

# CFCFA Logistics Management Training

## *Cold Chain Logistics*



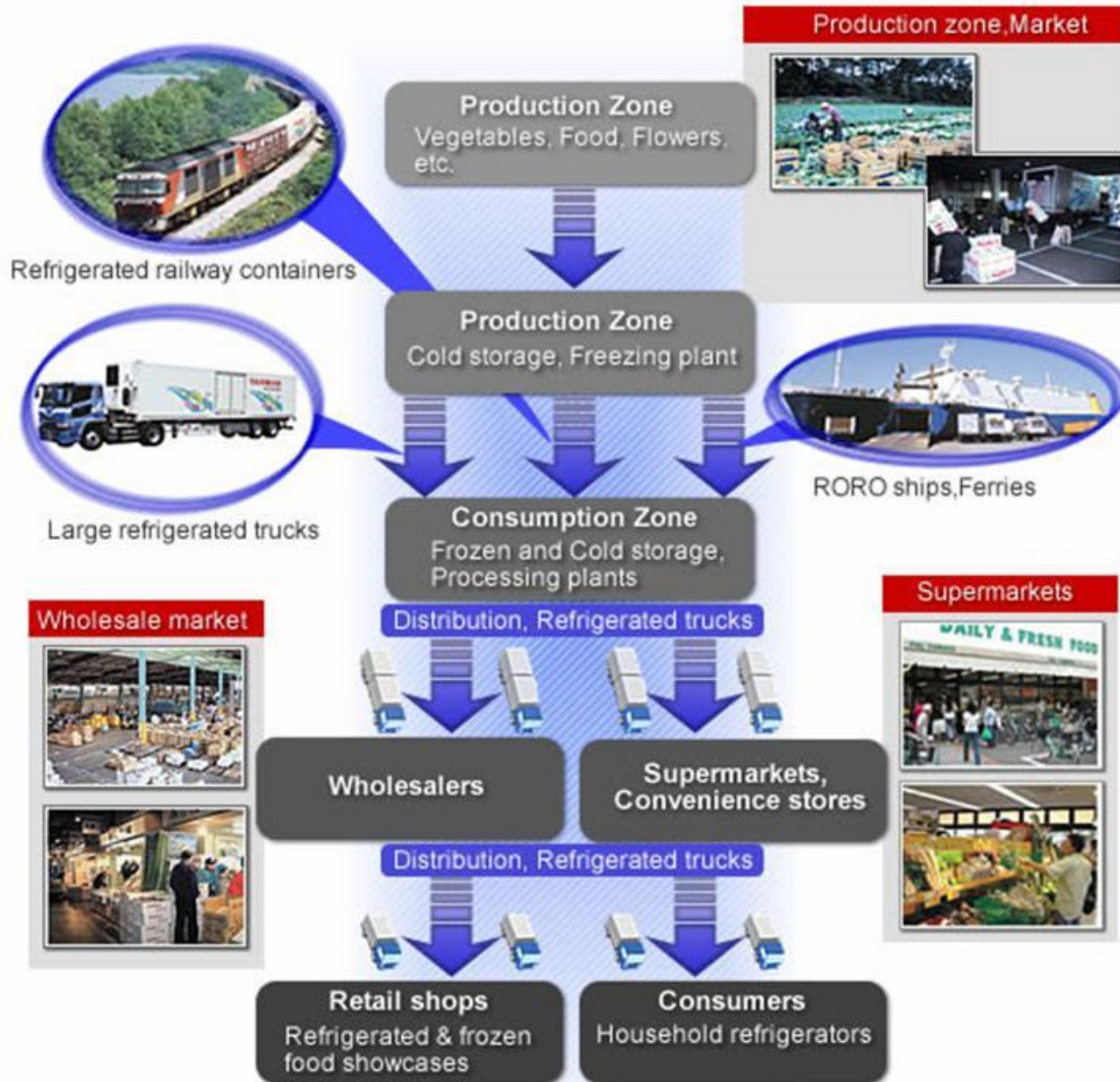
# Definition of Cold Chain

The **cold chain** refers to the transportation of temperature sensitive products along a supply chain through thermal and refrigerated packaging methods and the logistical planning to protect the integrity of these shipments.

