gov.bd)
- (iv) [www.bari.gov.bd](http://www.bari.gov.bd)
- (v) [www.dls.gov.bd](http://www.dls.gov.bd)
- (vi) [www.hortex.org](http://www.hortex.org)
- (vii) [www.badc.gov.bd](http://www.badc.gov.bd)
- (viii) [www.blri.org.bd](http://www.blri.org.bd)

## **b) Network of SME entrepreneur**

You may avail various business support services of SME Foundation for developing for fresh and processed fruits and vegetables. These are



- SME Foundation supports the SMEs with different kinds of services regularly. Major activities of BSS wing are as follows:
- Promotion and market expansion of SME product
- Preparation of sector wise SME product catalogue
- Create linkage between buyer and seller
- Provide guidance and advice to the entrepreneurs through advisory service center
- Provide business information
- Publish business guide/manual and distribution
- Preparation of Market Profile of SME product
- Organize National SME Entrepreneurs Award program to recognize successful SME enterprises in Bangladesh
- Organize business plan competition with a view to develop new entrepreneurs
- Organize SME product fair and so on.

The website of SME foundation can be found in the following link: <http://www.smef.gov.bd/>

**After log in the link above you will find following information:**

#### স্বাগতবার্তা



এসএমইফাউন্ডেশনএরওয়েবসাইটেস্বাগতম।দেশি-বিদেশিবিনিয়োগকারী, উদ্যোক্তাএবংস্টেকহোল্ডারদেরকেএসএমই সম্পর্কিতপ্রয়োজনীয়তথ্যঅনলাইনেপ্রদানইএওয়েবসাইটতৈরিরমূলউদ্দেশ্য।এরমাধ্যমেএসএমইফাউন্ডেশনএরসেবাওকার্যক্রমসম্পর্কেজনগণেরজানার এবংতাদেরগুরুত্বপূর্ণমতামত/পরামর্শপ্রদানকরারসুযোগসৃষ্টিহয়েছে।এসএমইফাউন্ডেশনদেশেরএসএমইউদ্যোক্তাদেরপ্রচার, বিস্তৃতিএবংটেকসইউন্নয়নেরজন্যনীতিওকৌশলবাস্তবায়নেরজন্যপ্রাথমিকভাবেদায়বদ্ধ।বর্তমানবিশ্বায়নেরযুগেএসএসএমইরাদেশেরশিল্পায়নেগুরুত্বপূর্ণভূমিকাপালনকরছে।তাইএসএমইফাউন্ডেশন দেশেরক্ষুদ্রওমাঝারীশিল্পউদ্যোক্তাদেরউন্নয়নেরলক্ষ্যেএকজনসহায়তাকারীরভূমিকাপালনকরছে। এওয়েবসাইটেএসএমইফাউন্ডেশনেরকাঠামো, সার্বিককার্যক্রম, অনলাইনসার্ভিস, নীতিমালা, বিধি-বিধান, প্রকাশনাএবংউদ্যোক্তাসহায়তাসম্পর্কিততথ্যাদিপ্রকাশকরাহয়েথাকে। আমরাআশাকরিএওয়েবসাইটএসএমইফাউন্ডেশনের সাথেসুবিধাভোগীদেরযোগাযোগসুবিধাসৃষ্টি করবেনাবরংসরকারিওবেসরকারিখাতেরঐক্যবদ্ধপ্রচেষ্টায়দেশেরশিল্পায়নেরপথসুগমকরতেগুরুত্বপূর্ণঅবদানরাখবে।আপনারমূল্যবানমতামতএবংসুচিন্তিতপরামর্শআমাদেরওয়েবসাইটকেসমৃদ্ধকরতেসহায়কহবে।



## নোটিশবোর্ড

- [প্রেসবিজ্ঞপ্তি \(০৬এপ্রিল২০২০\)](#)
- [জাতীয়এসএমইপণ্যমেলা-২০২০ \(অংশগ্রহণকারীউদ্যোক্তাদেরতালিকা - ২য়পর্ব\)](#)

### c) SME Women Entrepreneurs Directory

To ensure the participation of women entrepreneurs in the mainstream of development and empowerment is a significant aspect of the foundation's activities. You'll be glad to know that Women Entrepreneurship development Wing of the SME Foundation has published "SME Women Entrepreneurs Directory" related to the business related information of women entrepreneurs in order to expand their work range. Data obtained from various individuals, organizations, government and non-government organizations, women organizations, City Corporation, banks and non-bank financial institutions, has been inserted in the directory after proper sorting and processing. According to us, at present it is a database containing information of most women entrepreneurs of our country.

People / organizations who have helped us with the necessary information to publish directory, we express sincere gratitude to each of them. It was not possible to publish it without their assistance. We have made every effort to avoid errors of reliable data to insert. If any information is incorrect, it will be fixed in the next version.

### Download Files

<http://www.smef.gov.bd/site/page/dbb09ddc-cab5-44d4-b21d-57edfc7d76d0/->

#### 4.1.1 এসএমইওমেনএন্ট্রপ্রেনিউরসডিরেক্টরি

SL	Title	Download	Link
1.	SME Women Entrepreneurs Directory 2015	<a href="#">Download</a>	
2.	SME Women Entrepreneurs Directory 2014	<a href="#">Download</a>	

## Exercise: Improve your networking skill

Enhance your networking skill by using some popular apps

### 1. Use Google browser in your smart phone

Browse following web sites:

- (i) [www.dae.gov.bd](http://www.dae.gov.bd)
- (ii) [www.dam.gov.bd](http://www.dam.gov.bd)
- (iii) [www.hortex.org](http://www.hortex.org)
- (iv) [www.smef.gov.bd](http://www.smef.gov.bd)

Notes:

What you found in the web site?

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### 2. Can you use WhatsApp in your mobile phone?

Talk to one of the entrepreneur in the class about your idea of using WhatsApp in your business. First write useful ideas for improving market access of fruits and vegetables below then talk:

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Share some of your business photos and videos

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### 3. Open an email account using Google account

[Create your Google Account- Google Accounts](https://accounts.google.com/signUp)  
[accounts.google.com](https://accounts.google.com/signUp) > [sigNup](https://accounts.google.com/signUp)

A single username and password gets you into everything Google (**Gmail**, Chrome, YouTube, Google Maps). Set **up** your profile and preferences just the way ...

Top of Form

#### 4 Create your Google Account

First name  Last name

@gmail.com

Username

You can use letters, numbers & periods

Password

Use 8 or more characters with a mix of letters, numbers & symbols

Confirm

Next

Bottom of Form

#### (i) Send an email to a market actor about quality and price of your products

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#### Reference

1. *Network for Knowledge Transfer on Sustainable Agricultural Technologies and Market Linkages for South and Southeast Asia*  
<https://www.unescap.org/sites/default/files/Session%201%20SATNET%20Asia%20Project%20-%20Ashuman%20Varma.pdf>

## Thematic Area-F: Market Development

### Topic-F1

#### Various ways to domestic market access and marketing for fruits and vegetables, contract farming and group-based marketing

##### A. Various ways to domestic market access and marketing

Marketing is one of the most important factors in determining the success of any fruit and vegetable farming enterprise. Marketing includes all the operations and decisions made by producers. These decisions range from determining the most marketable crops for production to deciding how to best deliver quality produce to the consumers at a profit.

##### Major Markets

Fruits and vegetables are produced seasonally, but the market requires products throughout the year. This problem of matching product availability with consumer demand was solved in two ways:

- **Selling fresh products** during harvest and shortly thereafter
- **Processing** the rest to meet demand during the rest of the year

##### Non-Direct Market Access

Fruits and vegetables may be marketed directly by producers to consumers or non-directly through terminal market firms, wholesalers, brokers, processors, cooperatives, private packing facilities or buyers for retail outlets.

Important factors to be considered when choosing a non-direct marketing alternative are buyers' needs, requirements, and the abilities of the producer to meet those needs and requirements. Buyers may desire certain grades and varieties of produce, and they may require that the specific produce be packaged in certain containers. Buyers may demand certain quantity levels of produce for specified time periods. Small acreage producers should be aware of their abilities and shortcomings relative to the needs and requirements of buyers.

Some farmers, such as cash grain farmers or dairy farmers, have large, well-established markets. They can use existing organizations to perform the marketing function for them, or they can band together, form a cooperative, and market their products jointly. Small-scale fruit and vegetable growers generally have more difficulty finding established markets; therefore, they usually develop marketing systems tailored to their unique situations.

##### Terminal Market

Terminal markets are assembly and distribution centers located in large metropolitan areas. Producers truck their commodities in large amounts to terminal markets where buyers purchase and then redistribute the goods to local markets. Terminal markets in Bangladesh are located in Dhaka and Chittagong.

Terminal market buyers include buyers for chain stores or large wholesalers. They generally are looking for the following characteristics from their source of supply:

- A large volume from one source is needed, so they do not have to make many small purchases.

- A dependable supply which will be available over a period of time, so they do not have to keep locating new sources.
- A consistent quality of the product and as high a quality as can be purchased at the market price. They also desire to have a variety of consumer and wholesale packs available from the source, so they can meet the varied demands of their retailers.
- A source with an established reputation to minimize the risks of not obtaining the quality and condition desired.

A comparison of the small fruit and vegetable farmer's situation and the terminal market buyer's needs suggests that small farms do encounter problems in meeting many of the needs of terminal market produce buyers.

They encounter problems in meeting volume, timing, containers, delivery schedules, marketing experience and product quality. Although terminal market buyers do some business with small firms, many have tended to bypass these firms in favor of large producers located in established fruit and vegetable producing areas.

#### **Advantages of terminal markets:**

- Current market information is usually available at terminal markets.
- Growers have opportunities to contact many potential buyers.
- Growers may sell large quantities fairly quickly.

#### **Local traders/Farias**

Farias are small traders who dealt in product within three or four local markets and handled a small volume of product. They purchase product from farmers and sold that product either to the Beparies/wholesalers or the consumer. They are usually landless labors or small farmers having no full time work on the farm. Their volume of business is small because they possess a little capital.

#### **Wholesalers**

The farmers sales to a local market wholesalers who in turn sells the fruits and vegetables to terminal market buyers. Local market buyers may be wholesalers, area packing houses, or other handlers such as buying offices for large chain stores. For successful marketing, produce, grading, packing and cooling are required by most buyers.

Advantages to dealing with shipping point firms:

- Growers have the ability to market large volumes through pooling, and do not have to establish a terminal market sales program of its own.
- The buyers may provide guidance on grades, container sizes, etc.
- Produce may be sold to sources not otherwise available to producers.

#### **Brokers/Aratdars**

Brokers are individuals or firms who neither take title nor possession of produce, but serve as agents to negotiate sales contracts between buyers and sellers. Some sellers rely on brokers entirely while others use broker services in a supplemental fashion with their own sales and procurement staff. Brokers try to locate the best quality produce at fair prices for both buyers and sellers, and they inform buyers and sellers of terms, conditions and special agreements of proposed contracts. Brokers may

also handle invoicing, collections and remittance, but brokers are not responsible for payment if buyers fail to honor a contract. Brokers may be located in the local or terminal wholesale markets.

Some considerations important to brokers in grower clients are the ability to supply produce over a long season, consistently high quality, large volumes from one source and experience in growing produce. Brokers generally investigate growers' reputations to see if they have the needed production experience to meet the terminal market buyers' requirements. Although brokers handle the sale of produce, producers retain responsibility for most of the marketing functions. Producers are still responsible for the production, handling, assembling, grading and packing activities.

Advantages to selling through a broker:

- Growers obtain the services of a professional produce salesman and have access to a large number of buyers.
- Brokers provide needed price information.
- Producers are not responsible for the selling function which reduces personnel overhead for selling.

## **Processors**

Other non-direct marketing options for producers are fruit and vegetable processing plants. These plants have the capacity to process large quantities of produce. Almost all processors contract with growers for their raw-product needs. Most processors have their plants in major production areas. Producers usually contract to provide processing plants with a certain amount of quality produce over a certain period of time. However, processors do not contract for all of their produce. Generally, they have contract farmers, also purchase from the open market. This allows processors the freedom to "play" the market and possibly receive the supplies at lower prices.

Processors may control the production practices through the contracts and their field representatives.

Producer advantages associated with processor contracts:

- Price and quantity contract agreements assure producers of a market.
- Production expertise is sometimes provided by the processor.
- Processors may provide harvesting assistance.

## **Cooperatives**

Objectives of produce marketing cooperatives are to secure higher prices, guarantee markets for produce and reduce handling costs for their members. Most fruit and vegetable cooperatives also provide various marketing services for their patrons including harvesting, grading, packing, cooling, storage and transportation services. Cooperatives allow members to bring their produce to one location and pool their produce which allows producers to meet buyer requirements that they often cannot meet by themselves. However, some fruit and vegetable cooperatives also provide purchasing, pooling, processing and bargaining functions for their members.

Benefits rendered by cooperatives:

- Growers gain benefits of large volume marketing.
- Often a sales specialist is available.
- Growers gain benefits of increased bargaining strength.
- Producers may reduce level of market risk.



## **Retail Outlets and e-commerce**

Many opportunities exist for small producers who are willing to deliver fresh produce to retail outlets. Grocery super stores are also have potential contacts for fresh produce sales. Other potential markets include institutions such as schools, hospitals, prisons and hotels. Selling to these markets requires a truck to transport the merchandise; time to deliver to each location (as several will be needed to make delivery cost efficient); and the ability to deal with several buyers on an individual basis. Buyers and sellers usually negotiate prices and delivery times. These outlets require frequent low volume deliveries of a variety of produce. Institutional markets may purchase lower quality grades and not require specific containers.

Producers need to make contact with potential buyers before the growing season in order to identify packing, quality, container, variety requirements and to become acquainted with buyers. Contact should again be made with the buyers prior to harvest in order to deliver samples and place orders. Growers should deliver the amounts and qualities contracted on time. At the end of the season, producers should ask buyers what changes would improve the operation. Consulting with buyers allows them to influence the operation, and makes them more likely to purchase produce next season. On-line sales or virtual e-marketing now growing in Bangladesh for selling of fresh vegetables and fruits in Bangladesh

Advantages of dealing with retail outlets:

- Growers may be paid at time of delivery.
- Growers can bargain for price levels.
- Packing costs may decrease and special containers may not be necessary.
- Producers replace middlemen in the marketing process.

## **Direct Market Alternatives**

Direct marketing is an approach which is usually beneficial to both producers and consumers. When producers choose to use a direct market, they want to capture the retail price that consumers pay at other markets. If growers expect to receive prices similar to those at retail outlets, they must provide the same value of services as other retailers and wholesalers. Retail store produce price consumers pay generally covers the cost of producing, grading, packing transporting, wholesaling and retailing. In order to receive higher net returns, producers try to provide all the marketing services at a lower cost, provide services which are not available through other markets and eliminate certain unnecessary services. Consumers, on the other hand, purchase from direct markets to buy high quality fresh produce directly from producers at competitive prices.

Producers have the opportunity to discuss production practices, display ideas, usage of different types of produce and to socialize with friends, neighbours, and consumers. Consumers have the opportunity to visit a local farm and talk with others who share similar interests.

## **Roadside Stands**

Roadside stands or markets are a type of direct marketing system where a grower establishes a selling place (stand) near a roadway and sells produce directly to consumers. Roadside markets vary from small units selling one or two products on a seasonal basis to firms selling a diversified product mix. The roadside stand usually is located on or near the farm or orchard.

Producers use roadside stands to help supplement their income, provide employment for family members, and dispose of extra produce. Consumers shop at roadside stands in order to purchase fresh, flavorful, high quality produce in a convenient, friendly atmosphere at a reasonable price. Besides quality and price, other factors that draw people to roadside stands are convenience, advertising and recreation.

## **Farmers' Markets**

Farmers' markets are an increasingly popular form of direct marketing. Farmers' markets are a type of direct market where producers come to a designated place to sell their products directly to consumers. Successful farmers' markets are very helpful in increasing the incomes of small farmers who participate in them.

Consumers come to farmers' markets for a variety of reasons which generally include:

- They wish to take advantage of lower prices.
- They prefer fresher, higher quality produce.
- Farmers' markets offer a wide variety of produce to choose from.

## **Evaluating Market Demand**

If you are a new grower, or an established one planning to produce a new item, you should first attempt to evaluate the market demand for the product and then decide which marketing channel(s) will best meet the needs of your consumers. Your estimates of profitability should include the marketing channel costs as well as production costs.

Small-scale growers should collect three types of information before deciding to produce and market fresh fruits and vegetables.

- Determine and define the geographic area where you will market fresh fruits and vegetables. Identify potential customers before you investigate consumer demand.
- Assess the level of unfulfilled demand among consumers within the defined marketing area. It is advisable to estimate the amount that consumers (buyers) within that market buy at present. In the process, you will gain insight into how they might be better served.
- Consider the competitive structure of your market. Knowing who your potential competitors are, where they are located, and what services they provide are important pieces of information for you as a new grower-marketer. Note potential competitors who might have marketing advantages (lower costs, better locations, and higher-quality produce) or may provide potential consumers with similar products.

You must find out as much as possible about consumers who may buy your product(s). What products are your potential consumers buying, where are they buying, and when are these products available?

Determine the likely impact of increased production on future selling prices. If you place more produce on the market, and the products are not of different quality or do not meet some other "unmet need" for which consumers are willing to pay a higher price, then it is likely that prices will drop from current levels. An expected price is a vital piece of information for planning purposes. There is no simple, reliable way of predicting local market prices, but such information is very important to growers. Estimate prices by considering all the available information and using good judgment. When using these estimated prices for planning, remember to include marketing costs and the cost of unsold product.

