"FOOD SAFETY & HYGIENIC PRACTICES IN AGRICULTURE MARKETING"

(COSAMB Meeting during 18th to 20th Feb,2011 at Goa)

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Food safety

Safety of food is a basic requirement of food quality.

"Food safety" implies absence or acceptable and safe levels of contaminants, adulterants, naturally occurring toxins or any HAZARD that may make food injurious to health on an acute or chronic basis

Assurance that food will not cause harm to the consumer when it is prepared and/ or eaten according to its intended use.

Food Safety, Safe Food?

- Food Safety
  - Concept that food will not cause harm to the consumer when it is prepared and/or eaten according to its intended use.

- Safe Food
  - A product which is free of microbiological, chemical or physical hazards

    OR
  - A product that does not cause illness or injury when consumed as intended

Image source: www.akshayapatra.org/president/images/pres15.jpg

The Importance of Food Quality and Safety for Developing Countries

- For domestic and international trade
- building up the trust and confidence of importers in the quality and safety of food supply systems
- Improving Food Quality and Safety make economic sense also.

Consequences of Ignoring Food Safety

Image source – Royalty-Free/Corbis

Food borne illness : what is it?

- When certain bacteria enters the food supply, they cause food borne illness.
- General symptoms are nausea, vomiting, diarrhea, fever.

Sources of Micro organisms

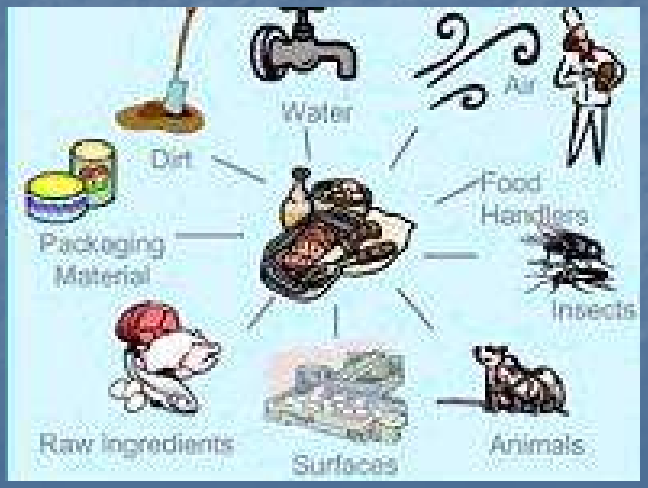

Image source: www.ucce.ucdavis.edu/files/filelibrary

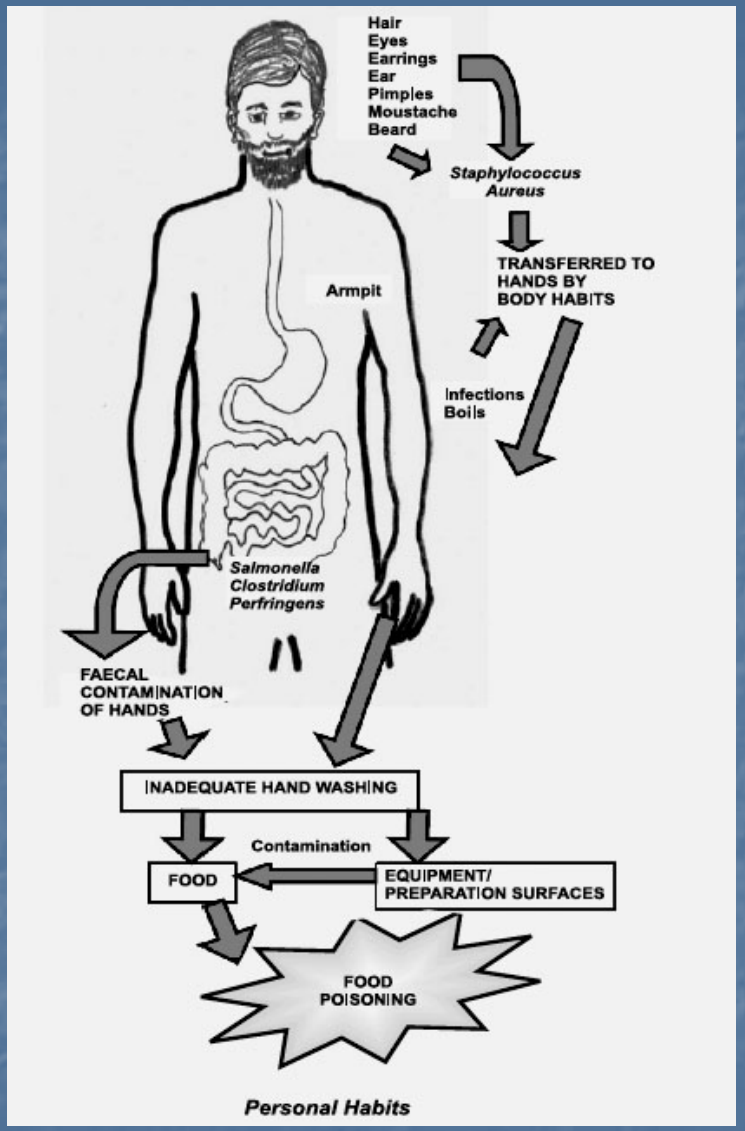

Image Source. Restaurant and Catering NSW –Food Management Plan July 2003 VI.I

Hard facts

In India

lack of Hygiene & Unsafe water

kills

7.8 L people annually

as per

“Safer Water, better health”

- WHO report 2008

Hard facts

- 1 in every 10 diseases and 6% of all deaths globally are caused by lack of Sanitation
- In India – 1.03 crore people die annually
  - 7.8 lakh (~7.5%) deaths are related to water, sanitation and hygiene
  - Diarrhoeal diseases cause 4.02 Lakh deaths
  - Malnutrition accounts for 2.17 Lakh deaths
  - Intestinal nematode infection and Water borne diseases like malaria, dengue and Japanese encephalitis cause) 0.19 Lakh deaths

Changes in Consumption Patterns

- Increase consumption of “riskier” foods?
  - Uncooked produce
  - Salad bars
  - Minimally processed/pre-prepared
  - Imported foods (year round availability)
  - Increased popularity of “riskier” produce
- green onions
- Cilantro 16% positive Salmonella and Shigella
- seed sprouts
- unpasteurized juices
- melons

Factors Driving Changing Food Safety Standards

- Increased public awareness

- Outbreaks
- activism
- availability of information

- Advances in scientific knowledge
- Increased and improved surveillance
- International trade

Rising awareness on food safety aspects and food borne diseases

Worldwide

- 840 million people do not have access to quality food.
- Around 70% of the food borne diseases are caused by biological contamination.

Food--borne Illness, USA

- Total Food-borne Illness Cases:
  - Illnesses 76,000,000
  - Hospitalizations 325,000
  - Deaths 5,000
- FBI Associated with Known Pathogens:
  - Illnesses 14,000,000
  - Hospitalizations 60,000
  - Deaths 1,800

US Centers for Disease Control and Prevention, 1999

Recent Food borne Outbreaks in the USA Domestic or Foreign ?

- Outbreaks can be from produce grown in USA

  September, 2006 fresh spinach outbreak, California produce

  Illnesses in 20 states from E. coli O157:H7

  Costs to industry estimated to be $100 million US Dollars
- Can also be from imported produce

  Salmonella outbreaks in cantaloupe from Mexico

  Most Mexican firms still unable to ship to USA
- Are outbreaks proportional to produce volume ?
- The US approach has been to use education and training to reduce the potential for food borne illnesses.

In industrialized countries up to 30% of people suffer from food-borne illnesses every year.

In developing countries

- It has been estimated that annually over 1,500 million children under the age of five years suffering from diarrhea and over 3 million die as a result (WHO, 1999).

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(Ref: US Centres for Disease Prevention and Control, 1999)

Projected Costs in the USA

- Estimated 76 million cases resulting in 323,000 hospitalization & and 5000 deaths each year in the U.S.A.
- 1 in 4 Americans will develop a foodborne illness
- 1 in 1000 will be hospitalized
- An estimated $6.5 billion cost per year

source: Mead, et. al.

Some notable cases of FBD in Asia have been:

- In 1988, in china, a Hepatitis A epidemic associated with the consumption of clams infected some 292,000 people, killing nine
- In 200, in Japan, food poisoning linked to milk products produced in an Osaka factory of Snow Brand Company sickened 14,780 persons, making it one of largest food poisoning out breaks ever in that country
- In 2002 , in china, more than 200 schoolchildren were sickened and 38 died from the international contamination of bakery products after a competitor allegedly put rat poison into the breakfast snacks of a restaurant in TangShan, a suburb of Nanjing.

Tainted infant formula in China

- As reported in September 20087 in China:
- 39,965 infants received medical treatment after consuming tainted infant formula
- 12,892 infants were hospitalized
- Three confirmed and one unconfirmed deaths were reported.
- Over 80% of the patients were below 2 year age

A chemical hazard-Melamine

Melamine is a byproduct of the coal industry. It is a chemical compound with various industrial uses, including the production of plastics, dishware, kitchenware, commercial filters, laminates, mouldings compounds, coatings and flame retardants. It is high in nitrogen and this has led to its illegal addition to food and feed for the purpose of increasing the apparent protein content of food products.

The Importance of Food Quality and Safety for Developing Countries

- For domestic and international trade
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- Improving Food Quality and Safety make economic sense also.

Food and its Impact

- Food **is a substance, whether processed, semi processed or raw, which is intended for human consumption, and includes drink, chewing gum & any substance which has been used in the manufacture, preparation or treatment of food but does not include cosmetics or tobacco or substances used only as drugs."**
- **Food must be suitable and safe for human consumption**

Food Bourne Diseases (FBD)

- Food Bourne Diseases (FBD) cause enormous suffering to human lives even in the most developed countries. The statistics are staggering. According to the WHO, Contaminated food contributes to 1.5 billion cases of diarrhea in children each year.
- In Industrialized countries, an estimated one in three persons is struck by FBD each year, largely from mass-catered food. In United States. FBD causes approximately 76 million illnesses annually, as well as 325,000 hospitalizations and 5,000 deaths
- Sadly, it is even worse in less-developed countries. There are an estimated 2,163,000 deaths annually throughout the world caused by diarrheal diseases including 684,000 in the south-east Asian region.