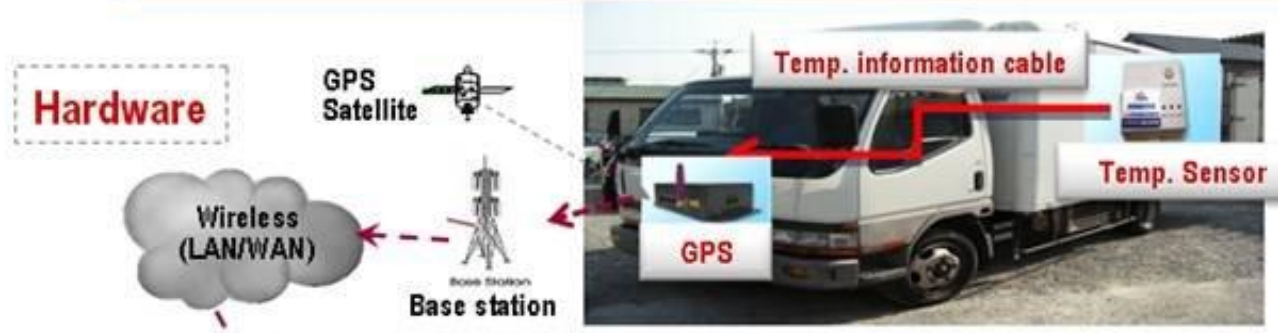
# Key Elements of Cold Chain

- **Product** A product is characterized by physical attributes requiring specific temperature and humidity conditions (e.g. perishability, fragility)
- **Origin / Destination** The respective locations where a temperature-sensitive product is produced and consumed. It is indicative of the potential difficulty of making a product available at a market.
- **Distribution** The methods and infrastructures available to transport a product in a temperature-controlled environment.

# An Example of Cold Chain



# Cold Chain Logistics interactive system



# Design Target of Cold Chains

- Safety & security are critical
- Integrity & trust of supply chain
- Clear, tight chain of control , with well articulated responsibilities of participants
- Traceability of product movement
- Tamper proof packaging
- Avoid cross-contamination (e.g. mixing Halal & non-Halal, product with pungent odor with delicate products and transporting food in trucks that previously handled toxic chemicals)
- Temperature monitoring device in product and in transport vehicle

# Relations Fundamental in Cold Chain Operations

- **Conditional demand** The demand of a product at a market (or place of consumption) is conditional to its qualitative attributes (freshness, number of days left until expiration date).
- **Load integrity** Relates to the load conditions that must be provided to insure that a product keeps its value during transport. It can include adequate packaging and packing, as well as the conditioning that the product must go through before transport (e.g. fruit washed and cooled down prior to transport & storage).
- **Transport & Storage integrity** The temperature controlled environment remains constant during transport, at the terminals and at the distribution centers involved in the transport chain

# Achieve Temperature Controlled Environments

- Different products require different temperature level maintenance to ensure their integrity throughout the travel process. For instance, the most common temperatures are "banana" (13 °C), "chill" (2 °C), "frozen" (-18 °C) and "deep frozen" (-29 °C).
- Proper temperature control depends on:
  - Temperature of product at origin
  - Desire temperature range
  - Duration of transit
  - Size of the shipment
  - Nature of product
  - Packaging
  - Ambient or outside temperatures
  - Targeted ending temperature of product at destination



# Means of Controlling Temperature

- Power source required
  - Mechanical refrigeration (e.g. Thermo King, Carrier) is used in 50% of all the refrigerated cargo transported in the world
  - Heater
  - Smudge pot
- Power source not required
  - Dry ice
  - Wet ice
  - Gel packs
  - Eutectic plates
  - Liquid nitrogen
  - Insulated blankets
  - Styrofoam containers

# Organization of Cold Chains

- **Shipment preparation.** Cold chain devices are commonly designed to keep temperature constant, not to bring shipment to desire temperature
- **Modal choice.** Based on distance between origin and destination, size and weight of the shipment, exterior temperature environment and time sensitivity
- **The "Last Mile".** Must match receiving requirements & final transfer of shipment into storage facilities
- **Integrity and quality assurance.** Share data from temperature recording devices & smart seals
- **Custom procedures.** Must be familiar with Customs procedures to avoid delays