Introducing a new product to consumers and getting them to buy it is difficult because most will not be familiar with it or its potential uses. The learning process takes time.

## **Quality is the Key to Marketing Success**

Price and quality are synonymous in fruit and vegetable production. Unfortunately, it is not always easy to know what is meant by "high quality" and quality judgment often varies from year to year. Buyers and consumers, however, often have additional criteria by which they judge produce quality, including flavor, ripeness, odour, cleanliness, and the presence of insects and foreign material. Proper

disease management, harvest practices (including picker instruction and supervision), and postharvest handling are critical to marketing success.

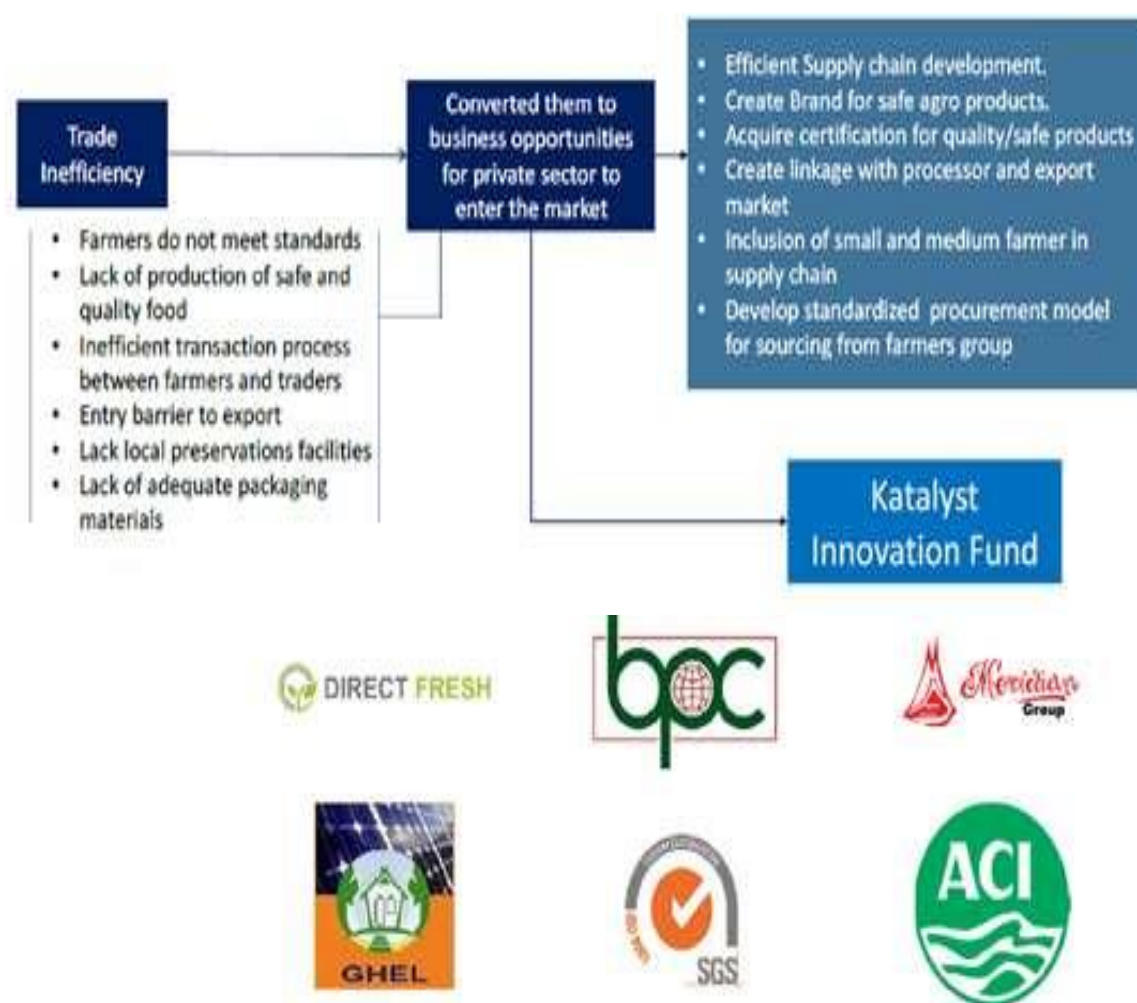
## Interventions

Existing inefficiencies in carrying trade both in the domestic and export markets were seen as a major deterrent to improve the value chain of both fruits and vegetables. A range of constraints add to trade inefficiencies e.g. farmers' produce not meeting quality specifications and standards, lack of production of safe and quality food, inefficient transaction process between farmers and traders, entry barrier to export markets, lack of local preservations facilities and lack of adequate packaging materials etc.

It was understood that Farm to Consumer movement can be significantly improved and embedded value can be unlocked if these trade constraints could be overcome. The focus was to bring about systemic change and partner with corporates who were not only facing these constraints but were willing to co-work on these constraints to bring efficiencies in the value chains.

### Interventions for Improving trade efficiency

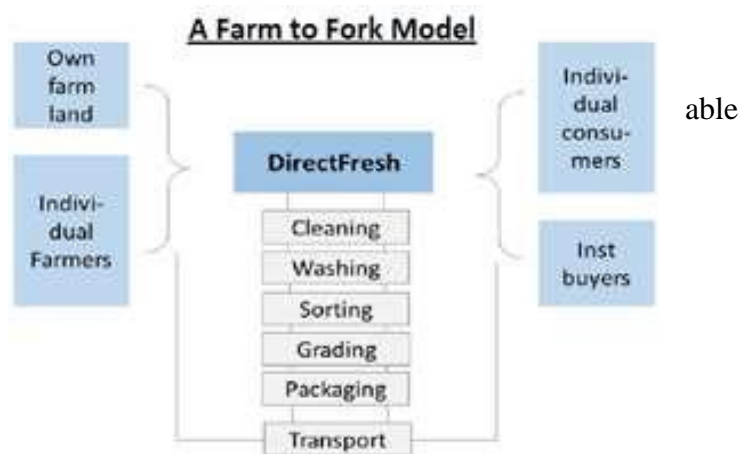
Katalyst identified various stakeholders who can contribute in bringing better trade efficiencies. Following are some of the interventions that aimed to bring in trade efficiencies. Following section depicts how partnerships with 6 organizations helped in addressing trade efficiencies across the value chain and improving market access of vegetables and fruits in Bangladesh.



Katalyst has closely worked with Direct Fresh, one of the largest supply chain outlets to leverage their facilities and establish direct network with the producers. This has helped in the establishing efficient and sustainable supply chain for vegetables and eliminating the middleman in the process.

The important outcomes of these initiatives are:

Through this initiative Direct Fresh was able to directly interact with large number of farmers. They thus substantially widened their product supplier base with farmers as direct suppliers. This also helped them to reduce middleman transaction costs. The direct interaction with the farmers also helped Direct Fresh to understand the ground realities including various constraints for production and plausible interventions.



- It also introduced Good Agricultural Practice (GAP), Integrated Pest Management (IPM) and Integrated Disease Management (IDM) and to adopt modern post-harvest management and fair procurement practices.
- Given this high reach-out with the producers Direct Fresh established proper software based MIS with the support of Katalyst. This ensured better efficiency in operations and led to availing certification.
- Direct Fresh also understood importance of cold storages and storage facilities. These facilities play an important role in reduction of the Post-harvest losses and enhance quality.
- Direct Fresh has also got the HACCP certificate through SGS. The handholding by SGS led to adoption of professional processes and systems. Introduction of all the above measures ensured quality, timely supply of goods, and allowed them to explore various possibilities for export (in international markets both neighbouring as well European).

## B. Contract farming

Establishing producers' organizations or linking farmers directly to buyers through contract is an important way of linking farmers to markets.

Contract farming as a tool to link farmers to markets has received much attention, although their share in total number of farmers is probably small. Such arrangements provide a guaranteed outlet for farmers and a steady supply of high quality produce for the contractor.

### Understanding contract farming

Contract farming happens when individuals or a group of farmers enter into formal (written) or informal (verbal) arrangements with buyers for the marketing their products. The number of ways or approaches through which farmers can market their produce are as follows:

- |   |                  |   |                 |   |                      |
|---|------------------|---|-----------------|---|----------------------|
| <div style="border: 1px solid black; padding: 5px; width: 40px; height: 40px; margin: 0 auto; background-color: #ccc; display: flex; align-items: center; justify-content: center;">1</div> | Contract farming | <div style="border: 1px solid black; padding: 5px; width: 40px; height: 40px; margin: 0 auto; background-color: #ccc; display: flex; align-items: center; justify-content: center;">2</div> | Group marketing | <div style="border: 1px solid black; padding: 5px; width: 40px; height: 40px; margin: 0 auto; background-color: #ccc; display: flex; align-items: center; justify-content: center;">3</div> | Individual marketing |
|---|------------------|---|-----------------|---|----------------------|

### Advantages of Contract farming

- Encourage small-scale producers to diversify into new enterprises.
- Can lead to improved supply of production inputs provided by the contractors.
- May help the farmer get credit.
- Potential buyers can provide extension.
- Offers opportunities to reach markets that are very far away, including export markets.
- Can help farmers learn new production methods and technical skills, improving productivity and profitability.

### Challenges of contract farming:

- Changes in the weather, pests and diseases might make it difficult for farmers to supply the amount and quality of output agreed in the contract.
- If the contract requires more capital-intensive production, the farmer may be required to borrow money to buy equipment and implements.
- An individual farmer may find it difficult to supply the quantity required by the buyers on his own, and other farmers may not want to join him.
- Producing under a contract means that the farmer is not free to run his farm as he wants. He must farm according to the terms of the contract. He loses some control over what he does on his farm.
- The farmers might not be able to sell all their produce if it does not meet the quality standards set in the contract.
- Farmers might find it difficult to bargain for a reasonable price.

### Tips to overcome challenges of contract farming:

- Small-scale farmers can work together in order to increase their power to negotiate the terms of the contract.
- Farmers can work together to supply larger quantities of produce. This is likely to attract the interest of the buyer.
- Groups are likely to find it easier to share the machinery for production, hence reducing the need

to borrow.

- Farmer groups are more likely to get grants and loans than individual farmers.
- Farmer groups can help farmers in the group if they are struggling to keep up with the terms of the contract. They can also put pressure on others in the group who to deliver according to the contract.

### Basic Characteristics of a Good Contract Document

Adherence to basic contracting principles lays the foundation for a successful contractual relationship.

#### Good contracts should:

- Be written down. Contracts that are not written down are difficult to enforce, although they are considered as binding.
- Be enforceable in a court of law. For contracts to be enforceable, they should not contain clauses that contradict the law.
- Clearly define the parties that are involved as seller-buyer, producer-processor, or supplier-purchaser.
- Clearly specify the product under consideration (quality and quantity).
- State the time of delivery.
- Clearly state prices, payment obligations, and other financial terms.
- Indicate mutual obligations, specifying the responsibilities of each party.
- Indicate duration.
- Refer to an arbitration mechanism for settlement of disputes.
- Have a signature clause.

### Advice for Producers before Signing a Contract

Producers must clearly understand the terms and conditions of contracts before they agree to sign a contract. Following is some advice that could keep growers away from contractual disappointments:

- Make sure the contract is read and understood, including all clauses in fine print. It is the producer's right to ask questions or ask the contractor to translate the contract into vernacular.
- Do not accept inputs out of desperation because some contractors may take advantage of such desperation to exploit producers.
- Understand contractual obligations and assess ability to fulfill them.
- Understand contractor obligations and ensure that they deliver on their side of the contract.
- Make an effort to get information about market trends, prices, and risks before signing a contract.
- Make an effort to find out more about contractor trading history and reputation before signing.
- Be wary of contractors who always bring their contracts and inputs late in the season.



## Government Support

Government's role in contract farming is to create an enabling regulatory environment that provides for competitiveness and protection of both producers and contractors. Government is also well-positioned to foster linkages and relationships between investors and producers.

## Enabling and Regulatory Role

Contract farming depends on either legal or informal agreements between the contracting parties. These, in turn, have to be backed up by appropriate laws and an efficient legal system. Government needs to be aware of the implications of all laws and policy decisions on agribusiness development, including contract farming. While it may not be considered a precondition, it is desirable that governments play an arbitration or dispute resolution role.

## Contract details

### Instructions

In your group, please describe the components given below, keeping in mind your farm's needs and issues.

No.	Components	Description
1	Contract duration	
2	Quality standards	
3	Production limits	
4	Cultivation practices	
5	Product delivery arrangements	
6	Pricing arrangement	
7	Payment procedures	
8	Arbitration terms	
9	Insurance arrangements	

Notes

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## Contract appraisal

### Instructions

Carefully review the contract below, and identify the strengths and weaknesses for both parties:

### Sample agreement for contract farming of rice

Company A offers to buy rice from farmer group (FG). The conditions under which the crop will be grown and sold are outlined below.

1. Farmer Group (FG) will plant no more than a total of 100 acres of rice.
2. All crop production activities must be followed in accordance with Company recommendations and instructions.
3. Company A guarantees to buy all grain rice produced from the allocated limit.
4. Buying will be at designated locations and buying slips will be issued immediately after purchase.
5. All rice fields must be effectively fenced against animals.
6. All necessary seed, chemicals and fertilizer will be supplied and charged to the farmers. Payment for pre-sowing cultivation charges may be advanced.
7. The pricing formula for grain purchase at 14.5 percent moisture level will be as follows:
  - (a) Production up to 3 500 kg/acre = 20 TK /kg
  - (b) Production from 3 501 to 4 000 kg/acre = 21 TK /kg
  - (c) Production from 4 001 kg/acre and over = 22 TK /kg
8. Farmers are not allowed to sell rice covered under this agreement, to any other buyer without the written consent of Company A. Any breach of this agreement will result in farmers giving up their contracts.
9. Bags will be supplied by Company A, which retains ownership thereof. Any loss of bags will be debited to the farmer's account.
10. Farmers will be paid when their crops have been harvested and sold to Company A and all outstanding crop advances have been deducted.

If you wish to grow rice on the above terms and conditions, please complete this form and return it to Company A's office before ..... so that we may reserve your quota of ..... acres.

Signed on ..... / ..... /20 .....

(Day)

(Month)

(Year)

\_\_\_\_\_  
Company Farmer

Manager Representative

\_\_\_\_\_  
(Farm No \_\_\_\_\_ )

### **Signing a contract for fresh produce**

Dry produce can be stored and transported easily. It is not easily damaged. Rice, for example, is easy to handle and package. Fresh produce can be easily damaged or spoiled due to rotting. Thus fresh produce needs special packaging and handling.

A contract for fresh produce would include:

- Packaging requirements
- Quality requirements
- Transport requirements
- Storage requirements

Notes: .....  
.....  
.....  
.....

### **Negotiating contracts**

Negotiation is a process whereby two parties discuss an issue and arrive at an agreement. Negotiation usually requires both parties to compromise, where each will give up something and hold on to something in order to come to an agreement.

### **Tips for successful negotiation**

### 1. Things you need to know:

- Range of buyers available
- Demand and supply of crops
- Market prices and conditions
- Break-even and cost of production
- Marketing costs
- Lowest price for product

### 2. Skills and abilities you need to have:

- Ability to say "No".
- Listening skills
- Focus on the end goal
- Self control

Notes:.....

.....

.....

.....

## Farm assessment audit checklist

Knowledge areas	Rating			Areas of improvement
				
Range of buyers available				
Demand and supply of crops				
Market prices and conditions				
Break-even and cost of production				
Marketing costs				
Lowest price for product				

Skills	Rating			Areas of improvement
				
Ability to say "No".				
Listening skills				
Focus on the end goal				
Self control				

Notes:.....

.....

.....

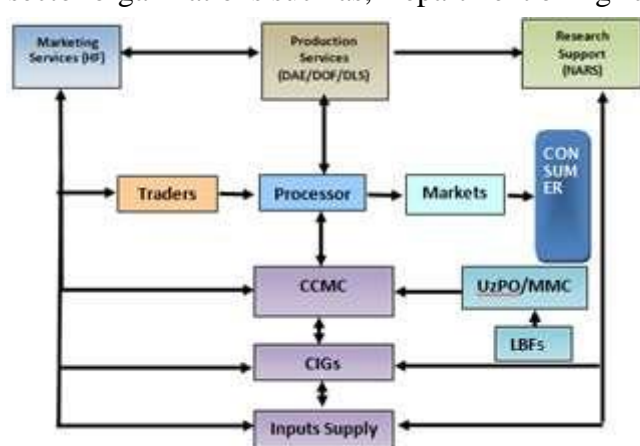
## C. Group Marketing

A forward market linkage with supermarkets, agro-processing industries, exporters and retailers can ensure smallholder farmer's access to guaranteed markets for produce. On the other hand a backward market linkage with suppliers of production inputs can ensure timely availability of inputs. Group marketing can help small holder vegetables and fruit producers to improve market linkages. In order to encourage small and medium scale farmers to grow fruits and vegetables, the government promoted the formation of marketing groups by supporting initiatives through the National Agricultural Technology Project (NATP) of DAE and the Hortex Foundation and different NGOs.