Deaths caused by diarrheal diseases

According to the WHO's 2004 Update on "The Global Burden of Disease," diarrheal diseases caused:
2,2 million deaths of all ages

Nearly 1.8 million deaths of children under the age of 5

Economic cost of food borne diseases- some examples

- USA- USD 5.6 to 9.4 billion in lost work and medical expenses annually
  -EU- EUR 3 billion incurred by the health care system annually (Salmonella infection).
  -Australia- AUD 2.6 billion from cases of food poisoning annually (11,500 daily cases)

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Concerned and Trends in Food safety

Food safety challenges differ by region due to differences in income level, diet, local conditions, and government infrastructure .Food safety concerns in developing countries typically include:

-Inappropriate use of Agricultural chemicals,
-Use of Untreated or partially treated wastewater
-Use of sewage or animal manure on crops as fertilizers
-absence of food inspection, including meat inspection
-lack of infrastructure, such as adequate refrigeration
-poor hygienic, including a lack of clean water supplies

Trends in food safety challenges

- -Changes in animal husbandry practices
- -Changes in agronomic practices
- -Increase in international trade
- -Changes in post harvest food and agriculture technology
- -increase in susceptible population
- -increase in international travel
- -Changes in lifestyle and consumer demand
- -Bioterrorism

Fresh fruits and vegetables refers to fresh produce that is likely to be sold to consumers in an unprocessed or minimally processed (i.e., raw) form.

These are recognized as important components of a healthy diet because of being source of vitamins, minerals, fiber, and antioxidants.

- **Growth of urban population, changing consumer perceptions about food safety and quality, together with increases in urban income and purchasing power, have led to a shift away from consumption of staple carbohydrates and highly processed foods, towards a demand for higher value, fresh and minimally preserved foods**
- **Because most of these produces are grown in a natural environment in fields and orchards, they are vulnerable to contamination with pathogens.**
- **Factors that may affect the occurrence of such contamination include agricultural water quality, the use of manure as fertilizer, the presence of animals in fields or packing areas, and the health and hygiene of workers handling the produce during production, packing, processing, transportation, distribution, or preparation.**

- **The fact that produce is often consumed raw consumed without further treatment to "destroy or remove" microorganisms contributes to its potential as a source of food borne illness.**
- **Food borne illness may be unpleasant; or even fatal. It can damage trade and tourism, lead to loss of earnings, unemployment and litigation. Food spoilage is wasteful, costly and can adversely affect trade and consumer confidence.**
- **Fresh foods consumed by consumers pass through a long supply chain from producer to consumer.**
- **This poses safety hazards due to use of polluted water, inappropriate storage conditions including lack of temperature control, and poor handling and transportation practices.**