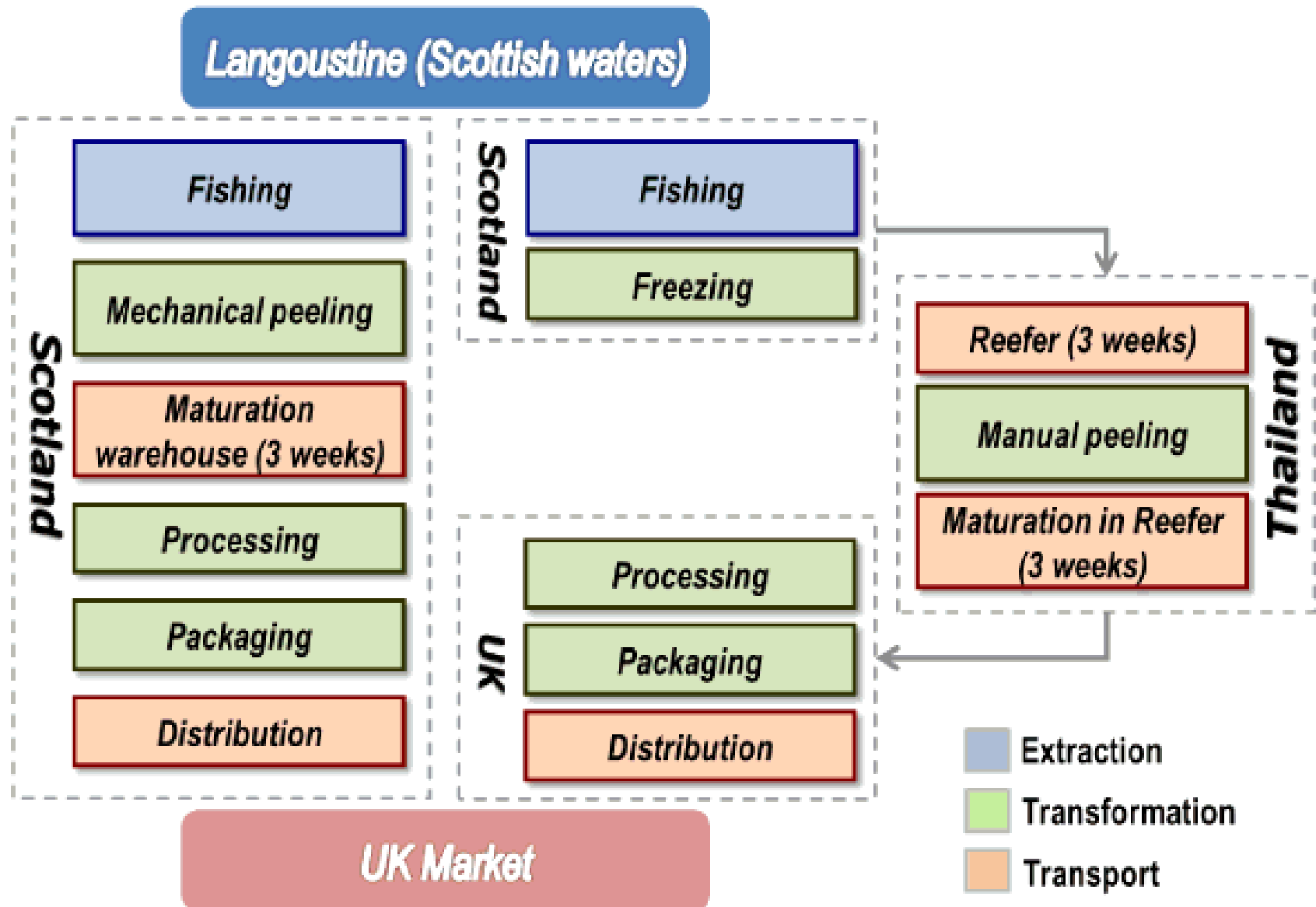
# Cold Chain Products

- Food – fruits, vegetable, meat, prepared food
- Beverages – wine, beer, juice, bottled water
- Pharmaceuticals – bio-engineered drugs, antibiotics, experimental drug compounds
- Medical products - IV solutions
- Specialty chemicals
- Water based paint & adhesives
- Human organs