The main purpose of this project is to congregate individual smallholder farmers in small business groups and integrate them in the supply chain. This project not only provide link of smallholder farmers to the market but also provide practical training on creation and maintenance of market linkages so that after the end of the project smallholder farmers group can create and maintain market linkages by themselves. For inputs, the project links smallholder farmers directly to various input suppliers. There are large number of Common Interest Groups (CIGs) working in various regions of Bangladesh. These organizations are very small (around 25-50 members) and are at community level. These farmers group work together, share information and ideas, pool resources, lower production costs and assemble their fresh produce through Commodity collection Centre for group marketing purpose. The traders can purchase fresh produces from the Commodity Collection and Marketing Centre (CCMC).



Hortex Foundation (HF) developed a comprehensive business model linking the public and private sector organizations such as, Department of Agricultural Extension (DAE), Department of Livestock



Services (DLS) and Department of Fisheries (DoF), entrepreneurs, traders, processors, exporters and farmers' organization - Common Interest Groups (CIGs) - and Producers' Organizations (POs) for extension and research support for production, financial services and linkages with the marketing organizations where strong linkage has been suggested between Commodity Collection and Marketing Centre (CCMC) and Producer Organization. In this model, line agencies such as, DAE, DLS and DoF will take leading role in facilitating production and making availability of

commodities to the Commodity Collection and Marketing Centre (CCMC), while Hortex Foundation facilitates marketing of different agro-commodities in domestic and export markets.

## References

1. *DLO, 2010 Markets, Chains and Sustainable Development Strategy and Policy Papers.*<http://www.boci.wur.nl/UK/Publications/>
2. *Farm Business School : Training of Farmers Programme South Asia, Handbook, Food and Agriculture Organization of the United Nations, Regional office for Asia and the Pacific, Bangkok 2011.* <http://www.fao.org/3/i2137e/i2137e00.htm>
3. *Fruit and Vegetable Marketing for Small-Scale and Part-Time Growers*  
<https://extension.psu.edu/fruit-and-vegetable-marketing-for-small-scale-and-part-time-growers>

## Topic F-2.

### **Orientation to International Trade Centre (ITC) market analysis methodology towards assessing export market potentialities of fresh and processed fruits and vegetables**

#### **CHALLENGE IN GLOBAL TRADE**

A key challenge for exporters is the scarcity of reliable trade information on markets.

Exporters need to stay on top of competitive conditions in their current markets, scan opportunities for new markets, and look for opportunities to diversify or value-add to their existing product range. At the same time importers worldwide also seek to optimize the potential offered by preferential trade agreements and improve the efficiency of their sourcing by scanning for new and competitive supplier countries.



ITC addresses these issues with its suite of market analysis tools and related market data and information sources.

#### **MARKET ANALYSIS TOOLS**

ITC has created a range of market analysis tools for developing countries – Trade Map, Market Access Map, Investment Map and Standards Map to help users examine the export and import

statistics of over 220 countries and territories to better understand supply and demand trends for around 5,300 internationally traded products.

The tools are unique in product detail, as well as in breadth of geographic coverage – particularly for developing and least developed countries. More than 230,000 users in 224 countries and territories have registered to use the tools. They include enterprises, governments, educational institutions and most of the World's top 100 companies.

Developing countries can use these tools to help grow their exports by identifying opportunities for product and market diversification. A wide range of navigation options, combined with a powerful set of analytical outputs – tables, maps and charts - make it easy to analyse trade-related information for sets of products, sectors or countries.

Users in developing countries can benefit from **FREE ACCESS** to the tools thanks to financing from the European Commission (EC) and donors to ITC Trust Fund.





# International Trade Centre

## Subscribers to ITC's Market Analysis Tools

### MULTINATIONAL COMPANIES

- Coca-Cola
- Walmart
- BASF
- Philips Morris International
- FORD
- Herbalife
- McCormick
- BMW
- VF Outdoor
- UPS
- LCH Cleanet
- Lubrizol

### GOVERNMENTAL AGENCIES

- Australian Trade Commission (AUSTRADE)
- New Zealand Trade & Enterprise (NZTE)
- NL Agency
- Slovenia Entrepreneurship and Foreign Investments Agency (JAPTI)
- Library of Congress
- US International Trade Commission
- UK Department for Environment, Food and Rural Affairs (DEFRA)



### FINANCIAL INSTITUTIONS

- Citigroup
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- INTESA SANPAOLO
- TRAVELEX
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### UNIVERSITIES

- UK - London School of Economics
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- DE - University of Cologne
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- SW - Lund University
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- McKinsey & Company
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Other services

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Exporters > Market Data and Information > Market analysis tools > Overview

Request More Information

ENHANCING THE TRANSPARENCY OF GLOBAL TRADE AND MARKET ACCESS

In 2012, the tools will remain free to users from developing countries.

The International Trade Centre has developed five online tools — [Trade Map](#), [Market Access Map](#), [Investment Map](#), [Trade Competitiveness Map](#) and [Standards Map](#) — that collectively help improve international-trade transparency and enable companies and trade support institutions to identify export/import opportunities and compare market-access requirements (e.g. tariffs, official market regulations and other non-tariff measures, and private voluntary standards such as organic certification or FAIRTRADE). The tools help trade policymakers monitor national trade performance and prepare for trade negotiations.

Free user support material, including video trainings, is also available [online](#).

As of the 1st January 2008, all users from [least developed and developing countries and territories](#) may access the ITC's market analysis tools free of charge.

If you are not registered yet, [please create your account here](#).

**PLEASE ENTER YOUR EMAIL AND PASSWORD TO ACCESS THE TOOLS:**

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1	2	3	4	5	6	7
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15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

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ITC launches NTM survey in Guinea

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**NEW:** As of September 1, 2012 ITC adds company data from more than 60 countries to Trade Map ([www.trademap.org](http://www.trademap.org)) improving the ability of companies to identify trading partners across the world.

The new Company Data table provides information on:

- a) Company name
- b) City and country
- c) List of traded products
- d) Number of employees
- e) Annual turnover
- f) Contact persons
- g) Website address
- h) Phone numbers

The inclusion of company data in ITC's Trade Map comes in response to a user survey of ITC's Market Analysis Tools, which suggested that adding company data would be an important supplement to the existing trade statistics. The addition of company data has been made possible following an agreement with Kompass International, a comprehensive Business-to-Business worldwide database.

#### **TRADE MAP** ([www.trademap.org](http://www.trademap.org))

An interactive online database on international trade statistics and presents indicators on export performance, international demand, alternative markets and the role of competitors from both the product and country perspective.

Trade Map covers the annual trade flows (mirror and direct) of over 220 countries and territories and 5,300 products defined at the 2, 4 or 6-digit level of the Harmonized System with different trade indicators (indices, values, quantities, trends, market share and unit values) and times series since 2001 displayed in graphic, map or tabular format. Trade values can be selected from 16 different currencies.

Recently, we also implemented two additional indicators in Trade Map. One indicator is on the Average Distance of importing or exporting countries and the other is on Market Concentration to give an idea of how competitive the market is.

#### **STRENGTHS**

The strength of Trade Map lies in its constant update of monthly and quarterly data from both developed and developing countries that cannot be found in other tools, as ITC collects this directly from national authorities. Moreover, users have the possibility of visualization of data with tables, graphs and maps that are simple to interpret.

#### **TRADE MAP FEATURES**

**Analysis of present export markets:** Examine the profile and dynamics of export markets for any product, assess the value, size and concentration of exports and highlight countries where market shares have increased.

**Pre-selection of priority markets:** View the world's major importing countries, illustrate the extent of import concentration and in which countries demand has increased over the past five years.

**Overview of competitors in global and specific markets:** Identify the leading exporting countries for a given product; highlight a country's position in world exports or in the imports of partner and neighbouring countries.

**Review of opportunities for product diversification in a specific market:** Make a comparative assessment of import demand for related products in an export market; identify imports of similar products and possible synergies.

**Visualization of trends and seasonality:** display the monthly data on graphs and identify slopes and regular peaks in values as well as in quantities and in unit values.

**Identification of existing and potential bilateral trade with any partner country:** Identify product-specific opportunities by comparing actual bilateral trade, the total import demand of partner countries and the overall export supply capacity of the home country.

**Data export:** convert all what you get from Trade Map into a file: download not only trade data as Excel or text files but also graphs as images.

**Information on tariffs:** View information on tariff equivalent ad valorem faced by countries in their exportations or applied by importing countries.

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TRADE MAP

Trade statistics for international business development

Home

Selection Menu

Investment

Market Access

Reference Material

My Account

FAQ

Tutorials

About

English

other criteria

Imports

Time Series

by product

Product Cluster at 10-digit

Monthly data

Values

US Dollar

List of products imported by Turkey

detailed products in the following category : 151211 Sunflower-seed or safflower oil, crude

Unit : US Dollar thousand

Table

Graph

Map

Companies

Export in

Time Period (number of columns) : 12 per page

Rows per page Default (25 per page)

Code	Product label	Imported Value in 2011-M08	Imported Value in 2011-M09	Imported Value in 2011-M10	Imported Value in 2011-M11	Imported Value in 2011-M12	Imported Value in 2012-M01	Imported Value in 2012-M02	Imported Value in 2012-M03	Imported Value in 2012-M04	Imported Value in 2012-M05	Imported Value in 2012-M06	Imported Value in 2012-M07
151211910000	Sunflower-seed, safflower or cotton-seed oil and fractions thereof, whether or not refined, but not chemically modified: Sunflower-seed or safflower oil and fractions thereof: Crude oil: Other: Sunflower-seed oil	72,323	17,420	27,828	49,407	57,670	95,329	42,052	83,308	78,113	120,786	111,629	73,184
151211100000	Sunflower-seed, safflower or cotton-seed oil and fractions thereof, whether or not refined, but not chemically modified: Sunflower-seed or safflower oil and fractions thereof: Crude oil: For technical or industrial uses other than the manufacture of foodstuffs for human consumption (a)	2,251	4,038	1,323	2,383	3,668	2,159	2,169	6,783	2,857	5,441	2,138	4,595

Sources : ITC calculations based on Turkish Statistical Institute (TURKSTAT) statistics.

Sources : ITC calculations based on [Turkish Statistical Institute \(TURKSTAT\)](#) statistics.

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Home

Selection Menu

Investment

Market Access

Reference Material

My Account

FAQ

Tutorials

About

English

other criteria

Imports

Trade Indicators

by country

Direct data

List of supplying markets for the product imported by Brazil in 2011

Product : 150910 Olive oil, virgin

Brazil's imports represent 4.73% of world imports for this product, its ranking in world imports is 5

Table

Graph

Map

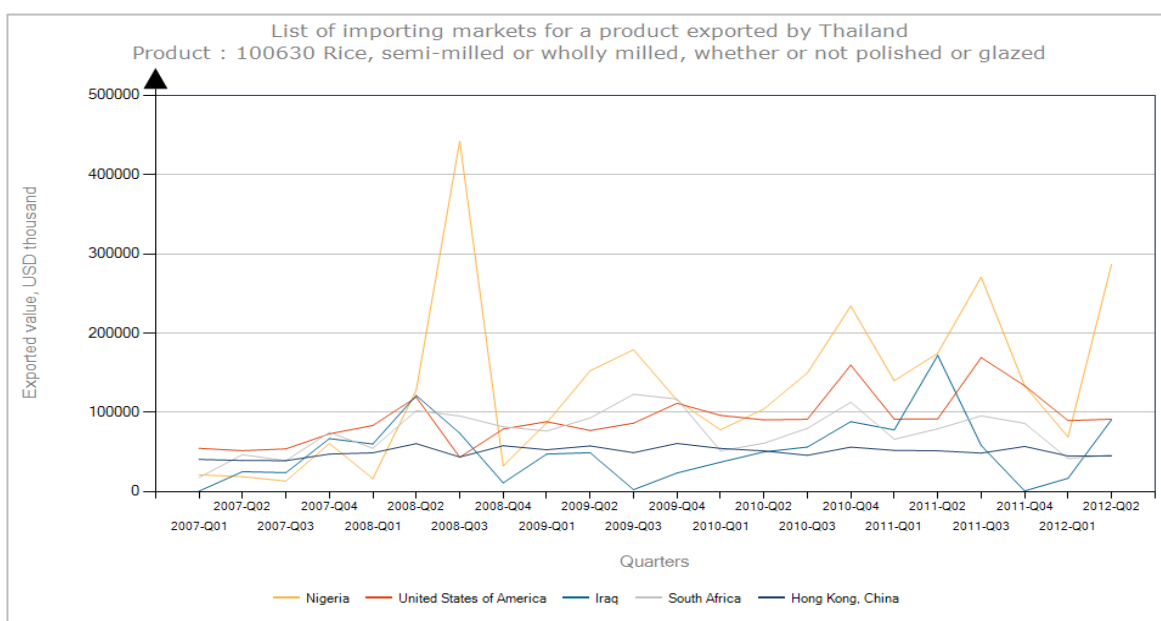
Companies

Export in

Rows per page

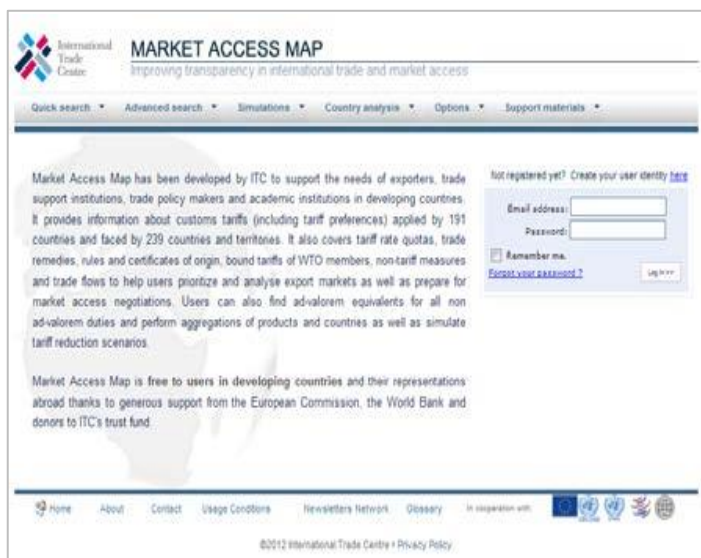
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Bilateral trade at 8-digit	Exporters	Trade Indicators											Tariff (estimated) applied by Brazil (%)
		Imported value 2011 (USD thousand)	Trade balance 2011 (USD thousand)	Share in Brazil's imports (%)	Imported quantity 2011	Quantity unit	Unit value (USD/unit)	Imported growth in value between 2007-2011 (% p.a.)	Imported growth in quantity between 2007-2011 (% p.a.)	Imported growth in value between 2010-2011 (% p.a.)	Ranking of partner countries in world exports	Share of partner countries in world exports (%)	
	World	225,248	-225,205	100	48,062	Tons	4,687	20	24	26		100	-1
	Portugal	115,300	-115,300	51.2	22,646	Tons	5,091	28	33	29	5	4.2	23
	Spain	61,439	-61,439	27.3	14,188	Tons	4,330	21	25	34	1	45.9	1
	Argentina	26,045	-26,045	11.6	6,734	Tons	3,868	2	6	9	6	1.6	-1
	Italy	17,616	-17,604	7.8	3,637	Tons	4,844	17	21	8	2	30.2	3
	Greece	2,765	-2,765	1.2	474	Tons	5,833	14	21	18	3	6.7	-7
	Chile	1,535	-1,534	0.7	306	Tons	5,016	121	138	73	10	0.6	64
	France	229	-229	0.1	12	Tons	19,083	13	-16	324	9	0.6	-1



## MARKET ACCESS MAP (www.macmap.org)

is an interactive analytical web application developed by the International Trade Centre (ITC) to support the needs of exporters and importers, trade support institutions, trade policy makers and academic institutions in developing countries. With the aim of enhancing market transparency and facilitating the analysis of trade-related policy issues, it presents a comprehensive perspective on the different types of barriers that affect international trade.



## STRENGTHS

The application provides information on applied customs tariffs including MFN tariffs and preferences granted unilaterally and in the framework of regional and bilateral trade agreements. Users can find ad valorem equivalents (AVEs) for non-ad valorem duties in order to compare tariffs across countries, perform product aggregations at a sectorial or regional level and simulate tariff reduction scenarios. The application also covers tariff rate quotas, trade remedies, rules of origin as well as the corresponding certificates, bound tariffs of WTO members, non-tariff measures (NTMs) and trade flows to help users prioritize and analyze export markets as well as prepare for market access negotiations.

## MARKET ACCESS MAP FEATURES

- A wide geographic coverage with applied MFN and preferential tariffs available for more than 190 countries and territories.
- A new database on NTM regulations, categorized according to a classification validated by key international organizations.
- Seamlessly integrated and continuously updated data on tariffs, trade and NTMs from multiple data sources which can be consulted simultaneously.
- Different methods of calculating AVEs of non-ad valorem tariffs and trade-weighted average tariffs.

- Access to extensive time-series and the possibility to download large sets of raw data.
- High flexibility for users to define tariff reduction simulations, including dismantling schedules.
- A flexible product selection based on two international classifications: the Harmonized System (HS) and the Standard International Trade Classification (SITC).
- The possibility to share queries with other users.