Field

Transport

Water

Potential sources of contamination in fresh fruits and vegetables

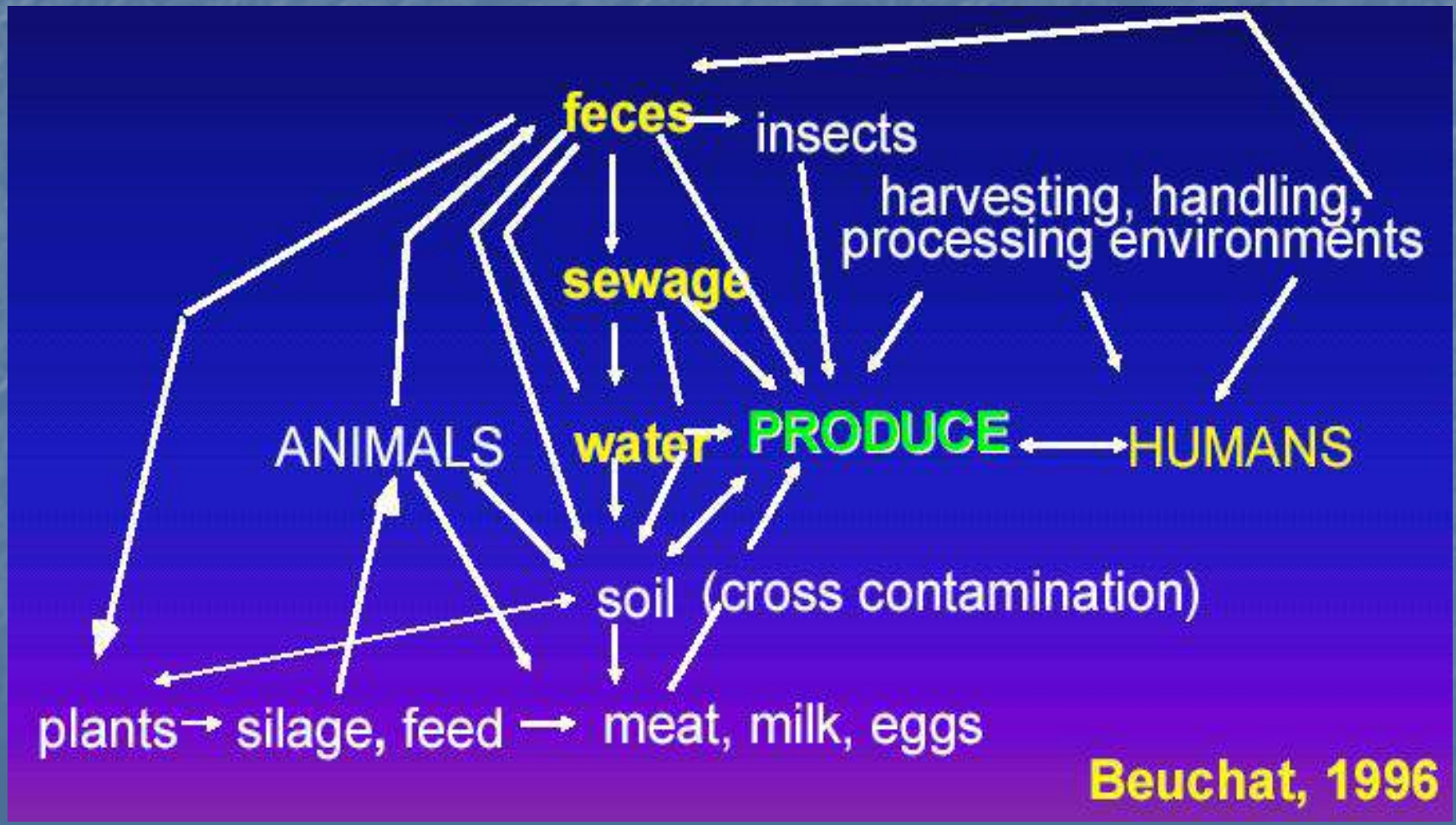
Establishment Hygiene

Manure

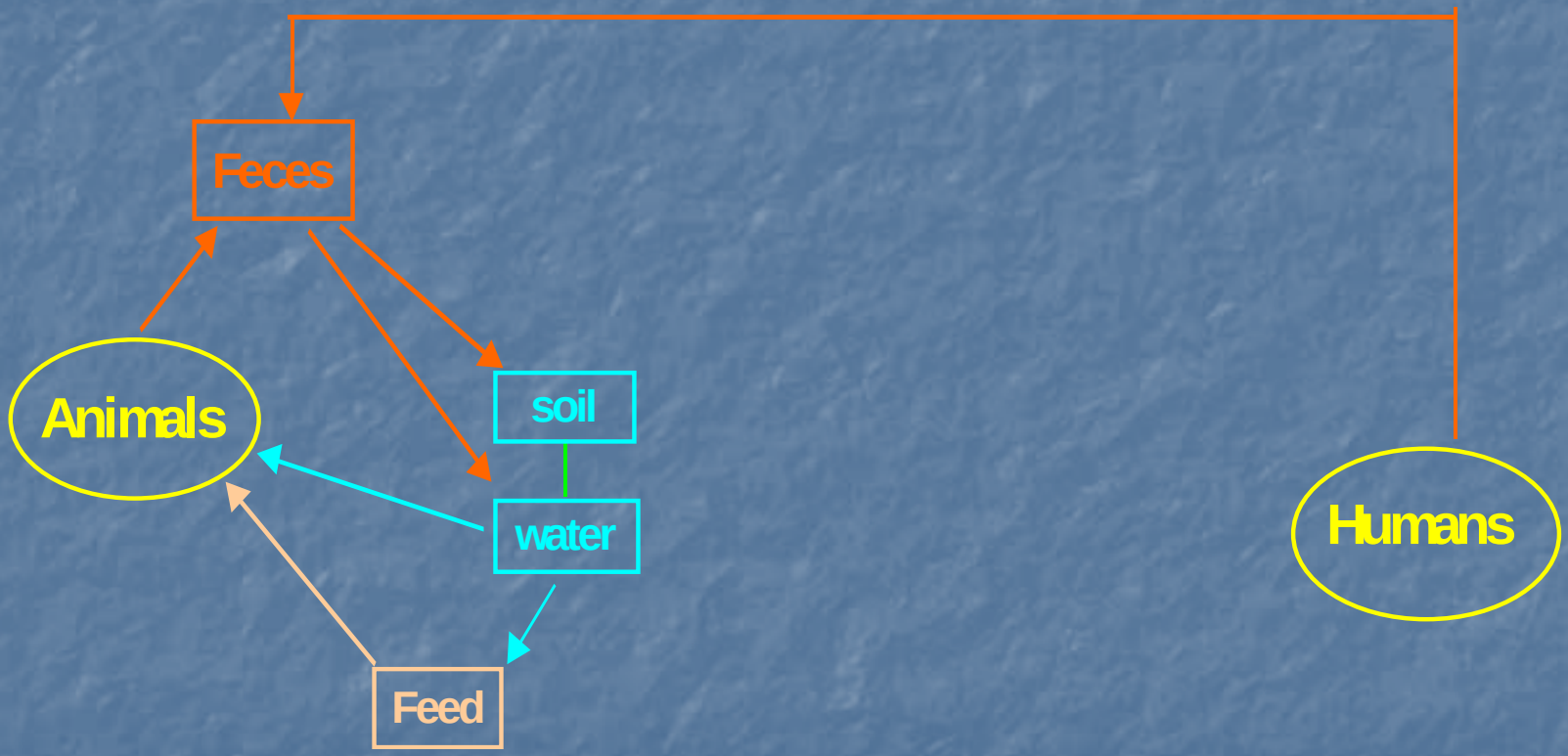
Personal Hygiene

Sewage

Contamination of Produce

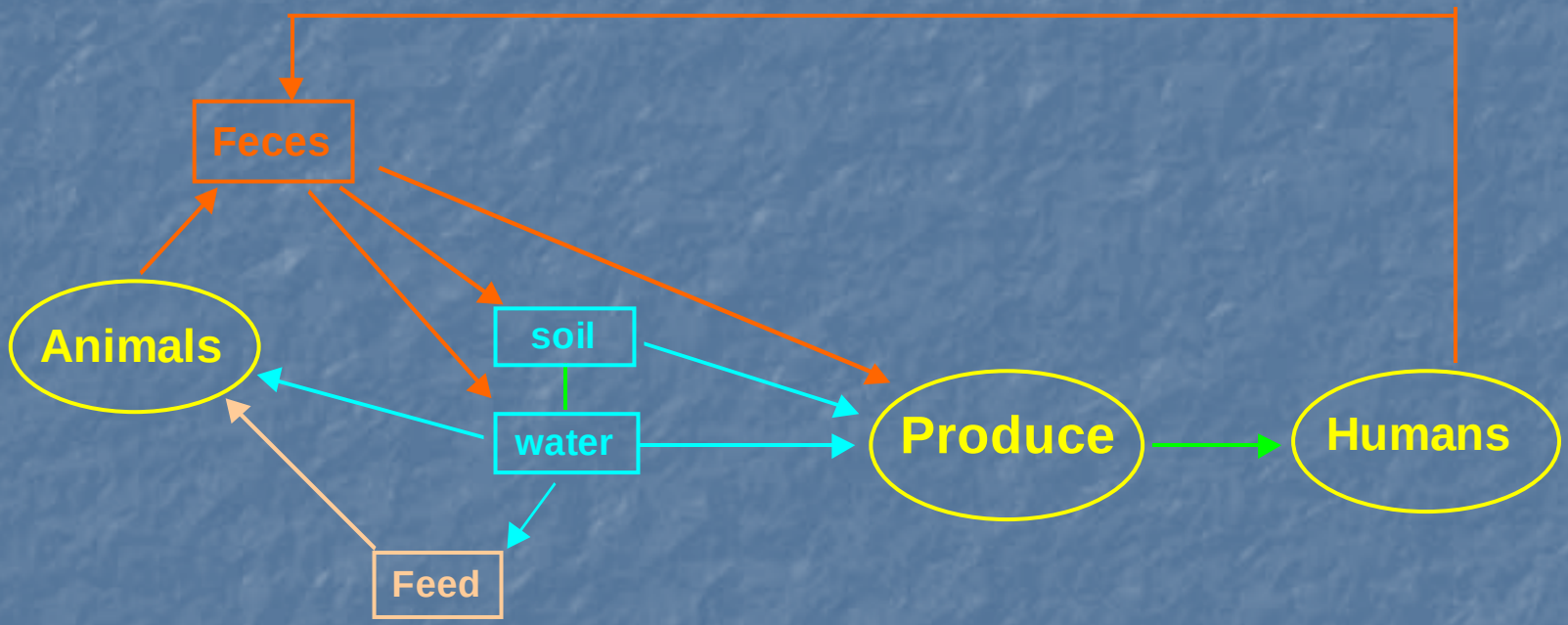


Animal Vectors



Modified from Beuchat, 1996

Animal Vectors



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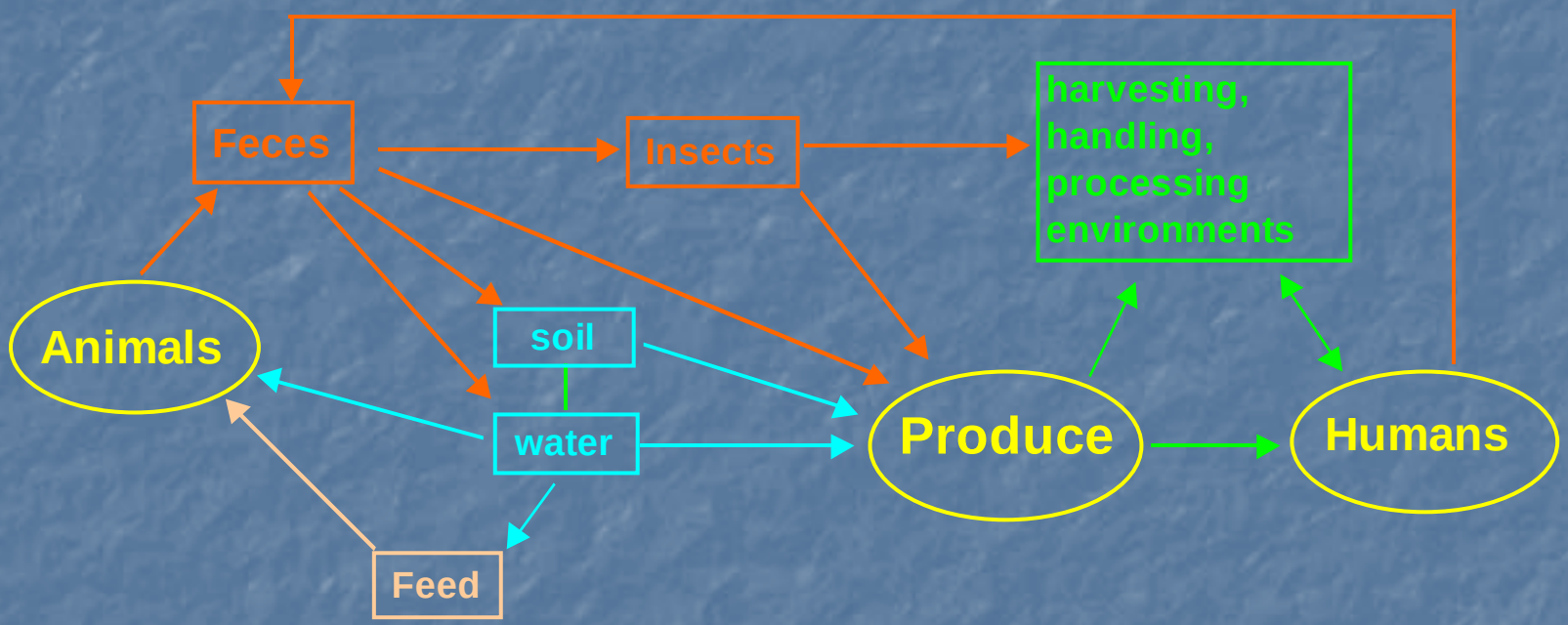

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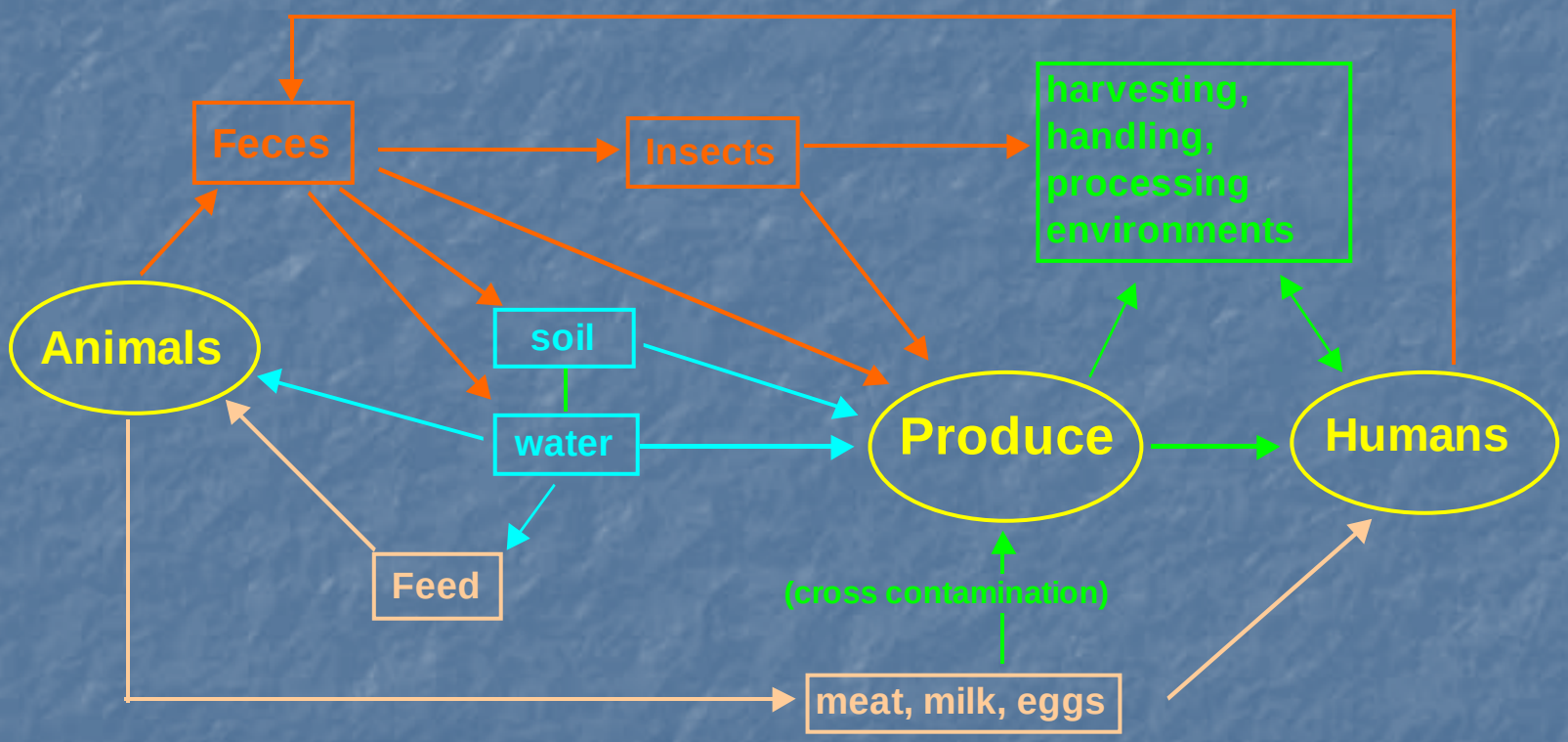