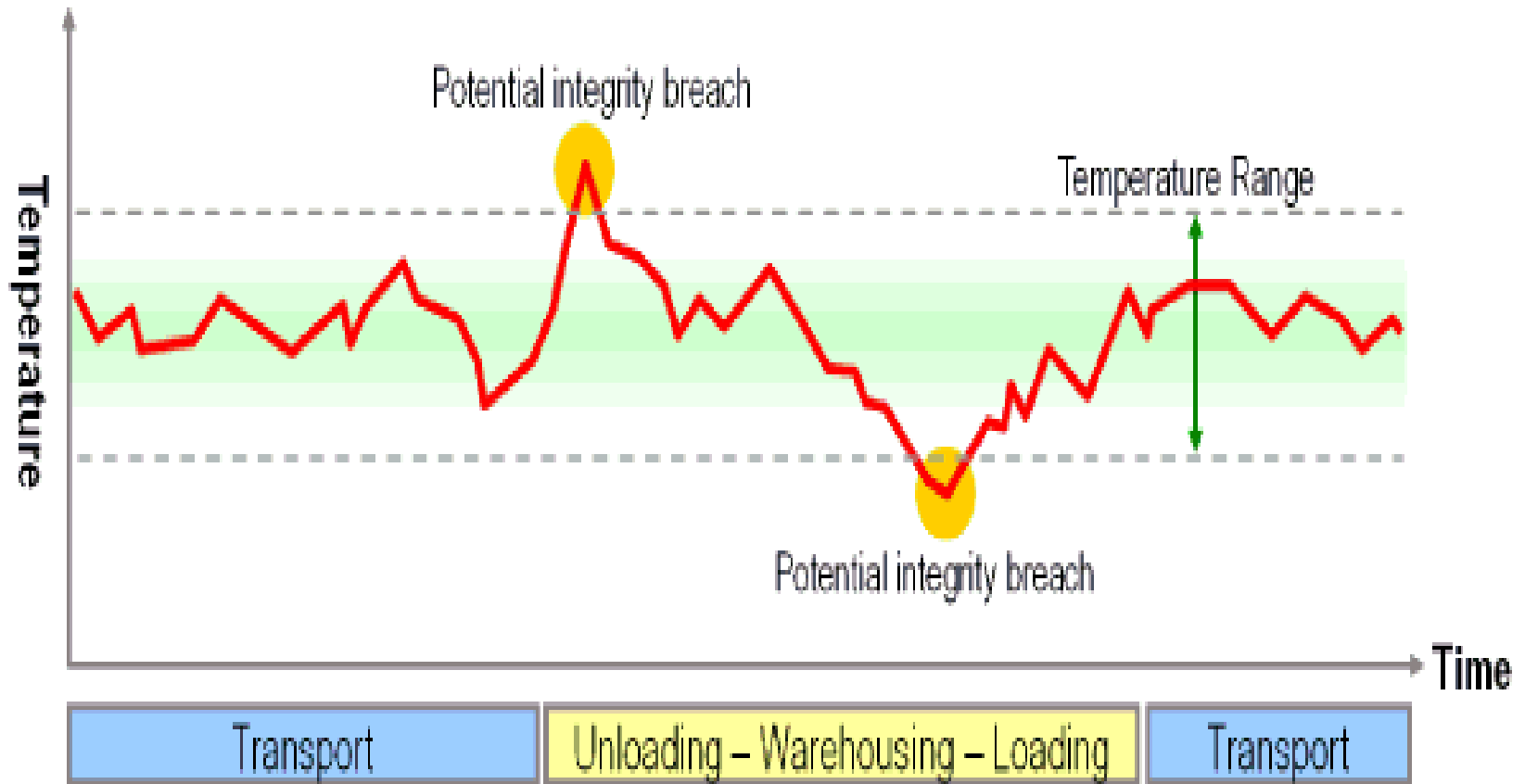
# Food Transportation

- Innovations in packaging, fruit and vegetable coatings & controlled ripening reduce deterioration and extend the reach of perishable products. (e.g. banana grown in Central America is sold around the world).
- Food industry can take advantage of global seasonable variations (e.g. during winter the southern hemisphere can export fruits/vegetables to the northern hemisphere) & wage patterns.
- Source loading directly into a reefer extends the shelf life of product.
- Integrity of food cold chain is critical for food safety

# Containerization & the Flexibility of Cold Chains



# Temperature Recording Device



# Ocean Reefer Storage at Port of New York/Newark



# Shelf Life & Optimal Temperature of Food Products

Product	Shelf Life (Days)	Optimum Temperature (Celcius)
Apple	90-240	0
Bananas	7-28	13.5
Bell Peppers	21-35	7
Cabbage	14-20	1
Eggs	180	1.1
Onions	30-180	1
Lettuce	12-14	0.6
Fresh Meat (beef, lamb, pork, poultry)	14-65	-2
Oranges	21-90	7
Pears	120-180	-0.6
Potatoes	30-50	10
Seafood (shrimp, lobster, crab)	120-360	-17.8
Strawberries	5-10	0.6
Tomatoes	7-14	12



# Meat Cold Chain Logistics

Cold Transport Chain	Transit Time (Days)	Typical Shelf Life (Days)
Refrigerated truck / Cold-storage facility transloading / Air	4-5	30-35
Refrigerated truck / Cold-storage facility transloading / Maritime shipping	15-16	30-35
Source loading with Reefer / Maritime shipping	15-16	55-60



# Practical Ideas on Building an Agricultural Product Logistics Network in KGZ and KAZ

Create an agricultural logistics network with very low capital investment.