## TARIFFS APPLIED BY THE UNITED STATES OF AMERICA TO IMPORTED MALAWIAN LEAF TOBACCO

Tariffs applied by **United States of America**

Product: **24012005 - Leaf tobacco, the product of two or more countries or dependencies, when mixed or packed together, partly or wholly stemmed, not threshed**

Partner: **Malawi**

Data source: **ITC (MAcMap)**

Year: **2011**

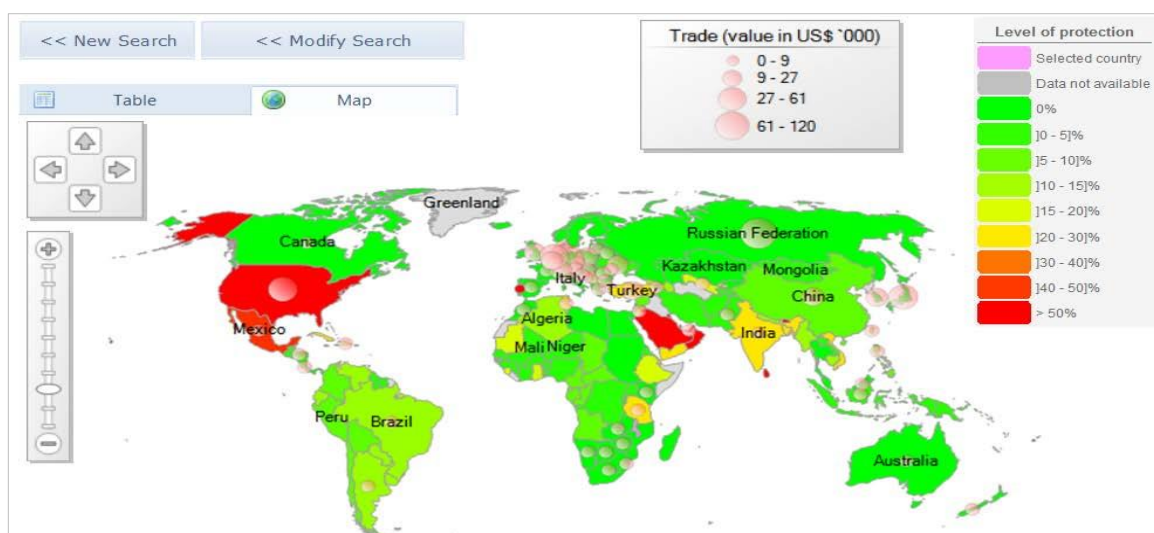
Nomenclature: **HS Rev.2007**

AVE Methodology: **AVE based on the World Unit Value**

<< New search << Modify search

Tariff regime	Applied tariff (specific duty as reported by the country)	Applied tariff	Total ad valorem equivalent tariff
MFN duties (Applied)	\$5.48/kg	5480.00 \$/Ton	130.34%
Preferential tariff for Least Developed Countries		0%	0%
Preferential tariff for AGOA countries		0%	0%

Page size: 50 3 items in 1 pages



## TARIFFS FACED BY MALAWIAN EXPORTED TOBACCO IN ALL POSSIBLE MARKETS

## NON-TARIFF MEASURES APPLIED BY HONG KONG, CHINA TO IMPORTED MALAWIAN TOBACCO

Import related non-tariff measures applied by **Hong Kong, China**

Product: **240120 - Tobacco, unmanufactured, partly or wholly stemmed or stripped**  
 Number of measures in this category: **18**  
 Total national tariff lines affected: **2**  
 Partner: **Malawi**  
 Time of last update: **June 2010**

<< New search      << Modify search

To examine in detail the NTMs, click on the marked-up text in the columns.

Measures applied by importing country	Number of affected NTL products
Sanitary and phytosanitary measures (SPS) (8)	2
Technical barriers to trade (TBT) (6)	2
Charges, taxes and other para-tariff measures (4)	2

To see the Rules of Origin and certificates applied by Hong Kong, China click [here](#)

## STANDARDS MAP ([www.standardsmap.org](http://www.standardsmap.org))

Standards Map is an interactive online database which presents comprehensive and comparable information on voluntary sustainability standards, private standards, sustainability schemes and retailer codes of conduct, with the aim to strengthen the capacity of producers, exporters and buyers to participate in more sustainable production and trade.

## STRENGTHS

The strength of Standards Map lies in its **impartiality and the quality of its data which is verified by standard initiatives and the extent of the information provided, with over 700 criteria analyzed for each initiative**. Standards Map is the only web platform providing information at such high level of detail. Standards' data in the tool is verified according to a process including third party experts and the respective standard organizations. Standards Map does not make value judgments or rate standards.

## STANDARDS MAP FEATURES

**Analyze and compare standards:** Over 70 voluntary standards operating in more than 200 target markets, certifying products and services in over 60 economic sectors - including agriculture, forestry, fisheries, mining, textiles and manufactured products, among others.

**Identify opportunities for product diversification and new niche markets:** Make a comparative assessment of standards requirements and assess potential costs and benefits linked to the adoption of private standards.

**Flexible analytical tool:** run customize searches based on whether you are a producer, exporter, trade support institution, policy maker or researcher. Review standards' coverage and scope, cost and price estimates, support and assistance, governance and environmental, social, economic, ethical, traceability and quality requirements. Construct advanced queries or refine pre-set queries from a pool of over 700 criteria.

**Review research documents on voluntary sustainability standards:** focusing on specific standards, product, countries or issues such as standards' impact, operational assessments and selected market data.

**Generate maps:** to view in which countries certified units operate, where specific certification bodies can certify/verify operations and now link your queries to ITC's Trade Map.

**Impartial information:** Standards Map is the only web platform providing information at such high level of detail. Standards' data in the tool is verified according to a process including third party experts and the respective standard organizations. Standards Map does not make value judgments or ratings of standards.

### ***Reference***

1. *ITC. Market Analysis and Research. Enhancing Understanding of International Trade Opportunities and Obstacles, International Trade Centre*
2. *ITC, 2014. Trade Map User Guide. Trade statistics for international business development. Market Analysis and Research (MAR) Division of Market Development*
3. <https://www.trademap.org/Index.aspx>



## **Procedure of export marketing and export growth of fresh and processed fruits and vegetables**

### **1. Procedure to be Followed while Making Export**

Developing countries are making all efforts to increase their exports. The exporters will have to get themselves registered for getting some incentives allowed under export promotion schemes. The exporters are also required to get a code number from the concerned bank. Every exporter and importer is also required to get Importer-Exporter Code Number from Licensing Authority concerned. Export trade has to follow a set procedure from receiving an enquiry to completion of the transaction. The following generalized procedure is usually followed for making exports:

#### **1.1 Receiving an Enquiry**

An exporter will advertise his product through brochures, leaflets, or other advertising media. He may introduce his product through sales representatives. When the product arouses interest in the mind of the prospective buyer, he will make an enquiry from the exporter.

It may not be possible to attend to all the enquiries. Some persons may enquire if they can be appointed sole-selling agents. Some may be dealing in some type of product and are interested to know the terms and conditions of sale etc.

There may be enquiries from persons who are genuinely interested to buy. Before replying to these enquiries, the exporter should first try to know about the enquiries. A letter should be written to the enquirer asking for information about them.

#### **The information to be obtained may relate to:**

- (a) The experience of handling the same product
- (b) Standing in the business
- (c) The area covered in the country
- (d) Names and addresses of firms, if any, with which they are already dealing
- (e) Mode of purchasing the goods whether on their own or as commission agents?

If the enquirer is serious to make purchases and is well established in the line, he will reply promptly. On the other hand, if the enquirer wrote casually then he will not pursue the correspondence further. If the enquirer sends the required information then the exporter should pursue the things further. After being satisfied that the enquirer is interested to buy the goods and will be in a position to meet his obligations in time, he should send the details of the terms of business and terms of payment etc.

## **1.2 Scrutinizing the Order**

The next stage in export procedure is the scrutiny of the export order. The order should be scrutinized with reference to the terms and conditions of the contract. The exporter should first see that if the buyer is from a country where foreign exchange restrictions are imposed, whether he has acquired the permission of the competent authority for releasing foreign exchange or not.

If this permission is not received by the buyer then he will not be in a position to make a payment for the purchase. Secondly, if there are import restrictions in the country of the importer then he should get import license from the competent authority. Though these are the issues having direct concern with the importer but exporter can also suffer if importer has not followed the rules and regulations of his country.

The order should correspond to the terms and conditions supplied to the overseas buyer. Care should be taken to see the following facts:

- (a) Mode of payment
- (b) Delivery schedule
- (c) Documents required.

Usually required documents are:

- (i) Bill of exchange
- (ii) Commercial invoice
- (iii) On board bill of lading
- (iv) Packing list
- (v) Certificate of origin.

The regulations of both exporting and importing countries should be taken into account while scrutinizing export order.

## **1.3 Acknowledgement of the Order**

After scrutiny of the order, it should be acknowledged if everything is as per decided terms and conditions. If the importer is an old customer then there will not be any hitch in confirming the order because credit limits, etc. will already be in operation and he will comply with the conditions of foreign exchange and import license at the first instance.

The confirmation of the order should contain the following information:

- (a) Acknowledging the receipt of the order with thanks.
- (b) The likely dates of dispatch of goods from the factory and from the seaboard.
- (c) If there is any variation in price from the one given in the order by giving sound explanation for the same.
- (d) Mode of shipment of the goods.
- (e) Method of packing.

- (f) Packing marks which will be used while sending the goods.
- (g) The name of the bank which will be used for collecting the draft.

The above-mentioned information will enable the importer to plan the receipt of goods and arranging for payments in a specific period of time.

#### **1.4 Arranging the Goods**

As soon as the order is confirmed, efforts should be made to arrange the goods. A manufacturer exporter will issue an indent to the Factory Manager or Works Manager giving details of goods to be supplied, the time when goods should be ready and date of shipment, etc.

If the importer has given some instructions about the goods then these should be passed on to the factory manager. There should not be any uncertainty about the dates by which the goods are to be manufactured. A merchant-exporter either procures the goods from the market or gets them manufactured from other manufacturers.

#### **1.5 Excise Clearance for Goods**

If the goods are excisable, there are two methods of getting the goods cleared. One method is that whenever the goods are to be removed for export, the excise duty is paid by the exporter. Later when the goods are exported a claim is made for refund of excise duty.

The second method is to fill a bond in form B-I (General Security) or form B-I (General Surety). The duty is not paid in this case. The bond is discharged when the goods are exported. Before removing excisable goods from the factory, each consignment is presented to the Central Excise Office having jurisdiction over the factory together with an application in form AR-4 (application for removal of excisable goods for export) for claiming rebate of excise duty. When the goods are removed from the factory, a copy of the application along-with the goods is presented to the customs collector at the port who certifies that the goods have actually been exported. On the basis of this acknowledgement a claim is filed for rebate of excise duty if it has already been paid or for discharge of obligation if the bond was executed for the same.

#### **1.6 Inspection of Goods**

Under this scheme the exporter makes an application in the prescribed form to the Export Inspection Agency (EIA) with the following documents:

- (a) A copy of the commercial invoice.
- (b) A draft for the necessary fees for inspection.
- (c) A copy of the export contract.
- (d) A declaration of the importer's technical specifications of quality or a sample approved by the importer in support of the declaration of specifications.

The application for inspection is made well in time before the date of shipment. An inspector is deputed by the Inspecting Agency to inspect the export consignment. If the goods conform to prescribed specifications, an inspection certificate is issued. The goods are then despatched to the port of shipment and the concerned receipt is obtained.

### **1.7 Getting Insurance Policy**

After getting a certificate of inspection the exporter applies for insurance cover or policy as the case may be. If the importer wants an insurance policy then it will be for CIF value plus 10 per cent to cover expenses. The insurance policy is received in duplicate.

### **1.8 Shipment of Goods**

The exporter has the option of using sea or air route to send the goods. A decision is taken depending upon the volume and weight of goods and amount of freight involved. When goods are to be sent by sea then these are sent to the concerned port. A number of formalities are to be performed up to the time the goods are boarded on ship. For this purpose, the services of clearing and forwarding agents are availed.

These agents are supplied the following documents:

- (a) Commercial invoice (in duplicate)
- (b) Original export order
- (c) Original letter of credit
- (d) GR-I (Guaranteed Remittance) form (in duplicate) showing exporter's code number
- (e) AR-4 form in original and in duplicate
- (f) Excise gate pass in original
- (g) Certificate of inspection, where necessary
- (h) Declaration form in triplicate
- (i) Packing and Weight lists
- (j) Railway receipt

### **1.9 Preparing Shipping Bill**

On the basis of railway receipt the clearing and forwarding agent takes delivery of the goods and arranges their storage in a warehouse. The agent prepares the requisite copies (generally five copies) of the Shipping Bill.

The shipping bill incorporates the following information:

- (a) Name and address of the importer
- (b) Vessel's name and rotation number
- (c) Agent's name
- (d) Port
- (e) Final destination
- (f) Exporter's name and address
- (g) Number of packages
- (h) Marks on packages
- (i) Gross and Net Weight

- (j) Description of goods
- (k) Real value
- (l) Country of origin
- (m) Code number of goods
- (n) Number and date of GR Form, AR-4 form etc.
- (o) Export license number where necessary

The agent presents a copy of the shipping bill to the shed superintendent of the port trust and obtains a carting order. It enables the agent to cart the goods to the transit shed for physical examination. The dock appraiser, if satisfied, makes an 'out of charge' endorsement on the duplicate copy of the shipping bill and returns it with the other documents. The duplicate copy of the shipping bill is presented to the preventive officer of the custom department who endorses it with 'Let Ship' order.

### **1.10 Obtaining Mate's Receipt**

After the clearance of goods by the customs authorities the cargo is loaded in the ship. The Mate's Receipt is signed by the captain of the ship or his agent indicating that goods have been received on board. The mate's receipt is delivered to the Port Authority's shed.

The clearing and forwarding agent pays the dock dues and obtains mate's receipt. The mate's receipt is presented to the Preventive Officer for certifying the fact of shipment on all copies of Shipping Bill and duplicate copy of AR-4 and all other documents which need post-shipment endorsement from him (Preventive Officer). The mate's receipt is presented to the Shipping Company and requisite copies of Bill of Lading are obtained by the agent.

### **1.11 Shipment Advice to Importer**

After the receipt of various documents from clearing and forwarding agent an intimation of shipment is sent to the importer. The intimation contains the date of dispatch of goods, name of the ship etc. The exporter also sends (a) Non-negotiable copy of the bill of loading and (b) Master document copy.

### **1.12 Presenting Documents to Bank**

Once the goods have been sent, the exporter should arrange to obtain his payment for the exports by submitting relevant documents to the bank. The process of submitting documents and obtaining payments is known as 'negotiating the documents'.

The bank examines the documents with reference to the terms and conditions of the original letter of credit. Thereafter, relevant documents are sent to the banker of the importer by the first air mail followed by a second set of documents by the second air mail to ensure that in case the first set is lost, the importer can take delivery of the consignment on the basis of second set of documents.

The original copy of the Bank Certificate along with attest copies of Commercial Invoice are returned to the exporter. The duplicate copy of the bank certificate is forwarded to the Chief Controller of Imports and Exports of the area. The bank also sends duplicate copy of GR Form to the Exchange Control Department of the concerned bank.

## 2. Export Growth of Fruits, Vegetables and other Agro-Processed Products in Bangladesh

### 2.1 Export Growth as per the Report of Hortex Foundation, Bangladesh

As per the report of Hortex Foundation, present Government of Bangladesh is attaching high importance for the production and export of high value agro-commodities especially horticultural crops through diversification of produces and market promotion. About 100 types of fresh horticultural crops are being exported from Bangladesh to more than 40 countries in the world. Export of fresh fruits and vegetables from Bangladesh are significantly increased from \$51million in FY2008-09 to \$125million in FY2015-16. However, the export value in FY2015-16 decreased 12% over the previous FY2014-15 (Table-1). In FY2015-16, vegetables export market to 38 countries comprises Middle East 62.05% (Saudi Arabia 24.70%, Qatar 15.04%, UAE 9.55%, Kuwait 9.21%, Bahrain 3.55%), EU countries 14.59% (UK 11.86%, Italy 2.73%), Malaysia 11.48%, Singapore 3.93% and others 7.95%. On the other hand, fruits are being exported from Bangladesh to 15 countries. Fresh potato export is also significantly increased from \$0.68million in FY2008-09 to \$10.06 million in FY2015-16. Hortex Foundation had direct and indirect role in these export achievements. Hortex Foundation facilitates export of high value horticultural crops and processed agro-commodities in the mainstream market of EU, Middle East, Far East in addition to ethnic markets. Some requirements to enter into mainstream market are adoption of Good Agricultural Practices (GAP), traceability system, strict compliance of sanitary & phyto-sanitary measures including good packaging. The list of major exported horticultural crops from Bangladesh are provided in Annex-1.

**Table-01: Export growth of fresh fruits and vegetables in Bangladesh**

Fiscal Year	Quantity Exported (MT)	Export Value (in Million US\$)	Export Growth (%)
2008-09	24670	50.71	
2009-10	29370	64.21	(+) 26.62
2009-10	29370	64.21	(+) 26.62
2010-11	48428	109.41	(+) 70.39
2011-12	59573*	134.59	(+) 23.01
2012-13	80660*	182.23	(+) 35.39
2013-14	92679*	209.38	(+) 14.89
2014-15	62730*	141.72	(-) 32.31
2015-16	55138*	124.57	(-) 12.10

Source: NBR, Export Promotion Bureau (EPB), 2016 and Data Analysis by Hortex Foundation, 2016

Note: \*Export quantity of fresh fruits & vegetables estimated by Hortex Foundation as per average export value of fruits and vegetables @2259.23

US\$/MT in FY2010-11 due to export quantity data is not available since FY2011-12 from EPB

Table-1 reveals that export quantity and value of fresh fruits and vegetables are in decreasing trend from FY2014-2015 due to restriction in EU countries on some fruits and vegetables including self-ban by the Government of Bangladesh. The major causes of restrictions are (i) not complying with the phytosanitary requirement of importing countries, (ii) presence of quarantine harmful organisms in fruits, vegetables, betel leaves, (iii) presence of brown rot

bacterial agent (*Ralstonia solanacearum* (Smith) Yabuuchi et al.) and potato tuber moth in potato; (iv) absence of product integrity, (v) documentary reasons i.e. modification of Phytosanitary Certificate (PC) and, sometimes absence of PC during export from Bangladesh.