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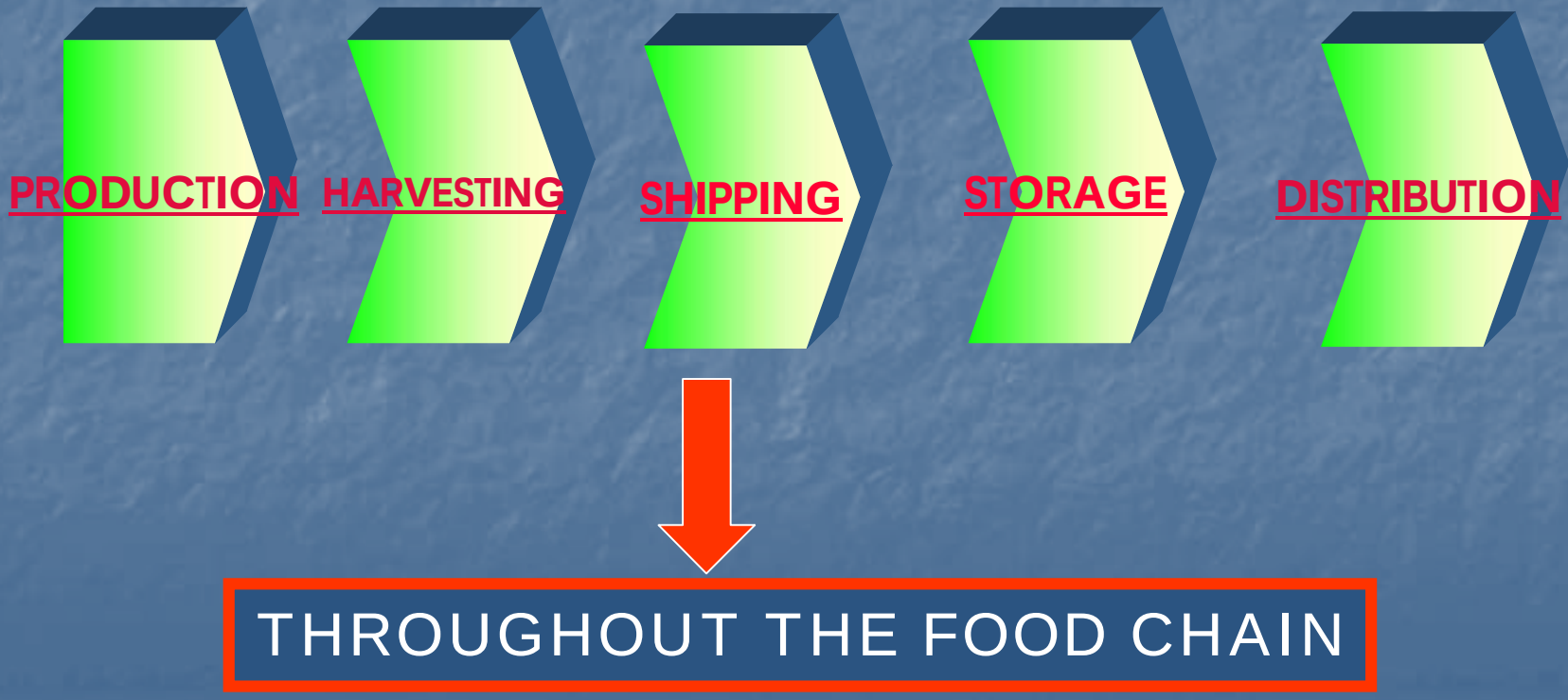
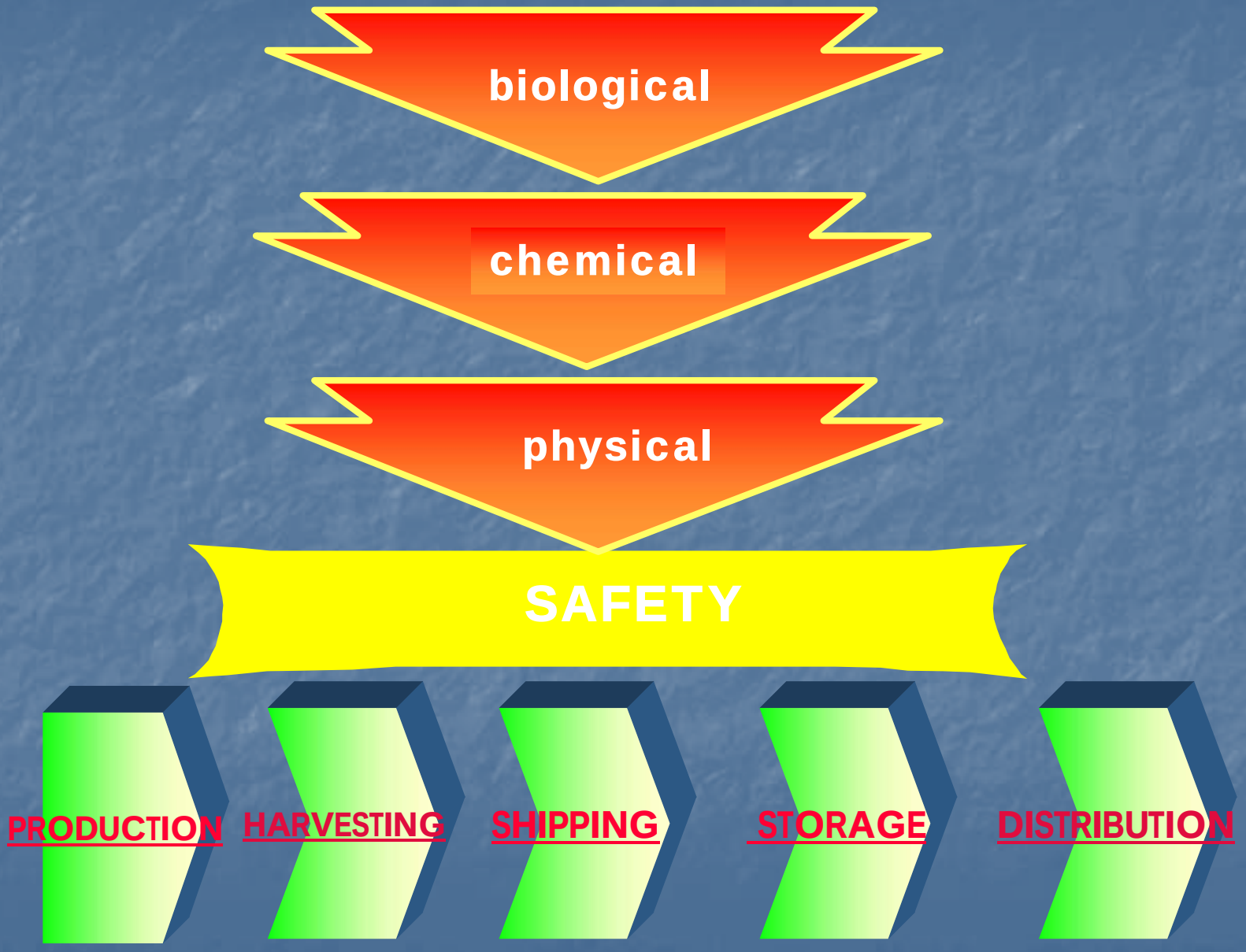
IN FRESH FRUITS AND VEGETABLES

- **Where should the hazards be prevented?**



PREVENTION AND CONTROL OF FOOD HAZARDS



Major Pathogens of Concern

Causes of Illness

- Campylobacter
- Salmonella
- Norwalk virus

Causes of Death

- Salmonella
- Listeria
- Toxoplasma
- Norwalk virus
- Campylobacter
- E. coli O157:H7

Sources of Pathogens on Fresh Produce

Environmental (soil)

- C. botulinum
- Bacillus cereus
- L.monocytogenes

Manure or Water

- Salmonella
- Shigella
- E. coli
- Campylobacter
- Viruses

Potential contamination sources during produce processing

- **Production and Harvest**

– Irrigation water, manure (intentional and

incidental), inadequate field sanitation

- Processing

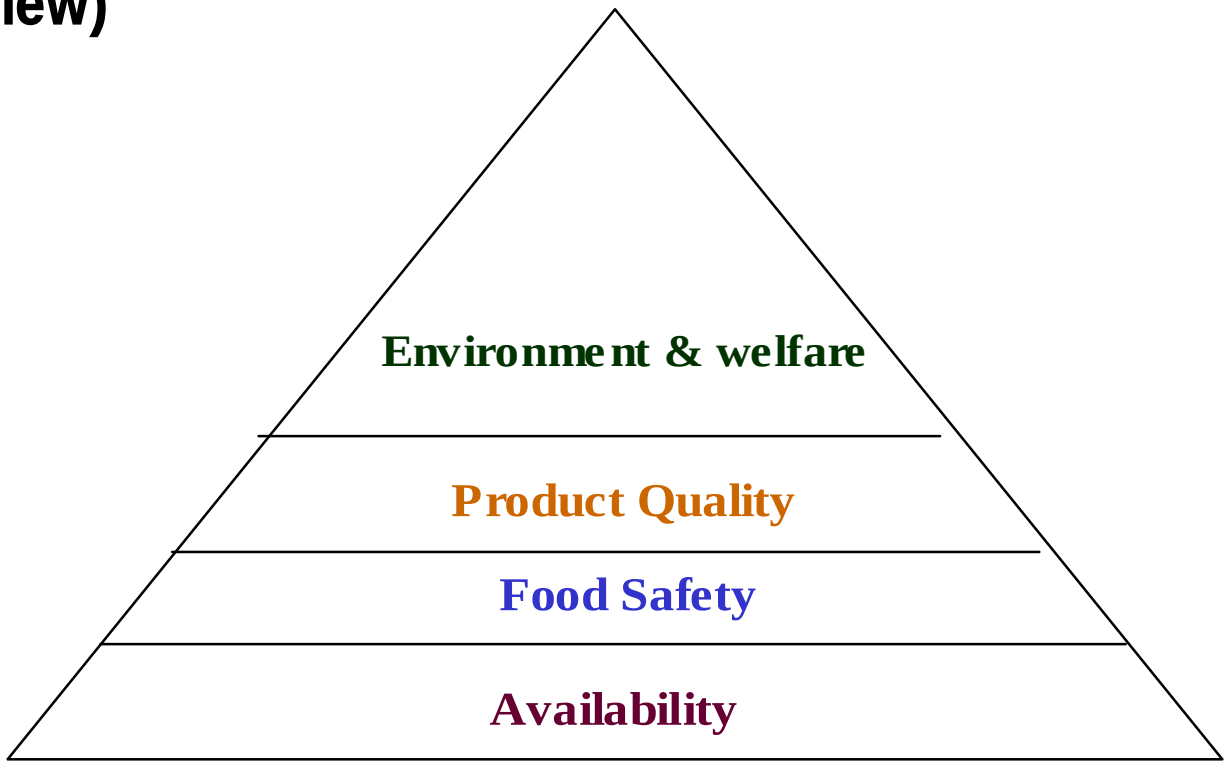
–Wash water, handling, cross contamination

- Distribution

– Ice, inadequate sanitation

Customer perception about food

Purchase Pyramid (from Customer's point of view)



Why the consumers are looking for Food Safety Standards ?