- Rebuild, repair Soviet era storage facilities in villages (including underground cellars, sheds)
- Set up packing facilities in towns to process agricultural products
- Build consolidation terminals at or near transport network nodes to consolidate packed products shipping

# Practical Ideas on Agricultural Product Logistics

The practical ideas are based on the following principles:

- Proper storage & packaging extend shelf life and protects quality
- Fast delivery means less spoilage and more selling time
- Damaged and over-ripen produce will quickly rot and spread to other products
- Avoid mixing ethylene generating produce with ethylene sensitive produce
- Careful handling, stowage & ventilation during transport will reduce damage

# Practical Ideas on Agricultural Product Logistics

## Preparation after harvest

- Remove rotten, over-ripen, damaged, bruised, insect infested products
- Wash and clean products
- Dry products thoroughly
- Handle product carefully to avoid damage
- Store products in clean, cool, dark, vented pest free environment (can be a cellar) before shipping
- Avoid storing incompatible products together

# Practical Ideas on Agricultural Product Logistics

## Preparation before shipping (usually at packing facility)

- Sort product by size, quality, degree of ripeness (ripe products have very short shelf life and must be delivered to market within a very short time)
- Cull out dirty, insect infested, damaged, rotten, over-ripen product
- Dry product completely
- Pack product properly (do not overfill carton) and use correct packaging to reduce handling and transport damage
- Provide sufficient space within shipping carton to maintain dryness and to reduce concentration of harmful gas emitted by agricultural products (e.g. ethylene, carbon dioxide)

# Practical Ideas on Agricultural Product Logistics

## Proper transport and handling

- Fruits and vegetables should have enough post harvest life left for trip to market & subsequent selling time. Do not accept hot, over-ripen, damaged, bruised, unclean, insect infested produce.
- When mechanical refrigeration is not available or too costly, consider using:
  - Insulated blanket
  - Styrofoam containers
  - Ice (if compatible with product)
- Avoid mixing product that emits ethylene gas (apricot, pear, melon, tomato) with products sensitive to ethylene gas (apple, cucumber, carrots, potato) in the same vehicle

*Insulated blankets & Styrofoam containers are only suitable for shipping robust fruits & vegetables (e.g. apple, melon potato, onion) when ambient temperature is between 2 to 15 Celsius*

# Practical Ideas on Agricultural Product Logistics

## Proper transport and handling

- Use a clean, cool, insect free vehicle to pick up product, preferably in the morning
- The vehicle should be in good running condition to avoid emergency repair that will delay delivery
- Load and secure product carefully, damage will cause fruit and vegetable to rot
- Use carton board or plywood decking to distribute weight pressure
- Apply bracing to secure the rear cartons
- Do not load produce sensitive to vibration damage directly above steel-spring

*Insulated blankets & Styrofoam containers are only suitable for shipping robust fruits & vegetables (e.g. apple, melon potato, onion) when ambient temperature is between 2 to 15 Celsius*

# Practical Ideas on Agricultural Product Logistics

## Proper transport and handling

- Keep trucks moving – movement supplies ventilation and speeds up delivery time
- When stopping is necessary, park the truck in a shaded, well ventilated location
- Work with border control officials to assign special times slots for agricultural product clearance or to set up a green corridor for expedited border crossing
- Work with border control officials to create practical means of dealing with overload (e.g. imposing a reasonable fine instead of blocking truck passage)

*Insulated blankets & Styrofoam containers are only suitable for shipping robust fruits & vegetables (e.g. apple, melon potato, onion) when ambient temperature is between 2 to 15 Celsius.*



# Practical Ideas on Agricultural Product Logistics

A basic fruit washing and packing facility



# Practical Ideas on Agricultural Product Logistics

A small but adequate cold storage facility near Ganja, AZE



# Practical Ideas on Agricultural Product Logistics

Setting up insulated blankets for produce shipping  
(Please note truck fully loaded with tomato in background)



# Practical Ideas on Agricultural Product Logistics

Oranges, lemons & apples are protected by insulated blankets



# Thank You!



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