**Table-02: Top ten export markets of Bangladeshi fresh vegetables in FY2015-16**

Export market	Export value (million US\$)	Percent (%) share of total export value	Ranking of partner countries in world imports (in 2015)*	Share of partner countries in world imports in 2015(%)*	Tariff (estimated) faced by Bangladesh (%)*
1. Saudi Arabia	25.77	24.70	21	1	2.4
2. Qatar	15.70	15.04	44	0.4	2.4
3. UK	12.38	11.86	3	6.3	0
4. Malaysia	11.98	11.48	16	1.3	1.1
5. UAE	9.96	9.55	n/a	n/a	n/a
6. Kuwait	9.61	9.21	36	15	2.4
7. Singapore	4.10	3.93	29	0.8	0
8. Bahrain	3.70	3.55	64	0.2	2.4
9. Italy	2.85	2.73	12	2.5	0
10. Saint Barthelemy	2.11	2.02	n/a	n/a	n/a
Total 10 countries	98.16	94.07			
Other 28 countries	6.18	5.93			
All 38 countries	104.34	100.00			

Source: NBR, Export Promotion Bureau (EPB) & Data Analysis by Mitul 2016, Hortex Foundation, Dhaka

Note: \*Data analysis from ITC Trade Map 2015, Geneva, Switzerland

n/a: data is not available

**Table-03: Top ten export markets of Bangladeshi fresh fruits in FY2015-16**

Export market	Export value (million US\$)	Percent (%) share of total export value	Ranking of partner countries in world imports (in 2015)*	Share of partner countries in world imports in 2015(%)*	Tariff (estimated) faced by Bangladesh (%)*
1. India	18.24	90.16	12	2.7	21.1
2. UK	0.74	3.65	3	5.5	0
3. Malaysia	0.63	3.11	34	0.6	5.9
4. Vietnam	0.48	2.37	15	2.1	17.4
5. Indonesia	0.07	0.34	33	0.6	6.7
6. Saudi Arabia	0.03	0.14	19	1.3	1.4
5. Indonesia	0.07	0.34	33	0.6	6.7
7. UAE	0.009	0.04	n/a	n/a	n/a
8. Singapore	0.0028	0.01	30	0.6	0
9. Saint Barthelemy	0.0027	0.01	n/a	n/a	n/a
10. New Zealand	0.0024	0.01	46	0.3	0
Total 10 countries	20.2069	99.84			



Other 5 countries (Canada, Germany, Japan, Myanmar and USA)	0.0231	0.16			
All 15 countries	20.23	100			

Source: National Board of Revenue (NBR), EPB 2016 & Data Analysis by Mitul 2016, Hortex Foundation, Dhaka

Note: \*Data analysis from ITC Trade Map 2015, Geneva, Switzerland

n/a: data is not available

**Table-04: Top 10 Agro-processed products exported from Bangladesh in FY2014-2015**

Top 10 agro-processed products exported	Quantity exported (MT)	Export value (million US\$)
1. Spices	17082.41	60.42
2. Juice	37566.95	37.85
3. Drinks	42175.99	29.00
4. Biscuits	10146.34	20.07
5. Chanachur	6016.55	12.28
6. Puffed rice	6896.12	11.21
7. Frozen snacks	4353.37	8.68
8. Candy	4204.37	7.40
9. Mustard oil	3140.00	6.58
10. Frozen meat	772.97	4.69
Total Top 10 products	132355.10	198.18
Other 34 products	17142.6	25.97
Total	149497.7	224.15

Source: BAPA 2016 & Data Analysis by Mitul 2016, Hortex Foundation

**Table-05: Top ten export markets of Bangladeshi Agro-Processed Items in FY2014-2015**

Top ten export markets	Quantity exported (MT)	Export value (million US\$)
1. UAE	22727.345	44.71
2. Saudi Arabia	19771.693	42.50
3. Malaysia	16473.824	22.49
4. India	29995.123	21.53
5. Oman	9061.125	12.40
6. Singapore	4430.31	11.91
7. United Kingdom	4720.951	10.07
8. USA	4382.044	8.98
9. Qatar	4140.499	6.47
10. Kuwait	2656.39	4.99
Export to 10 countries	118359.304	186.05
Export to other 84 countries	31138.40	38.095
Total export to 94 countries	149497.704	224.145

Source: BAPA 2016 & Data Analysis by Mitul 2016, Hortex Foundation

## **2.2 Vegetables Export Performance (as per [thefinancialexpress.com.bd](http://thefinancialexpress.com.bd))**

Country's vegetables exports showed strong performance in the first half of the fiscal year 2019-2020. Insiders said improvement in compliance issues and opening markets by the European Union for Bangladeshi fresh crops have helped achieve such exponential growth. A leap in cabbage, bean, brinjal, pointed gourd and potato exports contributed mostly to fetching US\$128 million in the first six months of FY'20, about 117 per cent growth compared to that of the previous fiscal year, according to the state-run Export Promotion Bureau (EPB) data. Overall export of vegetables was worth \$100 million in the FY '19.

## **2.3 Fruit Export Performance (as per [freshplaza.com](http://freshplaza.com))**

Bangladesh has achieved a significant growth in fruit exports to 42 countries. The export of fruits rose almost 114 percent year-on-year to \$2.22 million in the July-April period of fiscal 2017-2018. According to the Export Promotion Bureau (EPB), it is 113.46 percent higher than the same period of 2016-17, when earnings from fruits export were worth \$2.69 million.

This rising trend in export suggests that Bangladesh has potential to increase exports of fruits to international markets. It only needs to ensure that the fruits are safe for consumption as per the international standards.

But the sector has to battle a number of bottlenecks such as lack of cold chain facility, limited number of warehouses and frequent changes in air cargo fares. Maintaining proper temperature is a must for exporting fruits and vegetables to developed countries such as Canada, Sweden and the UK.

According to [thebangladeshpost.com](http://thebangladeshpost.com), Bangladesh mainly exports mango, jackfruit, litchi, blackberry, pineapple, banana, palm fruit, coconut, guava and watermelon.

Main destinations are England, Italy, France, Germany, Denmark, Spain, Sweden, Ireland, Greece, Poland, the Netherlands, Saudi Arabia, United Arab Emirates, Qatar, Oman, Bahrain, Kuwait, Malaysia, Singapore, USA and Canada.

## **Reference**

1. <https://thefinancialexpress.com.bd/trade/veg-exports-grow-by-117pc-in-h1-1579321602>
2. <https://www.freshplaza.com/article/2195615/bangladesh-fruit-exports-rising-114-percent/>
3. <http://www.hortex.org/produces.htm>
4. <https://www.yourarticlelibrary.com/export-management/procedure-to-be-followed-while-making-export-in-india/42105>

## Thematic Area-G: Entrepreneurship Development

*Topic GI*

### **Introduction to Development of Business Plans (Appraisal), Procedure and Government Regulations for Starting-up Agro-processing firms, product development and productivity improvement**

#### **Part 1: Introduction to Development of Business Plans (Appraisal)**

##### **1. Introduction**

A good business plan guides you through each stage of starting and managing your business. You'll use your business plan as a roadmap for how to structure, run, and grow your new business. It's a way to think through the key elements of your business.

Business plans can help you get funding or bring on new business partners. Investors want to feel confident they'll see a return on their investment. Your business plan is the tool you'll use to convince people that working with you or investing in your company - is a smart choice.

There's no right or wrong way to write a business plan. What's important is that your plan meets your needs. Most business plans fall into one of two common categories: traditional or lean startup.

**Traditional business plans** are more common, use a standard structure, and encourage you to go into detail in each section. They tend to require more work upfront and can be dozens of pages long.

**Lean startup business plans** are less common but still use a standard structure. They focus on summarizing only the most important points of the key elements of your plan. They can take as little as one hour to make and are typically only one page.

##### **2. Traditional business plan**

This type of plan is very detailed, takes more time to write, and is comprehensive. Lenders and investors commonly request this plan. This type of plan is high-level focus, fast to write, and contains key elements only. Some lenders and investors may ask for more information.

##### **2.1 Format of a Traditional Business Plan**

You might prefer a traditional business plan format if you're very detail oriented, want a comprehensive plan, or plan to request financing from traditional sources. When you write your business plan, you don't have to stick to the exact business plan outline. Instead, use the sections that

make the most sense for your business and your needs. Traditional business plans use some combination of these nine sections.

## **2.2 Executive summary**

Briefly tell your reader what your company is and why it will be successful. Include your mission statement, your product or service, and basic information about your company's leadership team, employees, and location. You should also include financial information and high-level growth plans if you plan to ask for financing.

## **2.3 Company description**

Use your company description to provide detailed information about your company. Go into detail about the problems your business solves. Be specific, and list out the consumers, organization, or businesses your company plans to serve.

Explain the competitive advantages that will make your business a success. Are there experts on your team? Have you found the perfect location for your store? Your company description is the place to boast about your strengths.

## **2.4 Market analysis**

You'll need a good understanding of your industry outlook and target market. Competitive research will show you what other businesses are doing and what their strengths are. In your market research, look for trends and themes. What do successful competitors do? Why does it work? Can you do it better? Now's the time to answer these questions.

## **2.5 Organization and management**

Tell your reader how your company will be structured and who will run it. Describe the legal structure of your business. State whether you have or intend to incorporate your business as a limited company or a partnership business or if you're a sole proprietor.

Use an organizational chart to lay out who's in charge of what in your company. Show how each person's unique experience will contribute to the success of your venture. Consider including resumes and CVs of key members of your team.

## **2.6 Service or product line**

Describe what you sell or what service you offer. Explain how it benefits your customers and what the product lifecycle looks like. Share your plans for intellectual property, like copyright or patent filings. If you're doing research and development for your service or product, explain it in detail.

## **2.7 Marketing and sales**

There's no single way to approach a marketing strategy. Your strategy should evolve and change to fit your unique needs. Your goal in this section is to describe how you'll attract and retain customers. You'll also describe how a sale will actually happen. You'll refer to this section later when you make financial projections, so make sure to thoroughly describe your complete marketing and sales strategies.

## **2.8 Funding request**

If you're asking for funding, this is where you'll outline your funding requirements. Your goal is to clearly explain how much funding you'll need over the next five years and what you'll use it for.

Specify whether you want debt or equity, the terms you'd like applied, and the length of time your request will cover. Give a detailed description of how you'll use your funds. Specify if you need funds to buy equipment or materials, pay salaries, or cover specific bills until revenue increases. Always include a description of your future strategic financial plans, like paying off debt or selling your business.

## **2.9 Financial projections**

Supplement your funding request with financial projections. Your goal is to convince the reader that your business is stable and will be a financial success.

If your business is already established, include income statements, balance sheets, and cash flow statements for the last three to five years. If you have other collateral you could put against a loan, make sure to list it now. Provide a prospective financial outlook for the next five years. Include forecasted income statements, balance sheets, cash flow statements, and capital expenditure budgets. For the first year, be even more specific and use quarterly — or even monthly — projections. Make sure to clearly explain your projections, and match them to your funding requests.

This is a great place to use graphs and charts to tell the financial story of your business.

## **2.10 Appendix**

Use your appendix to provide supporting documents or other materials were specially requested. Common items to include are credit histories, resumes, product pictures, letters of reference, licenses, permits, or patents, legal documents, permits, and other contracts.

### ***Reference:***

1. *U.S Small Business Administration. Write your business plan.*  
<https://www.sba.gov/business-guide/plan-your-business/write-your-business-plan>

## Part 2: Procedure and Government Regulations for Starting-up Agro-processing firms, product development and productivity improvement

### Ten Steps to Starting Agro-processing Firm



1. Your Product Idea
2. Market Research and Business Planning
3. Organizing Your Business
4. Government Regulations
5. Food Safety
6. Manufacturing Strategies
7. Product Development
8. Packaging and Labelling
9. Marketing
10. Distribution

#### 1. Product Idea

What is your product idea? Define your product - its features, its availability and the benefits it offers customers.

*Example: Fruit based food preparation, processing, preservation & marketing Juice, jam, jelly, tomato ketchup, sauce, pickle etc, production & marketing of dehydrated fruit canning, vegetable packaging, preservation & marketing, Prepared with traditional recipe. Available in different sizes glass jars.*

#### 2. Market Assessment and Business Planning

Once you have defined your product you need to learn about your market. Market assessment will help you determine if there is a market for your product, give you ideas for fine tuning your product, and help you decide how to distribute, set price and promote your product. The information you gather on the industry, competitors and customers will help you put your business plan together.

Market Assessment will help you determine if there is a market for your product

*Example: Your assessment may reveal that people like smaller sizes or are willing to pay more for unique local products produced in an environmentally responsible way. You may also discover that people are having a hard time finding jam suitable for diabetics.*

## Business Plan

When you have completed your *assessment* and identified the opportunity for a new business it is time to put together a business plan. This very important document provides information about your business, what it will do, how it will be operated and what your goals are. A business plan is required by most lenders and is valuable guideline to follow to improve your company's chance of success.

### 3. Organizing your Business

Your business plan will tell you if your idea is going to fly and if you should go ahead and set up your business. Before you can select and register your business name you must decide on a business structure. There are five main business structures in Bangladesh.

1. Sole proprietorship - You plan on operating the business on your own and assuming all responsibilities, liabilities, profits or losses.
2. Partnership - You plan on operating the business with one or more partners and sharing all responsibilities.
3. Corporation - You plan on operating the business as a separate legal entity – you and your assets are separate from the business's.
4. Co-operative - You plan on operating a business that is owned and controlled by members who benefit from the business.
5. Society - You plan on operating a not-for-profit organization where profits are used by the society.

Naming your business is very important,  
choose wisely - it is expensive to change a

### 4. Business start up process and Government Regulations

#### Business Startup Process in Bangladesh

- An entrepreneur has to follow nine specific procedures and legal steps to set up a business in Bangladesh.
- At the very first, the entrepreneur has to apply to Registrar of Joint Stock Companies and Firms (RJSC) for Name Clearance Certificate.
- After receiving the certificate, the next step is to pay stamp duty at a Designated Bank and again apply to RJSC for registration.
- Then the company makes seal and open a bank account and then apply for trade license to respective City Corporation or Municipal Corporations.



- After completing all those procedures, the entrepreneur has to approach to the National Board of Revenue (NBR) for receiving TIN Certificate and registering with the Customs, Excise, and VAT Commissionerate.
- Finally, the investor requires to apply to the Bangladesh Investment Development Authority (BIDA) for registration.

### **Provide details of the procedures:**

In order to increase the private sector investment both local and foreign, the government has introduced a development project titled as “Entrepreneurship & Skill Development Project” (ESDP) through Bangladesh Investment Development authority (BIDA) to achieve Sustainable Development Goal 8 (decent work and economic growth) by creating skilled entrepreneurs for supplier and linking development industries providing training to the potential youths on regulatory regime and business procedure

- ESDP provide full support for legal and documentation support for entrepreneur.
- ESDP also trains potential entrepreneurs and prepare them to move forward with their ideas.

For more information go to web site: <http://esdp.gov.bd/>

### **Business Insurance**

The main purpose of business insurance is to control or eliminate unnecessary risks. Types of insurance to consider include life and disability insurance, property insurance and liability insurance. When looking for an insurance agent, ask other food processors, friends and associates for referrals.

## **5. Food Safety**



As a food processor, making sure your food is safe is your number one priority. To prevent food safety problems you need to have a well designed food processing facility, procedures to prevent product contamination, proper food handler hygiene and food handling practices, a sanitation program and a pest management system.

As a food processor, making sure your food is safe is your number one priority. You need to get a safe food certification from Bangladesh Standard and Testing Institutes(BSTI)

## 6. Manufacturing Strategies



When deciding on a location to manufacture your product there are many factors to consider including construction or rental cost, customer location, material availability, trucking access and zoning. Many new food processors chose to have their products custom packed, that is pay a food manufacturing company to make their product, or rent a fully licensed commercial kitchen to reduce their start up costs.

Many new food processors have their products “custom packed” or rent a fully licensed commercial kitchen to reduce their start up costs

*Example: Certain low risk foods, like jam, may be prepared at home if they are being sold at temporary markets, like Farmer’s Markets, and they meet the BSTI Guidelines for the Sale of Foods at Food Markets.*

## 7. Product Development



Food product development involves building on your product idea and fine tuning it so that it is acceptable for commercial sale. Home recipes usually have to be modified to suit larger batch sizes and meet food safety regulatory requirements. Product development involves all aspects of a product including processing, packaging and labeling.