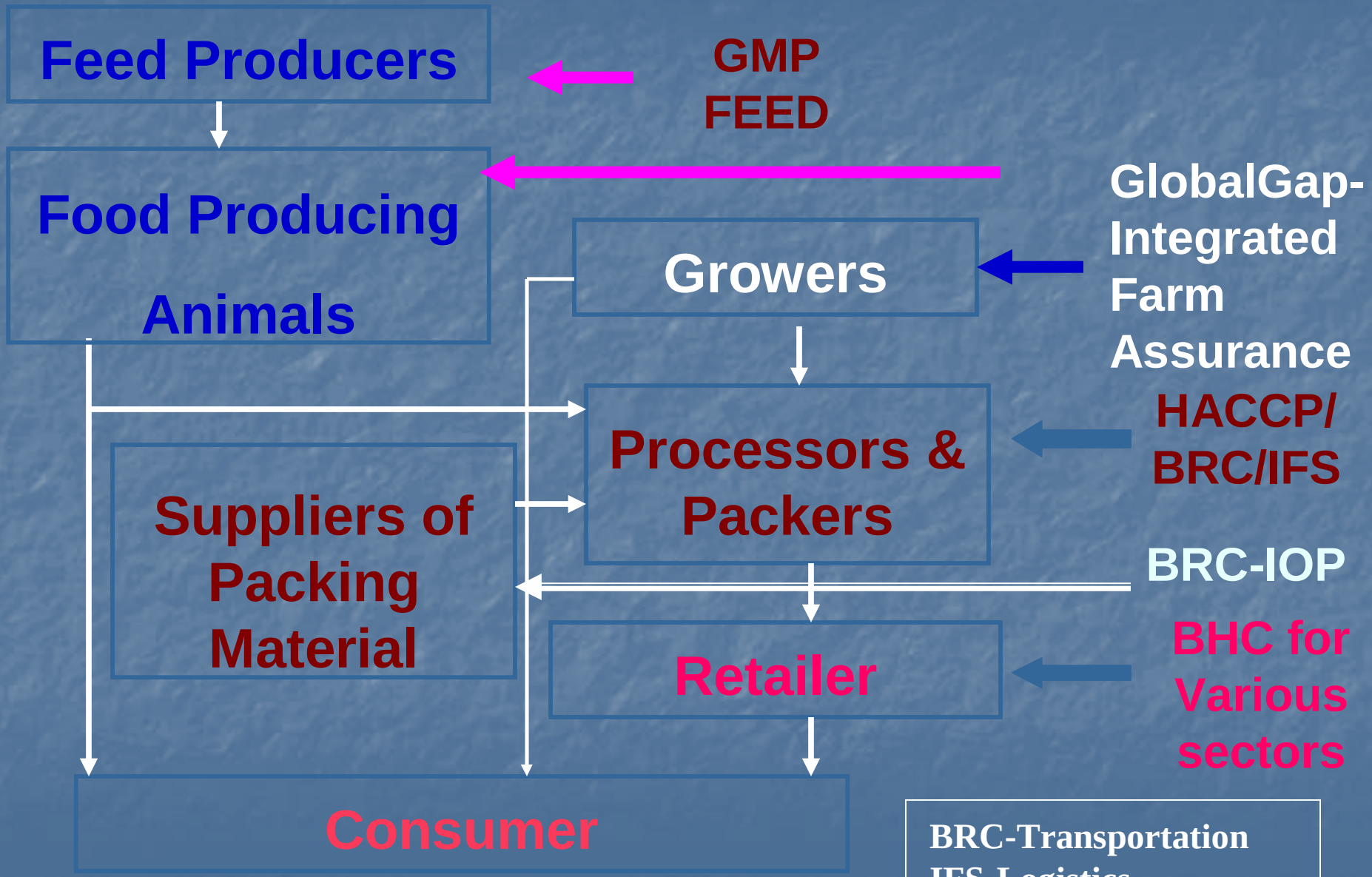
Food Safety concerns

- Foodsafety scares (recalls)
  - ✓ Mad cow disease (BSE)
  - ✓ Introduction of GM foods
  - ✓ Salmonella and Dioxin scandals
- Foot-and-mouth disease (cattle and sheep)
- Bird Flu
- Pesticide Residues and Allergens.

"Major scandals in the last decade in different food and feed chains have highlighted and confirmed the lack of traceability systems, affecting the food safety within the food chain.

- The increasing number and severity of food poisoning out breaks world wide and detection of harmful chemicals in the food products has considerably increased public awareness about food safety.
- Consumers all over the world wanted to know how the food is produced and demand assurance that it is safe and are willing to pay extra money for quality food.

What is Food chain ?



Type (s) of Standards:

1) Food Safety Management System Certifications

ISO 22000, HACCP

2) Product Certifications:

Retailer Driven (Group wise):

BRC: Global Food Safety (Processors)

(UK) IOP (Packaging Material suppliers)

Transportation (Transporters)

IFS: International Food Standard (Processors)

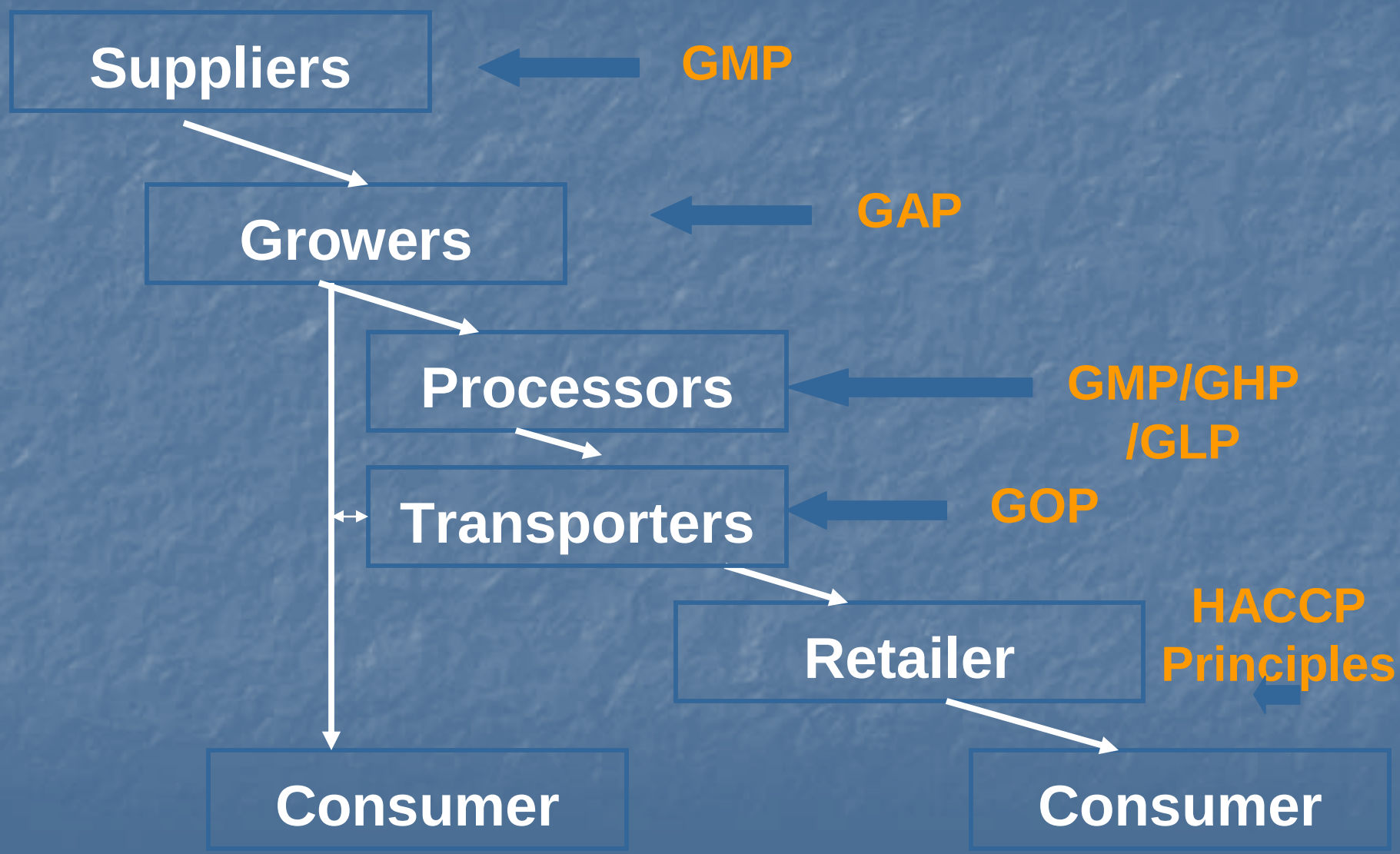
IFS-Logistics (Transporters)

GlobalGap: Primary Production.

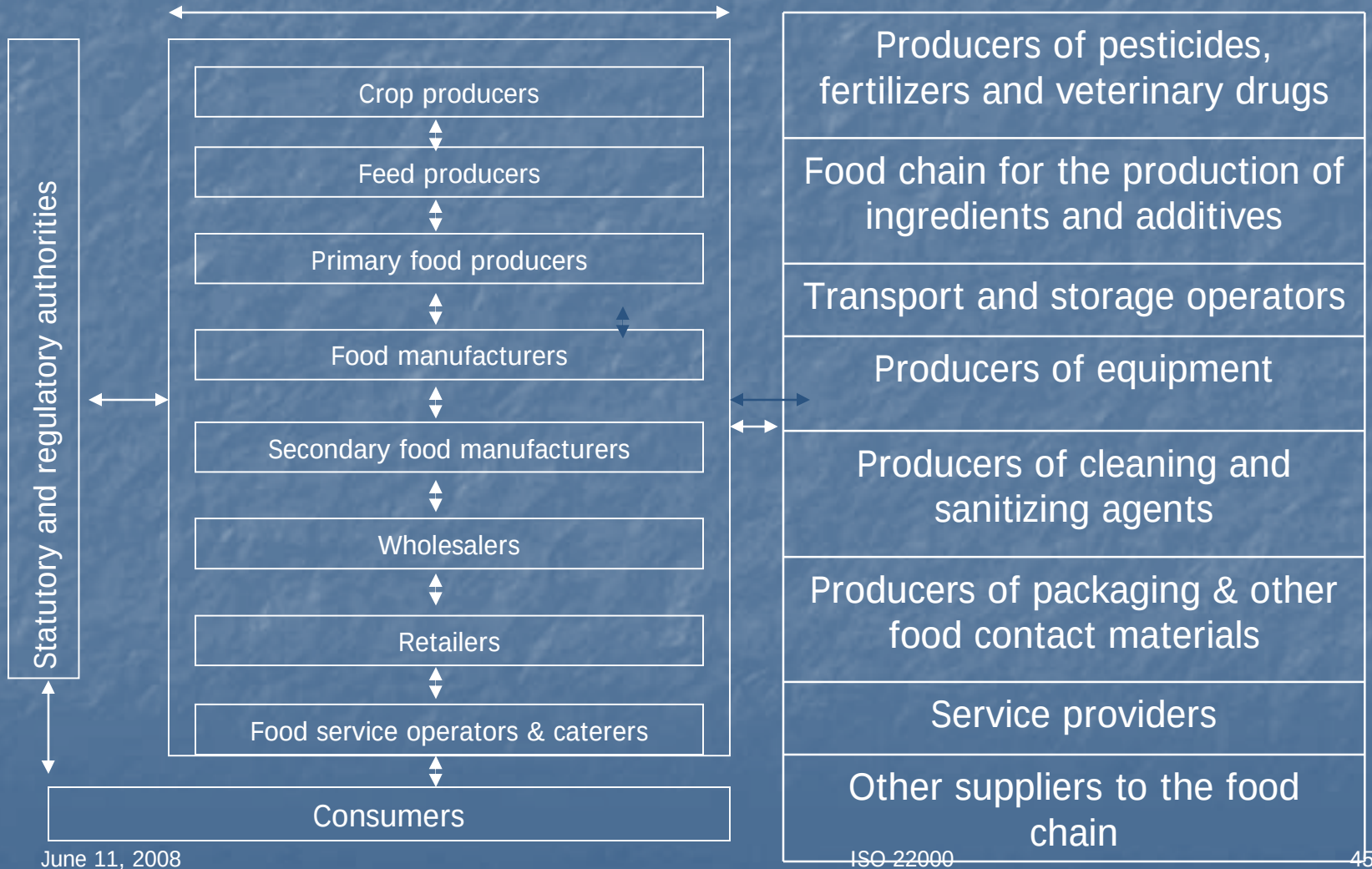
Specific:

Nature's Choice (Tesco): Primary Production and others.