Home recipes usually have to be modified to suit larger batch sizes and meet regulatory

requirements

*Example: Your previous market assessment indicates that you could differentiate the Jam by creating a product suitable for diabetics. A product development specialist can help develop a formulation that meets your requirements. The product development specialist can also help with processing, packaging and labeling.*

## 8. Packaging and Labeling

Food packaging is very important. Packaging protects your product and provides a place to present important information and advertising to your customer. Many people decide to buy a product based on how it is packaged.

Many people decide to buy a product  
based on how it is packaged

The ultimate goal is to produce a label that is educational, user-friendly, markets the product and meets **regulatory requirements**.

Information required on food labels:

- Common name
- Net quantity (by weight or volume)
- Ingredient list (declining order)
- Name and address
- Best before date
- Storage instructions
- Nutritional information

## 9. Marketing, Pricing and Promotion

Marketing is the process of planning and executing pricing, promotion and distribution to satisfy the customer's and your needs. In order to properly market your product you must know what is happening in the marketplace. Without good marketing, even the best product can fail.

Without good marketing, even the best product can fail

There are many ways to set prices. How you set your prices depends on your costs of production, your competition, the amount of quality, service and convenience provided and the types of buyers you are targeting. The goal is to cover costs, maximize profits and remain competitive.

Promotion includes all activities designed to inform, persuade and influence people to make the decision to buy your product.

Low cost promotion ideas:

- Product demonstrations
- Contests
- Fliers
- Posters

## 10. Distribution

Distribution channels are the paths that products flow from producer to the consumer. Direct selling is when the food processor sells directly to the consumer. Indirect selling is when you sell to the retailer or a distributor. Distributors, or wholesalers, purchase products from food processors and sell them to retail stores. A wholesaler usually represents a number of different products and has greater access to retail stores than an individual processor.



Whether selling directly or indirectly you will need selling skills:

- Investigating prospective buyers, the more you know the more you can sell
- Determining customer needs and desires
- Demonstrating how your product meets customer needs
- Making the sale and following up
  - »» Deliver as promised
  - »» Phone to make sure customers are satisfied

*Example: Selling directly to local stores, direct to customers through an on-line ordering system and indirectly through a specialty foods distributor specializing in health food stores are some options for selling processed food.*

## Productivity Improvement

Productivity can be measured as the amount of output produced using one unit of input. Example: Vegetable produced per unit of labour or any fresh or processed food output produced per Tk investment. A firm's productivity can be improved in following ways:

1. **Adoption of improved technology:** using improved food production and processing technologies like new hybrid crops, seeds, fertilizers, management & cultural practices, irrigation and mechanization, etc. Adopting improved food processing technology replacing traditional one.
2. **Increasing competitiveness:** Competitiveness of firms can be increased through reduction of costs of production per unit of output produced.
3. **Reducing high postharvest loss:** Adopting improved postharvest handling and transportation system could reduce substantial post harvest losses of fresh fruits and vegetables and enhance firms productivity.:
4. **Improved value chain and market access:** Improving value addition and market access can enable a firm to achieve higher return per TK investment made in the business.
5. **Improving knowledge and skill of firm management** and operators can improve efficiency of firming operation and reduce cost and increase outputs and productivity.

## Details of Regulation and Business Start-up Process in Bangladesh

### PROCEDURE 01

#### Name Clearance Certificate for Company

The first step is to apply to Registrar of Joint Stock Companies and Firms (RJSC) for receiving name clearance certificate. This is a pre-requisite for registration of a new company or a society or a trade organization. An applicant needs to apply via RJSC website. The RJSC office will check the database and issue name clearance if it does not closely match or resembles with any of the existing names. It will be valid for next 180 days. An applicant will have to apply for registration within this timeline.

Legal Basis of the Certificate, The Companies Act- 1994

Responsible Agency, Registrar of Joint Stock Companies and Firms (RJSC)

Process Step

Step 1: Applicant fills in the online application

Step 2: Opening an E-account an RJSC website

Step 3: Preliminary name search on RJSC website

Step 4: Payment of fees to designated Bank  
Step 5: Submits the money receipt  
Step 6: Obtain the name clearance certificate

### **Required Documents**

1. A print out of the name clearance certificate
2. Original copy of Money Receipt

Process map of Name Clearance Certificate for Company

Time Less than one day (online procedure)

Fee

BDT 600.00 for each of the proposed names

BDT 100.00 for each time extension application

Contact

Head Office of RJSC:

TCB Bhaban, 1 Kawran Bazar, Dhaka-1215, Bangladesh

TEL: 8189401, 8189403, FAX: 8189402

Email: rjsc@roc.gov.bd Website: www.roc.gov.bd

### **PROCEDURE 02**

#### **Pay Stamp Duty at a Designated Bank**

Payment of stamp duty is made to the account of the Treasury at the BRAC Bank. According to the Stamp Act 1899 as amended on June 30th, 2012, for an authorized share capital of up to BDT 1,000,000, the total stamp duty fees are BDT 4,000. These include BDT 3,000 for affixing stamps on the Articles of Association, and BDT 1,000 for stamps on the Memorandum of Association. In addition, a certified copy of each document costs BDT 50.

#### **Responsible Agency, Designated Bank**

Process Step

Step 1: Payment of stamp duty is made to the account of the Treasury at the BRAC Bank

Required Documents

No document is required

Process map of Pay Stamp Duty at a Designated Bank

**Time 1 day**

Fee

BDT 3,000 for the Articles of Association + BDT 50 for a certified copy and

BDT 1,000 for the Memorandum of Association + BDT 50 for a certified copy

Contact

Designated Bank's Branch Office

## PROCEDURE 03

### **Register at Registrar of Joint Stock Companies and Firms (RJSC)**

The promoters of a new entity (having name clearance, where applicable) apply for registration with necessary documents, prescribed forms & schedules and fees, as appropriate to the entity type. The promoters prepares Memorandum/Articles of Association as appropriate to the entity type, submit the registration application through website and Pay the registration fee at the designated Bank. RJSC issues a Certificate of Incorporation upon satisfaction that the promoters obtained name clearance of the proposed entity prior to the registration application, submitted the registration application the Memorandum & Articles of Association & prescribed forms and provided applicable fees.

### **Legal Basis of the Registration, The Companies Act- 1994**

### **Responsible Agency, Registrar of Joint Stock Companies and Firms (RJSC)**

#### Process Step

Step 1: Preparing Memorandum of Association (MOA) and Articles of Association (AOA) as appropriate to the entity type

Step 2: Visiting RJSC website to apply for company registration

Step 3: Filling in Name Clearance Submission number and letter number

Step 4: Filling in the prescribed forms

Step 5: Attaching the MOA and AOA

Step 6: Submitting the Registration Application

Step 7: Depositing the required fee & receiving the payment slip form designated bank

Step 8: Uploading document in online

Step 9: Printing the uploaded documents and Submitting those documents & payment slip to RJSC office

Step 10: Receiving a Certificate of Incorporation from the RJSC Office

#### Required Documents

1. Name clearance certificate
2. Memorandum and Articles of association
3. Filled in Form I: Declaration on Registration of Company
4. Filled in Form VI: Notice of Situation of Registered Office and of Any Change therein
5. Filled in Form IX: Consent of Director to act
6. Filled in Form X: List of Persons Consenting to be Directors

7. Filled in Form XII: Particulars of the Directors, Manager and Managing Agents and of any change therein Evidence of Name Clearance
8. Proof of payment (i.e. receipt from the designated bank) for Treasury Stamps
9. TIN Certificate of all Directors

Process map of Register at Registrar of Joint Stock Companies and Firms (RJSC)

**Time Less than one day (online procedure)**

#### Fee

Private Company (Companies Act, 1994)

Stamps

For affixing on the Memorandum of Association: BDT 500.00

For affixing on the Articles of Association:

For Authorized Capital (BDT)	Stamp (BDT)
Up to 10,00,000.00	2,000.0
10,00,000.00 up to 3,00,00,000.00	4,000.0
3,00,00,000.00	10,000.0

#### Registration Fee

For filing 6 documents (5 filled in forms plus 1 memorandum & articles of association, @ BDT 200.00 per document): BDT 1,200.00

#### Contact

Head Office of RJSC:

TCB Bhaban, 1 Kawran Bazar, Dhaka-1215, Bangladesh

TEL: 8189401, 8189403, FAX: 8189402

Email: rjsc@roc.gov.bd , Website: www.roc.gov.bd

#### References:

1. *List of 57 Profitable Food Processing Business Ideas*  
<https://muvsii.in/profitable-food-processing-business-ideas/>
2. *Entrepreneurship and Skill Development Project*  
<http://esdp.gov.bd/>



## **Soft Skills/Business Skills: Communication, Negotiation, Time-Management, Leadership, Sales and Customer Relationship**

### **Soft skills**

Harvard Business School conducted a survey to find out what makes a person wealth creator. They found that it was not good grades or marks in academics, nor family background and wealth but it was soft skills.

#### **What does it mean by soft skills?**

Soft skills are defined by Dictionary.com as desirable qualities for certain forms of employment that do not depend on acquired knowledge. They include common sense, the ability to deal with people and a positive flexible attitude. It is Interpersonal skills that determine a person's ability to excel or at least fit in a particular social structure, such as a project team, a company or even music band. Communication skills and positive attitudes are the most important soft skills.

#### **Importance of soft skill**

Soft skills are very important:

- To handle interpersonal relations
- To take appropriate decisions
- To communicate effectively
- To have good impression and impact to gain professional development

What is required to improve soft skills?

- Communication Skills
- Body language
- Presentation Skills
- Team Work
- Professional ethics
- Interpersonal Skills
- Time and Stress Management

### **Communication skills**

Every human being has to essentially & effectively communicate with others. The ability to speak fluently using the right word in the right order is good Communication. Message using appropriate vocabulary and syntax form effective communication

#### **Communication Defined.....**

- Exchange of Information.

- 2 Way Process.
- From Sender of Information to Receiver of Information.
- Information should be exchanged in its entirety.

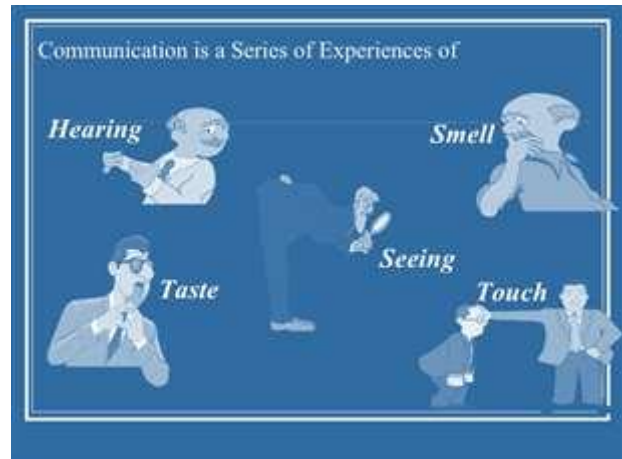
Communication is a Series of Experiences of Hearing, Seeing, Smell, Touch and Taste as illustrated in the picture below.

#### **Communication – Types:**

- Positive Communication
- Negative Communication

#### **Positive Communication**

- tells the recipient what can be done
- suggests alternatives and choices available to the recipient
- sounds helpful and encouraging rather than bureaucratic stresses positive actions and positive consequences that can be anticipated.



#### **Negative Communication.**

- tells the recipient what cannot be done.
- has a subtle tone of blame.
- includes words like can't, won't, unable to, that tell the recipient what the sending agency cannot do
- does not stress positive actions that would be appropriate, or positive consequences.

#### **Communication: Basic Skills**

- Verbal Communication
- Non verbal Communication : Use body language and writing

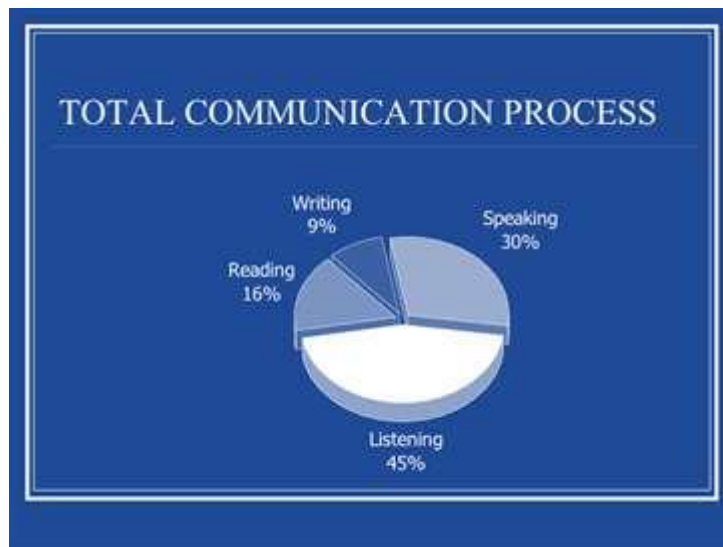
#### **Total Communication Process**

The total communication process consists of speaking, listening, reading and writing. This is illustrated in the picture below.

#### *Communication: Speaking*

- Body language
- Voice quality
- Intention Manner: directness, sincerity
- Dress and clothing (style, color, appropriateness for situation)

- Visual aids, animation, eye contact
- Emotional content, energy, strength Self-concept Concept of others Listening, hearing the underlying message
- Speaking from the heart
- Energy
- Setting, time, place, timing
- How the messenger holds the message
- Sensitivity
- Rhythm and pacing
- Attitude and confidence
- Rapport
- Agenda
- Purpose of communication - knowing what you want to communicate, Clarity



#### Communication : Listening

- Attentiveness to speaker
- Eye contact
- Intention be fully awake and aware
- Openness: to other person and your own
- Paying attention
- Listening to yourself
- Feedback
- Body language
- Change in pattern
- Expectations about person speaking, about their message, about their agenda

#### **TACTFUL Conversation.**

- T: Think Before You Speak
- A: Apologize quickly when you blunder
- C: Converse, don't compete

- T: Time your comments
- F: Focus on behavior - not on personality
- U: Uncover hidden feelings
- L: Listen for feedback

### Do's and DON'Ts

- DO be direct, courteous and calm
- DON'T be rude and pushy
- DO spare others your unsolicited advice
- DON'T be patronizing, superior or sarcastic
- DO acknowledge that what works for you may not work for others
- DON'T make personal attacks or insinuations
- DO say main points first, then offer more details if necessary
- DON'T expect others to follow your advice or always agree with you
- DO listen for hidden feelings
- DON'T suggest changes that a person can not easily make.

### Body Language:

Face is the index of the mind and it clearly displays the persons interest.

#### Non-verbal language

- Body language presents to the audience what we feel & think about the particular matter.  
Ex: Nodding one's head
- Body language (e.g, arms crossed, standing, sitting, relaxed)
- Emotion of the sender & receiver (e.g, speaking clearly, enthusiastic)



### Why is body language important?

- To keep people's attention
- To create a good atmosphere
- To create more impact

### Body language means:

- How you stand
- How you move
- How you appear to people
- How you look at people
- How you sound.



### How you stand

- Stand straight.

- Stand on both legs.
- Don't lean against anything.
- Stand where everyone can see you.
- Face the audience directly.
- Don't obstruct the foils.
- Stand by the screen when pointing to foils.
- Stand away from it when talking about them.

### **How you move**

- Avoid nervous movements.
- Don't walk up and down.
- Keep your hands down except for gestures.
- Don't fidget, scratch, jiggle your legs, etc.
- Use gestures for emphasis.
- Practice appropriate gestures.
- Don't overdo it.
- Avoid arm-waving.

### **Look energetic**

#### Why

- Energy holds people's attention. Lack of energy puts people to sleep.

#### How

- Stand straight.
- Put energy into your eyes, voice, and movements.

### **Look relaxed**

#### ➤ Why

- If you relax people will have more confidence in you.
- If you are not relaxed people cannot focus on the content .

#### ➤ How

- Smile.
- Make it informal.
- Use humor--enjoy yourself!
- Slow down.
- Breathe slowly.
- Let your arms hang loose.
- Don't make nervous movements.

### **Dressing For Success:**

#### First Impressions

- You have only one chance to make a good first impression.

- Your appearance tells others how you feel about yourself, which can define how they treat you.
- Your corporate ladder climb will be easier if you look like you belong there.

### **First Impression Test – Women Who would you hire?**



### **First Impression Test – Men Who would you hire?**



### **What influenced you?**

- Apparent level of sophistication
- Color of tie, shoes, dress
- Well-groomed appearance
- Conservative appearance
- Overall attractiveness
- Non-verbal signals
- Apparent level of self-confidence

### **What do your clothes say about you?**

- Your appearance plays a supporting role in the interview process.

- Your appearance can convey strong feelings of trust to a prospective employer. Your appearance can convey a sense of self-confidence, dependability and professionalism.
- Your appearance can determine how people you meet will react to you.

### **First Impression Guidelines - Colors That Work**

- Dark to medium range blues
- Navy Blue – respected by all socio-economic levels
- Gray
- Camel/Beige
- Black
- Dark Brown
- Burgundy
- Rust

### **First Impression Guidelines - Colors to Avoid**

#### **Women**

- Most pastels, especially pale yellow
- Bright orange

#### **Men and Women**

- Most shades of green
- Mustard – bad, bad, bad
- Dark Colors make you seem more powerful; only use when you need control.