Food chain


Suppliers
GMP
Growers
GAP
Processors
GMP/GHP
/GLP
Transporters
GOP
Retailer
HACCP
Principles
Consumer
Consumer

Communication within the Food Chain



Food Chain

- Direct Involvement
  - Feed producers
  - Primary producers
  - Food manufacturers
  - Transporters
  - Storage operators
  - Retailers
  - Food service outlets
  - Catering services
- Indirect Involvement
  - Suppliers of equipment, cleaning and sanitization agents,
  - Packaging materials
  - Other food contact surfaces

GAP- Facilities and Sanitation

SANITATION PROBLEM AT MANDI

GAP- Facilities and Sanitation

LACK OF FARM MANAGEMENT KNOWLEDGE

GAP- Facilities and Sanitation

HOUSE OF PATHOGENS AFTER HARVESTING

GAP- Facilities and Sanitation

INDIGENOUS TECHNICAL KNOWHOW - WOOLEN WASTE FOR INCREASING WATER HOLDING CAPACITY

FROM FARM TO FORK

- **GAPS**
- Pesticide use
- Manure use
- Harvesting
- Processing
- Packaging
- Storage
- Transport
- Worker Hygiene

HACCP

- Grading and Sorting Tables
- Elevated auction platforms
- Washing and Disinfection
- Washing of Crates
- Worker Hygiene
- Cold Storage

HACCP

- Grading and Sorting Tables
- Washing and Disinfection
- Worker Hygiene
- Cold Storage

- Consumer Education
- Consumer Awareness

Factors Driving Changing Food Safety Standards

- Increased public awareness
  - –outbreaks
  - –activism
  - –availability of information
- Advances in scientific knowledge
- Increased and improved surveillance
- International trade

Good Agricultural Practice Focus on Prevention and Redundant Reductions

FDA, 1998 guidance document

"Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables"

- **Not a regulation - guidelines only**
- **Potential to become a "de facto" standard**

Key Elements of Good Agricultural Practices

- **Water**
- **Manure and Municipal Biosolids**
- **Worker Health and Hygiene**
- **Sanitary Facilities**
- **Field / Packing Facility Sanitation**
- **Transportation**
- **Traceback / Tracibility**

Food safety hazards associated with fresh produce can be broadly divided into three categories: microbiological, chemical, and physical.

- **Biological hazards are microorganisms that cause food borne illness.**
- **Chemical hazards include agricultural chemicals used in the production of fruits and vegetables insecticides, fungicides, miticides, growth regulators and sometimes fertilizers fertilizers.**
- **Heavy metals are considered chemical hazards, too They can be found in contaminated sewage-sludge–the basis of some organic fertilizers, contaminated soils and tainted water.**
- **Chemicals used in cleaning and sanitizing also can be chemical hazards, if used incorrectly.**
- **Physical hazards are foreign material in the product that can cause injury.**
- **These physical hazards can cause injury or be a carrier of microorganisms.**

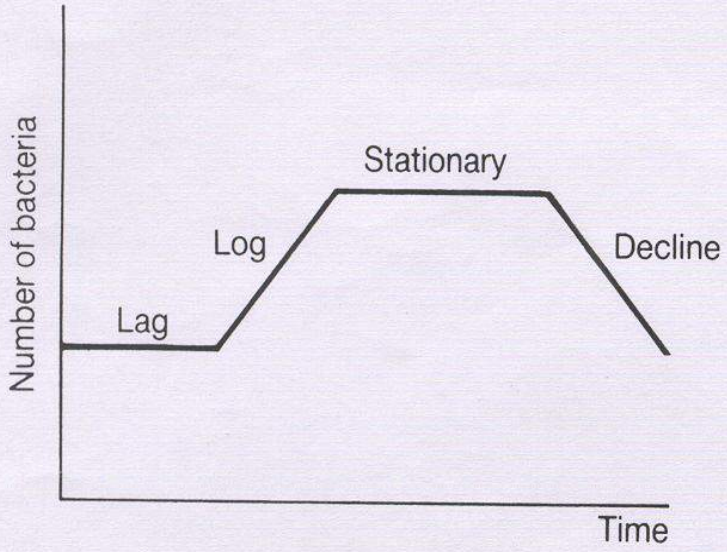
Biological Hazards

Microorganisms

Microorganisms are small organisms that can be observed through a microscope

In order to facilitate the study of microorganisms they are divided into five major classifications:

- Bacteria
- Yeasts
- Molds
- Parasites
- Viruses



Under ideal conditions bacteria can multiply by dividing into two every 20 minutes, in this way a single bacterium could increase to 2 097 152 within 7 hours

O'clock	Bacteria
12	1
12.20	2
12.40	4
13.00	8
14.00	64
15.00	512
16.00	4096
17.00	32 768
18.00	262 144
19.00	2 097 152

Lag[1] – the bacteria are adjusting to the conditions before they start to multiply

Log[2] – this is the phase of rapid growth

Stationary – growth has stopped because their food is running out

Decline – bacteria are dying

[1] (no growth or dormant)

[2] (abbreviation for logarithm, which is the means of using tables to calculate growth)

Danger temperature at which germs can multiply

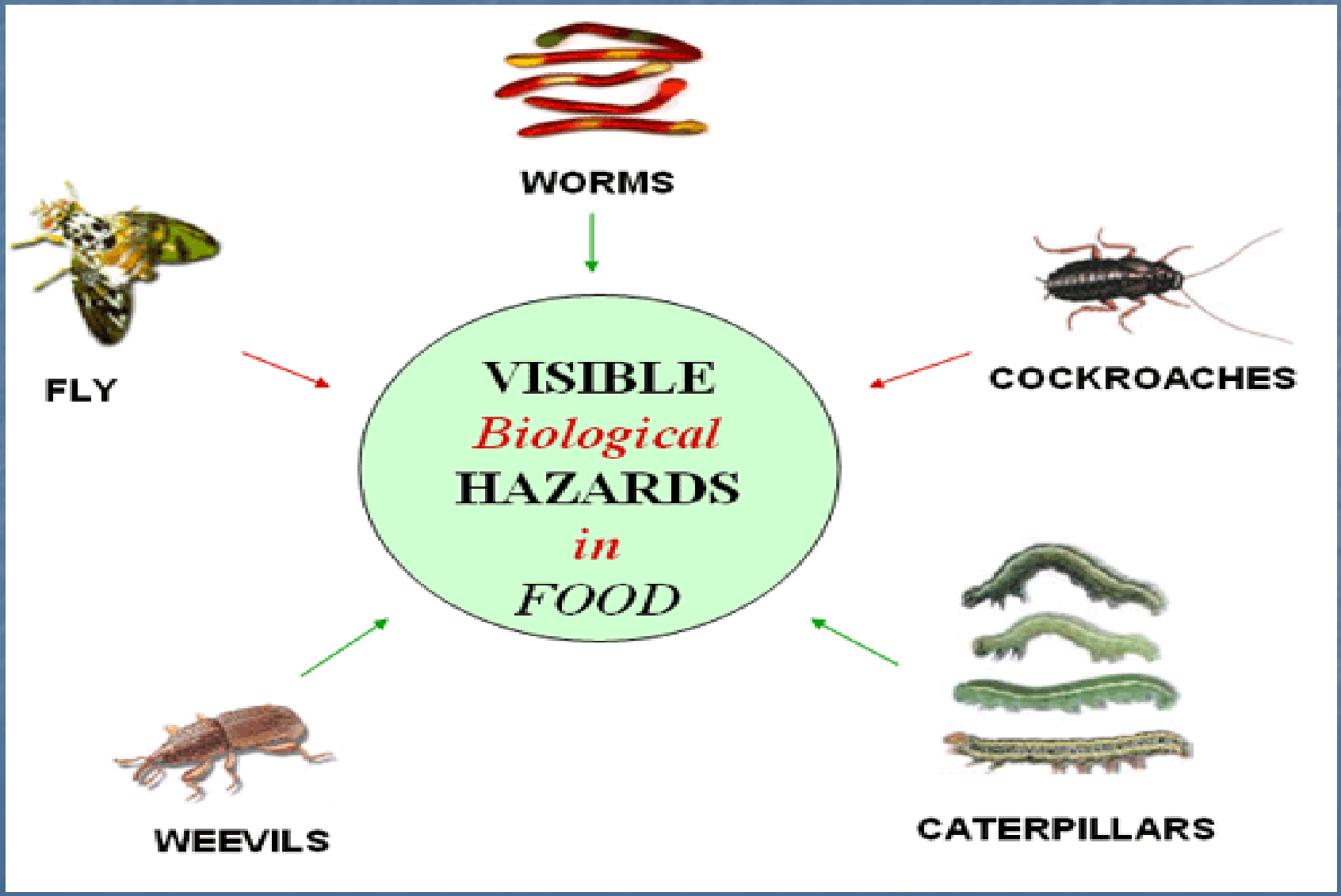
Logarithmic Increase in Bacteria

Time (hrs)	Bacteria
0	1
1	8
2	32
3	256
4	2,048
5	16,384
6	131,072
7	1,048,576
8	16,777,216
9	134,217,728
10	1,073,741,824

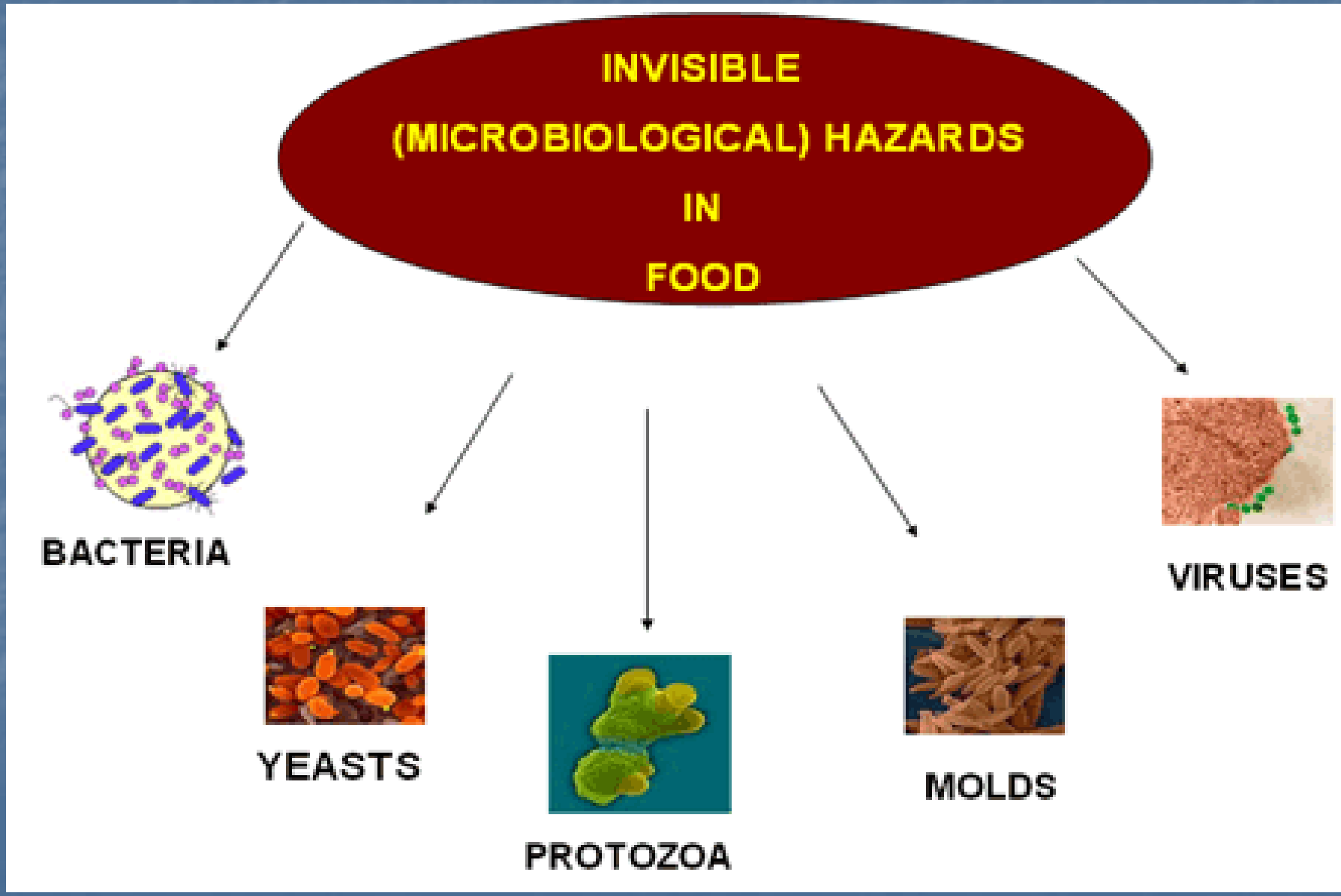
In 7 hours one cell can generate over a million cells. This is a 6-log increase in bacteria.

Visual I. 1-6

Macro biological Hazards



Microbiological Hazards



Pathogenic bacteria associated with fruits and vegetables include:

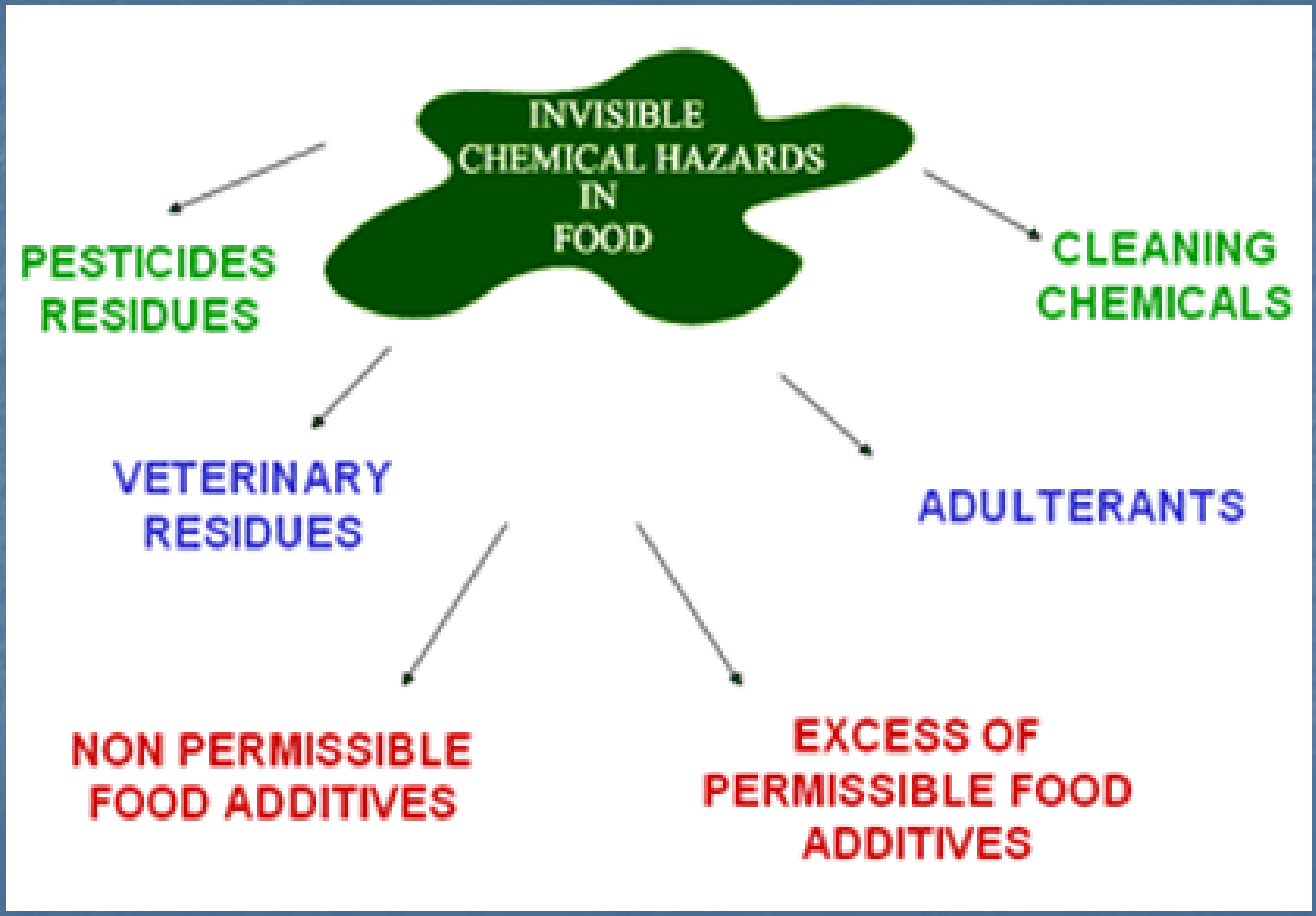
- Salmonella
- Shigella
- Escherichia Coli (pathogenic)
- Campylobacter species
- Yersinia enterocolitica
- Listeria monocytogenes
- Staphylococcus aureus
- Clostridium species
- Bacillus cereus
- Vibrio species

Viral Hazards:

Viruses that have been reported as transmitted by foods include:

- Hepatitis A
- Norwalk virus and Norwalk-like virus
- Rotaviruses, astroviruses, enteroviruses (polioviruses, echoviruses and coxsackie viruses), parvoviruses, adenoviruses and coronaviruses.

Chemical Hazards



To prevent pathogen reproduction in produce, control:

Nutrient availability
Humidity
Acidity
Temperature
Oxygen

The surface of fruits and vegetables can be contaminated with pathogenic microorganisms due to contact with:

Soil
Water
Manure
Sewage fluids
Air
Humans
Animals

Parasitic Hazards

Parasites most commonly associates with human infections include:
Cryptosporidium
Cyclospora
Giardia
Entamoeba
Toxoplasma
Sarcocysits
Isospora
Helminthes:

- **Nematodes (i.e. Ascaris lumbricoides, Thricuris trichiura)**
- **Plathemlminthes (i.e.Fasciola hepatica and Cysticercus spp.)**


Elvis
Presley

Chemical Hazards

Some Naturally Occurring Chemicals Hazards

- Allergens (e.g. weeds)
- Mycotoxins (e.g. aflatoxin)
- Mushroom toxins
- Phytohaemagglutinin
- Alkaloids
- **Added Chemical Hazards**

Polychlorinated biphenyls (PCBs) Agricultural chemicals

- Pesticides
- Fertilizers
- Antibiotics

Prohibited Substances

- Direct
- Indirect

Toxic elements and compounds

- Lead
- Zinc
- Cadmium
- Mercury
- Arsenic

- Cyanide

Contaminants

- Lubricants
- Cleaners
- Sanitizers
- Coatings
- Paints
- Refrigerants
- Water or steam treatment chemicals

- Pest control chemicals

From packaging materials

- Plasticizers
- Vinyl chloride
- Painting/coding inks
- Adhesives
- Lead
- Tin

Physical Hazards

Material	Injury	potential Sources
Glass	Cuts, bleeding; may require Surgery to find or remove	Bottles, Jars, light, fixtures, utensils, Gauge, covers, etc.
Wood	Cuts, infection, choking; may	Field sources, pallets, boxes, building materials
Stones	Choking, broken teeth	Fields, buildings
Insulation materials	Choking long-term if asbestos	Building
Plastic	Choking, cuts infection; may require surgery to remove	Packaging, pallets, equipment
Personal effects, i.e. jewelry, hair clips, pens	Choking, cuts, broken teeth; may require surgery to remove	Employees

KIND OF PHYSICAL HAZARDS

- METAL
  - Personal items
  - Machinery & equipment
- GLASS
- PLASTIC
- WOOD
- OTHERS













Potential for physical contamination ?

Physical hazard from unshielded lights?