### **First Impression Guidelines - The Suit**

- Decent formal attire
- Tailored and pressed clothes for men and women
- Minimal jewelry, cologne and makeup
- Leather lace-up shoes for men
- Avoid gaudy/flashy footwear (no floaters please)

### **First Impression Guidelines - Grooming**

- Hair – clean and neat
- Details – no missing buttons, lint or tags
- Hands – clean, manicured fingernails
- Fit – clean, pressed and proper fit
- Smell – little or no cologne; no cigarette odor
- Breath – fresh, clean breath; use a breathmint

### **First Impression Guidelines - Accessories**

- Belts – classic, quality leather
- Bags and briefcases – small, dark-colored leather briefcase
- Jewellery – minimal; business watch, nothing flashy
- Scarves and ties – silk

### **Writing communication skill**

- Writing evaluates a person's proficiency indications, spelling grammar etc...

- Errors committed while writing circulars, reports & agenda considerably spoil the image of the writer
- Good visual presentation using graphics, color, balanced design layout- adds so much to written communication.
- One important written communication media is through email.

### **E-mail etiquette**

The e-mail etiquette refers to the customary code of polite behaviour in society or among members of a particular profession or group.

The purpose of e-mail etiquette:

- Professionalism.
- Efficiency.
- Security.



#### **E-Mail Rules: 1**

- Know your internal policies.
- Keep responses concise.
- Answer questions asked in the original e-mail.
- Use proper punctuation, grammar and spelling.

#### **E-Mail Rules: 2**

- Personalize your e-mail.
- Avoid unnecessary file attachments.
- Check for proper layout.
- Use high-priority option sparingly.

#### **E-Mail Rules: 3**

- DO NOT USE ALL CAPITAL LETTERS!
- Read message thoroughly before sending.
- Know when to “reply to all.”
- Don’t abbreviate.
- Delete chain letters immediately.

#### **E-Mail Rules: 4**

- Protect confidential information.
- Clearly identify the subject.
- Avoid unprofessional language.



- Minimize use of bold font.
- Use blind copy (BC) when individuals don't know each other.

#### **E-Mail Rules: 5**

- Use appropriate opening and closing.
- Auto-respond when out of the office.

#### **Telephone Etiquette: 1**

- Answer calls within three rings.
- Greet the caller.
- Identify yourself.
- Identify your school.
- Ask how you can help.

#### **Telephone Etiquette: 2**

Answer with a smile.

#### **Telephone Etiquette: 3**

Placing callers on "hold":

- Ask if the caller minds being placed on hold.
- Check back with callers so they don't think you've forgotten them.
- It's okay if you don't know the answer immediately.
  - If you need to research, provide an estimate of when you will follow up.

#### **Telephone Etiquette: 4**

Transferring calls:

- Avoid transfers whenever possible.
  - Be the caller's single point of contact for the information you can give.
  - Use your resources.
  - Ask for help.

#### **Telephone Etiquette: 4**

When transfers are unavoidable:

- Do not "blind" transfer the call.
- Provide a phone number in case the call is disconnected.
- Communicate the customer's issue prior to transfer.
  - Saves time and frustration.

#### **Telephone Etiquette: 5**

When transfers are unavoidable...

- If voice mail reached, give the caller an option.
  - Leave a message.
  - Call back later.
    - Recommend a better time to call back.

#### **Telephone Etiquette: 6**

Voice mail greetings:

- Keep greeting updated.
- Provide detailed information.
  - Alternative contact information.
- Positive closing.

### **Telephone Etiquette: 7**

When leaving a message:

- Identify yourself.
- Repeat contact information.
- Respect privacy.
- Keep message concise and specific.

### **Telephone Etiquette: 8**

- Focus your attention on the caller.
- Use the caller's name during the conversation.
- Build rapport with the caller.
- Speak clearly.
- Always be polite.

### **Telephone Etiquette: 9**

- Avoid jargon and acronyms.
- Avoid eating, chewing or drinking.
- Respect others.
- Follow the "golden rule."
- Do unto others as you would have them do unto you.

## **Negotiating Skill of Entrepreneurs**

Negotiating is an important skill needed by all successful entrepreneurs. It is used when purchasing inputs, hiring labour, engaging transport and pricing products at the market. Negotiating is the process by which two or more parties discuss and agree on the arrangements for a particular activity or business arrangement.

To participate equitably in farm-agribusiness linkages, small rural entrepreneurs need to enhance their negotiation skills and compliance capabilities. In order to negotiate with their partners and buyers, entrepreneurs must be able to:

- Use active listening skills;
- Clarify issues by asking relevant questions;
- Identify the key issues involved in the negotiation;
- Identify areas of common ground between negotiating parties;
- Develop a line of logical, reasoned argument;
- Put their points across clearly and understandably using verbal communication skills;
- Identify and structure the problem, identify possible solutions or courses of action and decide on the most suitable option using problem-solving skills;
- Plan alternative outcomes if a satisfactory decision cannot be reached;
- Use decision-making skills;
- Use presented facts to make decisions with reasoning skills; and
- Use persuasion skills.

These are known as basic **negotiation** skills.

**Active listening:** A structured form of listening and responding in which the listener focuses attention on the speaker, thereby improving mutual understanding.

**Persuasion:** The process of changing an individual or a group's attitude or behaviour towards an idea, event or issue by means of written and verbal communication.

**Negotiation:** A discussion method where differences between individuals and groups are settled.

### **Key outcomes of negotiation skill**

- Yet there are numerous benefits to improving negotiation skills—it can boost sales and profits, lead to enhanced communication and collaboration.
- New contractual arrangements between POs and SMEs, respecting collectively established norms. Also more preferred and contracted arrangements between farmers and traders and middle men are made for bulk selling of produce.
- Better arrangements between producers and transporters resulting in reduced transport costs.
- More demand for inputs and consequently more (preferred) business deals between farmers and input providers.
- Structural involvement of “new” actors and steady increase of “new” members in the clusters (e.g., financial institutions, transport organisations).
- Improved trust among actors and better interaction among them (e.g., resulting in resolution of conflicts)
- Better access to credit and new developed credit arrangements between farmers and local financial institutions, resulting in easier conditions and lower interest rates.

## **Seven Tips for Better Negotiating**

### **1. Learn how to listen for key information**

One of the most important skills of negotiation is learning how to listen for key information, often before the official negotiating has begun. The more the negotiator can learn about the other person, the better. For example, if a potential customer says they don't have any other suppliers or their supplier is not very good, that's very interesting information to have, because it gives the negotiator an advantage and puts them in a position of strength from the outset

### **2. Make a detailed plan of possible outcomes**

Good negotiators don't just go in and play it by ear. They do quite a lot of thinking beforehand about what the other person might say, what their weaknesses might be, and which tradable they want to ask for and offer. Tradeables are things that one party wants or thinks the other party might be able to offer, or they're things that are valuable to the other party but easy for the negotiator to offer.

### **3. Overcome the fear of walking away**

Being assertive in a negotiation context means both being strong enough to walk away. This can be difficult, because we would all rather have the deal than not have it. In order to have the assertiveness to walk away, negotiators should always have a predetermined walk-away point that they won't go above (or below if they're selling). And even if the other person is

suggesting a small point beyond that, like paying TK 995 for something when TK 1,000 is my walk-away point, it's no deal! I would rather go home and not make anything than settle for something that's TK 5 below my walk-away point.

#### **4. Understand the other person's position**

I mentioned earlier that it's important to listen carefully for key information. As well as picking up useful information and signals, this makes negotiators stronger because it helps them focus on the other person's position rather than their own. By learning more about the other person, the negotiator can gain a position of strength.

Negotiating is all about how strong you feel, and we tend to focus on our OWN weaknesses rather than those of the other person, since those are the ones we know. For example, when selling a house, we know we have had it on the market and have had no potential buyers—we feel weak. And when we're buying we know that we have looked at lots of houses and this is the only one we like—we feel weak this way round, too. But imagine if you could focus on the other person, rather than yourself, you could suspect that they have weaknesses and then you could fish for those.

#### **5. Know your alternatives**

When negotiators only have a single option, they won't have as much bargaining or walk-away power. That's why it's essential to have a few alternatives available. I always recommend that negotiators shop around for a few options. Even if someone thinks they've found their dream house, for example, I recommend continuing to shop around so that they have a few alternative options in mind when they come to the negotiating table. And even if the negotiator is a favourite supplier or customer, I recommend having a few more so they don't get dependent.

#### **6. Use the “If you... then I” wording at the bargaining stage**

A good negotiation involves concession-making on both sides of the table. Consider what each person is giving up and gaining. I recommend doing this by using the phrase, “If you... then I.” If someone wanted to pay less for one of my food basket, for example, I might say, “If you book two, then I can come down on price.”

There are a few reasons for employing this technique: First, it means that the negotiator is always getting something back. They may even gain on the trade! Second, it means that the other party will be reluctant to continue asking for a discount since they know that they're going to have to offer something else in exchange. And finally, it makes the negotiator seem more honest. If they simply agree to a lower price without making any trades, it leads the other party to wonder why they were charging so much in the first place. By only agreeing to make trades, the negotiator demonstrates that their original price is actually reasonable for the value of what they're offering.

#### **7. Move in small steps**

One of the biggest mistakes I see when I run negotiating training sessions and ask people to do role-plays is that they come down too much in one jump. If the person's starting price is Tk 4,800, and some pressure is applied to them, they will generally make a first downward move to TK 4,000. It's important to come down in small increments, so they should go from TK 4,800 to TK 4,700, for example. When the negotiator employs this technique, they're signalling that they're only willing to come down a small amount and the other party is going to have to really struggle to get even that.

## Time Management

Time management is the process of planning and controlling how much time to spend on specific activities. Good time management enables an individual to complete more in a shorter period of time, lowers stress, and leads to career success.

### Benefits of Time Management

The ability to manage your time effectively is important. Good time management leads to improved efficiency and productivity, less stress, and more success in life. Here are some benefits of managing time effectively:

#### 1. Stress relief

Making and following a task schedule reduces anxiety. As you check off items on your “to-do” list, you can see that you are making tangible progress. This helps you avoid feeling stressed out with worry about whether you’re getting things done.



#### 2. More time

Good time management gives you extra time to spend in your daily life. People who can time-manage effectively enjoy having more time to spend on hobbies or other personal pursuits.

#### 3. More opportunities

Managing time well leads to more opportunities and less time wasted on trivial activities. Good time management skills are key qualities that employers look for. The ability to prioritize and schedule work is extremely desirable for any organization.

#### 4. Ability to realize goals

Individuals who practice good time management are able to better achieve goals and objectives, and do so in a shorter length of time.

### **List of Tips for Effective Time Management**

#### **1. Set goals correctly**

Set goals that are achievable and measurable. Use the SMART method when setting goals. In essence, make sure the goals you set are **S**pecific, **M**easurable, **A**ttainable, **R**elevant, and **T**imely.

#### **2. Prioritize wisely**

Prioritize tasks based on importance and urgency. For example, look at your daily tasks and determine which are:

- Important and urgent: Do these tasks right away.
- Important but not urgent: Decide when to do these tasks.
- Urgent but not important: Delegate these tasks if possible.
- Not urgent and not important: Set these aside to do later.

#### **3. Set a time limit to complete a task**

Setting time constraints for completing tasks helps you be more focused and efficient. Making the small extra effort to decide on how much time you need to allot for each task can also help you recognize potential problems before they arise. That way you can make plans for dealing with them.

For example, assume you need to write up five reviews in time for a meeting. However, you realize that you'll only be able to get four of them done in the time remaining before the meeting. If you become aware of this fact well in advance, you may be able to easily delegate writing up one of the reviews to someone else.

#### **4. Take a break between tasks**

When doing a lot of tasks without a break, it is harder to stay focused and motivated. Allow some downtime between tasks to clear your head and refresh yourself.

#### **5. Organize yourself**

Utilize your calendar for more long-term time management. Write down the deadlines for projects, or for tasks that are part of completing the overall project. Think about which days might be best to dedicate to specific tasks.

#### **6. Remove non-essential tasks/activities**

It is important to remove excess activities or tasks. Determine what is significant and what deserves your time. Removing non-essential tasks/activities frees up more of your time to be spent on genuinely important things.

#### **7. Plan ahead**

Make sure you start every day with a clear idea of what you need to do – what needs to get done **THAT DAY**. Consider making it a habit to, at the end of each workday, go ahead and write out your “to-do” list for the next workday.



## **Leadership skills**

A leader is one who

- Inspires a follower
- Accomplishes work
- Develops the follower
- Shows how to do the job\
- Assumes obligations and
- Overcome various obstacles in attaining the goal

### **Leadership**

- Leadership is lifting a person's performance to a higher standard, the building of a personality beyond his normal limitations/
- Leadership is the process of influencing the behavior of others towards the accomplishment of goals in a given situation.
- The process by which a person motivates and guides the group towards a visualized goal

### **Leadership Qualities**

- Motivating capacity
- Courage
- Imitativeness
- Source of Knowledge
- Responsibility
- Integrity
- Ability to communicate
- Loyalty
- Judgement
- Selflessness
- Problem solving capacity
- Openness to change
- Distant vision and close focus

### **Ways to develop Leadership Qualities**

- Learn to think more critically
- Do more to enthuse your team
- Make your goals and future vision attractive and attainable
- Learn to communicate clearly
- Improve your speaking skills
- Organize and allocate workflow
- Make sure work is done correctly and on time
- Find better ways to do things
- Encourage progress and recognize efforts
- Try to match individual skills and work
- Build team spirit
- Encourage people to work cooperatively
- Recognize success and learn from failure
- Trust your subordinates

### **Leadership Styles/Types**

Leadership types/styles are the pattern of behaviour that a leader adopts in influencing the behaviour of his subordinates. There are two main types of leaderships:

i. **Autocratic leadership**, also known as authoritarian leadership, is a leadership style characterized by individual control over all decisions and little input from group members. Autocratic leaders typically make choices based on their ideas and judgments and rarely accept advice from followers.

An authoritarian leadership style is exemplified when a leader dictates policies and procedures, decides what goals are to be achieved, and directs and controls all activities without any meaningful participation by the subordinates.

ii. **Democratic leadership**, also known as participative leadership, is a type of leadership style in which members of the group take a more participative role in the decision-making process. This type of leadership can apply to any organization, from private businesses to schools to government.

#### **Advantages of democratic leadership:**

- Democratic leadership encourages participation
- Allows for more efficient problem solving: With more minds working on a problem, the number of potential solutions increases.
- Invites higher levels of commitment: When you bring an idea to the table and it is heard, discussed, and potentially implemented in the eventual course of action, it's hard not to feel more involved in your team.
- Builds team relationships: By creating a workplace where people communicate, ideas flow, and discussions are had, the seeds are sown for stronger team relationships.

### **Customer Relations**

Customer relationship management (CRM) involves the application of practices, strategies and technologies to analyze and manage the interactions and relationships between a business and its customers.

#### **Benefits:**

- Increase in sales and profitability;
- Improved placement of products;
- Increased customer satisfaction;
- Increased chance for attracting new customers.

Customer relations refers to links between business actors in the market chain, referring to sales support, technical assistance and **customer service**.

Good customer relations include:

- Rapid and effective response to customer needs and questions;
- Active listening skills;
- Verbal and written communication skills to interact with the customer; and



**Customer service:** The process of ensuring customer satisfaction with a product or service by taking care of customer needs and providing professional and helpful assistance to the customer.

### **Marketing and Sales**



Marketing is central to any successful business, as it links the product to the customer. The most important marketing skills for entrepreneurs are:

- Interpersonal communication skills like active listening and verbal communication skills;
- Strong written communication skills and the ability to present content creatively;
- Influence, persuasion and negotiating skills; and
- Advertising and promotion skills;
- Sales drive business success.

The sales process has six basic steps:

- **Prospecting** for new **leads**;
- Initial contact with the prospect;
- **Presentation** of **sales** materials;
- Objection handling;
- Closing the sale; and
- Follow up/after sales service.

Closing a sale is the most important sales skill to perfect. It is also the most difficult area to overcome for people without a sales background.

The skills required to perform the sales function include:

- Prospecting skills;
- Written and verbal communication skills;
- Active listening skills;
- Influencing and persuasion skills;
- Presentation skills in order to make effective sales presentation; and
- Reporting writing skills in order to compile regular sales reports.

### **Exercise: Improve your negotiation skill**

Divide the trainees of the class room into two groups of market actors: A. Sellers group and B. Buyers group. Two groups should then negotiate on the following issues:

#### **Notes:**

Product quality:

.....

.....

Terms and condition on post-harvest handling: Sorting, grading and packing

.....

Mode of Transportation and time of delivery .....

.....

Price and mode of payment

.....



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**Reference:**

1. *Soft skills*, December, 2008, Slideshare. <https://www.slideshare.net/sharmaparish/soft-skills-1326670>

## Cost-Benefit Analysis for Agri-Business Enterprise Related to Fresh Fruits and Vegetables

### Cost and Benefit Analysis for Agri-business enterprise

Farm records are used in analysing the profitability of the farm with a cost-and-return analysis. If noncash inputs are assigned money value and these are added to the cash expenses incurred in the production of vegetables, the summation is called **production cost**. The income that the grower gets from his vegetables is his *returns*.

To help decide whether or not a plan like intercropping cabbage and onion is worth undertaking, or which among alternative plans (for example, what varieties to grow) has an acceptable profit, an analysis of the cost and return of the given plans is made. Thus, a cost-benefit ratio is computed. As percentage return on investment is computed when the farmer desires to see how much he got for the capital (investment) he used. The estimate of the costs and expenses constitutes the budget. The technique of analyzing the budget to determine profitability is called **cost-and return analysis**. In general, if the cost of production is subtracted from the returns, the difference is the net income or the profit. The higher is the difference, the better the plan.