Shielded ceiling lamp

Prevention of physical hazards – no jewelry on workers

Communication by the Organization

- External
  - Suppliers & contractors
  - Customers / consumers
  - Statutory and regulatory authorities
  - Others stakeholders
  - Particularly food safety hazards that need to be controlled by others in the Food Chain
- Internal
  - Effective communication with staff concerning food safety issues
  - Food Safety team must be swiftly informed relevant food safety aspects
  - Updating of FSMS
  - Management Review

Production to Consumption

- Boat to Throat
- Farm to Fork
- Plow to Plate
- Till to Tooth
- Stable to Table

Health Effects of Food borne Disease

Some Effects of Food bore Disease

- Vomiting
- Gastroenteritis
- Diarrheal disease
- Non-intestinal disease, i.e. neurological conditions, pre-mature labor, and stillbirths

Costs of Food borne Disease

Costs for Individuals

- Medical costs
- Missed work and lost wages
- Travel to get care
- Expenses for care taker
- Chronic disease

Cost of Society

- Loss of productivity
- Cost of disease investigation
- Loss of revenue due to business closure and product avoidance
- Chronic disease

FAO applies quality management systems for fresh foods such as

- Good Agricultural Practice (GAP),
- Good Hygiene Practice (GHP),
- Good Manufacturing Practice (GMP) and
- Hazard Analysis Critical Control Point (HACCP), thereby assuring that quality is maintained at each step of the supply chain.

Post-harvest operations in Fruits and Vegetables

Post harvest operations	Operational steps
Harvest	Harvest
Field packing	Collection, Transfer to field bin
Transport out of field	Transport to packing shed
Packing shed operations	Reception Treatment Pre-cooling Unloading from field bin Washing and drying Sorting/grading Packing Labeling Final shed quality control Palletization
Storage	Cooling Cool storage
Shipment to market	Loading and transportation
Retailing	Retailing operations

Good Agricultural Practices

- Good Agricultural Practices are a collection of principles to apply for on-farm production and post production processes, resulting in safe and healthy food and non-food agricultural products, while taking into account economical, social and environmental sustainability.

Objectives of GAP certification

- To increase the market access of produce in both the local and international market
- To empower farmers to respond to the demands of the consumers that specific criteria to achieve food safety and quality to be met
- To facilitate farmer adoption of sustainable agricultural practices

Key Elements of Good Agricultural Practices

- Water
- Manure and municipal biosolids
- Worker health and hygiene
- Sanitary facilities
- Field/Packing Facility Sanitation
- Transportation
- Traceback

Potential Contamination Sources during Produce Processing

- Production and harvest

-Irrigation water, manure, inadequate field sanitation

- Processing

-Wash water, handling, cross contamination

- Distribution

-ice, inadequate sanitation

International GAPS

Australia-AustralianGAP

- **SQF 1000 (Safe Quality Food)**
- **SQF 2000**

Freshcare

Ireland-Irish GAP

- **Code of practice for the food safety in the fresh produce supply in Ireland, introduced**
- **General hazard control**
- **Water-farm yard manure**
- **Compost and bio-solids**
- **Hygienic practices**

Safe use of pesticides and biocides

USA-GAP

Module 1- Soil and Water -Hazards associated with prior land use, topography/ Water source, agricultural use and practices
Module 2 – Organic and inorganic fertilizers
Module 3 – Animal exclusion and pest control
Module 4 – Worker health and safety
– Worker hygiene practices
Module 5 – Harvesting and cooling
Trace back or Tracibility

International-GAP- Continue

- Malaysia: introduced the SALM (Malaysian Farm Certification for GAP standard) system
- Thailand: The Q system
- Indonasia: The IndonGAP system
- Singapore: The GAP for vegetables system
- India: currently introducing the system
- FAO GAP

Global GAP (Formally Euro-GAP)

- Site history and site management
- Soil and substrate management
- Fertilizer use
- Irrigation
- Crop protection
- Harvesting
- Produce handling
- Waste and pollution management, recycling and re-use
- Worker health and safety and welfare
- Environmental issues
- Complaint handling
- Traceability
- Record keeping and internal self introspections

Good Agricultural Practices in Handling, Packing, Storage and Transportation of Fresh Produce

- To ensure safety of food during handling, storage and transport, the following procedures should be in place:
- ✓ Sort food and food ingredients to segregate material which is evidently unfit for human consumption
- ✓ Dispose of any rejected material in a hygenic manner
- ✓ Protect food and food ingredients from contamination by pests, or by chemicals, physical or microbiological contaminants or other objectionable substances during handling, storage and transport.

Good Agricultural Practices in Post Harvest Handling

- **Whether the hygiene procedures in handling of produce in the field been maintained.**
- **Whether the hygiene procedures have been maintained in transportation of produce from farm**
- **Have the workers access to clean hand washing in the area of work**
- **Whether workers have received basic instructions on hygiene before handling produce**

Hygiene

I. Worker Health and Hygiene

- Worker food safety training in place
- Workers practice good personal hygiene
- Clean clothing and shoes/boots
- No smoking or eating in work area
- Hair covered
- Wash hands as required
- Limit barehand contact with fresh produce

Sanitation

- Approved sanitizers used to sanitize food contact surfaces.
- Area and equipment cleaned and sanitized at least once a day.
- Unused and new packing containers. protected from contamination during storage.
- Produce waste is removed daily.
- Grounds maintained in good condition.
- Open wounds covered with a clean bandage and single-use glove
- Sick employees and those with uncovered open wounds, sores, etc are assigned to other duties having is no direct contact with fresh produce

Collection of produce

- Are adequate containers available for collection of produce.
- Are containers used in the field, in packinghouses, and for shipment kept clean.
- Are the reusable containers cleaned regularly.
- Whether the empty containers are stored separately.
- Are the disposable containers kept clean.
- Is clean shed available for collected produce.

Cleaning/Washing of produce

- Water used for final product washing is potable or declared suitably by the competent authorities
- If water is re-circulated for final product washing, has this water been filtered and exposure levels to disinfectant routinely monitored
- Wash water is changed when dirty and maintained at temperature no more than 10 degrees cooler than the produce.
- Packing lines, conveyor belts and all other food contact surfaces are washed, rinsed and sanitized at the end of the day.

Pre-cooling of produce

- Harvesting early in the day
- Keeping fruit in shade
- Dumping into cold water
- Placing fruit straight into precooler if fruit cannot be processed immediately
- If placed in precooler, records of temperature, humidity and time of precooling

Cooling of produce

- Produce should be cooled down to appropriate temperature for safe storage.
- Ice used for cooling is made of potable water.

Grading/Sorting

- Are Standard grading machines available.

Post Harvest Treatment

- Whether post harvest treatment has been applied in accordance with established recommendations.
- When chemicals are used, they shall be in accordance with the Food Act and Food regulations.
- In addition, where pesticides are involved, they shall be officially registered under the pesticide act.
- For crops to be exported, crop producers shall not use chemicals that are banned or disallowed in importing countries.
- A current list of all products that are used and approved on the use of crops being grown must be kept.
- Crop producers must consult their customers to determine if any additional commercial restriction exists.
- Crop producers must be able to demonstrate their competence and knowledge with regard to the post harvest treatment.
- Records for all post harvest treatment shall be kept to include crop name, location, date of treatment, reason for treatment, type of post harvest treatment, dosage, methods of treatment and name of operator.

Packaging

- Are packaging materials of proper specification.
- Do the packaging materials have requisite strength.

- Packaging material shall be stored to avoid contamination by physical and chemical hazards as well as pests.
- It shall be protected from rodents, birds and other animals.
- Where produce is field packed, packaging material shall not be left in the field overnight where risk on contamination exists.
- Re-usable crates shall be cleaned to ensure that they are free from foreign materials which may be detrimental to produce and/or consumer's health.

Labelling and coding

- Packages should be labelled for detailed product information and coded to identify the product.

Palletization

- Pallets should be suitable to fit into ship and aircraft as well as in road and rail systems.

Storage of Fresh Produce

- ⇒ **Keep storage area clean and free of contamination.**
- ⇒ **Storage areas are used exclusively for fresh produce.**
- ⇒ **Refrigerated storage units are maintained at the correct temperature.**
- ⇒ **Refrigeration units not loaded beyond capacity.**
- ⇒ **Depending on the nature of the crop, produce should be stored at least six inches off the floor. Rotate stock (First in First out).**

Disposal of waste material

Whether the rotten produce from the field has been removed in a safe manner.

Transportation of Fresh Produce

- Workers loading and transporting produce practice good personal hygiene
- Harvested produce loaded and stored in a manner to minimize physical damage and reduce risk of contamination during transport and to allow for air circulation.
- Packages/pallets are marked properly for loading.
- Vehicles used to transport fresh produce to market are clean (free of visible filth, odors and food particles) and well maintained.

- Transportation units should not have any water condensation and should not be wet.
- Hermetic seals are highly recommended to avoid pest access and environmental contamination during transportation.
- If the fresh commodity requires refrigeration during transportation, refrigeration equipment should be functioning appropriately. Temperature monitoring devices should be used to monitor the performance of the refrigeration system. Vehicles used to transport produce are not used to transport animals or animal products.

GAP- Facilities and Sanitation

LACK OF ADEQUATE STORAGE FACILITIES

GAP- Facilities and Sanitation

SANITATION PROBLEM AT MANDI

GAP- Facilities and Sanitation

LACK OF STORAGE FACILITIES AND GENERAL AWARENESS

GAP- Facilities and Sanitation

LACK OF FARM MANAGEMENT KNOWLEDGE

GAP- Facilities and Sanitation

HOUSE OF PATHOGENS AFTER HARVESTING

GAP- Facilities and Sanitation

INDIGENOUS TECHNICAL KNOWHOW - WOOLEN WASTE FOR INCREASING WATER HOLDING CAPACITY

Kolar –APMC (Karnataka)

GAP- Facilities and Sanitation

FACILITIES AT RELIANCE COLLECTION CENTRE

GAP- Facilities and Sanitation

PAYMENT THROUGH CREDIT CARD

GAP- Facilities and Sanitation

MODERN FACILITIES AT RELIANCE STORE

GAP- Facilities and Sanitation

ELECTRONIC WEIGHMENT AND BILLING

Food Safety and laws implementing and controlling authorities in India

- **Mandatory standards / Compulsory legislation: -**
- a. Prevention of Food Adulteration Act-1954.
- b. Essential commodity Act-1954. It includes various organization and quality standards or laws or acts, which "Implement and control" food laws and acts.
- **Voluntary standards**.
- Bureau of Indian Standards (B.I.S)
- Directorate of Marketing and Inspection (D.M.I)- "Agmark"
- Eco-Mark,
- I.S.O Standards.

Thank You