The analysis could be stated in a simple equation:

$$\text{Profit} = \text{TVV} - \text{TCP}$$

Where: TVV = total value of vegetables

TCP = total cost of production

The cost-and-return ratio also known as cost-benefit ratio (BCR) is computed by dividing the receipts or gross income by the cost of production.

So,  $\text{BCR} = \text{Gross income} / \text{Cost of production}$ , If  $\text{BCR} > 1$ , then vegetable production is profitable.

For calculating the costs and return, the costs items are classified into two groups: (i) variable cost, and (ii) fixed cost.

Gross return is calculated simply by multiplying the total volume of output with per unit of price in the harvesting period.

Gross margin calculation is done to have an estimate of the difference between total return and variable costs. It is calculated by deducting total return over variable cost.

Net return or income analysis is done by considering the fixed costs. Fixed costs of production are cost of rental value of land, interest on operating capital etc.

Interest on operating capital (IOC) is determined by taking all costs incurred on various operations in the process of cultivating vegetables. It is assumed that if the farmers borrowed the money from a bank, they had to pay interest at the same rate. It is estimated as: Interest on operating capital =  $\text{AI} \times i \times t$ ; Where, AI = (Total investment);  $i$  = Rate of interest;  $t$  = Period of crop cultivation (in month). The interest is charged at the rate of 10 percent per annum. A general format for cost and return analysis is presented in Table 1. The period considered for an enterprise ranged from the time of land preparation to the harvesting of the crop, i.e., 3 months of brinjal, country bean and cabbage production (Example in Table-2).

**Table 1. Format of computation of cost and return of crop production**

Items	Unit	Quantity	Price (Tk/Unit)	Cost
<b>A. Gross returns (i+ii)</b>	Tk.			
i. Main product	Kg			
ii. By product	Tk.	-		-
<b>Variable cost</b>				
Human labour	Man day			
Animal labour/ Power tiller	Tk.			
Land preparation	Tk.			
Seeds	Kg			
Urea	Kg			
TSP	Kg			
DAP	Kg			
MP	Kg			
Gypsum	Kg			
Cow dung	Kg			
Oil cake	Kg			
Boron	Kg			
Zinc	Kg			
Irrigation charge	Tk.			
Insecticides	Tk.			
Others costs	Tk.			
<b>B. Total variable cost</b>	Tk.			
Land use cost	Tk.			
Interest on operating capital	Tk.			
<b>C. Total fixed cost</b>	Tk.			
<b>D. Gross cost (B+C)</b>	Tk.			
<b>E. Gross margin(A-B)</b>	Tk.			
<b>F. Net returns (A-D)</b>	Tk.			
<b>G. Benefit-Cost Ration (BCR)</b>				

So, per hectare net return was determined by subtracting per hectare total cost (variable cost and fixed cost) of production from per hectare total return. The BCR is a relative measure, which was used to compare benefit per unit of cost. The BCR was estimated as a ratio of gross returns and gross costs as follows:

Benefit-cost ratio = Gross benefit (Return) / Gross cost

Table 2. Cost and Return of Production for per hectare brinjal, country bean and cabbage



Items	Unit	Brinjal		Country bean		Cabbage	
		Quantity	Total	Quantity	Total	Quantity	Total
<b>A. Gross returns (i+ii)</b>	Tk.		483500		347028		494140
i. Main product	Kg	24175	483500	15774	347028	24707	494140
ii. By product	Tk.	-	-				
<b>Variable cost</b>							
Human labour	Man day	315	82019	141	88887	392	101920
Animal labour/ Power tiller	Tk.	-				-	3027
Land preparation	Tk.		11708	-	3000		
Seeds	Kg	1.71	15446	41.8	20900	0.3	3900
Urea	Kg	278	5563	48.75	975	377	7540
TSP	Kg	236	8274	81.71	3000	245	8575
DAP	Kg	122	4293	23.41	796	250	8500
MP	Kg	64	1800	53.57	1500	260	4680
Gypsum	Kg	13	337	5.04	126	100	1000
Cow dung	Kg	15248	11436	7657	5743	6500	4890
Oil cake	Kg					40	880
Boron	Kg	36	2948				
Zinc	Kg	135	5287				
Irrigation charge	Tk.		14377				6739
Insecticides	Tk.		28580		11884		2500
Others costs	Tk.				12875		
<b>B. Total variable cost</b>	Tk.		<b>192068</b>		<b>130876</b>		<b>154152</b>
Land use cost	Tk.		44909		29940		45000
Interest on operating capital	Tk.		4298		1521		5000
<b>C. Total fixed cost</b>	Tk.		49207		31461		50000
<b>D. Gross cost (B+C)</b>	Tk.		241277		162337		204152
<b>E. Gross margin(A-B)</b>	Tk.		292432		216152		339988
<b>F. Net returns (A-D)</b>	Tk.		242223		184691		289988
<b>G. BCR</b>		2.003		2.14			2.42

### Farm Business Profitability

FARM INCOME	FARM COSTS	PROFIT
Money received from selling products and the value of produce consumed. (Note that farm income comes from the value of all the products produced on the farm).	Money spent to produce and market products; the value of all the things used to produce products on the farm.	Money left over from income after the costs are deducted.

Notes:.....  
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## Understanding the difference between Farm business and Farm enterprise

Farm business	Farm enterprise
<p>Farm business refers to the whole farm as a business. Together all enterprises make up the farm business as a whole.</p>	<p>Farm enterprises refer to the individual enterprises of the farm. Each crop or kind of livestock produced is an enterprise. A farmer may produce maize, beans and eggs. Each of these products is an enterprise. Maize is an enterprise; Beans is an enterprise; Eggs is an enterprise.</p>
	

Notes:.....  
 .....

## Understanding costs

### Variable Costs:





“ The costs of actual production. They apply to specific enterprises on the farm. These costs vary as output changes. These costs occur only if something is produced. They do not occur if nothing is produced. Variable costs can be allocated to specific enterprises. ”

					
Seeds	Fertilizers	Fuel for machines	Hired labour	Livestock feed	Veterinary

Notes:.....  
 .....

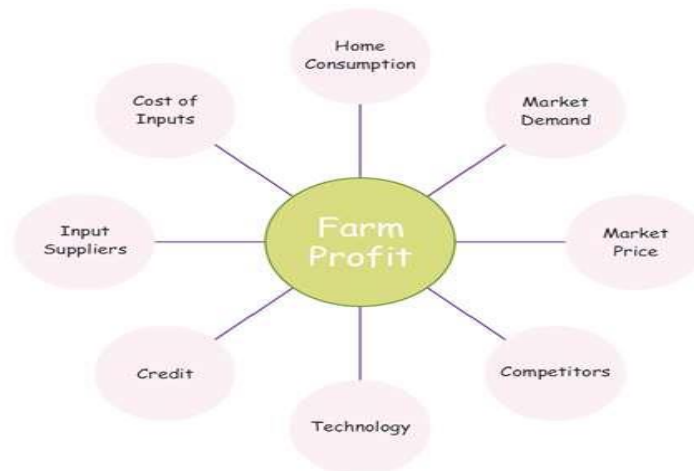
### Fixed Costs:

“ The fixed costs apply to the farm as a whole. Fixed costs are costs that do not vary with changes in production output of a specific product. Fixed costs remain the same regardless of the output. Even if there is no output, there will still be fixed costs. ”

			
Farm Equipment (e.g. Tractor)	Implements and tools	Packing shed	Farm infrastructure (e.g. fencing)

Notes:.....  
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## What can affect farm business profit?



Notes:.....

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## Understanding Farm Enterprises

Competitive enterprises	Supplementary enterprises	Complementary enterprises
Enterprises "compete" when they use the same resources.	Enterprises "supplement" one another when they use resources that might otherwise not be used.	Enterprises "complement" one another when they interact in a supportive, two way process.
<b>Example</b>  If a farmer does not have enough labour to harvest two different crops at the same time, one crop can only be increased if the other is reduced	<b>Example</b>  A farmer has fish and duck enterprises. The duck droppings are utilised by the fish in the fishpond which could otherwise have been wasted. In such a case, the two enterprises are supplementary; the ducks supplement the feed for the fish.	<b>Example</b>  Poultry produces manure. The manure can be applied as a fertilizer to crop enterprises. The maize grain can be fed to the poultry. This relationship between the livestock and crop enterprises shows that the two are complementary.

## From Analysis to Action

[illegible]



**Step-1:** Enterprise \_\_\_\_\_

**Step-2:** For the period: \_\_\_\_\_ to \_\_\_\_\_

**Step-3:** Area under cultivation (acre): \_\_\_\_\_

**Step-4: Income**

Item	Quantity	Unit Price (Rs.)	Value (Rs.)

**Step-5:** Total Income

**Step-6: Variable Costs**

Item	Quantity	Unit Price (Rs.)	Value (Rs.)

**Step-7:** Total Variable Costs

**Step-8:** Enterprise Profit (income - variable costs)

## Steps

**STEP-1:** Put the name of the enterprise (e.g. Potatoes) in the space provided on the top of the template.

**STEP-2:** Agree on a duration for this enterprise, e.g. for the period November 2009 to June 2010.

**STEP-3:** Estimate the area of the crop under cultivation (in acres).

**STEP-4:** Calculate the income by listing the various ways in which the potatoes have been disposed, including selling at farm gate, or a neighboring market, or to an exporter, or kept for home consumption, or given away. The quantities and prices for each form of disposal may be different. If the produce has been retained for home consumption, or given away, make sure that the unit price reflects a market value.

**STEP-5:** Once all the values have been added, it will reflect the total income from that particular enterprise. This total amount should be written in the space for "Total Income".

**STEP-6:** Calculate all costs directly related to the production of potatoes. Under the column items, list all the production costs associated with this enterprise. For each item, trace the specific quantity and the unit price to arrive at the value (in Rs.) for each item.

**STEP-7:** Total the value or cost for all the items to arrive at the "Total Variable Costs".

**STEP-8:** To arrive at the 'Enterprise Profit', subtract from the total income the total variable costs.

## A Budget Template

Notes:.....

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## Prepare A Budget!

Suppose that you have decided to plant wheat on one acre of land. Based on your market survey, you have estimated the following:

- Production from one acre plantation: 1600 kg
- Selling price: Tk. 33 per kg

You have also identified the variable costs associated with this enterprise as follows:

- Seed 50 kg @ Tk. 60 per kg

- Fertilizer (Urea) 1 bag @ Kg. 1000 per bag
- Fertilizer (DAP) 1 bag @ Tk. 4500 per bag
- Water charges 10 hours @Tk. 400 per hour
- Labour charges for tractor 8 hours @ Tk. 400 per hour
- Labor for harvesting the crop for 8 hours @ Tk. 400 per 8 hour

Determine the profit that you can expect from this enterprise.

Notes:.....  
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 .....

## **Determining the minimum price and yield for the enterprise**

### **1. Calculating Break-Even Price**

A break-even price is the minimum acceptable price that will, if nothing else, cover the cost of production. At this price the income received will be equal to the cost of production, and the profits will be zero.

The break-even price can be calculated from the information in the enterprise budget, using the following formula:

**Break-even Price = Total Variable Costs per acre / yield per acre**

Notes:.....  
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### **2. Calculating Break-Even Yield**

The break-even yield is the minimum level of production that you can produce to cover the costs

of production. It is calculated by dividing the Total Variable Costs/ha with the per unit price of the produce.

The break-even yield can be calculated from the information in the enterprise budget, using the following formula:

**Formula for break-even price = Total variable costs per acre / unit price of produce**

Notes:.....  
 .....

### **Reference:**

1. *Farm Business School : Training of Farmers Programme South Asia, Handbook, Food and Agriculture Organization of the United Nations, Regional office for Asia and the Pacific, Bangkok 201. <http://www.fao.org/3/i2137e/i2137e00.htm>*

## Annex-1. List of Major Exported Horticultural Crops from Bangladesh

Serial Number	Crops		Availability	
	Local name	English name	From	To
<b>Vegetables</b>				
1.	Karala	Bitter gourd	Throughout the year	
2.	Uchchay	Small bitter gourd	March - May	
3.	Jali kumra/Chal kumra	Ash/Wax gourd	Throughout the year (Peak time: April-October)	
4.	Kohi/Chichinga	Snake gourd	Throughout the year (Peak time: April – October)	
5.	Kadhu/Lao/Dudi	Bottle gourd	Throughout the year (Peak time: November-April)	
6.	Kakrol	Teasle gourd/Kantola	April - October	
7.	Misti Kumra	Pumpkin (green)	Throughout the year	
8.	Purol/Dundul	Sponge gourd	Throughout the year (Peak time: March – October)	
9.	Patol	Pointed gourd/ Tinduri/Palwal	Throughout the year (Peak time: April – November)	
10.	Shosha	Cucumber	February	
11.	Paka Chal Kumra	Matured Wax gourd	Throughout the year	
12.	Jinga/Tury	Ridged/Ribbed gourd	Throughout the year (Peak time: March – October)	
13.	Khira	Small Cucumber	October	
14.	Begun	Brinjal/Egg plant/Aubergine	Throughout the year	
15.	Lubiya/Barbati	Yard Long bean	Throughout the year (Peak time: June-December)	
16.	Deshi Seem	Hyacinth bean	October -December	
17.	Deshi Seem Bichi	Hyacinth bean seed	November	
18.	French bean	French bean	Mid-November to March	
19.	Motor Shutu	Pea seed	January-March	
20.	Lota/ Kachur Lati	Stolon of Taro	Throughout the year (Peak time: July – October)	
21.	Mukhi Kachu (cv. Bilashi)	Eddo	Throughout the year (Peak time: June – November)	
22.	Pani kachu	Taro	Throughout the year	
23.	Dudhkachu	Coco Yam	Throughout the year	
24.	Moulavi kachu	Yautia	Throughout the year	
25.	Mankachu	Giant Taro	Throughout the year	
26.	Kachu	Aroid	Throughout the year	
27.	Olkachu	Elephant foot Yam	June -September	
28.	Kachu Pata	Leaves of Aroid	Throughout the year	
29.	Kachur Doga	Stem of Aroid	Throughout the year	
30.	Gool Alu	Potatoes	Throughout the year (Supply availability for export March - October)	
31.	Misti Alu	Sweet Potato	March-May	
32.	Mattya Alu	White Yam	Throughout the year	
33.	Pesta Alu	Air Potatoes	April	
34.	Misti Alu	Sweet Potatoes	March	
35.	Data	Stem Amaranth	Throughout the year	
36.	Marich	Green Hot Chili	Throughout the year	
37.	Naga Marich	Naga Hot Chill	Throughout the year	
38.	Capsicum	Capsicum	January - March	
39.	Derosh	Okra	Throughout the year	
40.	Kacha Papay	Green Papaya	Throughout the year	

41.	Shajna	Drumstick	April-June
42.	Kathaler Bichi	Jackfruit seed	April-September
43.	Kacha Kola	Plantain	Throughout the year
44.	Kolar Thor/Mocha	Banana Flower	Throughout the year
45.	Kolar Anaj	Steam of Banana	Throughout the year

Serial Number	Crops		Availability	
	Local name	English name	From	To
<b>Fruits</b>				
01.	Ada Lebu	Ada Lebu	Throughout the year	
02.	Jara Lebu	Jara Lebu	Throughout the year	
03.	Elachi Lebu	Lemon	Throughout the year (Peak time: May – October)	
04.	Satkora	Satkora	Throughout the year (Peak time: April – October)	
05.	Kagozi Lebu	Lime	Throughout the year (Peak time: April-November)	
06.	Toikor	Toikor	November - December	
07.	Batabi Lebu	Pummelo	Mid-August - Mid-October	
08.	Kathal	Jackfruit (Matured)	May- July	
09.	Kacha Kathal/Echar	Jackfruit (Immature)	Mid-March –Mid May	
10.	Deshi Amra	Hog plum	May - October	
11.	Belati Amra	Golden Apple	July - October	
12.	Peyara	Guava (summer) Guava (Winter)	July -September February-March	
13.	Kalo Jam	Jamon	Mid-May – Mid-July	
14.	Zamrul	Wax apple	June-July	
15.	Bel	Wood Apple	April-June	
16.	Litchu	Litchi	Mid-June - July	
17.	Kothbel	Elephant foot apple	September- December	
18.	Lotkon	Lotkon	June - July	
19.	Kamranga	Carambola	November -July	
20.	Anarosh	Pineapple	Throughout the year, <i>for Baby Pine Apple</i> <i>(Peak Season: May – July)</i>	
21.	Kul/Boroi	Ber/Jujube	December - March	
22.	Jalpai	Indian Olive	August – December	
23.	Teatul	Tamarind	January - March	
24.	Karamcha	Karanda	Mid-August – Mid October	
25.	Chalta	Indian dellenia	August - December	
26.	Sharifa	Custard apple	August -October	
27.	Kaupha	Mangosteen/Cowa	June - July	
28.	Amloki	Aonla	August-September	
29.	Daophal	Daophal	Mid July- Mid September	
30.	Aam	Mango	May-July	
31.	Kacha Aam	Green Mango	April- May	
32.	Champa kola	Apple Banana	Throughout the year	
33.	Narikel	Coconut	Throughout the year	
34.	Pan	Betel Leaf	Throughout the year	
35.	Supari	Betel Nut (Kacha)	Throughout the year	

Source: <http://www.hortex.org/vegfruit.htm>